Examination Papers, 2016
[Delhi Set-I, II, III]

Time Allowed: **3 Hours**] [Maximum Marks: **90**

General Instructions:

(*i*) The question paper comprises of two sections, A and B. You are to attempt both the sections.
(*ii*) All questions are compulsory.
(*iii*) There is no choice in any of the questions.
(*iv*) All questions of section A and all questions of section B are to be attempted separately.
(*v*) Question numbers 1 to 3 in section A are one-mark questions. These are to be answered in one word or in one sentence.
(*vi*) Question numbers 4 to 6 in section A are two mark questions. These are to be answered in about 30 words each.
(*vii*) Question numbers 7 to 18 in section A are three-mark questions. These are to be answered in about 50 words each.
(*viii*) Question numbers 19 to 24 in section A are five-mark questions. These are to be answered in about 70 words each.
(*ix*) Question numbers 25 to 33 in section B are multiple choice questions based on practical skills. Each question is a one-mark question. You are to select one most appropriate response out of the four provided to you.
(*x*) Question numbers 34 to 36 in Section B are two marks questions based on practical skills. These are to be answered in brief.

Set-I

SECTION-A

1. Write the next homologue of each of the following:

(*i*) C_2H_4 **(*ii*) C_4H_6**

Ans. (*i*) C_3H_6 (*ii*) C_5H_8

2. Name the part of *Bryophyllum* where the buds are produced for vegetative propagation.

Ans. Adventitious buds that arise from the notches in the leaf margins of *Bryophyllum*.

3. List two natural ecosystems.

Ans. Natural ecosystems are lake and pond.

4. State two positions in which a concave mirror produces a magnified image of a given object. List two differences between the two images.

Ans. The following are the two positions in which a concave mirror produces a magnified image of the given object.

When the object is placed between:

(*i*) focus (F) and centre of curvature(C).

(*ii*) focus (F) and pole (P).

Two differences between the two images are that the image formed in case

(*i*) is real and inverted, whereas in case

(*ii*) is virtual and erect.

5. List four advantages of properly managed watershed management.

Ans. The main goal of watershed management is the sustainable management of natural resources to improve the quality of living. This can be done through:

(*i*) Improving and restoring the soil quality and thus, raising productivity rates.

(*ii*) Supplying and securing of clean and sufficient drinking water for the population.

(*iii*) Improvement of infrastructure for storage, transport and agricultural marketing.

(*iv*) Managing the watershed for beneficial developmental activities like domestic water supply, irrigation, hydropower generation etc.

(*v*)Minimizing the risks of floods, droughts and landslides.

6. Explain giving example where active involvement of local people lead to efficient management of forest.

Ans. In 1972, the forest department realized its mistake while reviving the degraded sal forests of Arabari forest range. Arabari forest lies in Midnapore district of West Bengal. The earlier methods of policing and surveillance were a total failure as they often led to frequent clashes with local people. It also led to alienation of people from the conservation programme. Then came a forest officer; named A K Banerjee; who was a real visionary. He involved the local people in the revival of 1,272 hectares of forest. In lieu of that the villagers were given employment in silviculture and harvest and were given 25% of the harvest. They were also allowed to gather firewood and fodder against a nominal payment. Due to active participation of the local community there was remarkable revival of the Arabari

sal forest. By 1983, the value of the forest rose to ₹ 12.5 crores. By this, active involvement of the village people and forest officials brought about efficient forest management.

7. What are covalent compounds? Why are they different from ionic compounds? List their three characteristic properties.

Ans. Those compounds which are formed by sharing of electrons are called covalent compounds. They differ from ionic compounds because they do not contain ions. Ionic compounds are formed by transfer of electrons.

Characteristics:

(*i*) They have low melting and boiling points.

(*ii*) They do not conduct electricity in molten state or in aqueous solution.

(*iii*) They are insoluble in water but soluble in organic solvents.

8. When ethanol reacts with ethanoic acid in the presence of conc. H_2SO_4, a substance with fruity smell is produced. Answer the following:

(*i*) State the class of compounds to which the fruity smelling compounds belong. Write the chemical equation for the reaction and write the chemical name of the product formed.

(*iii*) State the role of conc. H_2SO_4 in this reaction.

Ans. (*i*) Esters are formed which have pleasant fruity smell.

$$\underset{\text{Ethanoic acid}}{CH_3COOH} + \underset{\text{Ethanol}}{C_2H_5OH} \xrightarrow{\text{conc. } H_2SO_4} \underset{\text{Ethyl ethanoate}}{CH_3COOC_2H_5} + \underset{\text{Water}}{H_2O}$$

(*ii*) Conc. H_2SO_4 acts as dehydrating agent. It helps in removing water formed in the reaction.

9. Calcium is an element with atomic number 20. Stating reason answer each of the following questions:

(*i*) Is calcium a metal or non-metal?

(*ii*) Will its atomic radius be larger or smaller than that of potassium with atomic number 19?

(*iii*) Write the formula of its oxide.

Ans. (*i*) Ca(20): 2, 8, 8, 2

It is metal because it can lose 2 electrons to become stable.

(*ii*) It will be smaller due to greater effective nuclear charge.

(*iii*) CaO

10. An element 'M' with electronic configuration (2, 8, 2) combines separately with $(NO_3)^-$, $(SO_4)^{2-}$ and $(PO_4)^{3-}$ radicals. Write the formula of the three compounds so formed. To which group and period of the Modern Periodic Table does the element 'M' belong? Will 'M' form covalent or ionic compounds? Give reason to justify your answer.

Ans. $M(NO_3)_2$, MSO_4, $M_3(PO_4)_2$

'M' has 2 valence electrons, therefore, its valency is equal to 2.

or

$Mg(NO_3)_2$, $MgSO_4$, $Mg_3(PO_4)_2$

It belongs to group 2^{nd} and 3^{rd} period of Modern Periodic Table.

'M' will form ionic compounds because it can lose 2 electrons easily to become stable.

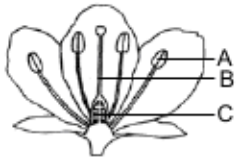
11. How do organisms, whether reproduced asexually or sexually maintain a constant chromosome number through several generations? Explain with the help of suitable example.

Ans. In asexual reproduction, parent cell divides mitotically to form the offspring. Thus, asexually reproducing organisms maintain a constant chromosome number.

In sexual reproduction, the gametes usually contain half number of chromosomes compared to the numbers present in the body cells. These haploid gametes when fuse produce a new cell with double number of chromosomes than the gametes and same as the body cells. In this way organisms restrict doubling of DNA and maintain the chromosome number.

For example: Human being somatic cells contain 46 chromosomes. When gametes are formed they contain half the number that is 23 chromosomes in each gamete. When these gametes fuse to form the zygote again they get to maintain the 46 number of chromosomes.

12. Name the parts A, B and C shown in the following diagram and state one function of each.



Ans. A: Stamen contains pollen grains.

B: Style carries pollen grains to the ovary from the stigma.

C: Ovary contains ovules.

13. Suggest three contraceptive methods to control the size of human population which is essential for the health and prosperity of a country. State the basic principle involved in each.

Ans. **I. Barrier or mechanical method:** A thin rubber sheath (condom) is placed on the erect penis before sexual intercourse which traps the sperms and prevents them to enter the uterus. In females a thin rubber disc is placed in the vagina, which covers the opening of the cervix stopping the entry of sperms into the uterus.

II. Hormonal-imbalance method: Specific chemicals are used by females, which are of two types:

(*i*) **Oral pills:** These type of chemicals contain hormones which prevents the release of ovum from the ovary. Since the ovum is not released, pregnancy cannot take place.

(*ii*) **Vaginal pills:** These are drugs that change the environment of the vagina and are not suitable for the survival of the sperms. Since the sperms get killed in the vagina itself, pregnancy is ruled out.

III. The use of Intrauterine Contraceptive Devices (IUCDs): These are contraceptive devices made of copper, plastic or stainless steel. Copper T is placed by a doctor at the opening of the cervix which prevents the entry of the sperms into the uterus.

IV. Surgical methods:

Vasectomy: A portion of man's sperm ducts are cut and both ends sealed by surgical procedure. So, no sperm is released and cannot fertilise the ovum.

Tubectomy: Woman's oviduct are tied, blocked or cut by surgical methods. Sperm cannot reach the ova and thus pregnancy is avoided.

Use of these contraceptive devices helps in preventing unwanted pregnancies. They can prevent the chances of frequent pregnancies which otherwise affect the health of a woman. They help in family planning by controlling the number of children in a family. So, proper care is provided to the children and it also reduces the chances of poverty.

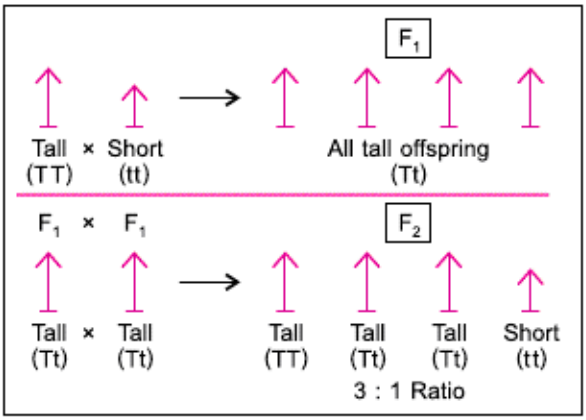
Use of contraceptive devices also reduces the chances of getting sexually transmitted diseases such as AIDS. In this way, the birth control methods play an important role in the health and prosperity of the family. (*any three*)

14. In one of his experiments with pea plants Mendel observed that when a pure tall pea plant is crossed with a pure dwarf pea plant, in the first generation, F_1 only tall plants appear.

(*a*) What happens to the traits of the dwarf plants in this case?

(*b*) When the F_1 generation plants were self-fertilised, he observed that in the plants of second generation, F_2 both tall plants and dwarf plants were present. Why it happened? Explain briefly.

Ans.



(*a*) The dwarfness being recessive trait was not visible in the F_1 generation.

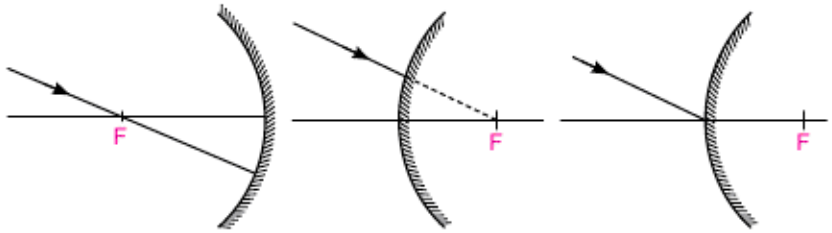
(*b*) Law of independent assortment says that alleles of different characters separate independent from each other during gamete formation. In this case, alleles of tall and dwarf characters were assorted independently.

15. List three distinguishing features, in tabular form, between acquired traits and the inherited traits.

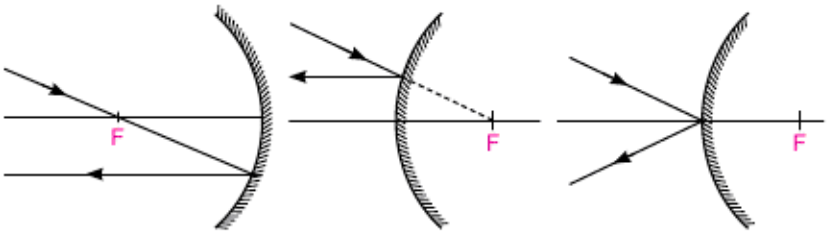
Ans.

Acquired traits	Inherited traits
(*i*) A trait (or characteristic) of an organism which is 'not inherited' but develops in response to the environment is called an acquired trait.	(*i*) A trait (or characteristic) of an organism which is caused by a change in its genes (or DNA) is called an inherited trait.
(*ii*) The acquired traits of an organism cannot be passed on to its future generations. e.g., 'low weight' of beetle. 'cut tail' of a mouse.	(*ii*) The inherited traits of an organism are passed on to its future generations. e.g., 'red colour of beetles, fur coat of guinea pigs.
(*iii*) An acquired trait is experienced by an individual during his life time. It involves changes in non-reproductive tissues (or somatic cells), which cannot be passed on to the germ cells or progeny.Consider the following example to understand acquired traits.	(*iii*) Inherited trait is a distinguishing quality or characteristic, which one acquires from the ancestors. These involve changes in the DNA.

16. Draw the following diagram, in which a ray of light is incident on a concave/ convex mirror, on your answer sheet. Show the path of this ray, after reflection, in each case.



Ans.



17. Why does the sun appear reddish early in the morning? Will this phenomenon be observed by an observer on the moon? Justify your answer with a reason.

Ans. At the time of sunrise, the sun is near the horizon and the sunlight has to travel through a larger atmospheric distance. The blue component and other shorter wavelength of the sunlight get scattered away by the fine particles of the atmosphere. Only red colour having longer wavelength and least scattered, reaches our eyes. Hence, the sun appears reddish early in the morning.

This phenomenon would not be observed by an observer on the moon due to the absence of atmosphere on its surface due to which sunlight will not scatter. Therefore, the sun does not appear reddish early in the morning to the observer.

18. Give reason to justify the following:

(*a*) The existence of decomposers is essential in a biosphere.

(*b*) Flow of energy in a food chain is unidirectional.

Ans. (*a*) Organic matter is recycled in an ecosystem by **decomposers**. **Decomposers** are organisms such as bacteria and fungi that break down the organic matter in the dead bodies of plants and animals. As the **decomposers** feed from the dead animals, they break down the organic compounds into simple nutrients.

(*b*) The flow of energy in the ecosystem is unidirectional. The energy enters the plants (from the sun) through photosynthesis during the making of food. This energy is then passed on from one organism to another in a food chain.

Energy given out by the organisms as heat is lost to the environment, it does not return to be used by the plants again. This makes the flow of energy in ecosystem 'unidirectional'.

During the transfer of energy through successive trophic levels in an ecosystem, there is a loss of energy all along the path. No transfer of energy is 100 per cent. The energy available at each successive trophic level is 10 per cent of the previous level. Thus, there is a progressive decline (gradual reduction) in the amount of energy available as we go from producer level to the higher trophic levels of organisms.

19. (*a*) Give a chemical test to distinguish between saturated and unsaturated hydrocarbon.

(*b*) Name the products formed when ethane burns in air. Write the balanced chemical equation for the reaction showing the types of energies liberated.

(*c*) Why is reaction between methane and chlorine in the presence of sunlight considered a substitution reaction?

Ans. (*a*) Add bromine water. Unsaturated hydrocarbon will decolourise bromine water, whereas saturated hydrocarbon will not.

(*b*) $2C_2H_6 + 7O_2 \longrightarrow \underset{\text{Carbon dioxide}}{4CO_2\ (g)} + \underset{\text{Water}}{6H_2O}$

It will liberate heat as well as light energy.

(*c*) $CH_4 + Cl_2 \xrightarrow{\text{Sunlight}} CH_3Cl + HCl$

It is because hydrogen atom of methane gets substituted by chlorine atom to form chloromethane.

20. (*a*) Write the functions of the following parts in human female reproductive system:

(*i*) Ovary (*ii*) Oviduct (*iii*) Uterus

(*b*) Describe the structure and function of placenta.

Ans. (*a*) (*i*) **Ovary:** It has two main reproductive functions in the body. They produce oocytes (eggs) for fertilization and also produce reproductive hormones, oestrogen and progesterone.

(*ii*) **Oviduct:** It is the long muscular tube that links the ovary to the uterus and which the ovulated oocyte travels down to become fertilized by sperm present in the female tract. It is also referred to as the **fallopian tube, uterine tube or ovarian tube.**

(*iii*) **Uterus:** Functions of the uterus include nurturing the fertilized ovum that develops into the foetus and holds it till the baby is mature enough for birth. The fertilized ovum gets implanted into the endometrium and derives nourishment from blood vessels which develop exclusively for this purpose.

(*b*) The placenta is an organ connecting the developing foetus to the uterine wall. It allows nutrient uptake, waste elimination, and gas exchange via the mother's blood supply. It saves both mother and foetus from probable infections by separating the blood of the mother from the baby, thus acting like a filter at the same time helps the uterus to complete the term till the baby has matured. It also helps in nutritional intake of the foetus.

21. What is meant by speciation? List four factors that could lead to speciation. Which of these cannot be a major factor in the speciation of a self-pollinating plant species? Give reason to justify your answer.

Ans. Speciation is the evolutionary process by which reproductively isolated biological populations evolve to become distinct species.

Factors which could lead to the formation of new species are:

(*i*) **Genetic drift:** Over generations, genetic drift may accumulate which leads to speciation.

(*ii*) **Natural selection:** Natural selection may work differently in different locations which may give rise to speciation.

(*iii*) Severe DNA change.

(*iv*) A variation may occur which does not allow sexual act between two groups.

Geographical isolation would not be a major factor in the speciation of a self pollinating plant species.

Since the plants are self pollinating, which means that the pollens are transferred from the anther of one flower to the stigma of the same flower or of another flower of the same plant. Therefore, there is no change in the genetic makeup of the plant over the generations.

22. (*a*) Define the following terms in the context of spherical mirrors:

(*i*) Pole

(*ii*) Centre of curvature

(*iii*) Principal axis

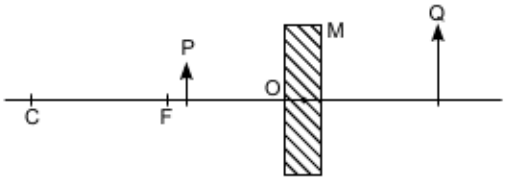
(*iv*) Principal focus

(*b*) Draw ray diagrams to show the principal focus of a:

(*i*) Concave mirror

(*ii*) Convex mirror

(c) Consider the following diagram in which M is a mirror and P is an object and Q is its magnified image formed by the mirror.



State the type of the mirror M and one characteristic property of the image Q.

Ans. (*a*) (*i*) Pole: The central point of the reflecting spherical surface is called pole (P). It lies on the surface of the mirror.

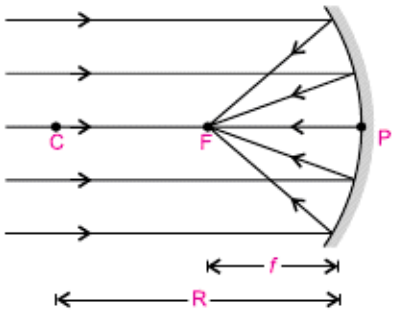
(*ii*) Centre of curvature: The centre of the hollow sphere of which, the spherical mirror is a part, is called centre of curvature(C).

(*iii*) Principal axis: The straight line joining the pole and the centre of curvature is called principal axis.

(*iv*) Principal focus: The point 'F' on the principal axis, where the incident light rays parallel to the principal axis actually meet (converge) (in case of concave mirror) or appear to diverge or come from a point on the principal axis (in case of convex mirror) after reflection is called its principal focus (F).

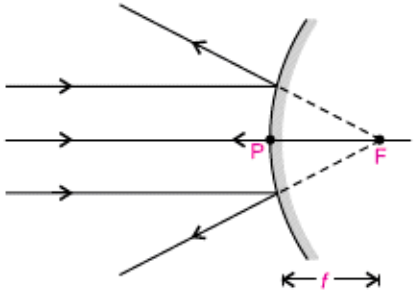
For a concave mirror, the focus lies on the same side of the reflecting surface, whereas in case of a convex mirror, it lies on the opposite side of the reflecting surface.

(*b*) (*i*)



Principal focus of a concave mirror

(*ii*)



Principal focus of a convex mirror

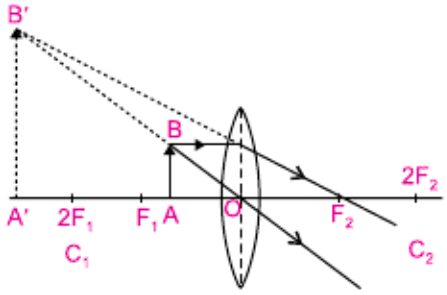
(*c*) The given mirror M is a concave spherical mirror. When the object lies between the pole and focus of a concave mirror, an erect, virtual and enlarged image is formed. So, one characteristic property of the image Q formed in the given figure is that it is virtual.

23. (*a*) Draw a ray diagram to show the formation of image by a convex lens when an object is placed in front of the lens between its optical centre and principal focus.

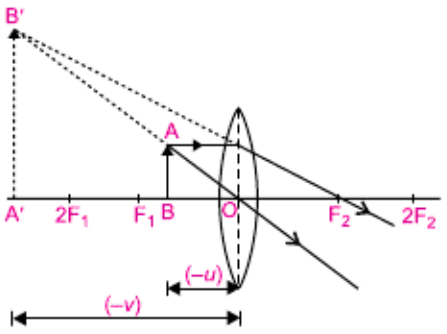
(*b*) In the above ray diagram mark the object-distance (*u*) and the image-distance (*v*) with their proper signs (+ve or –ve as per the new Cartesian sign convention) and state how these distances are related to the focal length (*f*) of the convex lens in this case.

(*c*) Find the power of a convex lens which forms a real, and inverted image of magnification –1 of an object placed at a distance of 20 cm from its optical centre.

Ans. (*a*) The formation of image by a convex lens when an object is placed in front of the lens between its optical centre and principal focus is shown below.



(*b*) All the distances measured to the right of the origin (along + *x*-axis), i.e. along the direction of incident ray are taken as positive, while those measured to the left of the origin (along – *x*-axis), i.e. opposite to the direction of incident ray are taken as negative. Accordingly object distance '*u*' and image distance '*v*' both are negative as they are measured opposite to the direction of incident ray.



The object distance (*u*), image distance (*v*) and the focal length (*f*) of a convex lens in the above case are related as given below.

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

(*c*) Given: object distance, $u = -20$ cm, Image distance, v = ?

Linear magnification, $m = -1$

For spherical lens, linear magnification is given by $m = \frac{v}{u}$

$$\Rightarrow \qquad -1 = \frac{v}{-20} \quad \Rightarrow \quad v = +20 \text{ cm}$$

Focal length of convex lens is calculated as

$$\therefore \quad \frac{1}{f} = \frac{1}{v} - \frac{1}{u} = \frac{1}{20} - \frac{1}{-20} = \frac{1}{10} \quad \Rightarrow \quad f = +10 \text{ cm}$$

Therefore, the power of the given convex lens is

$$\text{Power} = \frac{1}{\text{Focal length}} = \frac{1}{f(m)} = \frac{100}{10} = +10\,\text{D}$$

24. **(*a*) Write the function of each of the following parts of human eye:**

Cornea; iris; crystalline lens; ciliary muscles.

(*b*) Millions of people of the developing countries of world are suffering from corneal blindness. These persons can be cured by replacing the defective cornea with the cornea of a donated eye. A charitable society of your city has organised a campaign in your neighbourhood in order to create awareness about this fact.

(*i*) State the objective of organising such campaigns.

(*ii*) List two arguments which you would give to motivate the people to donate their eyes after death.

(*iii*) List two values which are developed in the persons who actively participate and contribute in such programmes.

Ans. (*a*) **Cornea:** It provides the refraction of light rays entering the eye and act as a primary lens.

Iris: It controls the size of pupil.

Crystalline lens: It forms a real and inverted image of the object on the retina.

Ciliary muscles: It helps the eye lens to focus the image of an object on the retina by increasing or decreasing the curvature of eye lens and holds the eye lens in position.

(*b*) (*i*) The objective of organising such campaigns will be stated as:

"One pair of eyes gives vision to TWO CORNEAL BLIND PERSONS."

Or

"Pledge & Donate the eyes after death to light up the darkness in the life of blind and enable them to see this beautiful world, through your eyes ! Gift your sight - make it your wish".

(*ii*) **Arguments:**

(*a*) Close your eyes and try to see the world. Nothing you find rather than darkness. Try to share the world of blindness.

(*b*) In India, the number of curable blind people, who are suffering from corneal blindness, exceeds more than 5 millions. Approximate 35000 to 50000 per year new victims are added to the total list. Much of the blindness in our country is treatable, or preventable. If we have gotten God's gift of vision; if our eyes can live even after death; why not try to pass it on to somebody who doesn't have it?

Who can donate eyes?

- Eye donors can belong to any age group or sex.
- People who use spectacles, short-sightedness, long-sightedness or astigmatism or even those operated for cataract can still donate, as these conditions may not affect the cornea.
- Patients who are diabetics, those suffering from hypertension, asthma patients and those without communicable diseases can also donate eyes.
- Persons who were infected with or died from AIDS, Hepatitis B or C, rabies, septicemia, acute leukemia, tetanus, cholera, meningitis or encephalitis cannot donate eyes.

(*iii*) The values which are developed in the persons who actively participate and contribute in such programs are social welfare and awareness about eye donation.

SECTION-B

25. Which of the following sets of materials can be used for conducting a saponification reaction for the preparation of soap?

(*a*) $Ca(OH)_2$ and neem oil **(*b*) NaOH and neem oil**

(*c*) NaOH and mineral oil **(*d*) $Ca(OH)_2$ and mineral oil**

Ans. (*b*) Neem oil reacts with NaOH to form soap.

26. A student takes four test tubes marked P, Q, R and S of 25 mL capacity and fill 10 mL of distilled water in each. He dissolves one spoon full of four different salts in each as – KCl in P, NaCl in Q, $CaCl_2$ in R and $MgCl_2$ in S. He then adds about 2 mL of a sample of soap solution to each of the above test tubes. On shaking the contents of each of the test tubes, he is likely to observe a good amount of lather (foam)in the test tubes marked:

(*a*) P and Q **(*b*) R and S** **(*c*) P, Q and R** **(*d*) P, Q and S**

Ans. (*a*) P and Q contain soft water which will form good amount of lather (foam) with soap solution.

27. Consider the following comments about saponification reactions:

I Heat is evolved in these reactions

II For quick precipitation of soap sodium chloride is added to the reaction mixture

III Saponification reactions are special kind of neutralisation reactions

IV Soaps are basic salts of long chain fatty acids

The correct comments are:

(*a*) I, II and III (*b*) II, III and IV (*c*) I, II and IV (*d*) Only I and IV

Ans. (*c*) The process is exothermic. Sodium chloride helps in complete precipitation of soap. Soaps are basic salts of long chain fatty acids.

28. A student has to perform the experiment "To identify the different parts of an embryo of a dicot seed." Select from the following an appropriate group of seeds:

(*a*) pea, gram, wheat (*b*) red kidney bean, maize, gram

(*c*) maize, wheat, red kidney bean (*d*) red kidney bean, pea, gram

Ans. (*d*)

29. Which of the following is a correct set of homologous organs?

(*a*) Forelimbs of frog, bird and lizard

(*b*) Spine of *Cactus* and thorn of *Bougainvillea*

(*c*) Wings of bat and wings of butterfly

(*d*) Wings of a bird and wings of a bat

Ans. (*a*)

30. A student obtained a sharp image of a candle flame placed at the distant end of the laboratory table on a screen using a concave mirror to determine its focal length. The teacher suggested him to focus a distant building about 1 km far from the laboratory, for getting more correct value of the focal length. In order to focus the distant building on the same screen the student should slightly move the:

(*a*) mirror away from the screen (*b*) screen away from the mirror

(*c*) screen towards the mirror (*d*) screen towards the building

Ans. (*c*) If the object distance from the concave mirror increases, the image distance decreases and shifted towards the focus of the concave mirror. Accordingly student slightly move the screen towards the mirror to get the sharp image of distant building.

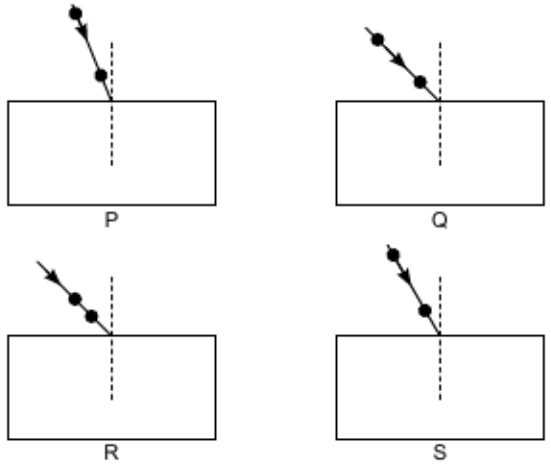
31. To determine the approximate focal length of the given convex lens by focussing a distant object (say, a sign board), you try to focus the image of the object on a screen. The image you obtain on the screen is always:

(*a*) erect and laterally inverted **(*b*) erect and diminished**

(*c*) inverted and diminished **(*d*) virtual, inverted and diminished**

Ans. (*c*) The image of the distant object formed at the focus of a convex lens is real, inverted and diminished in size.

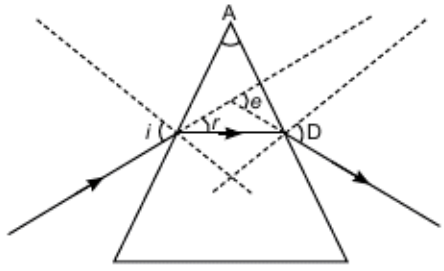
32. Select from the following the best experimental set-up for tracing the path of a ray of light passing through a rectangular glass slab:



(*a*) P **(*b*) Q** **(*c*) R** **(*d*) S**

Ans. (*b*) For better result, angle of incidence should be in the range 30° – 60° and larger separation between the pins will give better collinearity of the pins and accuracy of the result.

33. Study the following figure in which a student has marked the angle of incidence ($\angle i$), angle of refraction ($\angle r$), angle of emergence ($\angle e$), angle of prism ($\angle$A) and the angle of deviation ($\angle$D). The correctly marked angles are:



(*a*) $\angle$A and $\angle i$ **(*b*) $\angle$A, $\angle i$ and $\angle r$**

(*c*) $\angle$A, $\angle i$, $\angle e$ and $\angle$D **(*d*) $\angle$A, $\angle i$, $\angle r$ and $\angle$D**

Ans. (*a*) **Angle of incidence** $\angle i$: The angle between the incident ray and normal is called angle of incidence.

Angle of refraction $\angle r$: The angle between the refracted ray and normal is called angle of refraction.

Angle of emergence $\angle e$: The angle between the emergent ray and normal at the second refracting face of the prism is called angle of emergence.

Angle of deviation $\angle D$: Angle between the incident ray produced in the forward direction and emergent ray produced in the backward direction through the prism is called angle of deviation.

Angle of prism $\angle A$: The angle between the two refracting edges inclined to each other of the prism is called the angle of prism.

Hence, option (*a*) is correct.

34. What do you observe when you drop a few drops of acetic acid to a test tube containing:

(*i*) phenolphthalein

(*ii*) distilled water

(*iii*) universal indicator

(*iv*) sodium hydrogen carbonate powder.

Ans. (*i*) It will remain colourless.

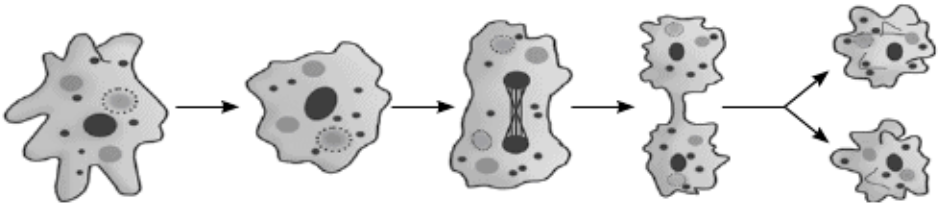
(*ii*) Acetic acid will get dissolved forming transparent solution.

(*iii*) Acetic acid will turn it orange.

(*iv*) Brisk effervescence due to CO_2 will be evolved.

35. Draw a labelled diagram to show that particular stage of binary fission in *amoeba* in which its nucleus elongates and divide into two and a constriction appears in its cell membrane.

Ans.



36. A student focuses the image of a well-illuminated distant object on a screen using a convex lens. After that he gradually moves the object towards the lens and each time focuses its image on the screen by adjusting the lens.

(*i*) In which direction—towards the screen or away from the screen—does he move the lens?

(*ii*) What happens to the size of the image—does it decrease or increase?

(*iii*) What happens to the image on the screen when he moves the object very close to the lens?

Ans. (*i*) Since the object is moved towards the lens, the image distance increases. Therefore, to focus the image again on the screen, student should move the lens away from the screen.

(*ii*) When object moves towards the lens, the size of image on the screen increases.

(*iii*) When the student moves the object very close to the lens, no image is formed on the screen. A virtual, erect and enlarged image is formed by convex lens on the same side of the object and behind it.

Set-II (*Uncommon Questions to Set-I*)

SECTION-A

1. Name the following compounds:

(*a*) $CH_3—CH_2—OH$, **(*b*)** $CH_3—\overset{\overset{H}{|}}{C}=O$

Ans. (*a*) Ethanol (*b*) Ethanal

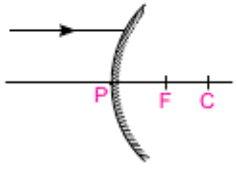
2. What is DNA?

Ans. Deoxyribonucleic acid, a self-replicating material which is present in nearly all living organisms as the main constituent of chromosomes. It is the carrier of genetic information.

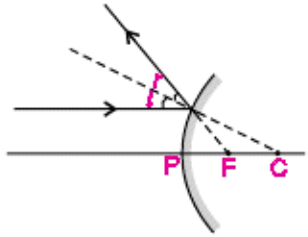
3. List two biotic components of a biosphere.

Ans. Plants (producers), animals (consumers) and micro-organisms (decomposers). (*any two*)

4. A ray of light is incident on a convex mirror as shown. Redraw the diagram and complete the path of this ray after reflection from the mirror. Mark angle of incident and angle of reflection on it.



Ans.



7. What is an oxidising agent? What happens when an oxidising agent is added to propanol? Explain with the help of a chemical equation.

Ans. Those substances which add oxygen are called oxidising agent and propanoic acid is formed.

$$\underset{\text{Propanol}}{CH_3CH_2CH_2OH} + 2[O] \xrightarrow{KMnO_4/H_2SO_4} \underset{\text{Propanoic acid}}{CH_3CH_2COOH} + H_2O$$

10. Name any two elements of group one and write their electronic configurations. What similarity do you observe in their electronic configurations? Write the formula of oxide of any of the aforesaid element.

Ans. Two elements of group one with electronic configuration:

Lithium (Li) : 2, 1

Sodium (Na) : 2, 8, 1

They both have one electron in their valence shell. Formula of their oxide : Li_2O and Na_2O.

11. What are the functions of testis in the human male reproductive system? Why are these located outside the abdominal cavity? Who is responsible for bringing about changes in appearance seen in boys at the time of puberty?

Ans. The functions of testis in human male reproductive system are:-

(*i*) To produce sperms

(*ii*) To produce the male hormone called testosterone.

The testis are located outside the abdominal cavity as the sperms need a lower temperature to mature than the normal body temperature.

Testosterone is responsible for bringing about the changes in the appearance seen in boys at the time of puberty.

13. What is multiple fission? How does it occur in an organism? Explain briefly. Name one organism which exhibits this type of reproduction.

Ans. Multiple fission is the process of asexual reproduction where the parent cell divides into several small and equal-sized daughter individuals. The nucleus divides to produce large number of nuclei and then the cytoplasm separates forming a membrane around it. Thus, creating multiple daughter cells. Plasmodium exhibits multiple fision.

14. How did Mendel interpret his result to show that traits may be dominate or recessive? Describe briefly.

Ans. Mendel conducted experiments on pea plant since they had short duration of life cycle. He first selected pure bred tall and short (dwarf) plant and cross pollinated them to produce F_1 generation of pea plants. All F_1 plants were tall proving that tallness is the dominant trait. He then produced F_2 generation by self-pollinating the F_1 plants and found that the F_2 generation had 3/4 tall and 1/4 dwarf plants. The hidden traits in F_1 generation were dwarf or the recessive trait.

16. What is meant by scattering of light? The sky appears blue and the sun appears reddish at sunrise and sunset. Explain these phenomena with reason.

Ans. **Scattering of light:** Phenomenon of deviation of ray of light from its original path when come in contact with particles of size equivalent to wavelength of light ray. Scattering is inversely proportional to wavelength of light. Fine particles present in atmosphere scatter rays of light to greater extent which are smaller in wavelength.

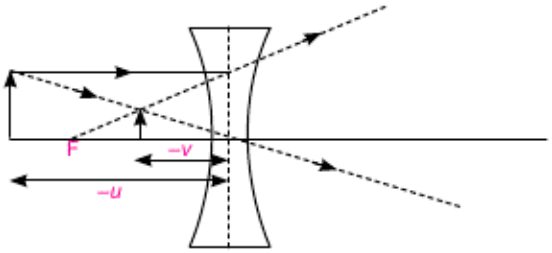
Blue colour present in visible light is scattered most and reach to earth in larger amount so sky appears blue. During sunset and sunrise, rays from sun propagate larger distance in atmosphere, so rays of smaller wavelength get scattered most to vanish and rays of larger wavelength light like red and orange reach to earth. Thus, sun appears reddish.

22. (*a*) Draw a ray diagram to show the formation of image by a concave lens when an object is placed in front of it.

(*b*) In the above diagram mark the object-distance(u) and the image-distance(v) wih their proper signs (+ve or –ve as per the new Cartesian sign convention) and state how these distances are related to the focal length (f) of the concave lens in this case.

(*c*) Find the nature and power of a lens which forms a real and inverted image of magnification–1 at a distance of 40 cm from its optical centre.

Ans. (*a*)



(*b*) Marking of the object-distance (u) and the image-distance(v) wih their proper signs (+ve or –ve as per the new Cartesian sign convention)are shown in the above figure.

The object distance(u), image-distance(v) and the focal length (f) of a convex lens is in the above case are related as given below:

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

(*c*) As, $m = -1$ hence, the lens is convex

$$\because \quad m = \frac{v}{u} \quad \therefore v = -u$$

Thus, object is at 2F

$$2f = 40 \text{ cm}$$

$$\therefore f = 20 \text{ cm} = 0.2 \text{ m}$$

$$P = \frac{1}{f} = \frac{1}{0.2} = +5\text{D (convex lens)}$$

Set-III (*Uncommon Questions to Set-I and Set-II*)

SECTION-A

1. Select saturated hydrocarbons from the following:

C_3H_6; C_5H_{10}; C_4H_{10}; C_6H_{14}; C_2H_4.

Ans. C_6H_{14} and C_4H_{10} are saturated hydrocarbons.

2. What happens when a *Planaria* gets cut into two pieces?

Ans. When *Planaria* gets cut into two pieces, each piece regenerates into a new *Planaria*.

3. Why are green plants called producers?

Ans. The green plants are called producers because they can prepare food by photosynthesis by trapping the heat from the sun by chlorophyll, and with the help of water and carbon dioxide converting it into food.

4. What is meant by power of a lens? What does its sign (+ve or – ve) indicate? State its S.I. unit. How is this unit related to focal length of a lens?

Ans. The ability of a lens to converge or diverge the rays of light is called power (P) of the lens. It is equal to the reciprocal of the focal length, i.e. $P = 1/f$.

The positive (+ve) sign of power indicates that the given lens is a converging or convex lens, while the negative (–ve) sign of power for a diverging or concave lens.

The SI unit of power of a lens is 'dioptre (D)'. If the focal length of the lens is expressed in metre, then power is in dioptre. A lens of focal length 100 cm has a power of 1 dioptre, i.e. 1 dioptre = 1 m^{-1}.

6. "Reuse is better than recycling of materials". Give reason to justify this statement.

Ans. Reusing is better than recycling because in the process of recycling certain energy is required and energy is a natural resource. We basically recycle or reuse things to conserve our resources and when energy is being consumed in the process of recycling it is using up a precious resource. This is the reason why simply reusing is better than recycling.

7. Name the compound formed when ethanol is heated in excess of conc. sulphuric acid at 443 K. Also write the chemical equation of the reaction stating the role of conc. sulphuric acid in it. What would happen if hydrogen is added to the product of this reaction in the presence of catalysts such as palladium or nickel?

Ans. Ethene is formed.

$$CH_3CH_2OH \xrightarrow[443\ K]{\text{conc. } H_2SO_4} CH_2{=}CH_2 + H_2O$$

Conc. H_2SO_4 is dehydrating agent.

Ethane will be formed.

$$CH_2{=}CH_2 + H_2 \xrightarrow{Pd \text{ or } Ni} CH_3{-}CH_3$$

9. Two elements 'A' and 'B' belong to the 3rd period of Modern Periodic Table and are in group 2 and 13 respectively. Compare their following characteristics in tabular form:

(*a*) Number of electrons in their atoms

(*b*) Size of their atoms

(*c*) Their tendencies to lose electrons

(*d*) The formula of their oxides

(*e*) Their metallic character.

(*f*) The formula of their chlorides

Ans. (*a*) 12 and 13

(*b*) Group 2 element 'A' is bigger than 'B' of group 13.

(*c*) 'A' can lose electrons easily

(*d*) AO, B_2O_3

(*e*) A is more metallic than B.

(*f*) ACl_2, BCl_3

11. What is meant by pollination? Name and differentiate between the two modes of pollination in flowering plants.

Ans. **Pollination** is the act of transferring pollen grains from the male anther to the female stigma of a flower. The goal of every living organism, including plants, is to create offspring for the next generation. One of the ways that plants can produce offspring is by making seeds.

The two modes of pollination are self-pollination and cross-pollination.

Self-pollination is the more basic type of pollination because it only involves one flower. This type of pollination occurs when pollen grains from the anther fall directly onto the stigma of the same flower.

Cross-pollination occur when pollen grains are transferred to a flower from a different plant. The process of cross pollination requires the help of abiotic or biotic agents like wind, water, insects, birds, bats, snails and other animals as pollinators.

14. In a monohybrid cross between tall pea plants (TT) and short pea plants (tt) a scientist obtained only tall pea plants (Tt) in the F_1 generation. However, on selfing the F_1 generation pea plants, he obtained both tall and short plants in F_2 generation. On the basis of above observations with other angiosperms also, can the scientist arrive at a law? If yes, explain the law. If not, give justification for your answer.

Ans. Yes, the scientist will arrive at a law on the basis of his observations. It is the law of dominance proposed by Mendel. According to this law, in pure breeding varieties of pea plant, the F_1 generation shows only dominant trait while in F_2 generation both dominant and recessive traits are expressed.

16. **(*a*) Draw a ray diagram to show the refraction of light through a glass slab and mark angle of refraction and the lateral shift suffered by the ray of light while passing through the slab.**

(*b*) If the refractive index of glass for light going from air to glass is 3/2, find the refractive index of air for light going from glass to air.

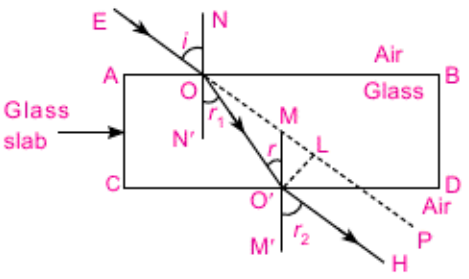
Ans. (*a*) $\angle r_1$ = angle of refraction when light propagate from air to glass.

$\angle r_2$ = angle of emergence of light ray from glass slab to air.

$\angle i$ = angle of incidence.

Incident ray EP is parallel to emergent ray O′H

O′L is lateral displacement of emergent ray from incident ray.

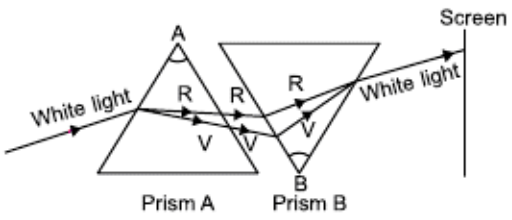


(*b*) Given: $n_{ga} = \frac{3}{2}$ (∴ refractive index of glass with respect to air)

as $n_{ag} = \frac{1}{n_{ga}} = \frac{2}{3}$

17. **State the cause of dispersion of white light passing through a glass prism. How did Newton show that white light of sun contains seven colours using two identical glass prisms? Draw a ray diagram to show the path of light when two identical glass prisms are arranged together in inverted position with respect to each other and a narrow beam of white light is allowed to fall obliquely on one of the focus of the first prism.**

Ans. Refractive index of glass prism is inversely proportional to wavelength of light rays. As white light consists of coloured rays of different wavelength so they have different speeds in glass. Thus, a white light when passed through a glass prism, different constituent coloured ray get refracted through different angle and deviate from their path to cause dispersion.



Newton took two identical glass prism and placed them in such a way that one is inverted with respect to other when a white light is passed through one prism, it dispersed into seven colours. Which again merged to form white light after passing through second inverted prism.

Examination Papers, 2016
[All India Set-I, II, III]

Time Allowed: **3 Hours**] [Maximum Marks: **90**

General Instructions:

(*i*) The question paper comprises of two sections, A and B. You are to attempt both the sections.
(*ii*) All questions are compulsory.
(*iii*) There is no choice in any of the questions.
(*iv*) All questions of section A and all questions of section B are to be attempted separately.
(*v*) Question numbers 1 to 3 in section A are one-mark questions. These are to be answered in one word or in one sentence.
(*vi*) Question numbers 4 to 6 in section A are two mark questions. These are to be answered in about 30 words each.
(*vii*) Question numbers 7 to 18 in section A are three-mark questions. These are to be answered in about 50 words each.
(*viii*) Question numbers 19 to 24 in section A are five-mark questions. These are to be answered in about 70 words each.
(*ix*) Question numbers 25 to 33 in section B are multiple choice questions based on practical skills. Each question is a one-mark question. You are to select one most appropriate response out of the four provided to you.
(*x*) Question numbers 34 to 36 in Section B are two marks questions based on practical skills. These are to be answered in brief.

Set-I

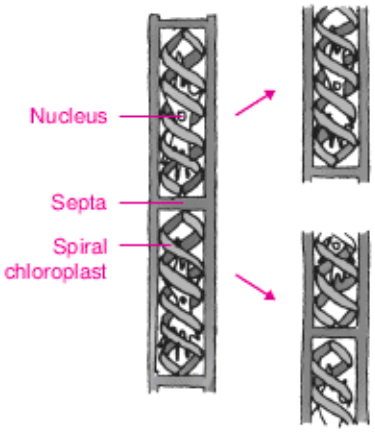
SECTION-A

1. Write the name and structure of an alcohol with three carbon atoms in its molecules.

Ans. $CH_3CH_2CH_2OH$, Propanol.

2. What happens when a mature *Spirogyra* filament attains considerable length?

Ans. When a filament of *Spirogyra* attains considerable length on maturation, it breaks into smaller fragments and each fragment then grows into a new plant. This mode of reproduction is called fragmentation.



3. The depletion of ozone layer is a cause of concern. Why?

Ans. The layer of ozone gas is what which protects us from the harmful ultraviolet radiations of the sun. The ozone layer absorbs these harmful radiations and thus prevents these rays from entering the earth's atmosphere. Exposure to these ultraviolet rays can cause skin cancer, eye damage, damage to immune system. It can also lead to difficulty in breathing, chest pain, throat irritation, etc.

4. Name the type of the mirrors used in design of solar furnaces. Explain how high temperature is achieved by this device?

Ans. A concave mirror is used in design of solar furnaces. High temperature is achieved by this device by focussing the light energy incident on the concave mirror to its focal point.

5. "What was Chipko Andolan?" How did this Andolan ultimately benefit the local people and the environment?

Ans. **Chipko Movement**

- During 1970, in Reni village of Garhwal, a contractor was allowed to cut trees in a forest near the village.
- When the contractor's workers went to the forest to cut trees the women of the village hug the tree trunks to prevent the workers from cutting trees.
- Chipko means 'hug' and the movement started by the villagers by hugging trees is called the 'Chipko Andolan'.

The movement benefitted the local population by making available the forest products. It benefitted the environment by conserving the quality of soil and sources of water thereby maintaining balance in nature.

6. "Burning of fossil fuels results in global warming." Give reasons to justify this statement.

Ans. The drastic increase in the emission of CO_2 (carbon dioxide) within the last 30 years caused by burning fossil fuels has been identified as the major reason for the change of temperature in the atmosphere.

Fossil fuels such as gasoline, methane and propane contain mostly carbon. When these fuels are burned, they react with oxygen and produce carbon dioxide. Because of our heavy use of fossil fuels, the amount of carbon dioxide in the atmosphere has been increasing since the industrial revolution The carbon dioxide absorbs heat and covers the earth surface as a blanket , which increases the temperature of the earth.

7. Write chemical equation of the reaction of ethanoic acid with the following: (*a*) Sodium; (*b*) Sodium hydroxide; (*c*) Ethanol.

Write the name of one main product of each reaction.

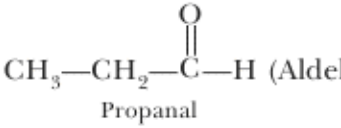
Ans. (*a*) $2CH_3COOH + 2Na \longrightarrow 2CH_3COONa + H_2$

(*b*) $CH_3COOH + NaOH \longrightarrow CH_3COONa + H_2O$

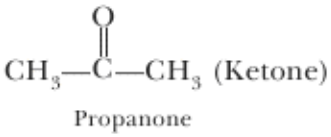
(*c*) $CH_3COOH + C_2H_5OH \xrightarrow{\text{Conc. } H_2SO_4} CH_3COOC_2H_5 + H_2O$

8. An aldehyde as well as a ketone can be represented by the same molecular formula, say C_3H_6O. Write their structures and name them. State the relation between the two in the language of science.

Ans.



Propanal (Aldehyde)



Propanone (Ketone)

They are functional isomers because they have same molecular formula but different structural formula (functional group).

9. An element 'X' belongs to 3rd period and group 16 of the Modern Periodic Table.

(*a*) Determine the number of valence electrons and the valency of 'X'.

(*b*) Molecular formula of the compound when 'X' reacts with hydrogen and write its electron dot structure.

(*c*) Name the element 'X' and state whether it is metallic or non-metallic.

Ans. (*a*) 'X' has electronic configuration 2, 8, 6 therefore it has 6 valence electrons, therefore, its valency is equal to 2.

(*b*) H^{1} X^{2-}

H_2X

(*c*) 'X' is Sulphur. It is non-metallic.

10. An element 'X' has mass number 35 and number of neutrons 18. Write atomic number and electronic configuration of 'X'. Also write group number, period number and valency of 'X'.

Ans. 'X' has mass number = 35

Number of neutrons = 18

Number of protons = Atomic number = 35 – 18 = 17

Electronic configuration 2, 8, 7

It belongs to group 17 and 3^{rd} period.

Its valency is equal to 1.

11. Define reproduction. How does it help in providing stability to the population of species?

Ans. Reproduction is the biological process by which new individual organisms, offspring are produced from their parents. Reproduction is a fundamental feature of all known life; each individual organism exists as the result of reproduction.

Every species has to constantly struggle for its survival. Natural predators and vagaries of nature keep on removing a large section of the population of a particular species. Moreover, the natural cycle of life and death also removes a section of the population. Reproduction is a way to replenish the lost section of population. Thus, it can be said that reproduction is linked to the stability of population of a species.

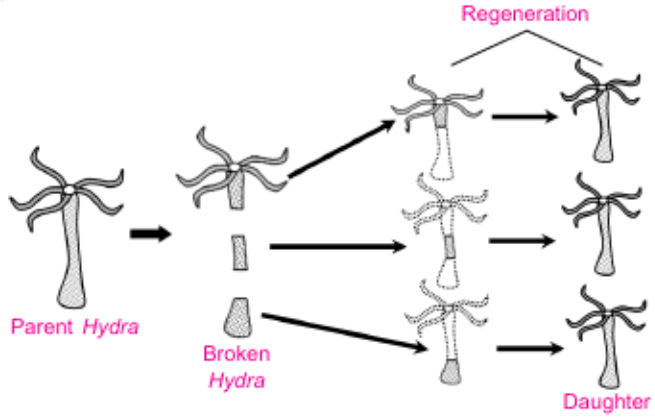
12. Explain the term "Regeneration" as used in relation to reproduction of organisms. Describe briefly how regeneration is carried out in multicellular organisms like *Hydra*.

Ans. Regeneration is the ability of organisms to generate lost or damaged body parts.

Many fully differentiated organisms show the ability of regeneration. If *Planaria* is cut into small pieces, then each piece develops into a new *Planaria*. Regeneration is carried out by specialised cells.

These cells form a mass of cells which undergo changes to form cells specialised in different functions.

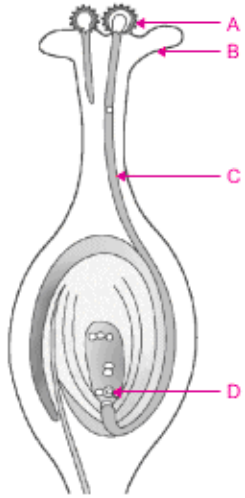
In *Hydra*, if the body is cut into half, the lower part will develop head while the upper part will develop a new foot. If its cells are separated and aggregated back, *Hydra* will reform its structure.



Regeneration in *Hydra*

13. **(*a*) List two reasons for the appearance of variations among the progeny formed by sexual reproduction.**

(*b*)



(*i*) Name the part marked 'A' in the diagram.

(*ii*) How does 'A' reaches part 'B'?

(*iii*) State the importance of the part 'C'.

(*iv*) What happens to the part marked 'D' after fertilisation is over?

Ans. (*a*) (*i*) Crossing over between two chromosomes during meiosis in the process of gametes formation is a major reason for variation.

(*ii*) Genetic material coming from two parents in the offspring cause variation.

(*b*) (*i*) Pollen grain.

(*ii*) By wind, animals, etc.

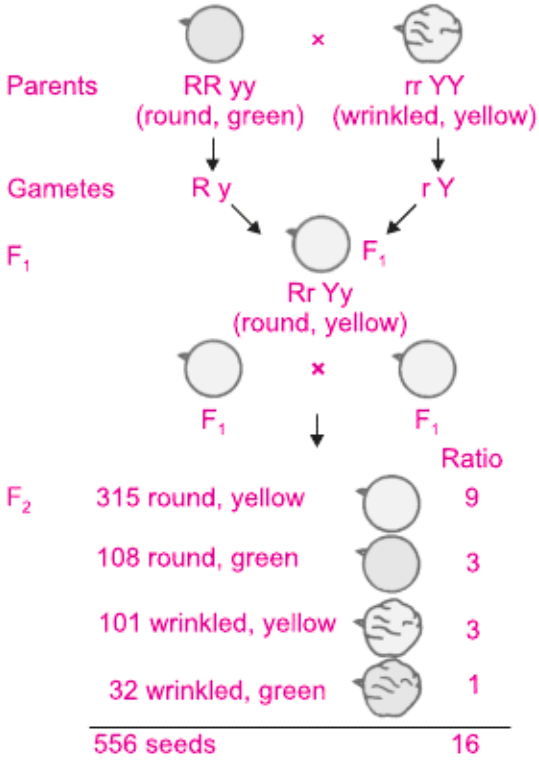
(*iii*) Pollen tube carries the pollens to the ovary.

(*iv*) After fertilization, the zygote formed and changes into a fruit.

14. How do Mendel's experiment show that traits are inherited independently?

Ans. Mendel cross-bred pea plants showing two different characteristics, rather than just one. When he cross-bred pea plants of round green seeds with wrinkled yellow seeds, he got F_1 generation with all such seeds which were yellow and round. So, it was concluded that round and yellow character of seeds were dominant traits in the pea plant.

When plants from seeds of F_1 generation were cross-bred by self pollination to get the seeds of F_2 generation, found different combination of characters in these seeds. The seeds were round-yellow, round-green, wrinkled-yellow and wrinkled-green seeds. Round seeds with yellow colour were more dominating. Also there were few wrinkled green seeds. So, traits of two different characters were inherited independent of each other and made new combination characteristics independent of their previous combinations.



Independent inheritance of two separate traits, shape and colour of seeds.

The ratio of his F_2 generation was:

9 : 3 : 3 : 1

9 Round yellow (both dominating traits)

3 Round green

3 Wrinkled yellow

1 Wrinkled green (both recessive traits)

15. "Two areas of study namely 'evolution' and 'classification' are interlinked." Justify this statement.

Ans. Every species or organism has inbuilt tendency for genetic variation which plays an important role in the origin of new species and forms the basis for evolution. Organisms appear to be same because of similarity in their inherited body designs. Classification of organisms necessarily involves organizing them in different groups, based on the similarities and differences of characteristics. Classifying organisms helps us in recognizing the basic arrangement of a hierarchical structure among diverse species. It tells us about the resemblances and relationships between various organisms thus facilitating studies or research of wide variety associated with organisms effortlessly. In fact, classification of species is a reflection of their evolutionary relationship. Thus, we can say the areas of study evolution and classification interlinked.

16. The image of an object formed by a mirror is real, inverted and is of magnification –1. If the image is at a distance of 40 cm from the mirror, where is the object placed? Where would the image be if the object is moved 20 cm towards the mirror? State reason and also draw ray diagram for the new position of the object to justify your answer.

Ans. Given: Magnification of spherical mirror, $m = -1$, Image distance, $v = -40$ cm

$$m = -\frac{v}{u} \Rightarrow u = -\frac{v}{m} = -\frac{-40}{-1} = -40 \text{ cm}$$

Therefore, the object is placed at a distance of 40 cm in front of the spherical mirror.

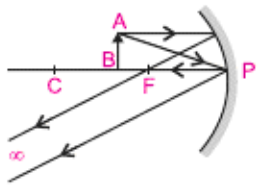
Case I: when $u = -40$ cm and $v = -40$ cm

Using mirror formula, we get

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u} \Rightarrow \frac{1}{f} = \frac{1}{-40} + \frac{1}{-40} = -\frac{2}{40} \Rightarrow f = -\frac{40}{2} = -20 \text{ cm}$$

Hence, the focal length of the mirror is 20 cm and the negative focal length shows that it is a concave mirror.

The new position of the object when it moves 20 cm towards the concave mirror, $u' = -(40 - 20) = -20$ cm.



Case II: $u' = -20$ cm, $f = -20$ cm, $v' = ?$

Using mirror formula, $\frac{1}{f} = \frac{1}{v'} + \frac{1}{u'}$

$$\Rightarrow \quad \frac{1}{-20} = \frac{1}{v'} + \frac{1}{-20} \Rightarrow \frac{1}{v'} = -\frac{1}{20} + \frac{1}{20} = -\left(\frac{1}{20} - \frac{1}{20}\right) = -\frac{0}{20}$$

$$\Rightarrow \quad v' = -\frac{20}{0} = \infty \text{ (infinity)}$$

Thus, the image is formed at infinity.

Hence, when the object is moved 20 cm towards the mirror, a real, inverted and highly enlarged image is formed at infinity.

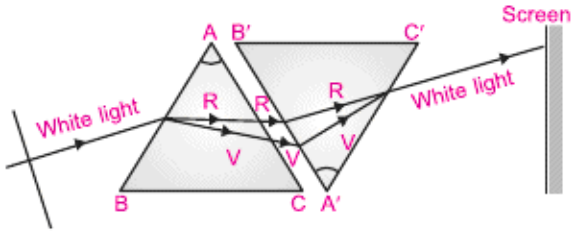
17. Describe an activity to show that the colours of white light splitted by a glass prism can be recombined to get white light by another identical glass prism. Also draw ray diagram to show the recombination of the spectrum of white light.

Ans. The colours of white light splitted by a glass prism can be recombined to get white light by another identical glass prism.

Newton demonstrated this phenomenon of recombination of the coloured rays of a spectrum to get back white light.

(*i*) A triangular prism *ABC* is placed on its base *BC*.

(*ii*) A similar prism *A'B'C'* is placed alongside with its refracting surface in the opposite direction, i.e. in an inverted position with respect to the first prism as shown in the figure.



(*iii*) A beam of white light entering the prism *ABC* undergoes refraction and is dispersed into its constituent seven colours.

(*iv*) The constituent seven colour rays are incident on the second inverted prism *A'B'C'* and get further refracted.

(*v*) The second prism recombines them into a beam of white light and emerges from the other side of the second prism and falls on a screen.

(*vi*) This is due to the fact that the refraction or bending produced by the second inverted prism is equal and opposite to the refraction or bending produced by the first prism. This causes the seven colours to recombine.

(*vii*) A white patch or spot of light is formed on the screen placed beyond the second prism.

This proves the phenomenon of the recombination of spectrum of white light.

18. The activities of man had adverse effects on all forms of living organisms in the biosphere. Unlimited exploitation of nature by man disturbed the delicate ecological balance between the living and non-living components of the biosphere. The unfavourable conditions created by man himself threatened the survival not only of himself but also of the entire living organisms on the mother earth. One of your classmates is an active member of 'Eco club' of your school which is creating environmental awareness amongst the school students, spreading the same in the society and also working hard for preventing environmental degradation of the surroundings.

(*a*) Why is it necessary to conserve our environment?

(*b*) State the importance of green and blue dust-bins in the safe disposal of the household waste.

(*c*) List two values exhibited by your classmate who is an active member of Eco-club of your school.

Ans. (*a*) Conservation of environment is required for preventing damage to environment and depletion of natural resources.

(*b*) Segregation of biodegradable and non-biodegradable wastes is very important to make it easy for disposal of wastes. Wastes can be segregated and recycled or broken down into simpler substances.

(*c*) Concern for the environment and creating awareness among his friends and colleagues.

19. A carbon compound 'P' on heating with excess conc. H_2SO_4 forms another carbon compound 'Q' which on addition of hydrogen in the presence of nickel catalyst forms a saturated carbon compound 'R'. One molecule of 'R' on combustion forms two molecules of carbon dioxide and three molecules of water. Identify P, Q and R and write chemical equations for the reactions involved.

Ans. $\underset{\text{Ethanol}}{\underset{\text{'P'}}{CH_3CH_2OH}} \xrightarrow{\text{Conc. } H_2SO_4} \underset{\text{Ethene}}{\underset{\text{'Q'}}{CH_2{=}CH_2}} + H_2O$

$\underset{\text{Ethene}}{\underset{\text{'Q'}}{CH_2{=}CH_2}} + H_2 \xrightarrow{Ni} \underset{\text{Ethane}}{\underset{\text{'R'}}{CH_3{-}CH_3}}$

$\underset{\text{'R'}}{C_2H_6} + \frac{7}{2}O_2 \longrightarrow 2\underset{\text{Carbon dioxide}}{CO_2(g)} + 3\underset{\text{Water}}{H_2O(l)}$

'P' is ethanol (C_2H_5—OH) 'Q' is ethene ($CH_2{=}CH_2$), 'R' is ethane (C_2H_6).

20. What is placenta? Describe its structure. State its functions in case of a pregnant human female.

Ans. Placenta is a special tissue that develops between the uterine wall and the embryo (foetus). This eventually grows into a flat disc–shaped structure covering part of the uterine wall.

Functions: The role of placenta in human female is as follows:

(*i*) During pregnancy, placenta attaches the foetus to uterine wall.

(*ii*) It possesses villi that increases the surface area for fixation and absorption.

(*iii*) It facilitates the passage of nutrition and oxygen to embryo from mother through blood.

(*iv*) Waste substances produced by embryo (foetus) are removed through placenta into mother's blood.

21. Define evolution. How does it occur? Describe how fossils provide us evidences in support of evolutions.

Ans. Evolution is the gradual change in a species genetic make-up that allows it to adapt to its surroundings better than others. Individuals with this beneficial mutation will have a better chance of surviving to pass on their genes. This is known as "survival of the fittest". Evolution happens when there is a genetic mutation. We get 50% of our genetic characteristics from each parent. These then combine during meiosis but with some alteration. This changes how the genes are expressed.

Evolution occurs when there is a genetic change from one generation to the other. It is a sudden change or a gradual change in the genetic make-up resulting in new species and varieties. When the new species evolved fails to survive in the present environmental condition, this may lead to its extinction. That is why it is called "survival of the fittest" by Charles Darwin.

One of the evidence for evolution is from the fossil.

Fossils:

Fossils are the preserved structures of dead organisms that existed in the past. The dead organism's structures could not be decayed by microorganisms and they got hardened. Fossils also provide a record of how plants and animals have developed from simple organisms to complex form and also provides proof of existence of life on earth billions of years ago. The study of fossils is called palaeontology and therefore, fossils are also palaeontological evidences.

Fossils show evidences of evolution by:

(*i*) species sharing similarities and having common ancestry.

(*ii*) progressions of species from time to time.

(*iii*) historical records of some species that have changed over time.

22. It is desired to obtain an erect image of an object, using concave mirror of focal length of 12 cm.

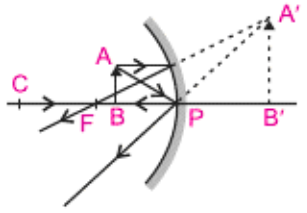
(*i*) What should be the range of distance of an object placed in front of the mirror?

(*ii*) Will the image be smaller or larger than the object. Draw ray diagram to show the formation of image in this case.

(*iii*) Where will the image of this object be, if it is placed 24 cm in front of the mirror? Draw ray diagram for this situation also to justify your answer.

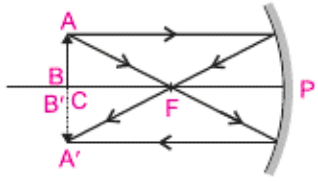
Show the positions of pole, principal focus and the centre of curvature in the above ray diagrams.

Ans. (*i*) To obtain an erect image of an object, using concave mirror of focal length of 12 cm, the object should be placed at a distance less than its focal length, i.e. 12 cm.



(*ii*) The obtained image will be larger than the object and the formation of image in this case is shown.

(*iii*) If object is placed at C (= 24 cm) in front of the concave mirror of focal length of 12 cm, then a real, inverted and same size image as that of object is formed at C. For this situation, the diagram is shown.



23. (*a*) Define optical centre of a spherical lens.

(*b*) A divergent lens has a focal length of 20 cm. At what distance should an object of height 4 cm from the optical centre of the lens be placed so that its image is formed 10 cm away from the lens. Find the size of the image also.

(*c*) Draw a ray diagram to show the formation of image in above situation.

Ans. (*a*) **Optical centre:** The central point 'O' on the principal axis of a spherical lens, through which an incident ray of light passes (refracted) without suffering any deviation is called optical centre of the spherical lens.

(*b*) Given: $f = -20$ cm, $h_o = 4$ cm, $v = -10$ cm

Using lens formula,

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

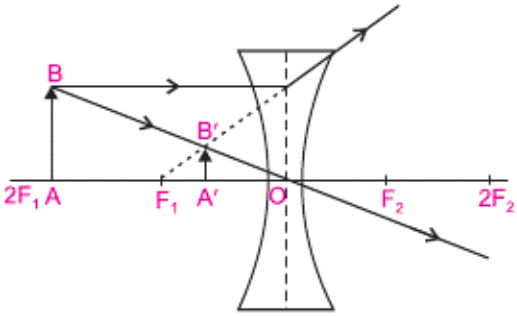
$$\Rightarrow \quad \frac{1}{u} = \frac{1}{v} - \frac{1}{f} \Rightarrow \frac{1}{-10} - \frac{1}{-20} = -\frac{1}{20} \quad \Rightarrow u = -20 \text{ cm}$$

Magnification produced by lens is given by

$$m = \frac{h_i}{h_o} = \frac{v}{u}, \text{ we get } h_i = \frac{v}{u} \times h_o = \frac{-10}{-20} \times 4 = +2 \text{ cm}$$

Therefore, a diminished image is formed and its size is 2 cm.

(*c*)



24. What is atmospheric refraction? Use this phenomenon to explain the following natural events.

(*a*) Twinkling of stars

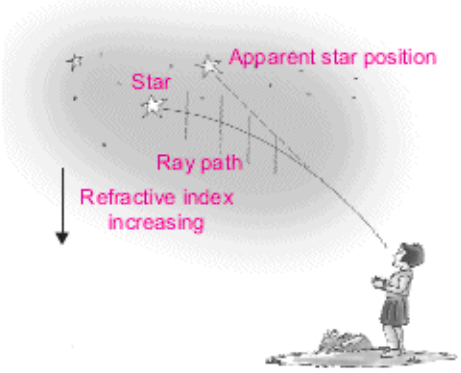
(*b*) Advanced sunrise and delayed sunset.

Draw diagrams to illustrate your answers.

Ans. **Atmospheric Refraction:** The refraction of light caused by the earth's atmosphere due to the gradual change in the refractive indices of its different layers due to the varying conditions of it, is called atmospheric refraction.

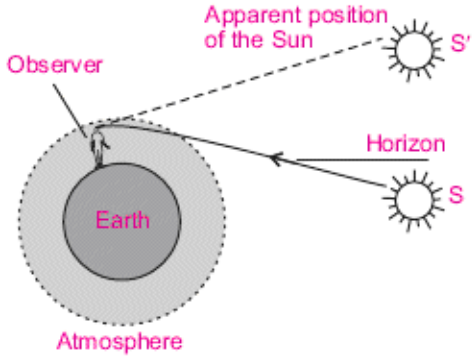
(*a*) **Twinkling of stars:** The hot layers (low densities) of air at a high altitude behave as an optically rarer medium for the rays, whereas the cold dense layers (high densities) of air, near the earth surface, behave as an optically denser medium for the light rays. So when the light rays (starlight) passing through the various layers of atmosphere, they get deviated and bend toward the normal. As a result, the apparent position of a star is slightly different from its actual position. Thus, the star appears slightly higher (above) than its actual position in the sky. The fluctuation in the position of the star occurs

continuously due to the changing amount of light entering into the eye. The star sometimes appears brighter and at some other times, it appears fainter. This causes the twinkling of stars.



(*b*) **Advanced sunrise:** The advance sunrise is due to atmospheric refraction. This can be explained as below:

The figure shows the actual position of the sun (S) at the time of sunrise, just below the horizon and its apparent position (S′), just above the horizon, appears to us.



Atmospheric refraction effects at sunset or sunrise

When the sun is slightly below the horizon, the light rays move through the varying refractive indices of different layers of the air, get bent towards the normal and appear to come from S′, which is the apparent position of the sun. That is why, the sun is visible to us when it has been actually risen. So, due to atmospheric refraction, the phenomenon of advance sunrise is observed.

Delayed sunset: The delayed sunset is due to atmospheric refraction. This can be explained as below:

The above figure in case (*b*) shows the actual position of sun (S) at the time of sunset, just below the horizon and its apparent position S′, just above the horizon appears to us.

After the sunset, when the sun is slightly below the horizon, the light rays move through the varying refractive indices of different layers of the air, get bent towards the normal and appear to come from S′, which is the apparent position of the sun. That is why, the sun is visible to us when it is actually set. So, due to atmospheric refraction, the phenomenon of delayed sunset is observed.

SECTION-B

25. A student puts a drop of reaction mixture of a saponification reaction first on a blue litmus paper and then on a red litmus paper. He may observe that:

(*a*) There is no change in the blue litmus paper and the red litmus paper turns white.

(*b*) There is no change in the red litmus paper and the blue litmus paper turns red.

(*c*) There is no change in the blue litmus paper and the red litmus paper turns blue.

(*d*) No change in colour is observed in both the litmus papers.

Ans. (*c*) Basic solution turns red litmus blue but there is no effect on blue litmus.

26. For preparing soap in the laboratory we require an oil and a base. Which of the following combinations of an oil and a base would be best suited for the preparation of soap?

(*a*) Castor oil and calcium hydroxide

(*b*) Turpentine oil and sodium hydroxide

(*c*) Castor oil and sodium hydroxide

(*d*) Mustard oil and calcium hydroxide

Ans. (*c*) Castor oil will react with NaOH to form soap.

27. In the neighbourhood of your school, hard water required for an experiment is not available. Select from the following groups of salts available in your school, a group each member of which, if dissolved in distilled water, will make it hard:

(*a*) Sodium chloride, calcium chloride

(*b*) **Potassium chloride, sodium chloride**

(*c*) **Sodium chloride, magnesium chloride**

(*d*) **Calcium chloride, magnesium chloride**

Ans. (*d*) $CaCl_2$ and $MgCl_2$ will give hard water.

28. **A student while observing an embryo of a pea seed in the laboratory listed various parts of the embryo as given below:**

Testa, Tegmen, Radicle, Plumule, Micropyle, Cotyledon.

On examining the list the teacher remarked that only three parts are correct. Select three correct parts from the above list:

(*a*) **Testa, Radicle, Cotyledon** (*b*) **Tegmen, Radicle, Micropyle**

(*c*) **Cotyledon, Plumule, Testa** (*d*) **Radicle, Cotyledon, Plumule**

Ans. (*d*)

29. **If you are asked to select a group of two vegetables, out of the following, having homologous structures which one would you select?**

(*a*) **Carrot and radish** (*b*) **Potato and sweet potato**

(*c*) **Potato and tomato** (*d*) **Lady finger and potato**

Ans. (*a*)

30. **To determine the approximate value of the focal length of a given concave mirror, you focus the image of a distant object formed by the mirror on a screen. The image obtained on the screen, as compared to the object is always:**

(*a*) **Laterally inverted and diminished**

(*b*) **Inverted and diminished**

(*c*) **Erect and diminished**

(*d*) **Erect and highly diminished**

Ans. (*b*) Inverted and diminished image is formed by the concave mirror on a screen.

31. **Suppose you have focused on a screen the image of candle flame placed at the farthest end of the laboratory table using a convex lens. If your teacher suggests you to focus the parallel rays of the sun, reaching your laboratory table, on the same screen, what you are expected to do is to move the:**

(*a*) **lens slightly towards the screen**

(*b*) **lens slightly away from the screen**

(*c*) **lens slightly towards the sun**

(*d*) **lens and screen both towards the sun**

Ans. (*a*) In order to focus the parallel rays coming from sun on the same screen, we must move the lens towards the screen because, Sun will be considered at infinity, the image formed by the lens is exactly at its focus.

32. In your laboratory you trace the path of light rays through a glass slab for different values of angle of incidence ($\angle i$) and in each case measure the values of the corresponding angle of refraction ($\angle r$) and angle of emergence ($\angle e$). On the basis of your observations your correct conclusion is

(*a*) $\angle i$ is more than $\angle r$, but nearly equal to $\angle e$

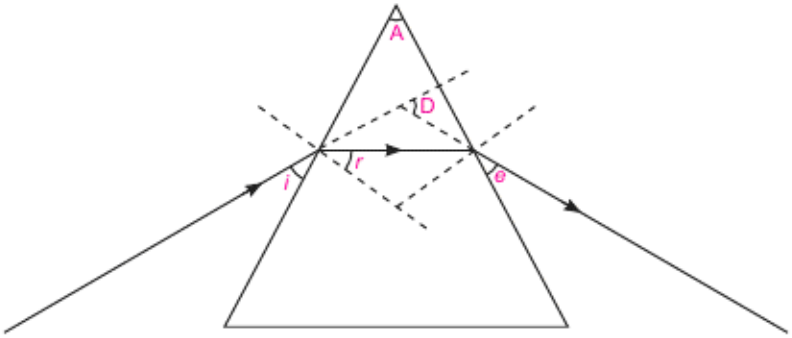
(*b*) $\angle i$ is less than $\angle r$, but nearly equal to $\angle e$

(*c*) $\angle i$ is more than $\angle e$, but nearly equal to $\angle r$

(*d*) $\angle i$ is less than $\angle e$, but nearly equal to $\angle r$

Ans. (*a*) At the rarer-denser interface, the angle of refraction is always less than the angle of incidence, i.e. $\angle i > \angle r$ and due to parallel surface, $\angle i = \angle e$.

33. In the following ray diagram the correctly marked angle are:



(*a*) $\angle i$ and $\angle e$ **(*b*) $\angle A$ and $\angle D$**

(*c*) $\angle i$, $\angle e$ and $\angle D$ **(*d*) $\angle r$, $\angle A$ and $\angle D$**

Ans. (*d*) Only angle of prism $\angle A$, angle of refraction $\angle r$ and angle of deviation $\angle D$ are correclty marked in the given figure.

34. A student adds a spoon full of powdered sodium hydrogen carbonate to a flask containing ethanoic acid. List two main observations, he must note in his note book, about the reaction that takes place. Also write chemical equation for the reaction.

Ans. (*i*) Brisk effervescence are observed.

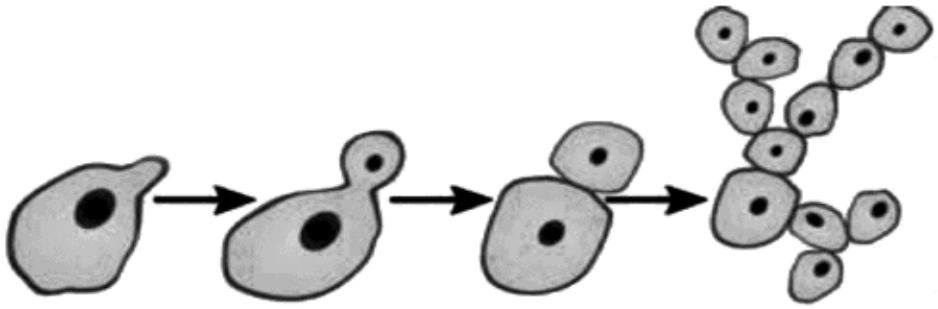
(*ii*) Colourless, odourless gas is evolved which turns lime water milky.

$CH_3COOH + NaHCO_3 \longrightarrow CH_3COONa + H_2O + CO_2$

$Ca(OH)_2 + CO_3 \longrightarrow CaCO_3 + H_2O$

35. A student is observing a permanent slide showing sequentially the different stages of asexual reproduction taking place in yeast. Name this process and draw diagrams, of what he observes, in a proper sequence.

Ans.



Bud begins to form on parent cell. | Nucleus copies and divides. The bud receives a copy. | Bud now becomes a separate daughter cell. | Budding produces chains of cells.

36. An object of height 2.5 cm is placed at a distance of 15 cm from the optical centre 'O' of a convex lens of focal length 10 cm. Draw a ray diagram to find the position and size of the image formed. Mark optical centre 'O', principal focus F and height of the image on the diagram.

Ans. Using lens formula,

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

$$\Rightarrow \quad \frac{1}{+10} = \frac{1}{v} - \frac{1}{-15}$$

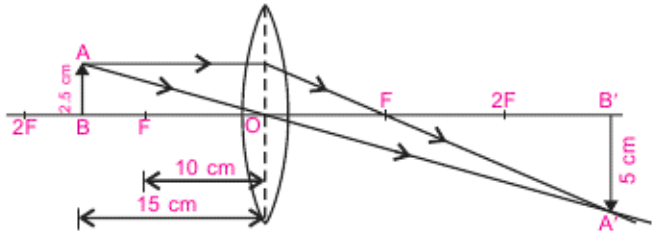
$$\Rightarrow \quad \frac{1}{v} = \frac{1}{10} - \frac{1}{15} = \frac{3-2}{30} = \frac{1}{30}$$

$$\Rightarrow \quad v = +\ 30 \text{ cm.}$$

Also, magnification, $m = \frac{v}{u} = \frac{h_2}{h_1}$

$$\Rightarrow \quad \frac{30}{-15} = \frac{h_2}{2.5}$$

$$\Rightarrow \quad h_2 = -\ 5.0 \text{ cm.}$$



In diagram, AB = 2.5 cm = height of object

OB = 15 cm = object distance

O = optical centre

A′B′ = 5 cm = height of image

Set-II (*Uncommon Questions to Set-I*)

1. Write the name and structure of an alcohol with four carbon atoms in its molecule.

Ans. $CH_3CH_2CH_2CH_2OH$, Butanol

2. What are those organisms called which bear both the sex organs in the same individual? Give one example of such organism.

Ans. These organisms are called hermaphrodites, e.g. earthworms and leech.

3. Write one negative effect, on the environment, of affluent life style of few persons of a society.

Ans. One negative effect of our affluent life style on the environment is Global Warming.

4. "The magnification produced by a spherical mirror is – 3". List four informations you obtain from this statement about the mirror/image.

Ans. (*i*) Concave mirror
(*ii*) Real image
(*iii*) Inverted and
(*iv*) Three times magnified image is formed.

5. Forests are "biodiversity hot spots". Justify this statement.

Ans. A large number of life forms such as bacteria, insects, birds, reptiles, mammals, etc., are found in a forest. It is a region with large biodiversity of endangered species, many of them being highly endemic and such regions being subjected to large scale destruction are designated as "hot spots" by ecologists.

6. What is water harvesting? How can this technique help in the conservation of water?

Ans. Catching and storing water for future use when it is available like capturing rain water from a roof top or from runoff.
This technique is quite helpful as:
(*a*) Reduces demand on ground water.
(*b*) Reduces floods and soil erosion.

7. On dropping a small piece of sodium in a test tube containing carbon compound 'X' With molecular formula C_2H_6O, a brisk effervescence is observed and a gas 'Y' is produced, On bringing a burning splinter at the mouth of the test tube the gas evolved burns with a pop sound. Identify 'X' and 'Y'. Also write the chemical equation for the reaction. Write the name and structure of the product formed, when you heat 'X' with excess conc. sulphuric acid.

Ans. 'X' is C_2H_5OH

$$2C_2H_5OH + 2Na \longrightarrow 2C_2H_5ONa + H_2$$

'X' — Sodium — 'Y'

Ethanol — Sodium — Ethoxide — Hydrogen

'Y' is $H_2(g)$ which burns with 'pop' sound.

$$CH_3CH_2OH \xrightarrow[\text{Heat}]{\text{Conc } H_2SO_4} CH_2{=}CH_2 + H_2O$$

Ethanol ('X') — Ethene — Water

10. Three elements 'X', 'Y' and 'Z' have atomic numbers 7, 8 and 9 respectively.

(*a*) State their positions (Group number and period number both) in the Modern Periodic Table.

(*b*) Arrange these elements in the decreasing order of their atomic radii.

(*c*) Write the formula of the compound formed when 'X' combines with 'Z'.

Ans. (*a*) X, Y, Z belong to Group 15, 16 and 17 respectively. They belong to same period.

(*b*) X > Y > Z is decreasing order of their atomic radii.

(*c*) X^3 Z^1

XZ_3

$\Rightarrow XZ_3$ is formula of compound formed.

12. In the context of reproduction of species state the main difference between fission and fragmentation. Also give one example of each.

Ans.

Fission	Fragmentation
1. It occurs in unicellular organisms.	1. It occurs in multicellular organisms.
2. The cells splits into 2 or more cells, giving rise to daughter cells.	2. The body of the organism simply breaks into smaller pieces upon maturation. These pieces grow into new individuals.
e.g. *Amoeba*	e.g. *Spirogyra*

15. With the help of an example justify the following statement:

"A trait may be inherited, but may not expressed".

Ans. Yes, it is possible that a trait is inherited but not expressed.

Example: When pure tall pea plants are crossed with pure dwarf pea plants, only tall pea plants are obtained in F_1 generation. On selfing, tall plants of F_1 generation, both tall and dwarf plants are obtained in F_2 generation in the ratio 3:1. Reappearance of the dwarf character, a recessive trait in F_2 generation shows that the dwarf trait/character was present in individuals of F_1 but it did not express (due to the presence of tallness, a dominant trait/character).

16. The image of an object formed by a lens is of magnification–1. If the distance between the object and its image is 60 cm, what is the focal lengh of the lens? If the object is moved 20 cm towards the lens, where would the image be formed? State reason and also draw a ray diagram in support of your answer.

Ans. The image of an object formed by a lens is of magnification–1. It shows that image is inverted and of the same size.

As $m = -1$ hence, the lens is convex

$$m = \frac{v}{u} \quad \therefore \; v = -u$$

Thus, object is at 2F.

Thus, when the object is at 2F and the image is also formed at 2F on the other side of the lens. Therefore, distance between the object and its image is $4f$ which is equal to 60 cm (given).

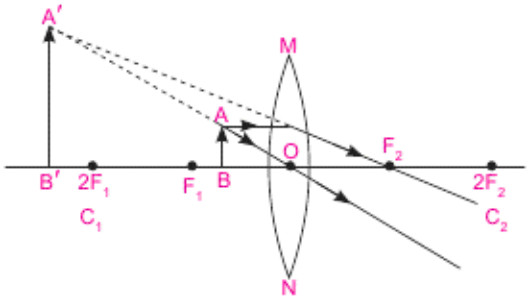
i.e., $4f = 60$ cm

or $f = 15$ cm.

Object distance $2f = 30$ cm.

Now, if the object is shifted towards the lens by 20 cm,

the new object distance, $u = 30$ cm $- 20$ cm $= 10$ cm. This distance is less than the focal length of the convex lens, and therefore, the image formed in this case would be virtual, erect and will form on the same side as the object.



19. (*a*) Define focal length of a spherical lens.

(*b*) A divergent lens has a focal length of 30 cm. At what distance should an object of height 5cm from the optical centre of the lens be placed so that its image is formed 15 cm away from the lens? Find the size of the image also.

(*c*) Draw a ray diagram to show the formation of image in the above situation.

Ans. (*a*) **Focal length of spherical lens:** Distance between optical centre and focus is known as focal length of spherical lens.

(*b*) $f = -30$ cm, $h_o = 5$ cm, $v = -15$ cm, $h_i = ?$

Focal length of concave lens is

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u} \Rightarrow \frac{1}{u} = \frac{1}{v} - \frac{1}{f} = \frac{1}{-15} - \frac{1}{-30} = -\frac{1}{30}$$

$$\Rightarrow \quad u = -30 \text{ cm}$$

$$m = \frac{h_i}{h_o} = \frac{v}{u}$$

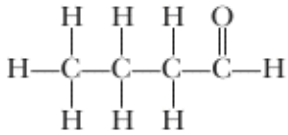
Using, $$h_i = \frac{v}{u} \times h_o = \frac{-15}{-30} \times 5 = +2.5 \text{ cm}$$

Therefore, diminished image is formed and its size is 2.5 cm

Set-III (*Uncommon Questions to Set-I and Set-II*)

1. Write the name and structure of an aldehyde with four carbon atoms in its molecule.

Ans. Butanal,



2. List two functions of ovary of human female reproductive system.

Ans. The ovaries have two main reproductive functions in the body. They produce oocytes (eggs) for fertilisation and also produce the reproductive hormones, oestrogen and progesterone.

3. In a food chain of frog, grass, insect and snake, assign trophic level to frog.

Ans. Secondary consumer.

4. The refractive indices of glass and water with respect to air are 3/2 and 4/3 respectively. If speed of light in glass is 2×10^8 m/s, find the speed of light in water.

Ans. Given: $n_g = \frac{3}{2}, n_w = \frac{4}{3}, v_g = 2 \times 10^8$ m/s

We know that $$n_w = \frac{\text{Speed of light in vacuum}}{\text{Speed of light in water}}$$

$$\frac{4}{3} = \frac{3 \times 10^8}{v_w} \Rightarrow v_w = \frac{9}{4} \times 10^8 = 2.25 \times 10^8 \text{ ms}^{-1}$$

5. List four stakeholders which may be helpful in the conservation of forests.

Ans. The conservation of forests depend on various stakeholders. These are as following:

(*i*) People who live in and around forests.

(*ii*) Forest department of the government.

(*iii*) Industrialist.

(*iv*) Wildlife and nature enthusiasts.

6. The construction of large dams leads to social and environmental problems. List two problems of each category.

Ans. 1. Social problems:

(*a*) adequate rehabilitation

(*b*) compensation to the displaced.

2. Environmental problems:

(*a*) afforestation

(*b*) soil cover to prevent erosion.

7. The position of eight elements in the Modern Periodic Table is given below where atomic numbers of elements are given in the parenthesis.

Period No.		
2	Li (3)	Be (4)
3	Na (11)	Mg (12)
4	K (19)	Ca (20)
5	Rb (37)	Sr (38)

(*i*) Write the electronic configuration of Ca.

(*ii*) Predict the number of valence electrons in Rb.

(*iii*) What is the number of shells in Sr?

(*iv*) Predict whether K is a metal or a non-metal.

(*v*) Which one of these elements has the largest atom in size?

(*vi*) Arrange Be, Ca, Mg and Rb in the increasing order of the size of their respective atoms.

Ans. (*i*) 2, 8, 8, 2.

(*ii*) It has one valence electron.

(*iii*) 2, 8, 18, 8, 2. It has five shells.

(*iv*) 'K' is a metal.

(*v*) Rubidium is largest atom in size.

(*vi*) Be < Mg < Ca < Rb is increasing order of atomic size.

8. Write three different chemical reactions showing the conversion of ethanoic acid to sodium ethanoate. Write balanced chemical equation in each case. Write the name of the reactants and the products other than ethanoic acid and sodium ethanoate in each case.

Ans. (*i*) $2CH_3COOH + 2Na \longrightarrow 2CH_3COONa + H_2$

Sodium — Hydrogen

(*ii*) $CH_3COOH + NaOH \longrightarrow CH_3COONa + H_2O$

Sodium hydroxide — Water

(*iii*) $CH_3COOH + NaHCO_3 \longrightarrow CH_3COONa + H_2O + CO_2$

Sodium hydrogen carbonate — Water — Carbon dioxide

9. An element 'X' belong to 3rd period and group 13 of the Modern Periodic Table.

(*a*) Determine the valence electrons and the valency of 'X'.

(*b*) Molecular formula of the compound formed when 'X' reacts with an element 'Y' (atomic number = 8).

(*c*) Write the name and formula of the compound formed when 'X' combines with chlorine.

Ans. (*a*) As 'X' has 3 valence electrons. 'X' has valency equal to 3. It is aluminium.

(*b*) X^3 Y^2 or Al_2O_3

X_2Y_3 is formula of compound formed or Al_2O_3

(*c*) XCl_3, Aluminium chloride ($AlCl_3$)

17. The image formed by a spherical mirror is real, inverted and is of magnification–2. If the image is at a distance of 30 cm from the mirror, where is the object placed? Find the focal length of the mirror. List two characteristics of the image formed if the object is moved 10 cm towards the mirror.

Ans. Given: Magnification of spherical mirror = –2, Image distance, v = –30 cm

Magnification: $m = -\frac{v}{u}$

$$u = -\frac{v}{m} = -\frac{-30}{-2} = -15\,\text{cm}$$

Therefore, object is placed at a distance of 15 cm in front of the spherical mirror.

Focal length of the mirror is given by

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u} \Rightarrow \frac{1}{f} = \frac{1}{-30} + \frac{1}{-15} = -\frac{3}{30}$$

$$f = -\frac{30}{3} = -10 \text{ cm}$$

If the object is shifted 10 cm towards the mirror, new position of the object is $u' = -15 - (-10) = -5$ cm

It means object is now placed between pole and focus and hence, the characteristics of the image formed is

(*i*) Virtual

(*ii*) Erect

(*iii*) Magnified (*any two*)

24. (*a*) Define focal length of a divergent lens.

(*b*) A divergent lens of focal length 30 cm forms the image of an object of size 6 cm on the same side as the object at a distance of 15 cm from its optical centre. Use lens formula to determine the distance of the object from the lens and the size of the image formed.

(*c*) Draw a ray diagram to show the formation of image in the above situation.

Ans. (*a*) **Focal length of a divergent lens:** When a parallel beam of light is incident on either of the spherical surface of a divergent lens, i.e. concave lens, after refraction through it, it appears to come from a fixed point on the principal axis. This point is called the principal focus of a concave lens. The distance of the principal focus from the optical centre of the divergent lens is called the focal length '*f*' of the lens.

(*b*) Given: $f = -30$ cm, $h_o = 6$ cm, $v = -15$ cm

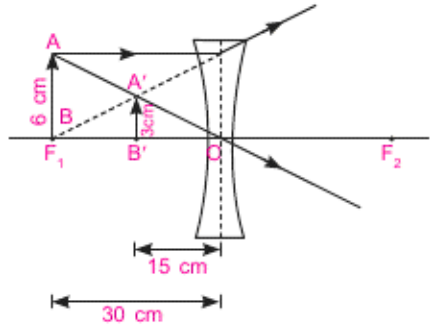
Focal length of concave lens is given by

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u} \Rightarrow \frac{1}{u} = \frac{1}{v} - \frac{1}{f} = \frac{1}{-15} - \frac{1}{-30} = -\frac{1}{30} \Rightarrow u = -30 \text{ cm}$$

Using the formula, $m = \frac{h_i}{h_o} = \frac{v}{u}$ we get $h_i = \frac{v}{u} \times h_o = \frac{-15}{-30} \times 6 = +3$ cm

Therefore, a diminished image is formed and its size is 3 cm.

(*c*)



Examination Papers, 2016
[Foreign Set-I, II, III]

Time Allowed: **3 Hours**] [Maximum Marks: **90**

General Instructions:

(*i*) The question paper comprises of two sections, A and B. You are to attempt both the sections.
(*ii*) All questions are compulsory.
(*iii*) There is no choice in any of the questions.
(*iv*) All questions of section A and all questions of section B are to be attempted separately.
(*v*) Question numbers 1 to 3 in section A are one-mark questions. These are to be answered in one word or in one sentence.
(*vi*) Question numbers 4 to 6 in section A are two mark questions. These are to be answered in about 30 words each.
(*vii*) Question numbers 7 to 18 in section A are three-mark questions. These are to be answered in about 50 words each.
(*viii*) Question numbers 19 to 24 in section A are five-mark questions. These are to be answered in about 70 words each.
(*ix*) Question numbers 25 to 33 in section B are multiple choice questions based on practical skills. Each question is a one-mark question. You are to select one most appropriate response out of the four provided to you.
(*x*) Question numbers 34 to 36 in Section B are two marks questions based on practical skills. These are to be answered in brief.

Set-I

SECTION-A

1. Which element exhibits the property of catenation to maximum extent and why?

Ans. Carbon because it forms strong covalent bond.

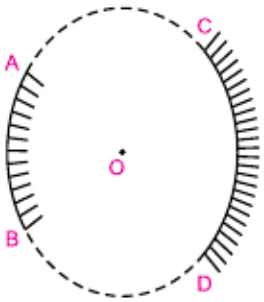
2. Name the method by which *Hydra* reproduces. Is this method sexual or asexual?

Ans. *Hydra* reproduces by the method of budding. This is an asexual method of reproduction.

3. We often use the word environment. What does it mean?

Ans. All of the physical, chemical, and biological conditions that together act on an organism or an ecological community and influence its growth and development. Soil, air, water, climate, plant and animal life, noise level, and pollution are all components of an environment.

4. AB and CD, two spherical mirrors, form parts of a hollow spherical ball with its centre at O as shown in the diagram. If arc AB = $\frac{1}{2}$ arc CD, what is the ratio of their focal lengths? State which of the two mirrors will always form virtual image of an object placed in front of it and why.



Ans. The focal length of a spherical mirror depends only on the radius of curvature of the hollow sphere of which the mirror is a part (f = R/2). Both spherical mirrors are the part of the same hollow spherical ball. Hence, their radius of curvature is same. Therefore, ratio of their focal lengths will be 1 : 1.
Mirror AB will always form a virtual image of an object placed in front of it because it is a convex mirror.

5. What is sustainable development? State its two main objectives.

Ans. Developmental activities should be in accordance with the sustainability of the environment. Natural resources should not be used excessively to fulfil the needs of increased population.

(*i*) to reduce pollution

(*ii*) efficient use of natural resources.

6. List four causes of damage to forests.

Ans. Four main causes of damage to forests are:

(*i*) Deforestation for various uses; indiscriminate cutting of trees.

(*ii*) Natural calamities like forest fires, floods, etc.

(*iii*) Felling of trees for fuel wood.

(*iv*) Overgrazing in forests.

7. Write the name and molecular formula of an organic compound having its name suffixed with 'ol' and having two carbon atoms in its molecule. Write balanced chemical equation to indicate what happens when this compound is heated with excess conc. H_2SO_4 and the name of main product formed. Also state the role of conc. H_2SO_4 in the reaction.

Ans. Ethanol, C_2H_5OH

$$\underset{\text{Ethanol}}{CH_3CH_2OH} \xrightarrow[\text{Heat}]{\text{Conc. } H_2SO_4} \underset{\text{Ethene}}{CH_2{=}CH_2} + H_2O$$

Conc. H_2SO_4 acts as dehydrating agent.

8. An organic compound 'P' is a constituent of wine. 'P' on reacting with acidified $K_2Cr_2O_7$ forms another compound 'Q'. When a piece of sodium is added to 'Q' a gas 'R' evolves which burns with a pop sound. Identify P, Q and R and write the chemical equations of the reactions involved.

Ans. 'P' is ethyl alcohol (C_2H_5OH) and 'Q' is ethanoic acid (CH_3COOH).

$$\underset{\text{'P'}}{CH_3CH_2OH} + 2[O] \xrightarrow{K_2Cr_2O_7/\text{Conc. } H_2SO_4} \underset{\text{'Q'}}{CH_3COOH} + H_2O$$

$$\underset{\text{'Q'}}{2CH_3COOH} + 2Na \longrightarrow 2CH_3COONa + \underset{\text{'R'}}{H_2}$$

'R' is hydrogen gas which burns with 'pop' sound.

9. State the main aim of classifying elements. Which is the more fundamental property of elements that is used in the development of Modern Periodic Table. Name and state the law based on this fundamental property. On which side of the periodic table one can find metals, non-metals and metalloids?

Ans. The main aim of classification of elements is to study properties of elements conveniently.

Atomic number is more fundamental property to classify elements.

Modern Periodic Law: It states properties of elements are periodic function of their atomic number.

Metals are on left hand side, non-metals are on right hand side, metalloids are between metals and non-metals in zig-zag manner.

10. An element 'X' (Atomic number=20) burns in the presence of oxygen to form a basic oxide.

(*a*) Identify the element and write its electronic configuration.

(*b*) State its group number and period number in the Modern Periodic Table.

(*c*) Write a balanced chemical equation for the reaction when this oxide is dissolved in water.

Ans. (*a*) Calcium, its electronic configuration is 2, 8, 8, 2

(*b*) Group 2, period 4. (*c*) $CaO + H_2O \longrightarrow Ca(OH)_2$.

11. What is pollination? List its two types and write a distinguishing feature between the two.

Ans. The transfer of pollen grains from anther to stigma is called pollination. Pollen grains are shed from the anther and reach the stigma of either the same flower or a different flower.

The two types are:

(*a*) self-pollination

(*b*) cross-pollination

Self-pollination occurs when the pollen from the anther is deposited on the stigma of the same flower or another flower on the same plant. Cross-pollination is the transfer of pollen from the anther of one flower to the stigma of another flower on a different individual of the same species.

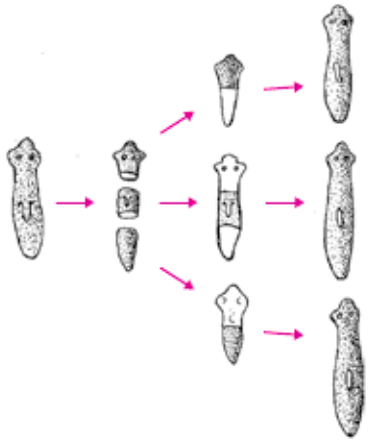
12. What happens when

(*a*) *Planaria* gets cut into two pieces?

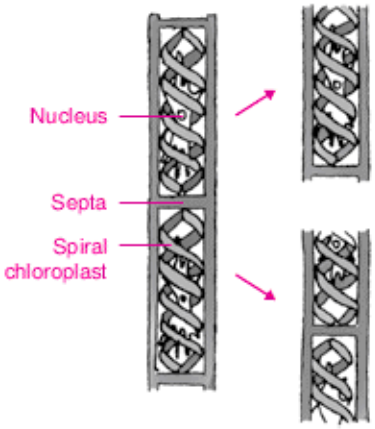
(*b*) A mature *Spirogyra* filament attains considerable length?

(*c*) On maturation sporangia burst?

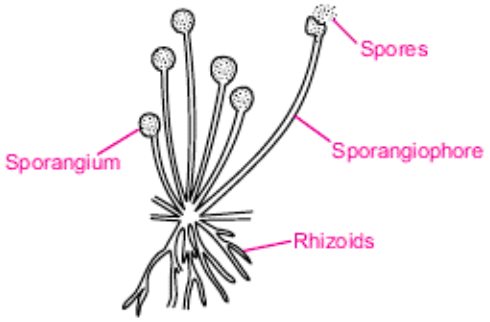
Ans. (*a*) *Planaria* can be cut into pieces, and each piece can regenerate into a complete organism. Cells at the location of the wound site proliferate to form a small ball of cells that will differentiate into new tissues and regenerate the missing parts of the piece of the cut *Planaria*.



(*b*) When a filament of *Spirogyra* attains considerable length it breaks into smaller fragments and each fragment grows into a new plant.



(*c*) These are non-motile spores produced inside structures called sporangia in fungi such as *Rhizopus* and *Mucor*. On maturation, sporangial wall rupture and spores are dispersed to grow into a new individual. These spores are dispersed by wind.



13. What is sexual reproduction? List its four significances.

Ans. The production of new living organisms by combining genetic information from two individuals of different types (sexes). In most higher organisms, one sex (male) produces a small motile gamete which travels to fuse with a larger stationary gamete produced by the other (female).

(*i*) Sexual reproduction promotes diversity of characters in the offsprings.

(*ii*) It results in new combinations of genes brought together in the gamete and this reshuffling increases genetic variation.

(*iii*) It plays a prominent role in the origin of new species.

(*iv*) The sexual mode of reproduction incorporates process of combining DNA from two different individuals during reproduction.

14. List two differences in tabular form between dominant trait and recessive traits. What percentage/proportion of the plants in the F_2 generation/progeny were round, in Mendel's cross between round and wrinkled pea plants?

Ans.

Dominance	Recessive
(*i*) A dominant factor allele expresses itself in the presence or absence of a recessive trait.	(*i*) A recessive trait is able to express itself only in the absence of a dominant trait.
(*ii*) For example, tall plant, round seed, violet flower, etc. are dominant characters in a pea plant.	(*ii*) For example, dwarf plant, wrinkled seed, white flower, etc. are recessive traits in a pea plant.

In F_2 generation, 75% of pea plant showed round and yellow traits.

15. List three factors that provide evidences in favour of evolution in organisms and state the role of each in brief.

Ans. The three factors that provided evidences in favour of evolution in organism are:

(*i*) **Fossils:** They are the remains of dead animals and plants that lived on this earth many centuries ago. They provide help in tracing the evolutionary organism history and also to know the evolutionary relationships with new and the old species.

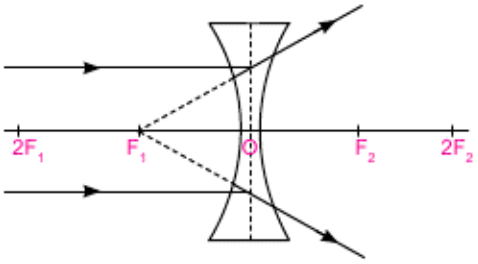
(*ii*) **Homologous organs:** The organisms having organs of similar basic structure and origin but they perform different functions in different species. e.g. forelimb of frog and human.

(*iii*) **Analogous organs:** The organisms having organs of different structure and origin but performing same function. e.g. an insects wing and a birds wing.

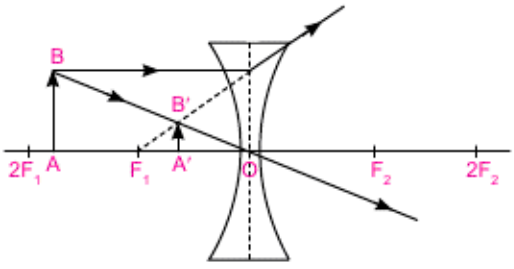
16. If the image formed by a lens for all positions of the object placed in front of it is always virtual, erect and diminished, state the type of the lens. Draw a ray diagram in support of your answer. If the numerical value of focal length of such a lens is 20 cm, find its power in new cartesian sign conventions.

Ans. Concave lens.

When the object is at infinity.



When the object is in between F_1 and $2F_1$.



Thus, from the figure, it is clear that whatever be the position of the object in front of a concave lens, the image formed is always virtual, erect and diminished,

Power of the given lens is calculated as

$$\text{Power} = \frac{1}{\text{Focal length}} = \frac{1}{f(m)} = \frac{100\,\text{cm}}{-20\,\text{cm}} = -5\,\text{D}$$

17. Explain in brief the reason for each of the following:

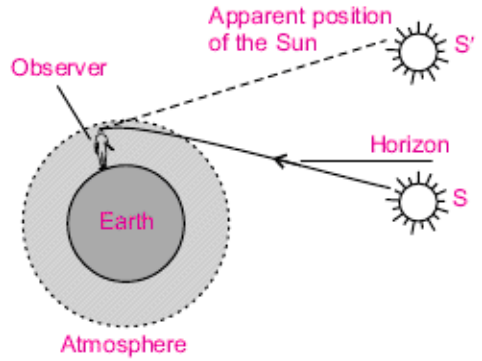
(*a*) Advanced sunrise

(*b*) Delayed sunset

(*c*) Twinkling of stars

Ans. (*a*) **Advanced sunrise:** The advance sunrise is due to atmospheric refraction. This can be explained as below:

The figure shows the actual position of the sun (S) at the time of sunrise, just below the horizon and its apparent position (S′), just above the horizon, appears to us.



Atmospheric refraction effects at sunset or sunrise

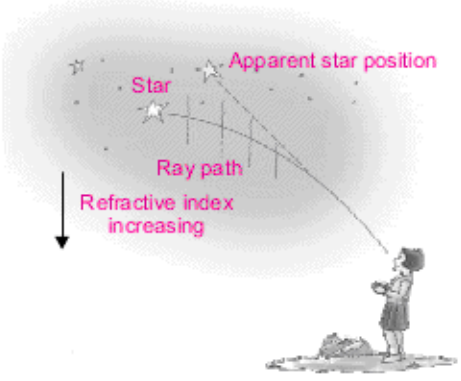
When the sun is slightly below the horizon, the light rays move through the varying refractive indices of different layers of the air, get bent towards the normal and appear to come from S′, which is the apparent position of the sun. That is why, the sun is visible to us when it has been actually risen. So, due to atmospheric refraction, the phenomenon of advance sunrise is observed.

(*b*) **Delayed sunset:** The delayed sunset is due to atmospheric refraction. This can be explained as below:

The above figure in case (*a*) shows the actual position of sun (S) at the time of sunset, just below the horizon and its apparent position S′, just above the horizon appears to us.

After the sunset, when the sun is slightly below the horizon, the light rays move through the varying refractive indices of different layers of the air, get bent towards the normal and appear to come from S′, which is the apparent position of the sun. That is why, the sun is visible to us when it is actually set. So, due to atmospheric refraction, the phenomenon of delayed sunset is observed.

(*c*) **Twinkling of stars:** The hot layers (low densities) of air at a high altitude behave as an optically rarer medium for the rays, whereas the cold dense layers (high densities) of air, near the earth surface, behave as an optically denser medium for the light rays. So when the light rays (starlight) passing through the various layers of atmosphere, they get deviated and bend toward the normal. As a result, the apparent position of a star is slightly different from its actual position. Thus, the star appears slightly higher (above) than its actual position in the sky. The fluctuation in the position of the star occurs continuously due to the changing amount of light entering into the eye. The star sometimes appears brighter and at some other times, it appears fainter. This causes the twinkling of stars.



18. While discussing about coal and petroleum, a teacher told his students about PCRA's (Petroleum Conservation Research Association) guidelines to save the fossil fuels while driving vehicles. Deepa was going to her school with her mother who was driving the car. At the traffic signal, when the light was red, Deepa suggested to her mother to switch off the engine.

After reading the above passage, answer the following questions.

(*a*) Fossil fuels are natural resources, then why do we need to conserve them?

(*b*) List any two ways of saving the fossil fuels.

(*c*) State two values exhibited by Deepa.

Ans. (*a*) Fossil fuels such as coal and petroleum are the natural resources but they need to be used judiciously as they require millions of years to be formed.

(*b*) (*i*) Walk more or cycle to the destination.

(*ii*) Car pooling is a good way to reduce use of fuel.

(*c*) Values exhibited by Deepa

(*i*) Concern for her surrounding environment.

(*ii*) Knows the importance of saving fuel by putting off the engine at traffic signal if the light is red.

19. (*a*) You have three unlabelled test tubes containing ethanol, ethanoic acid and soap solution. Explain the method you would use to identify the compounds in different test tubes by chemical tests using litmus paper and sodium metal.

(*b*) Give the reason of formation of scum when soaps are used with hard water.

Ans. (*a*) Ethanol will not be affected by blue litmus as well as red litmus paper. Ethanoic acid will turn blue litmus red, whereas red litmus will remain as it is. Soap solution will turn red litmus blue but blue litmus will remain as it is. Sodium metal will liberate hydrogen gas with ethanol as well as ethanoic acid. Soap solution will not react with sodium metal.

(*b*) Ca^{2+} and Mg^{2+} present in hard water react with soap to form calcium and magnesium salt of fatty acids which are insoluble in water and form scum.

20. What is vegetative propagation? List with brief explanation three advantages of practising this process for growing some types of plants. Select two plants from the following which are grown by this process:

Banana, Wheat, Mustard, Jasmine, Gram.

Ans. **Vegetative propagation:** It is a process by which new organisms arise without production of seeds or spores. It can occur naturally or be induced by using chemicals by horticulturists.

The advantages of vegetative propagation are as follows:

- It helps in the easy propagation of non-flowering plants.
- It helps in producing hybrid varieties of various plants with improved qualities.
- It helps in propagation of plants in a fast way.
- It helps in the propagation of plants which do not produce seeds, e.g. banana and jasmine.

21. (*a*) Why did Mendel choose garden pea for his experiments? Write two reasons.

(*b*) List two contrasting visible characters of garden pea Mendel used for his experiment.

(*c*) Explain in brief how Mendel interpreted his results to show that the traits may be dominant or recessive.

Ans. (*a*) Normally pea plant was self-fertilizing, because petals enclose the reproductive organs till fertilization. The self-fertilization through many generations helps in easily obtaining the pure line with constant trait in pea plants. The pea plant was easy to cultivate.

(*b*) The two characteristics used by Mendel for his experiments were:

(*i*) Tall and Dwarf Variety (*ii*) Round and wrinkled seed coats.

(*c*) Mendel took pea plants with different characteristics-a tall plant with a short plant, produced progeny by cross-pollination and calculated the percentage of tall and short progeny. There were no half way characteristics in the first generation, no medium height plants in the F_1 generation. All plants were tall. He carried his experiment further by getting both the parental plants of the F_1 generation to reproduce by self-pollination. In the second generation F_2, all plants were not tall. One quarter of them were short. This indicated that both traits tall and dwarf were inherited in the F_1 generation but only tallness which was a dominant trait was expressed in F_1 generation,the dwarf trait which was recessive trait was not visible in F_1 but was visible in F_2 generation.

22. Suppose you have three concave mirrors A, B and C of focal length 10 cm, 15 cm and 20 cm. For each concave mirror you perform the experiment of image formation for three values of object distance of 10 cm, 20 cm and 30 cm. Giving reason answer the following:

(*a*) For the three object distances, identify the mirror/mirrors which will form an image of magnification –1.

(*b*) Out of the three mirrors identify the mirror which would be preferred to be used for shaving purposes/makeup.

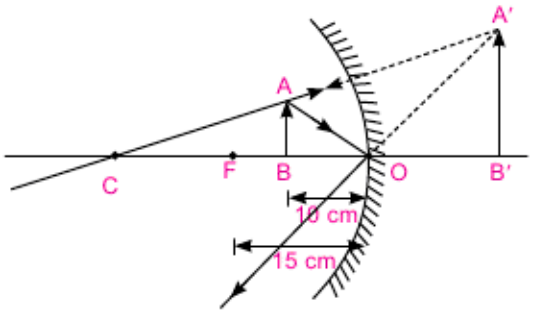
(*c*) For the mirror B draw ray diagram for image formation for object distances 10 cm and 20 cm.

Ans. (*a*) A real, inverted and same size image as that of object formed by the concave mirror will form an image of magnification –1. It is possible only when the object is placed at C ($R = 2f$). Hence, for the object distances of 20 cm and 30 cm ,concave mirrors 'A' and 'B' will form the real, inverted and same size images as that of the object. Therefore, the mirrors 'A' and 'B' will form an image of magnification –1.

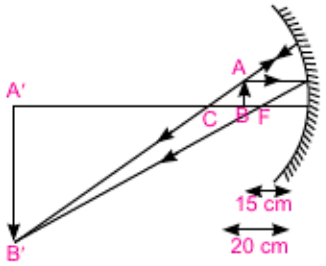
(*b*) Concave mirror 'C' of focal length 20 cm will be preferred to be used for shaving purposes/makeup. This is because when we bring our face within its focal length, it forms a virtual, erect and enlarged image of our face.

(*c*) Ray diagram for image formation by mirror 'B'

(*i*) For object distance 10 cm



(*ii*) For object distance 20 cm



23. At what distance from a concave lens of focal length 20 cm a 6 cm tall object be placed so as to obtain its image at 15 cm from the lens? Also calculate the size of the image formed. Draw a ray diagram to justify your answer for the above situation and label it.

Ans. Given: $f = -20$ cm, $h_o = 6$ cm, $v = -15$ cm

Using lens formula

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

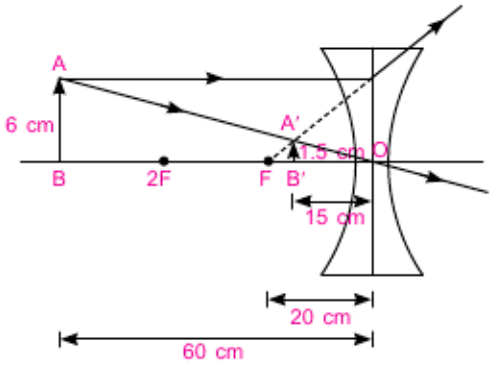
$$\Rightarrow \quad \frac{1}{u} = \frac{1}{v} - \frac{1}{f} = \frac{1}{-15} - \frac{1}{-20} = -\frac{1}{60}$$

$$\Rightarrow \quad u = -60 \text{ cm}$$

Using magnification formula, $m = \frac{h_i}{h_o} = \frac{v}{u}$

we get $\quad h_i = \frac{v}{u} \times h_o = \frac{-15}{-60} \times 6 = +1.5$ cm

Therefore, a diminished image is formed and its size is 1.5 cm.



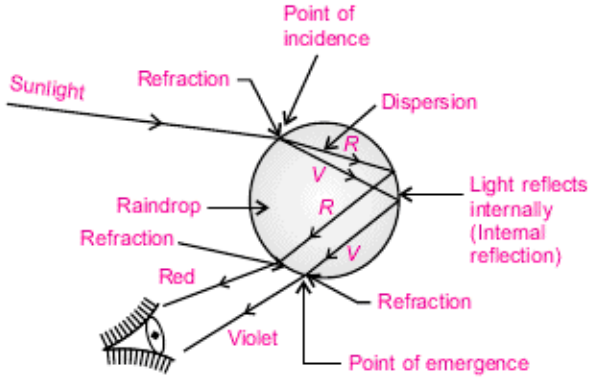
24. **(*a*) What is dispersion of white light? State its cause.**

(*b*) "Rainbow is an example of dispersion of sunlight." Justify this statement by explaining, with the help of a labelled diagram, the formation of a rainbow in the sky. List two essential conditions for observing a rainbow.

Ans. (*a*) **Dispersion:** The splitting of white light into its constituent colours is called dispersion.

The dispersion of light is caused because the different constituent colours of light offer different refractive indices to the material of the prism. Therefore, each colour bends (refracted) through a different angle with respect to the incident ray. The red colour has maximum speed in glass prism. So, it is least deviated, while the violet colour has minimum speed so its deviation is maximum. Thus, the ray of each colour emerges along different paths and becomes distinct.

(*b*) **Rainbow:** It is an optical natural spectrum, produced by the nature in the sky, in the form of a multicoloured arc.



Formation of primary rainbow

The rainbow is formed due to the dispersion of sunlight by the water droplets suspended in the atmosphere after a rainfall. These water droplets act like a prism. The rays of sunlight enter the water droplets. At the point of incidence, these rays refract and disperse into its constituent colours, then gets reflected internally, and finally its refracted rays again at the point of emergence and will came out from the rain drop. Therefore, due to refraction, dispersion and internal reflection of sunlight, different colours reacts the observer's eye along different paths and becomes distinct. It creates a rainbow in the sky.

Hence "Rainbow is an example of dispersion of sunlight."

Necessary conditions for the formation of a rainbow:

(*i*) The presence of water droplets in the atmosphere, and

(*ii*) The sun must be at the back of the observer, i.e. observer must stand with his back towards the sun.

SECTION-B

25. Consider the following oils:

I. Mobil oil **II. Castor oil**

III. Turpentine oil **IV. Kerosene**

V. Mustard oil **VI. Coconut oil**

Which of these can be used for preparation of soap?

(*a*) I, II, III, VI **(*b*) II, V, VI** **(*c*) II, III, V, VI** **(*d*) II, III, VI**

Ans. (*b*) Castor oil, mustard oil and coconut oil are the vegetable oils used for preparation of soap.

26. The chemical mostly used in the preparation of most of the soaps we use is

(*a*) Sodium chloride **(*b*) Potassium hydroxide**

(*c*) Sodium hydroxide **(*d*) Potassium chloride**

Ans. (*c*) Sodium hydroxide.

27. A student is testing water to know which is best for cleansing purposes with soaps. He would find that the cleansing action of soaps is best when he uses water obtained from

(*a*) rain **(*b*) tap** **(*c*) hand pump** **(*d*) pond**

Ans. (*a*) Rain water is distilled water. It does not contain calcium and magnesium ions. It is best for washing clothes.

28. A student determines the focal length of a device 'X' by focusing the image of a distant object on a screen placed 20 cm from the device on the same side as the object. The device 'X' is

(*a*) Concave lens of focal length 10 cm

(*b*) Convex lens of focal length 20 cm

(*c*) Concave mirror of focal length 10 cm

(*d*) Concave mirror of focal length 20 cm

Ans. (*d*) A real image at the focus is obtained on the screen by reflecting the parallel rays coming from the distant object. So, device is a concave mirror. The focal length of concave mirror is the difference between mirror and screen, so $f = 20$ cm.

29. A teacher sets up the stand carrying a convex lens of focal length 15 cm at 42.7 cm mark on the optical bench. He asks four students A, B, C and D to suggest the position of screen on the optical bench so that a distinct image of a distant tree is obtained almost immediately on it. The positions suggested by the students were as:

A. 12.7 cm

B. 29.7 cm

C. 57.7 cm

D. 72.7 cm

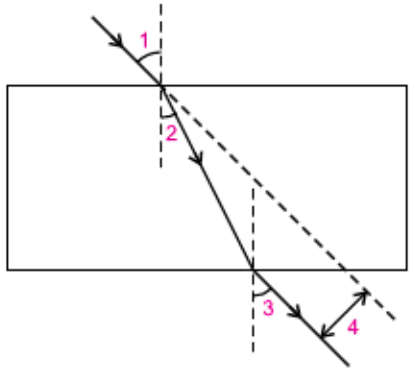
The correct position of the screen was suggested by

(*a*) A **(*b*) B**

(*c*) C **(*d*) D**

Ans. (*c*) Rays from an object at infinity, after refraction through a convex lens, meet at the second principal focus. So, screen should be placed at the second principal focus of a convex lens. The distance between the position of lens and screen is equal to the focal length of convex lens. Hence, correct position of screen on the optical bench is $42.7 + 15 = 57.7$ cm.

30. A student has traced the path of a ray of light through a glass slab as follows. If you are asked to label 1, 2, 3 and 4, the correct sequencing of labelling $\angle i$, $\angle e$, $\angle r$ and lateral displacement respectively is



(*a*) 2, 1, 3, 4 **(*b*) 1, 2, 3, 4**

(*c*) 1, 3, 2, 4 **(*d*) 1, 3, 4, 2**

Ans. (*c*) The correct sequencing of labelling is $\angle i \rightarrow 1$, $\angle e \rightarrow 3$, $\angle r \rightarrow 2$ and lateral displacement $\rightarrow 4$.

31. In an experiment to trace the path of a ray of light through a triangular glass prism, a student would observe that the emergent ray

(*a*) is parallel to the incident ray.

(*b*) is along the same direction of incident ray.

(*c*) gets deviated and bends towards the thinner part of the prism.

(*d*) gets deviated and bends towards the thicker part (base) of the prism.

Ans. (*d*) After refraction at the glass-air interface of the prism, emergent ray gets deviated and bends away from the normal at this face, i.e. bends towards the thicker part (base) of the prism.

32. The students of a class were asked by the teacher to study the different parts of an embryo of an angiosperm. Given below are the essential steps for the experiment:

A. Soak the seeds in plain water and keep them overnight.

B. Cut open the soaked seed and observe its different parts.

C. Take some healthy seeds in a petri-dish.

D. Drain the excess water, cover the seeds with a wet cotton cloth and leave them as it is for a day.

The correct sequence of these steps is:

(*a*) C, A, D, B **(*b*) C, D, A, B**

(*c*) A, C, D, B **(*d*) A, C, B, D**

Ans. (*a*)

33. A basket of vegetables contains Carrot, Potato, Sweet potato, Radish, Tomato and Brinjal. Which of them represent the homologous structures?

(*a*) Carrot, sweet potato and potato

(*b*) Radish and carrot

(*c*) Carrot, potato and tomato

(*d*) Brinjal and radish

Ans. (*b*)

34. A student is studying the properties of acetic acid in his school laboratory. List two physical and two chemical properties which he must observe and note in his record book.

Ans. **Physical properties:**

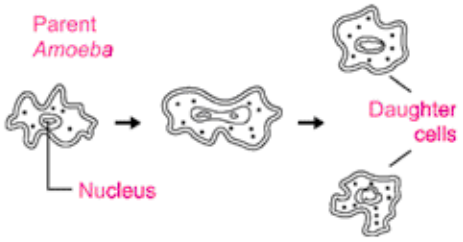
1. It has vinegar like smell.
2. It is soluble in water.

Chemical properties:

1. It turns blue litmus red.
2. It liberates CO_2 with $NaHCO_3$.

35. In which asexual reproduction two individuals are formed from a single parent and the parental identity is lost? Draw the initial and the final stages of this type of reproduction to justify your answer. Write the event with which this process starts.

Ans. This type of reproduction is called binary fission.



Binary Fission in *Amoeba*

When the organisms finds the environmental condition suitable and the mother cell has attained maturity.

36. To find the image distance for varying object distances in case of a convex lens of focal length 15 cm, a student obtains on a screen a sharp image of a bright object by placing it at 20 cm distance from the lens. After that he gradually moves the object away from the lens and each time focuses the image on the screen.

(a) In which direction-towards or away from the lens does he move the screen to focus the object?

(b) How does the size of image change?

(c) Approximately at what distance does he obtain the image of magnification–1?

(d) How does the intensity of image change as the object moves farther and farther away from the lens?

Ans. (a) **Towards the lens:** When object gradually moves away from the lens, screen has to moved towards the lens to focus the image on it. This is because when object distance increases the image distance decreases.

(b) Using magnification, $m = \frac{v}{u} = \frac{h_2}{h_1}$, we find that if image distance decreases, the size of image (h_2) also decreases.

(c) Using $m = \frac{v}{u} = -1 \quad \Rightarrow \quad v = -u$.

So, when image distance is equal to object distance, magnification –1 can be achieved. Therefore, approximately at a distance of 20 cm, screen should be placed on the other side of the lens to get the magnification –1.

(d) The intensity of image will decrease as the object gradually moves farther and farther away from the lens. This is because, less number of incident rays are falling on the convex lens from the increasing object distance.

Set-II (*Uncommon Questions to Set-I*)

1. Write the name and molecular formula of the fourth member of alkane series.

Ans. C_4H_{10}, Butane.

2. List two unisexual flowers.

Ans. Cucumber and watermelon.

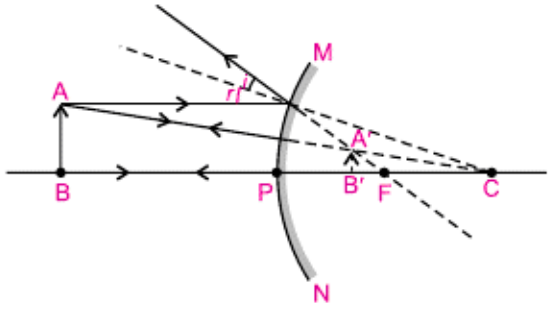
3. Why do producers always occupy the first trophic level on every food chain?

Ans. Producers are the plants which make their own food from the inorganic substances in the presence of sunlight. The plants are the source of energy for all herbivorous animals. Thus, they occupy the first trophic level.

4. List two properties of the images formed by convex mirrors. Draw ray diagram in support of your answer.

Ans. (i) Image formed is behind the mirror between pole (P) and focus (F).

(*ii*) Virtual, erect and diminished image is formed.



5. "Industrialisation has adversely deteriorated the environment". Give four reasons in support of this statement.

Ans. The four reasons that has caused environment to deteriorate are:

(*i*) Loss of biodiversities due to deforestation, buildings construction, etc.

(*ii*) Global warming and acid rain is caused due to the release of harmful chemicals like CFC in the atmosphere.

(*iii*) Air, water, noise and soil pollution.

(*iv*) Nuclear power plants generating nuclear radiation that causes the adjoining environment (plants, animals and human) to be affected by its radiation.

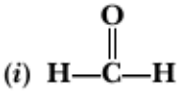
6. How did 'Chipko Andolan' ultimately benefit the local people? Explain briefly.

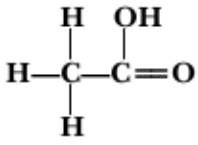
Ans. Chipko Movement

- During 1970, in Reni village of Garhwal, a contractor was allowed to cut trees in a forest near the village.
- When the contractor's workers went to the forest to cut trees the women of the village hug the tree trunks to prevent the workers from cutting trees.
- Chipko means 'hug' and the movement started by the villagers by hugging trees is called the 'Chipko Andolan'.

The movement benefitted the local population by making available the forest products.

7. (*a*) Define the term functional group. Identify the functional group present in

(*i*) 

(*ii*) 

(*b*) What happens when 5% alkaline $KMnO_4$ solution is added drop by drop to warm ethanol taken in a test tube? State the role of alkaline $KMnO_4$ solution in this reaction.

Ans. (*a*) It is atom or group of atoms or reactive part of compound which largely determine the chemical properties of compound.

(*i*) Methanal has aldehyde as functional group.

(*ii*) Ethanoic acid has carboxylic acid as functional group.

(*b*) $CH_3CH_2OH + 2[O] \xrightarrow{KMnO_4/KOH} CH_3COOH + H_2O$

Alkaline $KMnO_4$ acts as oxidising agent.

9. An element 'X' belongs to third period and second group of the Modern Periodic Table.

(*a*) Write its electronic configuration.

(*b*) Is it a metal or non-metal? Why?

(*c*) Write the formula of the compound formed when 'X' reacts with an element (*i*) Y of electronic configuration 2, 6 and (*ii*) Z with electronic configuration 2, 8, 7.

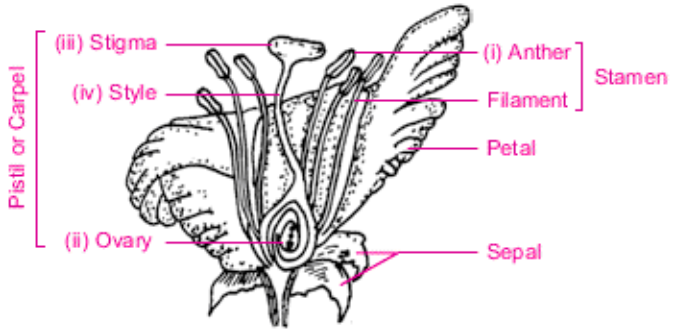
Ans. (*a*) 2, 8, 2

(*b*) It is metal because it can lose 2 electrons easily.

(*c*) (*i*) X^2 Y^2 → XY (*ii*) X^2 Y^1 → XY_2

12. Name the reproductive parts of an angiosperm. Where are these parts located? Explain in brief the structure of its female reproductive parts.

Ans. The male reproductive part of an angiosperm is the stamen and female reproductive part is the pistil/carpel. They are located in the flower.



Female reproductive part (carpel/pistil) consists of the following:

Stigma: Sticky landing site for pollen grains.

Style: A tube that contains male germ cells, and leads to ovary.

Ovary: Contains ovules that develops into seeds.

14. What is speciation? Explain in brief the role of natural selection and genetic drift in this process.

Ans. Speciation is arising of a new species from a sub-population of a species which is geographically or reproductively isolated over a long period of time from the other population of the same species.

Natural Selection

Natural selection is one of the basic mechanisms of evolution, along with mutation, migration, and genetic drift. Darwin's grand idea of evolution by natural selection is relatively simple but often misunderstood. To find out how it works, imagine a population of beetles:

For example: Some beetles are green and some are brown. Since the environment can't support unlimited population growth, not all individuals get to reproduce to their full potential. In this example, green beetles tend to get eaten by birds and survive to reproduce less often than brown beetles do. The surviving brown beetles have brown baby beetles because this trait has a genetic basis. The more advantageous trait, brown coloration, which allows the beetle to have more offspring, becomes more common in the population. If this process continues, eventually, all individuals in the population will be brown and green beetles will be eliminated.

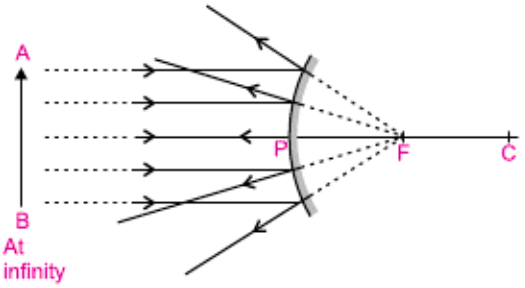
Genetic Drift

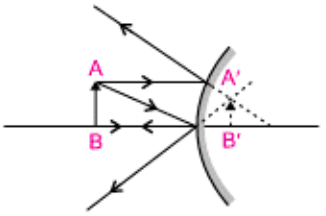
Genetic drift occurs when there is a change in the genetic makeup over the generations. This change or evolution of new species is not due to environmental or other kind of stress on individuals.

For example: Suppose, a garden has red and white poppies. The red poppies exchange genetic material with white poppies. Over a period of time, only red poppies are seen while the white poppies soon become rare.

16. If the image formed by mirror for all positions of the object placed in front of it is always virtual and diminished, state the type of the mirror. Draw a ray diagram in support of your answer. Where are such mirrors commonly used and why?

Ans. Convex mirror





A convex mirror is used as rear-view mirror in vehicles because it always produces a virtual and erect image whose size is smaller than the object. Therefore, it enables the driver to see a wide field view of the traffic behind the vehicle in a small mirror.

Set-III (*Uncommon Questions to Set-I and Set-II*)

1. What is a homologous series of carbon compounds?

Ans. It is series of organic compounds which have same functional group, similar chemical properties.

2 Why is fertilization not possible without pollination?

Ans. Fertilization is the process in which the pollen and the egg fuse to form the zygote. Pollination is the process through which pollen grains are transferred from anthers of the stamen to the stigma of the carpel. Fertilization is not possible if matured pollen grains do not reach the receptive stigma.

3. Why is excessive use of CFCs a cause of concern?

Ans. CFCs are a cause of concern because they are the prime reason for the depletion of the ozone layer in the atmosphere.

4. The linear magnification produced by a spherical mirror is +3. Analyse this value and state the (*i*) type of mirror and (*ii*) position of the object with respect to the pole of the mirror. Draw ray diagram to show the formation of image in this case.

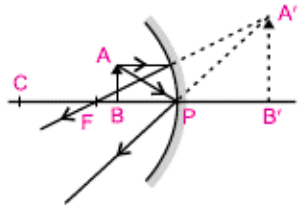
Ans. The linear magnification produced by a spherical mirror is +3. It shows that:

- the size of image is three times the size of object, and
- the image is virtual and erect, and formed behind the mirror.

Hence,

(*i*) the mirror is a concave mirror, and

(*ii*) the object is placed between the pole and the focus of a concave mirror.



9. The atomic number of an element 'X' is 19.

(*a*) Write its electronic configuration.

(*b*) To which period of the Modern Periodic Table does it belong and what is its valency?

(*c*) If 'X' burns in oxygen to form its oxide, what will be its nature – acidic, basic or neutral?

(*d*) Write balanced chemical equation for the reaction when this oxide is dissolved in water.

Ans. (*a*) 2, 8, 8, 1.

(*b*) It belongs to group 1 and its valency is equal to 1.

(*c*) Its oxide will be basic.

(*d*) $X_2O + H_2O \longrightarrow 2XOH$

or $K_2O + H_2O \longrightarrow 2KOH$

10. How does the tendency of the elements to lose electrons change in the Modern Periodic Table in (*i*) a group, (*ii*) a period and why?

Ans. (*i*) Tendency to lose electrons increases down the group due to increase in atomic size, therefore, decrease in effective nuclear charge can lose electron easily.

(*ii*) Tendency to lose electrons decreases along a period from left to right due to decrease in atomic size, increase in effective nuclear charge, therefore, it cannot lose electron easily.

12. (*a*) Mention the role of the following organs of human male reproductive system:

(*i*) Testis **(*ii*) Scrotum**

(*iii*) Vas deferens **(*iv*) Prostate glands.**

(*b*) What are the two roles of testosterone?

Ans. (*a*) (*i*) **Testis:** These are the male reproductive organs responsible for producing male hormone testosterone and sperms.

(*ii*) **Scrotum:** It regulates the temperature of the testes and maintains it at 35 degrees Celsius (95 degrees Fahrenheit), i.e. two degrees below the body temperature of 37 degrees Celsius.

(*iii*) **Vas deferens:** It transports mature sperm to the urethra, the tube that carries urine or sperm to outside of the body, in preparation for ejaculation.

(*iv*) **Prostate glands:** The job of the prostate gland is to secrete prostate fluid, one of the components of semen. The mixture of sperm and fluid is called semen. The muscles of the prostate gland also help to propel the seminal fluid through the urethra and into the female reproductive organ during ejaculation.

(*b*) **Two roles of testosterone are as follows:**

(*i*) It regulates the formation of sperms.

(*ii*) At the time of puberty, certain changes are seen in the appearance in boys. These are due to this hormone.

15. Explain Mendel's experiment with peas on inheritance of characters considering only one visible contrasting character.

Ans. Mendel assumed that the unit of hereditary characters is the factors of determiners which occur in pairs. One of each comes from the mother while the other comes from the father. The unit character or factor is now called as gene.

When a pair of contrasting characters (alleles) are present together, only one of them expresses itself and the other remains suppressed or hidden The character which is expressed (or is visible) is called as dominant and the character which remains hidden is termed as recessive.

16. Explain in brief the reason for each of the following:

(*i*) The sun appears reddish during sunrise.

(*ii*) At noon the sun appears white.

(*iii*) To an astronaut the sky appears dark instead of blue.

Ans. (*i*) At the time of sunrise, the sun is near the horizon and the sunlight has to travel through a larger atmospheric distance. The blue component and other shorter wavelength of the sunlight get scattered away by the fine particles of the atmosphere. Only red colour having longer wavelength and least scattered, reaches our eyes. Hence, the sun appears reddish early in the morning.

(*ii*) At noon when the sun nearly overhead, the sunlight has to travel through a smaller atmospheric distance. Therefore, the scattering is much less and the sun appears white.

(*iii*) The sky appears dark to the astronaut as scattering does not take place at very high altitude due to the absence of atmosphere.

19. (*a*) State in brief the functions of the following organs in the human female reproductive system:

Ovary, Fallopian tube, Uterus.

(*b*) What is menstruation? Why does it occur?

Ans. (*a*) (*i*) **Ovary:** It has two main reproductive functions in the body. They produce oocytes (eggs) for fertilization and also produce reproductive hormones, oestrogen and progesterone.

(*ii*) **Oviduct:** It is the long muscular tube that links the ovary to the uterus and which the ovulated oocyte travels down to become fertilized by sperm present in the female tract. It is also referred to as the **fallopian tube, uterine tube or ovarian tube.**

(*iii*) **Uterus:** Functions of the uterus include nurturing the fertilized ovum that develops into the foetus and holds it till the baby is mature enough for birth. The fertilized ovum gets implanted into the endometrium and derives nourishment from blood vessels which develop exclusively for this purpose.

(*b*) Every month or so, the uterus lining gets thicker to prepare for a fertilized egg, if the woman becomes pregnant. If the egg doesn't get fertilized, that lining is released from the body as blood through the vagina. This monthly process is called menstruation.

20. What are micelles? Why does it form when soap is added to water? Will a micelle be formed in other solvents such as ethanol also? State briefly how the formation of micelles help to clean the clothes having oily spots.

Ans. **Micelles:** When molecular ions in soaps and detergents aggregate, they form micelles. Soap molecules have two ends, hydrocarbon end, water repellant where as ionic part which is water loving.

When soap is added to water, the hydrophobic 'tail' of soap will not dissolve in water and soap will align along the surface of water with ionic end in water and hydrocarbon 'tail' out of water by forming cluster of molecules called micelle.

No, micelle will not be formed in ethanol, as soap will dissolve in ethanol.

Micelles trap (attract) dirt, grease, oily spot, etc. which is washed away by water or the oily dirt is collected at the centre of micelles which forms an emulsion in water and on rinsing the water washes away dirt attached to them.

21. What are fossils? How are they formed? List two methods of determining the age of fossils. Explain in brief the importance of fossils in deciding the evolutionary relationships.

Ans. Fossils are the remains of ancient animals and plants, the traces or impressions of living things.

How fossils are formed?

Some animals were quickly buried after their death. Over time, more and more sediment covered the remains. The parts of the animals that didn't rot (usually the harder parts likes bones and teeth) were encased in the newly-formed sediment. In the right circumstances parts of the animal turned into fossils over time.

The age of fossils can be estimated by the following two methods:

(*i*) It can be assumed that while digging the earth, the fossils found closer to the surface are more recent than those found in the inner/deeper layers of the earth.

(*ii*) By detecting the ratios of different isotopes of the same element in the fossil material.

Importance of fossils in deciding the evolutionary relationship:

They provide an ancestral linkage to modern species. For example, the chordates (which includes we humans) can be traced back to our common ancestry to sea squirts! The fossils record is database for evolution.

Latest Examination Papers, 2015

[Delhi Set-I, II, III]

***General Instructions*:**

(*i*) The question paper comprises of **two** sections, **A** and **B**. You are to attempt both the sections.

(*ii*) All questions are compulsory.

(*iii*) There is no choice in any of the questions.

(*iv*) All questions of section A and all questions of section B are to be attempted separately.

(*v*) Question numbers **1 to 3** in section A are **one-mark** questions. These are to be answered in **one word** or in **one sentence**.

(*vi*) Question numbers **4** to **6** in section A are **two-mark** questions. These are to be answered in about **30 words** each.

(*vii*) Question numbers **7** to **18** in section A are **three-mark** questions. These are to be answered in about **50 words** each.

(*viii*) Question numbers **19** to **24** in section A are **five-mark** questions. These are to be answered in about **70 words** each.

(*ix*) Question numbers **25** to **33** in section B are multiple choice questions based on practical skills. Each question is a **one-mark** question. You are to select one most appropriate response out of the four provided to you.

(*x*) Question numbers **34 to 36** in **Section B** are two marks questions based on partical skills. These are to be answered in brief.

Set-I

SECTION-A

1. Write the name and formula of the 2nd member of homologous series having general formula C_nH_{2n}.

Ans. C_2H_4 $CH_2 = CH_2$ is first member. Its name is ethene.

C_3H_6 $CH_2 = CH—CH_3$ is second member. Its name is propene.

2. List two functions performed by the testis in human beings.

Ans. Two functions of testes are:

(*i*) to produce sperms

(*ii*) to produce male sex hormone called testosterone.

3. What is the function of ozone in the upper atmosphere?

Ans. Ozone protects the earth from harmful radiations like high energy UV rays.

4. List four characteristics of the images formed by plane mirrors.

Ans. Properties of image formed by a plane mirror

(*i*) It is always virtual and erect.

(*ii*) Size of image is equal to that of the object.

(*iii*) Image is formed at the same distance behind the mirror as the object is in front of the mirror.

(*iv*) Image is laterally inverted.

5. Why are forests considered "biodiversity hot spots"? List two ways in which an individual can contribute effectively to the management of forests and wildlife.

Ans. Biodiversity is measured by the number of different life forms found in an area. In a forest, various species are available which include bacteria, fungi, ferns, plants, nematodes, insects, birds, reptiles and mammals. Forests are therefore, called biodiversity hot spots.

An individual can contribute in management of forest and wildlife by:

(*i*) Avoiding cutting of forest and killing of wildlife.

(*ii*) Educating people about the importance of forest and wildlife in our life.

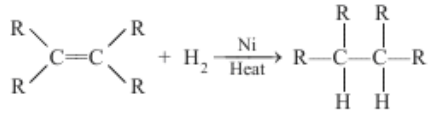
6. What is meant by "sustainable management"? Why is reuse considered better than recycling?

Ans. Natural resources are limited. If it is over exploited for short time gain, future generations will suffer heavily. Sustainable Management of natural resources is therefore necessary so that natural resources lasts for a longer period and future generations can also enjoy the benefits from it.

Out of reuse and recycle, I will suggest people to practice reuse as it does not consume any energy.

7. With the help of an example, explain the process of hydrogenation. Mention the essential conditions for the reaction and state the change in physical property with the formation of the product.

Ans. Hydrogenation is the process in which unsaturated hydrocarbon like alkenes react with hydrogen in presence of nickel as catalyst to form saturated compounds.



(Unsaturated liquid) (Saturated solid)

The liquid reactant change into solid product. Vegetable oils are converted into vegetable ghee by hydrogenation.

8. What is the difference between the molecules of soaps and detergents, chemically? Explain the cleansing action of soaps.

Ans. Soaps are sodium or potassium salts of long chain fatty acids, *e.g.* $C_{17}H_{35}COONa$. (Sodium stearate)

Detergents are sodium or potassium salts of sulphonic acids of benzene or alkene. They have $-SO_3Na$ or $-SO_4Na$ group.

Soaps have hydrocarbon part which is hydrophobic and attracts dirt, greese, oil, etc. whereas –COONa part is hydrophillic which attracts water. Hydrophobic part entrap the dirt and greese which is washed away by water attracted by hydrophillic part.

9. How many groups and periods are there in the modern periodic table? How do the atomic size and metallic character of elements vary as we move:

(*i*) down a group and

(*ii*) from left to right in a period

Ans. There are 18 groups and 7 periods in Modern Periodic Table.

(*i*) Atomic size goes on increasing down the group.

Metallic character goes on increasing down the group.

(*ii*) Atomic size goes on decreasing along a period from left to right.

Metallic character also goes on decreasing along a period from left to right.

10. From the following elements: $_4Be$; $_9F$; $_{19}K$; $_{20}Ca$

(*i*) Select the element having one electron in the outermost shell.

(*ii*) two elements of the same group.

Write the formula of and mention the nature of the compound formed by the union of $_{19}K$ and element X(2, 8, 7).

Ans. (*i*) $_{19}K$ has electronic configuration $\overset{K}{2},\overset{L}{8},\overset{M}{8},\overset{N}{1}$. It has one valence electron.

(*ii*) $_4Be$ and $_{20}Ca$ belong to same group.

$_{19}K$ 2, 8, 8, 1

$$\underset{2,8,8,1}{K} \longrightarrow \underset{2,8,8}{K^+} + e^-$$

$$\underset{2,8,7}{Cl} + e^- \longrightarrow \underset{2,8,7}{Cl^-}$$

(K^+) $(:\ddot{C}l:^-)$ KCl is formula of compound. It is ionic compound.

11. What is DNA copying? State its importance.

Ans. DNA in the cell nucleus is the informal source for making proteins and different proteins lead to different designs. During reproduction, similar copy of DNA is generated and the process is called DNA copying. Importance of DNA copying are-

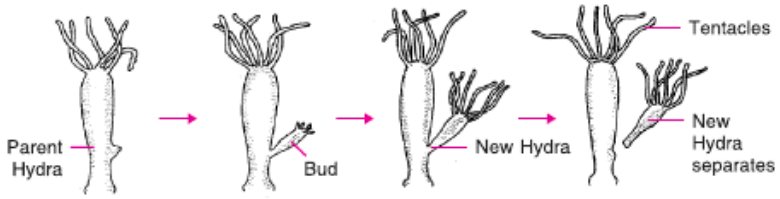
(*i*) DNA copying provides cellular apparatus in the daughter cells.

(*ii*) DNA in daughter cells will be able to control the functioning of the daughter cells.

(*iii*) DNA copies will retain the trait.

12. Explain budding in hydra with the help of labelled diagrams only.

Ans.



Budding in *Hydra*

13. List any four methods of contraceptions used by humans. How does their use have a direct effect on the health and prosperity of a family.

Ans. Four methods of contraception used by humans are:

(*i*) Mechanical barrier such as condom

(*ii*) Surgical method such as vasectomy for male and tubectomy for female.

(*iii*) Chemical method such as oral and vaginal pills.

(*iv*) Copper T

Sexual act always has the potential to pregnancy. Pregnancy makes major demand on the body and mind of the woman and if she is not ready for it, her health will be adversely affected. Contraceptive methods help in avoiding pregnancy and also help in keeping gap between two children so that the woman's body recovers. These methods help in limiting number of children to one or two. If family size is small, the family can save some amount after meeting the day to day expenditure. This will improve the economic condition of the family and the family will prosper.

14. "We cannot pass on to our progeny the experiences and qualifications earned during our life time". Justify the statement giving reason and examples.

Ans. Experiences of life and qualifications we earn donot make any change in the gene of the individual. Changes made in the gene are only passed on from one generation to the next. These qualities are acquired by an individual in his life and are called acquired trait which cannot be passed on to future progeny. For example, if a person reads a book on birds, the knowledge he earns by reading the book does not make any change in the gene. Hence, this knowledge will not get automatically transmitted to his next generation.

15. (*i*) Planaria, insects, octopus and vertebrates all have eyes. Can we group eyes of these animals together to establish a common evolutionary origin? Justify your answer.

(*ii*) "Birds have evolved from reptiles". State evidence to prove the statement.

Ans. (*i*) Yes, eyes can be grouped together, which have evolved over generation from imperfect eyes in *Planaria* to perfect eyes in vertebrates.

(*ii*) Dinosaur is a type of reptile which has wings. Birds also have wings, so it can be opined that birds have evolved from reptiles.

16. To construct a ray diagram we use two rays of light which are so chosen that it is easy to determine their directions after reflection from the mirror. Choose these two rays and state the path of these rays after reflection from a concave mirror. Use these two rays to find the nature and position of the image of an object placed at a distance of 15 cm from a concave mirror of focal length 10 cm.

Ans. (*a*) **Rays which are choose to construct ray diagram for reflection are**

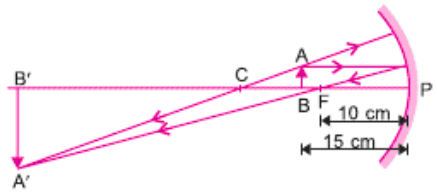
(*i*) A ray parallel to the principal axis and

(*ii*) A ray passing through the centre of curvature of a concave mirror.

Path of these rays after reflection

(*i*) A ray parallel to the principle axis, after reflection, it will pass through the principal focus of a concave mirror.

(*ii*) A ray passing through the centre of curvature, after reflection, it will reflected back along the same path.



For concave mirror

$$f = -10 \text{ cm}, \; u = -15 \text{ cm}, \; v = ?$$

Using, $\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$, we get

$$\frac{1}{v} = \frac{1}{f} - \frac{1}{u} = \frac{1}{-10} - \frac{1}{-15} = -\frac{1}{10} + \frac{1}{15}$$

or $$\frac{1}{v} = \frac{-3+2}{30} = -\frac{1}{30}$$

or $$v = -30 \text{ cm}$$

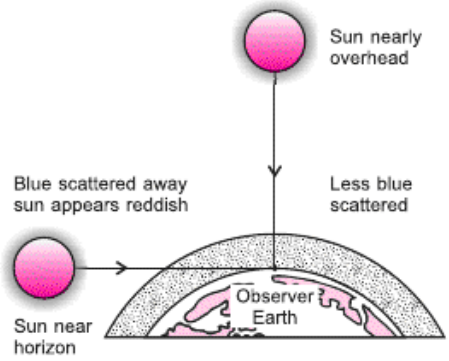
So screen should be placed at a distance of 30 cm on the same side of the object in order to obtain a sharp image.

Nature of image : Real, inverted and enlarge.

17. With the help of a labelled diagram, explain why the sun appears reddish at the sun-rise and the sun-set.

Ans. At sunrise or sunset, the sun looks almost reddish, while at noon, the sun appears white.

Explanation: At the time of sunrise/sunset, sun is near the horizon, so the sun rays have to travel through a larger atmospheric distance. The fine particles of the atmosphere scatter away the blue component and other shorter wavelengths of sunlight. Only red colour having longer wavelength and least scattered, reaches our eyes. Hence, sun appears red at sunrise or sunset.



18. After the examinations Rakesh with his friends went on a picnic to a nearby park. All friends carried cooked food packed in plastic bags or plastic cans. After eating the food some friends collected the leftover food and plastic bags etc and planned to dispose them off by burning. Rakesh immediately checked them and suggested to segregate the leftover food and peels of fruits from the plastic materials and respectively dispose them off separately in the green and red dustbins placed in the corner of the park.

(*i*) In your opinion, is burning plastic an eco-friendly method of waste disposal? Why? State the advantage of method suggested by Rakesh.

(*ii*) How can we contribute in maintaining the parks and roads neat and clean?

Ans. (*i*) Burning plastic is not an eco-friendly method of waste disposal- because it causes air pollution.

If the wastes are disposed as per the method suggested by Rakesh, different treatment can be given to the segregated waste separately. The organic waste can go for compost and the waste like plastic, glass, tin etc can go for recycling.

(*ii*) We should not throw packets, canes, etc on road or parks. The waste material should be thrown in dustbins. If separate dust bins are available for biodegradable and non-biodegradable waste, we should dispose off waste accordingly.

19. Explain why carbon forms compounds mainly by covalent bond. Explain in brief two main reasons for carbon forming a large number of compounds. Why does carbon form strong bonds with most other elements?

Ans. Carbon has atomic number 6. Its electronic configuration is 2, 4. It cannot lose four electrons because very high energy is required to remove four electrons.

It cannot gain four electrons because 6 protons cannot hold 10 electrons.

$\therefore$ Carbon can share four electrons forming four covalent bonds.

(*i*) **Catenation:** Carbon forms maximum number of compounds due to property of catenation (Self linking).

(*ii*) **Tetra valency:** Carbon can form four covalent bonds, therefore, it forms large number of compounds.

Isomerism is also responsible for large number of carbon compounds. Carbon is small in size, therefore it forms strong bonds with most other elements. It can also form double and triple bonds with some of elements which are very strong.

20. Write the functions of the following in human female reproductive system:

Ovary, oviduct, uterus

How does the embryo get nourishment inside the mother's body? Explain in brief.

Ans. (*i*) Ovaries:

(*a*) They produce female gametes

(*b*) They secrete female sex hormones estrogen & progesterone

(*ii*) Fallopian tubes (Oviduct):

(*a*) Carry eggs from ovaries to uterus

(*b*) Allow sperm to travel to meet the egg.

(*iii*) Uterus:

(*a*) Allows implantation of zygote on its wall.

(*b*) Causes menstruation when egg is not fertilized.

The embryo gets nutrition from the mother's blood with the help of a special tissue called placenta. This is a disc which is embedded in the uterine wall and transfers glucose and oxygen from the mother to the embryo.

21. How many pairs of chromosomes are present in human beings? Out of these how many are sex chromosomes? How many types of sex chromosomes are found in human beings?

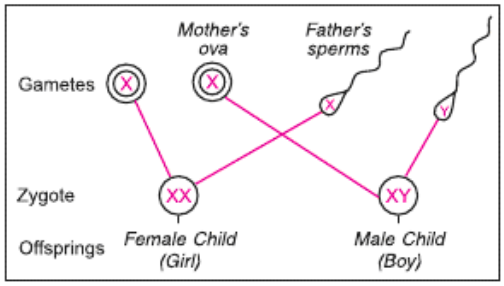
"The sex of a newborn child is a matter of chance and none of the parents may be considered responsible for it". Draw a flow chart showing determination of sex of a newborn to justify this statement.

Ans. There are 23 pairs of chromosomes present in human beings. Out of these 23 pairs, one pair is sex chromosome. There are two type of sex chromosomes found in human being, X and Y. A female has 2 nos of X chromosomes and a male has one X and one Y chromosome.

Sex of a child depends on what happens during fertilization:

(*i*) The female gamete, ova always contributes an X chromosome during fertilization.

(*ii*) The male gamete, sperm contributes either X or Y chromosome during fertilization. But whether sperm will contribute the X chromosome or Y chromosome is a matter of chance and the man does not have any control on it.



Determination of Sex in Human beings

(*iii*) If a sperm carrying X chromosome fertilizes an ova which always carries an X chromosome, then the child born will be a girl. But if a sperm carrying Y chromosome fertilizes an egg which always carries X chromosome, then the child born will be a boy.

(*iv*) Thus, sex of a newborn child is a matter of chance and none of the parents may be considered responsible for it.

22. (*a*) State the laws of refraction of light. Explain the term absolute refractive index of a medium and write an expression to relate it with the speed of light in vacuum.

(*b*) The absolute refractive indices of two media 'A' and 'B' are 2.0 and 1.5 respectively. If the speed of light in medium 'B' is 2×10^8 m/s, calculate the speed of light in:

(*i*) vaccum,

(*ii*) medium 'A'.

Ans. (*a*) **Laws of refraction of light**

(*i*) The incident ray, the normal and the refracted ray at the point of incidence all lies in the same plane for the two given transparent medium.

(*ii*) The ratio of sine of angle of incidence (*i.e.*, sin *i*) to the sine of angle of refraction (*i.e.*, sin *r*) is always constant for the light of given colour and for the given pair of media.

Mathematically,

$$\frac{\sin i}{\sin r} = \text{constant} = n_{21}$$

The constant 'n_{21}' is called refractive index of the second medium with respect to the first medium.

(*b*) Given: $\eta_A = 2.0, \quad \eta_B = 1.5$

From the above relation,

(*i*) $\eta_B = \dfrac{c}{v_B}$

where c = speed of light in vacuum.

and v_B = speed of light in medium 'B' = 2×10^8 m/s

$$1.5 = \frac{c}{2 \times 10^8}$$

or $c = 1.5 \times 2 \times 10^8 = 3 \times 10^8 \text{ ms}^{-1}$

So, speed of light in vacuum = $3 \times 10^8 \text{ ms}^{-1}$.

(*ii*) Again, $\eta_A = \dfrac{c}{v_A}$ where η_A = Absolute refractive index of medium 'A'

v_A = Speed of light in medium 'A'.

$$2.0 = \frac{3 \times 10^8}{v_A}$$

or $$v_A = \frac{3 \times 10^8}{2.0} = 1.5 \times 10^8 \text{ ms}^{-1}$$

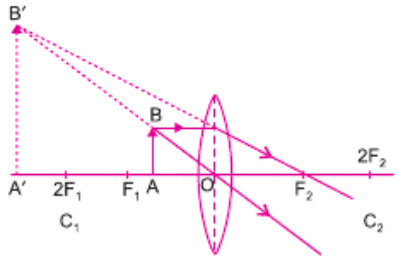
So, speed of light in medium 'A' is $1.5 \times 10^8 \text{ ms}^{-1}$.

23. "A convex lens can form a magnified erect as well as magnified inverted image of an object placed in front of it". Draw ray diagram to justify this statement stating the position of the object with respect to the lens in each case.

An object of height 4 cm is placed at a distance of 20 cm from a concave lens of focal length 10 cm. Use lens formula to determine the position of the image formed.

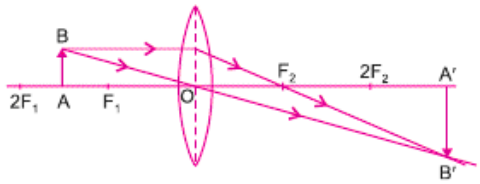
Ans. A convex lens of focal length 'f' can form

(a) a magnified and erect image only when object is placed between its focus 'F' and optical centre 'O' of the lens.

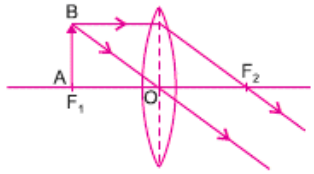


(b) a magnified and inverted image in the following position of an object placed in front of convex lens:

(i) between F and 2F and



(ii) at focus 'F'.



Therefore, for the given positions of the object with respect to convex lens, the given statement is justified.

For concave lens

$h_0 = +4$ cm, $u = -20$ cm, $f = -10$ cm, $v = ?$

Using lens formula,

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

or $$\frac{1}{v} = \frac{1}{f} + \frac{1}{u} = \frac{1}{-10} + \frac{1}{-20} = -\frac{1}{10} - \frac{1}{20}$$

or $$\frac{1}{v} = \frac{-2-1}{20} = -\frac{3}{20}$$

or $$v = -\frac{20}{3} = -6.67 \text{ cm}$$

So, image is formed on the same side of the object at 6.67 cm from the optical centre of a concave lens.

24. A student is unable to see clearly the words written on the blackboard placed at a distance of approximately 4 m from him. Name the defect of vision the boy is suffering from. Explain the method of correcting this defect. Draw ray diagram for the:

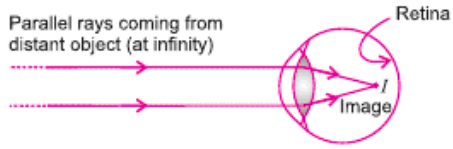
(i) defect of vision and also

(ii) for its correction.

Ans. Defect of vision-Myopia or short-sightedness

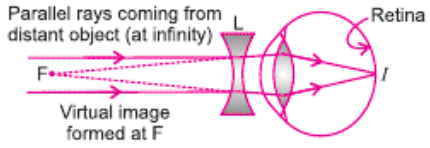
The short-sightedness is corrected by using a concave lens which diverges and shifts the image to the retina.

(*i*) **Defect of vision**



In a myopic eye, image of distant object is formed in front of the retina (and not on the retina)

(*ii*) **Correction for defect of vision**



Correction of Myopia. The concave lens placed in front of eye forms a virtual image of distant object at far point (F) of the myopic eye.

SECTION-B

25. A student adds 2 mL of acetic acid to a test tube containing 2 mL of distilled water. He then shakes the test well and leaves it to settle for some time. After about 5 minutes he observes that in the test tube there is:

(*a*) a clear transparent colourless solution

(*b*) a clear transparent pink solution

(*c*) a precipitate settling at the bottom of the test tube

(*d*) a layer of water over the layer of acetic acid

Ans. (*a*) Homogeneous, clear, transparent, colourless solution is formed as acetic acid is soluble in water.

26. A student prepared 20% sodium hydroxide solution in a beaker to study saponification reaction. Some observations related to this are given below:

(*i*) Sodium hydroxide solution turns red litmus blue

(*ii*) Sodium hydroxide readily dissolves in water

(*iii*) The beaker containing solution appears cold when touched from outside

(*iv*) The blue litmus paper turns red when dipped into the solution

The correct observations are:

(*a*) I, II and IV

(*b*) I, II and III

(*c*) only III and IV

(*d*) only I and II

Ans. (*d*) NaOH turns red litmus blue and it is soluble in water. The dissolution is exothermic process.

27. Hard water is not available for an experiment. Some salts are given below:

(*i*) Sodium chloride

(*ii*) Sodium sulphate

(*iii*) Calcium chloride

(*iv*) Calcium sulphate

(*v*) Potassium chloride

(*vi*) Magnesium sulphate

Select from the following a group of these salts, each member of which may be dissolved in water to make it hard.

(*a*) I, II, V

(*b*) I, III, V

(*c*) III, IV, VI

(*d*) II, IV, VI

Ans. (*c*) $CaCl_2$, $CaSO_4$ and $MgSO_4$ will make water hard.

28. A student identified the various parts of an embryo of a gram seed and listed them as given below:

(*i*) Testa

(*ii*) Plumule

(*iii*) Radicle

(*iv*) Cotyledon

(*v*) Tegman

Out of these the actual parts of the embryo are:

(*a*) I, II, III

(*b*) II, III, IV

(*c*) III, IV, V

(*d*) II, IV, V

Ans. (*b*) These are the parts of an embryo.

29. Four students A, B, C and D reported the following set of organs to be homologous. Who is correct?

(*a*) Wings of a bat and a butterfly

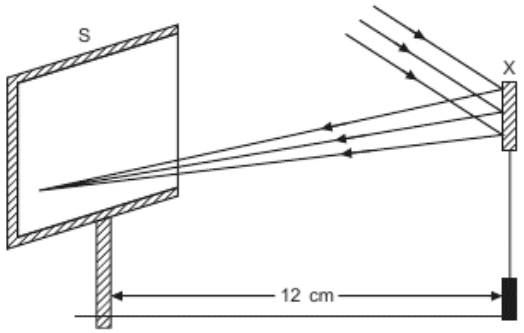
(*b*) Wings of a pigeon and a bat

(*c*) Wings of a pigeon and a butterfly

(*d*) Forelimbs of cow, a duck and a lizard

Ans. (*d*) They have similar structures but different functions.

30. Study the following diagram and select the correct statement about the device 'X':



(*a*) Device 'X' is a concave mirror of radius of curvature 12 cm

(*b*) Device 'X' is a concave mirror of focal length 6 cm

(*c*) Device 'X' is a concave mirror of focal length 12 cm

(*d*) Device 'X' is a convex mirror of focal length 12 cm

Ans. (*c*) Converging nature of the rays indicates that device '*X*' is a concave mirror as shown in the figure. Also, focal length of the mirror is equal to the distance between pole of mirror and screen. So, $f = 12$ cm.

31. A student has obtained a point image of a distant object using the given convex lens. To find the focal length of the lens he should measure the distance between the:

(*a*) lens and the object only

(*b*) lens and the screen only

(*c*) object and the image only

(*d*) lens and the object and also between the object and the image

Ans. (*b*) The difference between the distance from the optical centre of the lens and screen gives the focal length of convex lens.

32. Four students P, Q, R and S traced the path of a ray of light passing through a glass slab for an angle of incidence 40° and measured the angle of refraction. The values as measured them were 18°; 22°; 25° and 30° respectively. The student who has performed the experiment methodically is:

(*a*) P

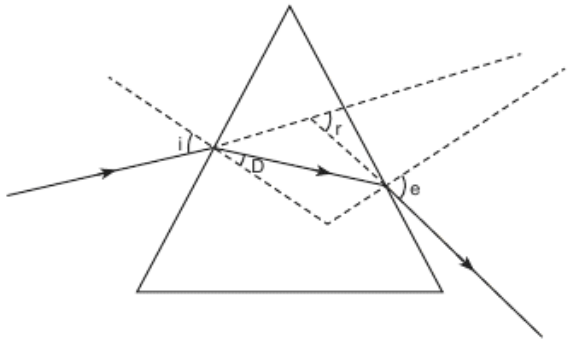
(*b*) Q

(*c*) R

(*d*) S

Ans. (*a*) At the rarer-denser interface, the angle of refraction is always less than the angle of incidence, *i.e.* $\angle r < \angle i$.

33. After tracing the path of a ray of light through a glass prism a student marked the angle of incidence ($\angle i$), angle of refraction ($\angle r$), angle of emergence ($\angle e$) and the angle of deviation ($\angle D$) as shown in the diagram. The correctly marked angles are:



(*a*) $\angle i$ and $\angle r$

(*b*) $\angle i$ and $\angle e$

(*c*) $\angle i$, $\angle e$ and $\angle D$

(*d*) $\angle i$, $\angle r$ and $\angle e$

Ans. (*b*) Angle of incidence ($\angle i$) is the angle between incident ray and normal.

Angle of emergence ($\angle e$) is the angle between normal and emergent ray.

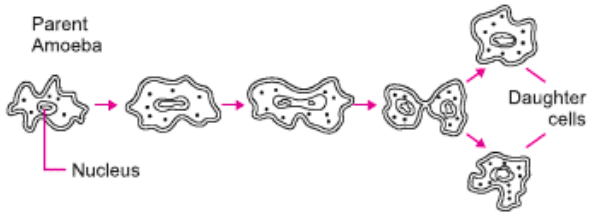
34. List two observations which you make when you add a pinch of sodium hydrogen carbonate to acetic acid in a test tube. Write chemical equation for the reaction that occurs.

Ans. Brisk effervescence due to colourless, odourless CO_2 gas will be observed.

$CH_3COOH + NaHCO_3 \longrightarrow CH_3COONa + H_2O + CO_2$.

35. Name the type of asexual reproduction in which two individuals are formed from a single parent and the parental identity is lost. Draw the initial and the final stages of this type of reproduction. State the event with which this reproduction starts.

Ans. This type of reproduction is called binary fission.



Binary Fission in *Amoeba*

This type of reproduction starts with elongation of nucleus.

36. To find the image-distance for varying object-distances in case of a convex lens, a student obtains on a screen a sharp image of a bright object placed very far from the lens. After that he gradually moves the object towards the lens and each time focuses its image of the screen.

(*a*) In which direction – towards or away from the lens, does he move the screen to focus the object?

(*b*) What happens to the size of image – does it increase or decrease?

(*c*)What happen when he moves the object very close to the lens?

Ans. (*a*) When an object moves gradually from very far off position *i.e.*, from infinity towards the lens, the image starts from its principal focus on the other side of the lens towards infinity. So, he moves the screen away from the lens to focus the object.

(*b*) Size of image increases.

(*c*) When object lies very close to the lens, *i.e.* object lies in between focus and optical centre, the image is formed on the same side of the object. Virtual and magnified image is formed.

Set-II (*Uncommon Questions to Set-I*)

1. Write the name and formula of the 2nd member of homologous series having general formula C_nH_{2n+2}.

Ans. C_2H_6 is ethane, second member of homologous series having general formula C_nH_{2n+2}.

2. What is the magnification of the images formed by plane mirrors and why?

Ans. Magnification of images formed by a plane mirrors is +1. This is because the size of image formed by plane mirror is equal to the size of object.

3. What is meant by power of a lens?

Ans. Power of a lens: The ability of a lens to converge or diverge the rays of light is called power of a lens.

4. Write two differences between binary fission and multiple fission in a tabular form.

Ans. **Differences between:**

Binary fission	Multiple fission
(*i*) It is the division of the parent into two nearly equal sized daughter individuals.	(*i*) It is the division of the parent into many small daughter individuals.
(*ii*) Two daughter individuals are formed by a simple division or splitting.	(*ii*) Nucleus of the parent cell divides to form a number of nuclei.

5. (*i*) Why do we need to manage our resources carefully?

(*ii*) Why management of natural resources requires a long term perspective?

Ans. (*i*) Resources are limited and with the human population increasing at a tremendous rate, demand for all resources are increasing at an exponential rate. We therefore need to manage our resources carefully.

(*ii*) Management of natural resources requires a long term perspective, so that these resources last for generations to come and will not merely be exploited for short term gain. Management of natural resources also ensures equitable distribution of resources, so that all get the benefit from development of these resources.

6. List four measures that can be taken to conserve forests.

Ans. (*i*) Vegetative propagation is a cheaper, easier and more rapid method of propagation in plants than growing plants from their seeds.

(*ii*) The traits or characters of the parent plant are preserved by vegetative propagation.

(*iii*) Better quality of the plants can be maintained by this method.

(*iv*) It results in propagation of those plants which do not produce viable seeds or produce seeds with prolonged period of dormancy.

7. Na, Mg and Al are the elements of the same period of Modern Periodic Table having one, two and three valence electrons respectively. Which of these elements (*i*) has the largest atomic radius, (*ii*) is least reactive? Justify your answer stating reason for each case.

Ans. (*i*) Na has largest atomic radius because it has 11 protons and 11 electrons and least effective nuclear charge among these elements.

(*ii*) Al is least reactive because it is smallest in size, therefore, has most effective nuclear charge, least tendency to lose electrons.

9. What is meant by isomers? Draw the structures of two isomers of butane, C_4H_{10}. Explain why we cannot have isomers of first three members of alkane series.

Ans. Isomers are those compounds which have same molecular formula but different structural formula.

$CH_3CH_2CH_2CH_3$ and $CH_3—\underset{\displaystyle CH_3}{\underset{|}{CH}}—CH_3$ are two isomers of C_4H_{10}. Isomers are not possible for first three members because branching is not possible.

11. What are sexually transmitted diseases. List two example of each diseases caused due to (*i*) bacterial infection and (*ii*) viral infection. Which device or devices may be used to prevent the spread of such diseases.

Ans. STDs are diseases which are spread by sexual contact from an infected person to a healthy person.

(*i*) Gonorrhoea and Syphilis are STDs caused by bacterial infection.

(*ii*) AIDS and Wart are STDs caused by viral infection.

Spread of STDs can be prevented by-

(*a*) Avoiding sexual contact with infected persons.

(*b*) Using condom for penis during sexual act.

14. What is speciation? List four factors responsible for speciation.

Ans. **Speciation:** Speciation is the evolution of reproductive isolation among once interbreeding population.

Factors which can lead to speciation are-

(*i*) **Genetic drift:** Over generation, genetic drift may accumulate which lead to speciation.

(*ii*) **Natural selection:** Natural selection may work differently in different location which may give rise to speciation.

(*iii*) Severe DNA change

(*iv*) A variation may occur which does not allow sexual act between two groups.

19. The image of a candle flame placed at a distance of 30 cm from a spherical lens is formed on a screen placed on the other side of the lens at a distance of 60 cm from the optical centre of the lens. Identify the type of lens and calculate its focal length. If the height of the flame is 3 cm, find the height of its image.

Ans. Given: $u = -30$ cm, $v = +60$ cm, $h_0 = +3$ cm

Using lens formula $\dfrac{1}{f} = \dfrac{1}{v} - \dfrac{1}{u} = \dfrac{1}{60} - \dfrac{1}{-30} = \dfrac{1}{60} + \dfrac{1}{30} = \dfrac{3}{60} = \dfrac{1}{20}$

$\therefore$ $f = +20$ cm

Positive sign of focal length indicates that the given lens is convex in nature whose focal length is 20 cm.

Again, $m = \dfrac{h_i}{h_0} = \dfrac{v}{u}$

or $h_i = \dfrac{v}{u} \times h_0 = \dfrac{+60}{-30} \times 3 = -6$ cm

So, height of image is 6 cm. Negative sign indicates that it is formed below the principal axis and is real and inverted.

Set-III (*Uncommon Questions to Set-I and Set-II*)

1. Write the name and formula of the 2nd member of homologous series having general formula C_nH_{2n-2}.

Ans. $HC{\equiv}C{-}CH_3$, Propyne (C_3H_4) is second members of homologous series.

2. What is speciation?

Ans. **Speciation** is the evolution of reproductive isolation among once–interbreeding populations, *i.e.*, the development of one or more species from an existing species.

3. Why should biodegradable and non-biodegradable wastes be discarded in two separate dustbins?

Ans. Biodegradable materials are broken down by micro organisms in nature into simple harmless substances. Non biodegradable materials need a different treatment like heat and temperature and hence should be discarded in a different bin.

4. List four specific characteristics of the images of the object formed by convex mirrors.

Ans. **Properties of image formed by a convex mirror:**

(*i*) It always formed behind the mirror, between the pole and its focus.

(*ii*) The image is always virtual and erect.

(*iii*) The size of image is always smaller than the object.

(*iv*) Magnification is always positive.

5. List two advantages associated with water harvesting at the community level.

Ans. (*i*) Water harvested will percolate down and will increase the ground water level.

(*ii*) Water harvested at community level can be used for drinking and irrigation purpose.

6. Everyone of us can do something to reduce our personal consumption of various natural resources. List four such activities based on 3-R approach.

Ans. The consumption of various natural resources can be reduced in the following ways:

(*i*) Saving electricity by switching off unnecessary lights and fans.

(*ii*) Walking or cycling when possible than using vehicle.

(*iii*) Repairing leaky taps.

(*iv*) Not wasting food.

7. Write the name and structural formula of the compound obtained when ethanol is heated at 443 K with excess of conc. H_2SO_4. Also write chemical equation for the reaction stating the role of conc. H_2SO_4 in it.

Ans. $\underset{\text{Ethanol}}{CH_3CH_2OH} \xrightarrow[443\,K]{\text{conc } H_2SO_4} \underset{\text{Ethene}}{CH_2{=}CH_2} + H_2O$

is structural formula. Its name is ethene.

Conc. H_2SO_4 acts as dehydrating agent.

10. Write the number of periods the Modern Periodic Table has. State the changes in valency and metallic character of elements as we move from left to right in a period. Also state the changes, if any, in the valency and atomic size of elements as we move down a group.

Ans. Modern Periodic Table has 7 periods.

Valency first increases till middle and then decreases along a period from left to right. Metallic character decreases from left to right in a period.

There is no change in valency we move down the group.

Atomic size goes on increasing down the group.

12. (*a*) Name the following:

(*i*) Thread like non-reproductive structures present in Rhizopus.

(*ii*) 'Blobs' that develop at the tips of the non-reproductive threads in Rhizopus.

(*b*) Explain how these structures protect themselves and what is the function of the structures released from the 'blobs' in *Rhizopus*.

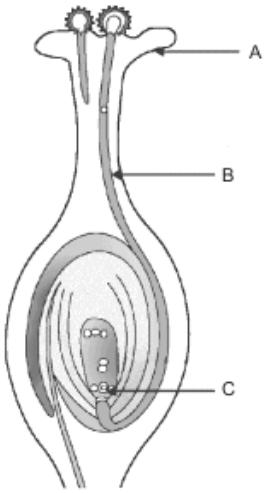
Ans. (*a*) (*i*) Hyphae

(*ii*) Sporangium

(*b*) Spores are enclosed within sporangia which protects the spores.

Spores when released from sporangia Develops into new Rhizopus.

13. Name the parts A, B and C shown in the diagram and write their functions.



Ans. A = Stigma. Stigma allows pollens to land on it and then to grow.

B = Pollen tube. It allows male germ cell to travel through it and to reach the female germ cell.

C = Female germ cell. When the male germ cell reaches the female germ cell, fertilization takes place and zygote is formed.

15. List in tabular form, two distinguishing features between the acquired traits and the inherited traits with one example of each.

Ans. **Differences:**

Acquired traits	Inherited traits
(*i*) These traits are the characteristics which are developed during the lifetime of an individual.	(*i*) These are the characteristics transmitted from parent to the offspring.
(*ii*) Acquired traits are not passed on to the next generation. *e.g.*, **Acquired trait:** Less body weight due to starvation.	(*ii*) Inherited trait is genetically determined characteristic that distinguishes a person. *e.g.*, **Inherited trait:** Colour of hair and eye.

16. To construct ray diagrams, two rays of light are generally so chosen that it is easy to determine their directions after reflection from a mirror. Choose two such rays and state the path/direction of these rays after reflection from a concave mirror. Use these two rays to find the position and nature of the image of an object placed at a distance of 8 cm from a concave mirror of focal length 12 cm.

Ans. (*a*) **Rays which are choose to construct ray diagram for reflection are**

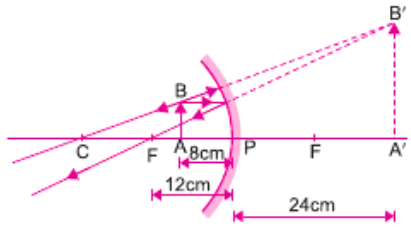
(*i*) A ray parallel to the principal axis and

(*ii*) A ray passing through the centre of curvature of a concave mirror.

Path of there rays after reflection

(*i*) A ray parallel to the principle axis, after reflection, it will pass through the principal focus of a concave mirror.

(*ii*) A ray passing through the centre of curvature, after reflection, it will reflected back along the same path.



For concave mirror

$$f = -12 \text{ cm}, \; u = -8 \text{ cm}, \; v = ?$$

Using mirror formula, $\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$, we get

$$\frac{1}{-12} = \frac{1}{v} + \frac{1}{-8}$$

or $$\frac{1}{v} = \frac{1}{8} - \frac{1}{12} = \frac{3-2}{24} = \frac{1}{24}$$

or $$v = +24 \text{ cm}$$

So, the image is formed behind the mirror at a distance of 24 cm from its pole and it is virtual, erect and magnified.

Latest Examination Papers, 2015

[All India Set-I, II, III]

Time Allowed : **3 Hours**] [*Maximum Marks* : **70**

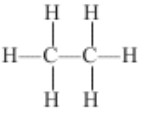
General Instructions : *As given in Examination Paper, Delhi 2015*

Set-I

SECTION-A

1. Write the number of covalent bonds in the molecule of ethane.

Ans.



There are 7 covalent bonds.

2. Name the life process of an organism that helps in the growth of its population.

Ans. Reproduction.

3. What will be the amount of energy available to the organisms of the 2nd trophic level of a food chain, if the energy available at the first trophic level is 10,000 joules?

Ans. 100 Joules of energy will be available to the organism in the 2^{nd} trophic level.

4. The absolute refractive indices of glass and water are 3/2 and 4/3 respectively. If the speed of light in glass is 2×10^8 m/s, calculate the speed of light in (*i*) vacuum, (*ii*) water.

Ans. Given: $n_g = \frac{3}{2}$ and $n_w = \frac{4}{3}$

$v_g = 2 \times 10^8$ m/s

(*i*) We know that $n_g = \frac{\text{Speed of light in vacuum}}{\text{Speed of light in glass}} = \frac{c}{v_g}$

$$\frac{3}{2} = \frac{c}{2 \times 10^8} \Rightarrow c = 3 \times 10^8 \text{ ms}^{-1}$$

So, speed of light in vacuum $= 3 \times 10^8$ m/s

(*ii*) Again, $n_w = \frac{c}{v_w}$

$$\frac{4}{3} = \frac{3 \times 10^8}{v_w}$$

or $v_w = \frac{9}{4} \times 10^8 = 2.25 \times 10^8 \text{ ms}^{-1}$

5. List two main causes of the pollution of water of the river Ganga. State how pollution and contamination of river water prove harmful for the health of the people of neighbouring areas.

Ans.

- Largely untreated sewage such as garbage and excreta are dumped into the Ganga.
- Industries also contribute in Ganga's pollution by loading chemical effluents and makes the water toxic, killing aquatic organisms.

Harmful effects:

(*i*) It has made the water unfit for consumption and if consumed without treatment, it causes diarrhoea, skin disease and many other diseases in human being.

(*ii*) It causes death to aquatic animals.

6. What is biodiversity? What will happen if biodiversity of an area is not preserved? Mention one effect of it.

Ans. **Biodiversity** is the existence of a wide variety of species of plants, animals and microorganisms in a natural habitat within a particular environment or of genetic variation within a species. Biodiversity of an area is the number of species or range of different life forms found there. Forests are 'biodiversity hotspots'.

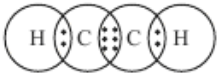
Every living being is dependent on another living being. It is a chain. If biodiversity is not maintained, the links of the chain go missing. If one organism goes missing, this will affect all the living beings who are dependent on it.

7. List two tests for experimentally distinguishing between an alcohol and a carboxylic acid and describe how these tests are performed.

Ans. (*i*) **$NaHCO_3$ test:** Add sodium hydrogen carbonate to alcohol and a carboxylic acid separately. Alcohol will not react, whereas carboxylic acid will give brisk effervescence. Pass the gas through lime water. It will turn milky.

(*ii*) **Blue litmus test:** Add few drops of alcohol and solution of carboxylic acid on blue litmus paper separately. Blue litmus will remain as it is in case of alcohol, whereas it will turn red in carboxylic acid.

8. Draw the electron-dot structure for ethyne. A mixture of ethyne and oxygen is burnt for welding. In your opinion, why cannot we use a mixture of ethyne and air for this purpose?

Ans. 

H—C≡C—H

Ethyne and air will not produce enough heat which can be used for welding purpose. Ethyne and oxygen will produce lot of heat which can be used for welding purposes.

9. Two elements 'P' and 'Q' belong to the same period of the modern periodic table and are in Group-1 and Group-2 respectively. Compare their following characteristics in tabular form:

(*a*) The number of electrons in their atoms

(*b*) The sizes of their atoms

(*c*) Their metallic characters

(*d*) Their tendencies to lose electrons

(*e*) The formula of their oxides

(*f*) The formula of their chlorides

Ans.

Group-1	Group-2
(*a*) They have one valence electron.	(*a*) They have 2 valence electrons.
(*b*) They are larger in size.	(*b*) They are smaller in size.
(*c*) They are more metallic.	(*c*) They are less metallic.
(*d*) They can lose electrons easily.	(*d*) They have less tendency to lose electron than Group-1.
(*e*) P_2O is formula of oxide.	(*e*) QO is formula of their oxides.
(*f*) PCl is formula of chloride.	(*f*) QCl_2 is formula of their chloride.

10. Taking the example of an element of atomic number 16, explain how the electronic configuration of the atom of an element relates to its position in the modern periodic table and how valency of an element is calculated on the basis of its atomic number.

Ans. S(16) has electronic configuration 2, 8, 6. It has 6 valence electrons. It belongs to Group 16. It has three shells, therefore, it belongs to 3rd period. It has 6 valence electrons. It can gain 2 electrons to complete its octet, therefore, its valency is equal to 2.

11. List six specific characteristics of sexual reproduction.

Ans. **Specific Characteristics of Sexual Mode of Reproduction.**

(*i*) Sexual reproduction promotes diversity of characters in the offsprings.

(*ii*) It results in new combinations of genes brought together in the gamete and this reshuffling increases genetic variation.

(*iii*) It plays a prominent role in the origin of new species.

(*iv*) The sexual mode of reproduction incorporates process of combining DNA from two different individuals during reproduction.

(*v*) Sexual reproduction need two parents to produce an offspring.

(*vi*) Sex cells are used in sexual reproduction.

12. What are chromosomes? Explain how in sexually reproducing organisms the number of chromosomes in the progeny is maintained.

Ans. 'Chromosomes' are long thread-like structures which contain hereditary information of the individual and are thereby the carriers of genes. Chromosomes are located in the nucleus of a cell.

The parents are diploid (2n) as each of them has two sets of chromosomes. They form haploid (1n) male and female gametes through the process of meiosis. The haploid gametes have one set of chromosomes. These two gametes fuse during fertilisation and the offspring become diploid (2n) which is same as parents chromosome number.

13. List four points of significance of reproductive health in a society. Name any two areas related to reproductive health which have improved over the past 50 years in our country.

Ans. (*i*) The mother carrying a child should be physically matured.

(*ii*) The mother should be mentally fit to take care of the child.

(*iii*) There should be at least 3 years gap between 2 children.

(*iv*) Nutritious food should be available to the mother during pregnancy and during lactation period.

14. Explain with an example for each, how the following provides evidences in favour of evolution in organisms:

(*a*) Homologous organs

(*b*) Analogous organs

(*c*) Fossils

Ans. (*a*) Forelimb of human and bird are homologous organs. They have same structural design and developmental origin but they have different functions and appearance.

Homologous organs help us to understand that the organism have evolved from a common ancestor. The more common characteristics the two species have, the more closely they are related.

(*b*) Analogous organs are those organs which have different basic structural design and developmental origin but have similar appearance and perform similar functions.

Example: The wings of birds and bats look similar but have different design in their structure. They have a common function of flying but their origins are not common. So, birds and bats are not closely related.

(*c*) Fossils and their study is useful in knowing about the species which are no longer alive. They provide evidence and missing links between two classes. They are helpful in forming a sequence of organisms in the pathway of evolution. Thus, fossils have an importance in deciding evolutionary relationship. Archaeopteryx is a fossil bird. It had feathers, fused bones and beak which are exclusively bird structures. It also had some features which are found in reptiles, *e.g.*, teeth in jaw, claws on free fingers and a long tail. This fossil provides a clue that birds have evolved from reptiles.

15. Explain the following:

(*a*) Speciation

(*b*) Natural Selection

Ans. (*a*) **Speciation.** It is the evolution of reproductive isolation among once–interbreeding populations, *i.e.* the development of one or more species from an existing species.

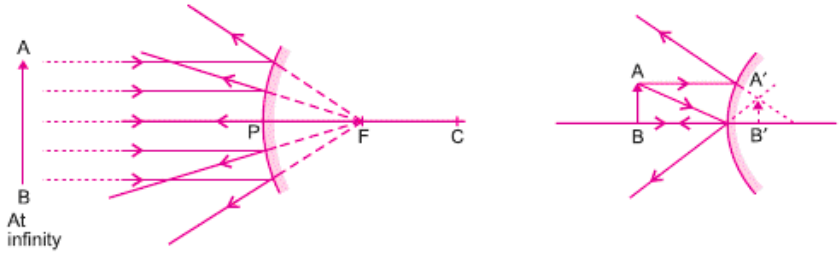
(*b*) **Natural Selection.** It is the process, according to Darwin, which brings about the evolution of new species of animals and plants.

- It was noted that the size of any population tends to remain constant despite the fact that more offsprings are produced than are needed to maintain.
- Darwin found that variations existed between individuals of the population and concluded that disease, competition and other forces acting on the population eliminated those individuals which are less well adapted to their environment.
- The surviving population would pass the hereditary advantageous characteristics to their offsprings.

16. If the image formed by a mirror for all positions of the object placed in front of it is always erect and diminished, what type of mirror is it? Draw a ray diagram to justify your answer. Where and why do we generally use this type of mirror?

Ans. • Convex Mirror

•



• **Rear view mirror of vehicles: Convex mirror**

Convex mirror is used because it always produces a virtual, and erect image. whose size is smaller than the object. Therefore, it enabling the driver to see wide field view of the traffic behind the vehicle in a small mirror.

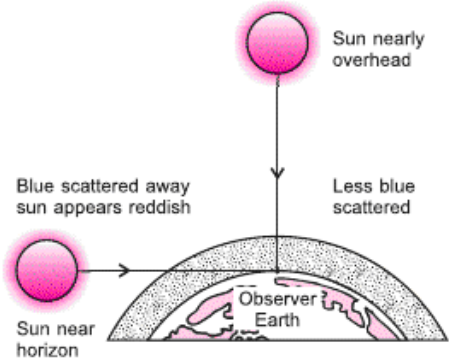
17. What is meant by scattering of light? Use this phenomenon to explain why the clear sky appears blue or the sun appears reddish at sunrise.

Ans. **Scattering of light:** The phenomenon of change of direction of propagation of light caused by a large number of molecules, such as smoke, tiny water droplets, suspended particles of dust and molecules of air present in the earth's atmosphere is called scattering of light.

Blue Colour of Sky: Blue colour has a shorter wavelength than red. So, according to Rayleigh scattering law, blue colour of sunlight scattered much more strongly by the large number of molecules present in the earth's atmosphere. Hence, the sky appears blue.

At Sunset or Sunrise, the Sun looks almost Reddish. The sun rays have to travel through a larger atmospheric distance. As $\lambda_b < \lambda_r$, most of the blue light and shorter wavelengths are removed by scattering. Only red colour, which is least scattered is received by our eye and appears to come from the sun.

Hence, the appearance of sun at sunset or sunrise, full moon near the horizon may look almost reddish.



18. Differentiate between biodegradable and non-biodegradable substances with the help of one example each. List two changes in habit that people must adopt to dispose non-biodegradable waste, for saving the environment.

Ans. Difference between Biodegradable and Non-biodegradable waste.

Biodegradable	Non-biodegradable
These wastes can be broken down into non poisonous substances in nature by the action of microorganisms. Example : Vegetable peel.	These wastes cannot be broken down in non poisonous substances by the action of microorganisms. Example : Polythene bags.

Following changes in habit, people should adopt:

(*i*) Disposal of non-biodegradable waste separately from biodegradable waste.

(*ii*) To reuse non-biodegradable waste as much as possible. For example reuse of polythene bags.

19. Both soap and detergent are same type of salts. What is the difference between them? Describe in brief the cleansing action of soap. Why do soaps not form lather in hard water? List two problems that arise due to the use of detergents instead of soaps.

Ans. Soaps are sodium or potassium salts of higher fatty acids. Detergents are sodium or potassium salts of sulphonic acids of benzene or alkene type hydrocarbons.

Soaps have, –COONa group, whereas detergents have $-SO_3Na$ or $-SO_4Na$.

Soap have hydrophobic part which attracts dirt, greese whereas hydrophillic part attracts water. Dirt, greese is washed away by water.

Soaps react with Ca^{2+} and Mg^{2+} ion present in hard water to form scum (calcium and magnesium salt of fatty acids) and soap goes waste.

(*i*) Detergents are more expensive.

(*ii*) Some detergents are not biodegradable and create water pollution.

20. (*a*) Name the human male reproductive organ that produces sperms and also secretes a hormone. Write the functions of the secreted hormone.

(*b*) Name the parts of the human female reproductive system where

(*i*) fertilisation takes place,

(*ii*) implantation of the fertilised egg occurs.

Explain how the embryo gets nourishment inside the mother's body.

Ans. (*a*) Sperms are produced by testes in male reproductive system. Testes also secrete male sex hormone, called testosterone.. Testosterone brings about changes in appearance in boys at the time of puberty.

(*b*) (*i*) Fertilisation occurs in fallopian tubes.

(*ii*) Implantation of fertilized egg takes place in the uterus.

Placenta provides nutrition from the mother's blood to the embryo. It facilitates movement of glucose and oxygen from the mother to the embryo. The developing embryo also generates waste substances which are removed by transferring into the mother's blood through placenta.

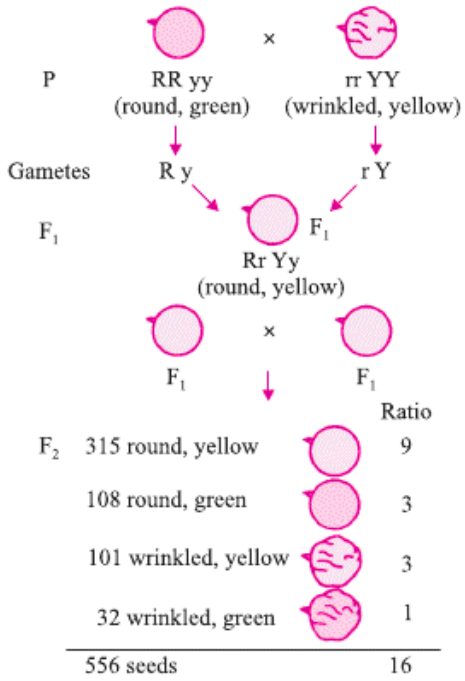
21. How do Mendel's experiments show that the

(*a*) traits may be dominant or recessive,

(*b*) traits are inherited independently?

Ans. Mendel's Experiments on Inheritance of Traits. Mendel used a number of contrasting visible characters of garden peas like round/wrinkled seeds, tall/short plants, white/violet flowers, etc.

Two Visible Contrasting Characters:



- Mendel took pea plants with two different characteristics such as plant with round and green seed and plant with wrinkled and yellow seeds.
- In F_1 progeny, all the plants will have round and yellow seeds. The round and yellow are dominant traits.
- Mendel then allowed F_1 progeny plants for self-pollination to get F_2 progeny.
- F_2 progeny will have plants with round and yellow seeds, round and green seeds, wrinkled and yellow seeds and wrinkled and green seed.
- The ratio of plants with above characteristics will be 9 : 3 : 3 : 1
- Therefore, tall/short trait and round seed/wrinkled seed trait are independently inherited.

(*a*) In F_1 progeny, all the plants will have round and yellow seeds. Wrinkled and green traits were not seen. But wrinkled and green characters appeared in the F_2 progeny . This means that wrinkle and green characters were recessive trait in F_1 progeny whereas round and yellow traits were dominant trait.

(*b*) New mixture of traits are seen in both F_1 and F_2 progeny . This means traits are independently inherited.

22. What is meant by power of a lens? Define its S.I. unit.

You have two lenses A and B of focal lengths +10 cm and –10 cm respectively. State the nature and power of each lens. Which of the two lenses will form a virtual and magnified image of an object placed 8 cm from the lens? Draw a ray diagram to justify your answer.

Ans. • (*a*) **Power of a Lens:** The ability of a lens to converge or diverge the ray of light after refraction is called power (P) of the lens. It is defined as the reciprocal of the focal length (*i.e.*) $P = \frac{1}{f}$.

(*b*) The SI unit of power of a lens is 'dioptre'. A lens of focal length 100 cm has a power of 1 dioptre (*i.e.*) 1 dioptre = $1m^{-1}$.

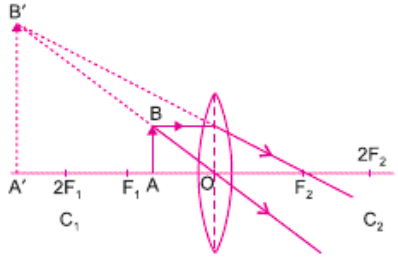
- Given: $f_A = +10$ cm, $f_B = -10$ cm

  So, its nature of lens A – Convex and lens B – Concave

  Power of lens A, $P_A = \frac{100}{f_A} = \frac{100}{10} = +10$ D

  Power of lens B, $P_B = \frac{100}{f_B} = -\frac{100}{10} = -10$ D

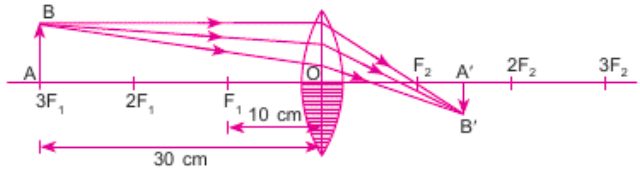
- Convex lens will form a virtual and magnified image of an object placed 8 cm from the lens, because object distance is less than that of the focal length of convex lens.



23. One half of a convex lens of focal length 10 cm is covered with a black paper. Can such a lens produce an image of a complete object placed at a distance of 30 cm from the lens? Draw a ray diagram to justify your answer.

A 4 cm tall object is placed perpendicular to the principal axis of a convex lens of focal length 20 cm. The distance of the object from the lens is 15 cm. Find the nature, position and size of the image.

Ans. • Yes, complete image of an object will be formed but of less intensity, the light falling on the covered portion will not reach at the image position.



- For convex lens, $h_1 = +4$ cm, $f = +20$ cm, $u = -15$ cm

  Using lens formula,

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

$$\frac{1}{20} = \frac{1}{v} - \frac{1}{-15} = \frac{1}{v} + \frac{1}{15}$$

$$\therefore \quad \frac{1}{v} = \frac{1}{20} - \frac{1}{15} = \frac{3-4}{60} = -\frac{1}{60}$$

or $$v = -60 \text{ cm}$$

Thus, the image is formed on the same side of the object at a distance of 60 cm from the optical centre of the lens. Negative sign indicates that image is virtual.

Using, $$m = \frac{h_2}{h_1} = \frac{v}{u}$$

$$\Rightarrow \quad h_2 = \frac{v}{u} \times h_1$$

$$= \frac{-60}{-15} \times 4 = +16 \text{ cm}$$

So, image is four times larger than the size of object *i.e.* 16 cm. Positive sign indicates that the image is erect.

24. Write the importance of ciliary muscles in the human eye. Name the defect of vision that arises due to gradual weakening of the ciliary muscles in old age. What type of lenses are required by the persons suffering from this defect to see the objects clearly?

Akshay, sitting in the last row in his class, could not see clearly the words written on the blackboard. When the teacher noticed it, he announced if any student sitting in the front row could volunteer to exchange his seat with Akshay. Salman immediately agreed to exchange his seat with Akshay. He could now see the words written on the blackboard clearly. The teacher thought it fit to send the message to Akshay's parents advising them to get his eyesight checked.

In the context of the above event, answer the following questions:

(*a*) Which defect of vision is Akshay suffering from? Which type of lens is used to correct this defect?

(*b*) State the values displayed by the teacher and Salman.

(*c*) In your opinion, in what way can Akshay express his gratitude towards the teacher and Salman?

Ans. • **Importance of Ciliary muscles in the Human Eye:**

(*i*) It helps the eye lens to focus the image of an object on the retina by increasing or decreasing the curvature of eye lens.

(*ii*) It holds the eye lens in position.

- Presbyopia is the defect of vision that arises due to gradual weakening of ciliary musles in old age.
- Bifocal lenses are required.
- (*a*) Akshay is suffering from Myopia (short-sightedness). Concave lens is used to correct this defect.

  (*b*) Friendship, concern for others, helping nature.

  (*c*) By expressing his love, thanks and gratitude to the teacher and his friend Salwan, for their dedication, caring attitude and support without which his life would not have been that easy.

SECTION-B

25. What do we observe on pouring acetic acid on red and blue litmus papers?

(*a*) Red litmus remains red and blue litmus turns red.

(*b*) Red litmus turns blue and blue litmus remains blue.

(*c*) Red litmus turns blue and blue litmus turns red.

(*d*) Red litmus becomes colourless and blue litmus remains blue.

Ans. (*a*) Acetic acid turns blue litmus red.

26. While preparing soap a small quantity of common salt is generally added to the reaction mixture of vegetable oil and sodium hydroxide. Which one of the following may be the purpose of adding common salt?

(*a*) To reduce the basic nature of the soap

(*b*) To make the soap neutral

(*c*) To enhance the cleansing power of the soap

(*d*) To favour the precipitation of the soap

Ans. (*d*) NaCl helps in complete precipitation of the soap.

27. A student takes about 4 mL of distilled water in four test tubes marked P, Q, R and S. He then dissolves in each test tube an equal amount of one salt in one test tube, namely sodium sulphate in P, potassium sulphate in Q, calcium sulphate in R and magnesium sulphate in S. Ater that he adds an equal amount of soap solution in each test tube. One shaking each of these test tubes well, he observes a good amount of lather (foam) in the test tubes marked

(*a*) P and Q (*b*) Q and R

(*c*) P, Q and S (*d*) P, R and S

Ans. (*a*) P and Q will have good lather as these contain soft water.

28. A student was asked to observe and identify the various parts of an embryo of a red kidney bean seed. He identified the parts and listed them as under:

I. Tegmen

II. Testa

III. Cotyledon

IV. Radicle

V. Plumule

The correctly identified parts among these are

(*a*) I, II and III (*b*) II, III and IV

(*c*) III, IV and V (*d*) I, III, IV and V

Ans. (*c*) Plumule, Radicle and Cotyledon are the three parts of a germinating seed.

29. Given below is the list of vegetables available in the market. Select from these the two vegetables having homologous structures:

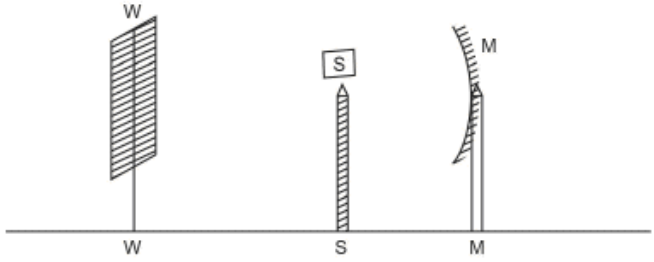
Potato, sweet potato, ginger, radish, tomato, carrot, okra (Lady's finger)

(*a*) Potato and sweet potato (*b*) Radish and carrot

(*c*) Okra and sweet potato (*d*) Potato and tomato

Ans. (*b*) Their structures are similar.

30. A student obtains a sharp image of the distant window (W) of the school laboratory on the screen (S) using the given concave mirror (M) to determine its focal length. Which is the following distances should he measure to get the focal length of the mirror?

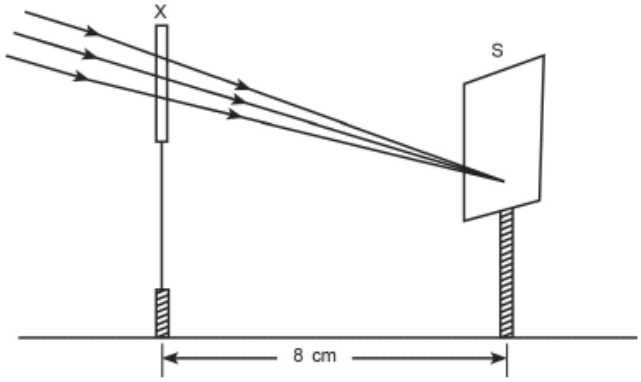


(*a*) MW (*b*) MS

(*c*) SW (*d*) MW – MS

Ans. (*c*) Focal length of concave mirror = Distance between mirror and screen.

31. A student used a device (X) to obtain/focus the image of a well illuminated distant building on a screen (S) as shown below in the diagram. Select the correct statement about the device (X).



(*a*) This device is a concave lens of focal length 8 cm.

(*b*) This device is a convex mirror of focal length 8 cm.

(*c*) This device is a convex lens of focal length 4 cm.

(*d*) This device is a convex lens of focal length 8 cm.

Ans. (*d*) Rays from an object at infinity, on refraction through a convex lens, meet at the second principal focus. The distance of second principal focus of the convex lens from its optical centre is called focal length.

32. A student traces the path of a ray of light through a rectangular glass slab for the different values of angle of incidence. He observes all possible precautions at each step of the experiment. At the end of the experiment, on analysing the measurements, which of the following conclusions is he likely to draw?

(*a*) $\angle i = \angle e < \angle r$ (*b*) $\angle i < \angle e < \angle r$

(*c*) $\angle i > \angle e > \angle r$ (*d*) $\angle i = \angle e > \angle r$

Ans. (*d*) At the rarer-denser interface, the angle of refraction is always less than the angle of incidence, *i.e.* $\angle i > \angle r$ and due to parallel surface, $\angle i = \angle e$.

33. A student traces the path of a ray of light through a triangular glass prism for different values of angle of incidence. On analysing the ray diagrams, which one of the following conclusions is he likely to draw?

(*a*) The emergent ray is parallel to the incident ray.

(*b*) The emergent ray bends at an angle to the direction of the incident ray.

(*c*) The emergent ray and the refracted ray are at right angles to each other.

(*d*) The emergent ray is perpendicular to the incident ray.

Ans. (*b*) The ray that emerges out of the glass prism at the glass air boundary suffers successive refractions and bends towards the base of the prism.

34. When you add sodium hydrogen carbonate to acetic acid in a test tube, a gas liberates immediately with a brisk effervescence. Name this gas. Describe the method of testing this gas.

Ans. Carbon dioxide gas is liberated. Pass the gas through lime water. Lime water turns milky due to formation of calcium carbonate.

35. Students were asked to observe the permanent slides showing different stages of budding in yeast under high power of a microscope.

(*a*) Which adjustment screw (coarse/fine) were you asked to move to focus the slides?

(*b*) Draw three diagrams in correct sequence showing budding in yeast.

Ans. (*a*) Fine adjustment screw to be moved to focus the slide.

(*b*)

36. A 4 cm tall object is placed on the principal axis of a convex lens. The distance of the object from the optical centre of the lens is 12 cm and its sharp image if formed at a distance of 24 cm from it on a screen on the other side of the lens. If the object is now moved a little away from the lens, in which way (towards the lens or away from the lens) will he have to move the screen to get a sharp image of the object on it again? How will the magnification of the image be affected?

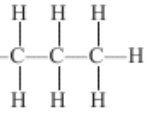
Ans. As the distance of the object increases, the image formed by a convex lens will be more close to its focus. So, he will move the screen towards the lens to get a sharp image of the object on it again with decrease in magnification.

Set-II (*Uncommon Questions to Set-I*)

SECTION-A

1. Write the number of covalent bonds in the molecule of propane, C_3H_8.

Ans.



There are 10 covalent bonds.

2. Where is DNA found in a cell?

Ans. DNA is found in the chromosome.

3. The first trophic level in a food chain is always a green plant. Why?

Ans. Only green plants can make their own food from sunlight. Green plants therefore, always occupy the 1st trophic level in a food chain.

5. We often observe domestic waste decomposing in the bylanes of our homes. List four ways to make the residents aware that the improper disposal of wastes is harmful to the environment and also for their own health.

Ans. Four ways to make the residents aware are:

(*i*) By door to door awareness campaign.

(*ii*) By displaying banner in various locations in the lane.

(*iii*) By organizing street play.

(*iv*) By giving a slip of appreciation or a rose to the people who dispose waste in the dustbins.

6. List any two advantages associated with water stored in the ground.

Ans. Advantages of storing water in the ground are:

(*i*) It does not evaporate.

(*ii*) It is relatively protected from contamination by human and animal waste.

7. What is meant by homologous series of carbon compounds? Classify the following carbon compounds into two homologous series and name them.

$$C_3H_4,\ C_3H_6,\ C_4H_6,\ C_4H_8,\ C_5H_8,\ C_5H_{10}$$

Ans. Homologous series is series of organic compounds which have same functional group, similar chemical properties but gradation in physical properties.

		Alkenes		Alkyne	
C_3H_6	Propene	$CH_3—CH=CH_2$	C_3H_4	$HC\equiv C—CH_3$	Propyne
C_4H_8	—Butene	$CH_2=CH—CH_2—CH_3$	C_4H_6	$HC\equiv C—CH_2—CH_3$	—Butyne
C_5H_{10}	—Pentene	$CH_2=CH—CH_2—CH_2—CH_3$	C_5H_8	$HC\equiv C—CH_2—CH_2—CH_3$	1-Pentyne

9. The elements $_4$Be, $_{12}$Mg and $_{20}$Ca, each having two valence electrons in their valence shells, are in periods 2, 3 and 4 respectively of the modern periodic table. Answer the following questions associated with these elements, giving reason in each case:

(*a*) In which group should they be?

(*b*) Which one of them is least reactive?

(*c*) Which one of them has the largest atomic size?

Ans. (*a*) They belong to group 2.

(*b*) 'Be' is least reactive.

(*c*) 'Ca' has the largest atomic size.

11. List three distinguishing features between sexual and asexual types of reproduction, in tabular form.

Ans. Distinguishing features between sexual and asexual reproduction:

Sexual reproduction	Asexual reproduction
(*i*) Sexual reproduction uses two individuals.	(*i*) Asexual reproduction need only one individual.
(*ii*) Hereditary characters vary from one generation to next generation.	(*ii*) Hereditary characters remain same.
(*iii*) It plays a prominent role in origin of a new species.	(*iii*) Its role in origin of new species is minimum.

14. A pea plant with blue colour flower denoted by BB is cross-bred with a pea plant with white flower denoted by ww.

(*a*) What is the expected colour of the flowers in their F_1 progeny?

(*b*) What will be the percentage of plants bearing white flower in F_2 generation, when the flowers of F_1 plants were selfed?

(*c*) State the expected ratio of the genotype BB and Bw in the F_2 progeny.

Ans.

BB × ww

F_1 Bw Bw Bw Bw

Bw × Bw

F_2 BB Bw Bw ww

(*a*) All flowers in F_1 progeny will be blue.

(*b*) 25% of flowers in F_2 progeny will be white.

(*c*) Ratio of BB and Bw will be 1 : 2.

18. What is an ecosystem? List its two main components. We do not clean natural ponds or lakes but an aquarium needs to be cleaned regularly. Why is it so? Explain.

Ans. **Ecosystem:** It is the structural and functional unit of biosphere, comprising of all the interacting organisms in an area together with the non-living constituents of the environment. Thus, an ecosystem is a self sustaining system where energy and matter are exchanged between living and non-living components.

Main components of ecosystem:

Biotic Component: It means the living organisms of the environment–plants, animals, human beings and microorganisms like bacteria and fungi, which are distinguished on the basis of their nutritional relationship.

Abiotic Component: It means the non-living part of the environment – air, water, soil and minerals. The climatic or physical factors such as sunlight, temperature, rainfall, humidity, pressure and wind are a part of the abiotic environment.

An aquarium is an artificial and incomplete ecosystem compared to pond or lakes which are natural, self-sustaining and complete ecosystem where there is a perfect recycling of materials.

An aquarium therefore needs regular cleaning.

19. What are fossils? How are they formed? Describe in brief two methods of determining the age of fossils. State any one role of fossils in the study of the process of evolution.

Ans. Fossils are the preserved traces or remains of living organisms of geological past.

When organisms die, their bodies decompose due to action of microorganisms. However, sometimes the body or at least some parts of the body may be in such an environment that does not let it decompose completely. All such preserved traces of living organisms are called fossils.

The age of fossil can be estimated by the following two methods:

(*i*) If we dig into the earth and start finding fossils, it can be assumed that the fossils closer to the surface are more recent to those found in deeper layers.

(*ii*) By detecting the ratios of different isotopes of the same element in the fossil material.

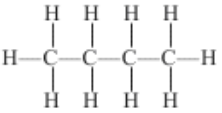
Fossils and their study is useful in knowing about the species which are no longer alive. They provide evidence and missing links between two classes. They are helpful in forming a sequence of organisms in the pathway of evolution. Thus, fossils have an importance in deciding evolutionary relationship.

Set-III (*Uncommon Questions to Set-I and Set-II*)

SECTION-A

1. Write the number of covalent bonds in the molecule of butane, C_4H_{10}.

Ans.



There are 13 covalent bonds.

2. Name two simple organisms having the ability of regeneration.

Ans. *Hydra* and *Planaria*.

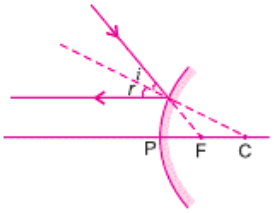
3. Which of the following are always at the second trophic level of food chains?

Carnivores, Autotrophs, Herbivores

Ans. Herbivores are always at the 2^{nd} trophic level.

4. Draw a ray diagram to show the path of the reflected ray corresponding to an incident ray of light parallel to the principal axis of a convex mirror and show the angle of incidence and angle of reflection on it.

Ans.



5. Why is sustainable management of natural resources necessary? Out of the two-reuse and recycle-which, in your opinion, is better to practise? Give reason.

Ans. Natural resources are limited. If it is over exploited for short time gain, future generations will suffer heavily. Sustainable management of natural resources is therefore, necessary so that natural resources lasts for a longer period and future generations can also enjoy the benefits from it.

Out of reuse and recycle, I will suggest people to practice reuse as it does not consume any energy.

6. What is meant by biodiversity? List two advantages of conserving forests and wild life.

Ans. Biodiversity is the existence of a wide variety of species of plants, animals and microorganisms in a natural habitat within a particular environment.

Two reasons each of conserving:

(*a*) Forest

(*i*) It helps in retaining the sub-soil water.

(*ii*) It checks flood.

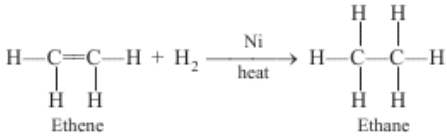
(*b*) Wildlife

(*i*) To maintain ecological equilibrium.

(*ii*) To protect the nature.

7. Write the name and general formula of a chain of hydrocarbons in which an addition reaction with hydrogen is possible. State the essential condition for an addition reaction. Stating this condition, write a chemical equation giving the name of the reactant and the product of the reaction.

Ans. C_nH_{2n} and C_nH_{2n-2} are general formula of alkene and alkynes in which addition reaction with hydrogen is possible. Hydrogen is added to unsaturated hydrocarbon (having double or triple bond) in presence of nickel as catalyst.



9. Given below are some elements of the modern periodic table. Atomic number of the element is given in the parentheses:

A(4), B(9), C(14), D(19), E(20)

(*a*) Select the element that has one electron in the outermost shell. Also write the electronic configuration of this element.

(*b*) Which two elements amongst these belong to the same group? Give reason for your answer.

(*c*) Which two elements amongst these belong to the same period? Which one of the two has bigger atomic radius?

Ans. (*a*) D(19) = 2, 8, 8, 1

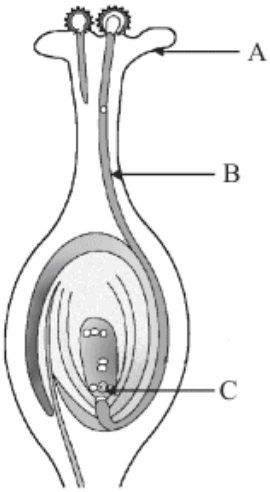
It has one valence electron.

(*b*) 'A' and 'E' belong to same group because they have same number of valence electrons.

(*c*) 'A' and 'B' belong to same period as they have same number of shells.

'A' has bigger atomic size due to less effective nuclear charge.

11. Identify A, B and C in the given diagram and write one function of each.



Ans. A = Stigma

B = Pollen tube

C = Female germ cell

Function of stigma: Stigma helps in receiving the pollen grains from the anther of stamen during pollination.

Function of pollen tube: The pollen tube facilitates movement of male germ cell through it to reach female germ cell.

Function of female germ cell: It meets with the male germ cell to form zygote which divides many times to form an embryo.

12. List four categories of contraceptive methods. State in brief two advantages of adopting such preventive methods.

Ans. Four methods of contraceptives used by humans are:

(*i*) Mechanical barrier such as condom.

(*ii*) Surgical method such as vasectomy or tubectomy.

(*iii*) Chemical method such as oral or vaginal pill.

(*iv*) Copper T.

Advantages of using contraceptives.

(*a*) It helps in avoiding unwanted pregnancy.

(*b*) Condom helps in preventing transmission of STDs.

16. With the help of scattering of light, explain the reason for the difference in colours of the sun as it appears during sunrise/ sunset and noon.

Ans. At sunrise or sunset, the sun looks almost reddish, while at noon, the sun appears white.

Explanation: At the time of sunrise/sunset, sun is near the horizon, so the sun rays have to travel through a larger atmospheric distance. The fine particles of the atmosphere scatter away the blue component and other shorter wavelengths of sunlight. Only red colour having longer wavelength and least scattered, reaches our eyes. Hence, sun appears red at sunrise or sunset.

However, the light from the sun, at noon, travels relatively shorter distance. So, blue and violet components of sunlight are less scattered by the particles of atmosphere. Hence, sun appears white at noon.

17. An object of height 5 cm is placed perpendicular to the principal axis of a concave lens of focal length 10 cm. If the distance of the object from the optical centre of the lens is 20 cm, determine the position, nature and size of the image formed using the lens formula.

Ans. For concave lens,

$h_o = +5$ cm, $f = -10$ cm, $u = -20$ cm, $v = ?$, $h_2 = ?$

Using, $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$, we get

$$\frac{1}{-10} = \frac{1}{v} - \frac{1}{-20} = \frac{1}{v} + \frac{1}{20}$$

$$\therefore \quad \frac{1}{v} = -\frac{1}{10} - \frac{1}{20} = \frac{-2-1}{20} = -\frac{3}{20}$$

$$v = -\frac{20}{3} = -6.67 \text{ cm}$$

So, image is formed on the same side of the object at a distance of 6.67 cm. Negative sign indicates that image is virtual.

Also $|v| < |u|$, so image is diminished.

As, $m = \frac{v}{u} = \frac{h_i}{h_o}$

or $\frac{-20/3}{-20} = \frac{h_i}{5}$

or $h_i = \frac{5}{3} = 1.66$ cm

So, image is virtual, erect diminished and of size 1.66 cm.

Latest Examination Papers, 2015

[Foreign Set-I, II, III]

Time Allowed : **3 Hours**] [*Maximum Marks* : **70**

General Instructions : *As given in Examination Paper, Delhi 2015*

Set-I

SECTION-A

1. Name the process by which unsaturated fats are changed to saturated fats.

Ans. Hydrogenation.

2. Name the causative agent of the disease "Kala-azar" and its mode of asexual reproduction.

Ans. *Leishmania* causes kala-azar. It reproduces by binary fission.

3. The following organisms form a food chain. Which of these will have the highest concentration of non-biodegradable chemicals? Name the phenomenon associated with it.

Insects, Hawk, Grass, Snake, Frog.

Ans. Hawk will have highest concentration of non-biodegradable chemical. The phenomenon is called biomagnification.

4. Why do stars appear to twinkle? Explain.

Ans. **Twinkling of Star:** The physical condition such as temperature, humidity, etc of the atmosphere continuously changing even at the same altitude. When star light passes through such changing atmosphere, the direction of refracted ray due to atmospheric refraction continuously change. The amount of light entering the eye also keeps changing. Some times star appears brighter and at some other time, it appears to be dim. Thus, the fluctuation in the intensity of starlight produces a twinkling effect to us.

5. What is meant by three types of 'R' (3-R's) to save the environment? Explain with examples how would you follow the 3-R's in your school to save the environment.

Ans. The three R-s mean Reduce, Recycle and Reuse to save the environment.

Reduce means to use less. We can switch off unnecessary lights and fans in school.

Recycle means to collect materials like plastic, glass, metal, etc and recycle them to make required items. We can dispose biodegradable and non-biodegradable materials in separate bins in school to facilitate recycle.

Reuse means to use thins again and again. We can use both sides of pages in school. Envelpops used in the school can be reversed and reused.

6. List four advantages of water stored in the ground as "ground water".

Ans. Four advantages of storing water in the ground are:

(*i*) It does not evaporate

(*ii*) It is relatively protected from contamination by human and animal waste

(*iii*) It does not provide breeding ground for mosquitoes

(*iv*) It provides moisture for vegetation.

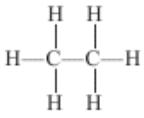
7. Write the molecular formula of the following compounds and draw their electron-dot structures:

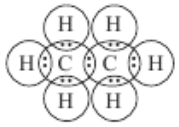
(*i*) Ethane

(*ii*) Ethene

(*iii*) Ethyne

Ans. (*i*) Ethane (C_2H_6)





(*ii*) Ethene (C_2H_4)

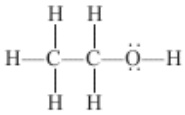
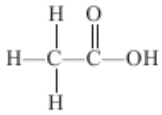
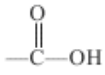
(*iii*) Ethyne (C_2H_2)

8. What is meant by functional group in carbon compounds? Write in tabular form the structural formula and the functional group present in the following compounds:

(*i*) Ethanol

(*ii*) Ethanoic acid

Ans. **Functional Group:** An atom or group of atoms which determines chemical properties of the organic compounds is called functional group.

(*i*) Ethanol	**(*ii*) Ethanoic acid**
C_2H_5OH 	CH_3COOH 
Functional group —OH	Functional group 

9. Write the main aim of classifying elements. Name the basic property of elements used in the development of Modern Periodic Table. State the Modern Periodic Law. On which side (part) of the Modern Periodic Table do you find metals, metalloids and non-metals?

Ans. The main aim of classification is to study the properties of 118 elements conveniently.

Atomic number is the basic property used in development of periodic table.

Modern Periodic Law: It states 'properties of elements are periodic function of their atomic number'.

Metals are on left hand side and middle of periodic table.

Non-metals are on right hand side of periodic table.

Metalloids are on right hand side in Zig-Zag manner between metals and non-metals.

10. The atomic number of an element 'X' is 20.

(*i*) Determine the position of the element 'X' in the periodic table.

(*ii*) Write the formula of the compound formed when 'X' reacts/combines with another element 'Y' (atomic number 8).

(*iii*) What would be the nature (acidic or basic) of the compound formed? Justify your answer.

Ans. (*i*) The element belongs to Group 2 and 4th period because it has 2 valence electrons and four shells.

(*ii*) X^2 Y^2

X has electronic configuration 2, 8, 8, 2 Valency = 2

Y has electronic configuration 2, 6 Valency = 2.

XY is the formula of the compound.

(*iii*) Basic oxide because 'X' is metal. It can lose 2 electrons to become stable. Metallic oxides are basic in nature.

11. Write one main difference between asexual and sexual mode of reproduction. Which species is likely to have comparatively better chances of survival—the one reproducing asexually or the one reproducing sexually? Justify your answer.

Ans.

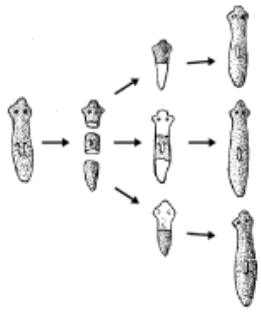
Sexual Reproduction	**Asexual Reproduction**
(*i*) Sexual reproduction needs two parents.	(*i*) Asexual reproduction needs only single parent.
(*ii*) Example : Human	(*ii*) *Amoeba*

In asexual reproduction, organisms raised are exact copies of their parents. They tend to preserve the similarities among all the individuals belonging to a given line of descent. But in sexual reproduction, two parents are involved and there is fusion of gametes. The offsprings show variations from their parents due to crossing over and exchange of gene segment.

In case of adverse environmental changes, the asexually reproducing organisms may not survive. But for sexually reproducing organisms, the change in environment may not be adverse for all the descent as some of the variations it has may have advantages in the changed environment. Hence, sexually reproducing organisms have comparatively better chances of survival.

12. Explain the process of regeneration in *Planaria*. How is this process different from reproduction?

Ans. (*a*) If a *Planaria* is cut into any number of pieces, each piece will grow into a complete organism. Regeneration is carried out by specialised cells which proliferate and make large number of cells of various types and tissues.



(*b*) In regeneration, the organism need to be cut into pieces to get more organisms. In Reproduction, the organism need not to be cut to multiply.

13. What is placenta? Explain its function in humans.

Ans. **Placenta** in human female is a complex double layered spongy vascular tissue formed by the joint activity of maternal and foetal tissues in the wall of uterus that is meant for attachment, nourishment and waste disposal for the foetus.

Through placenta, the foetus gets nutrients and oxygen from mother. Waste products from foetus are also transported to mother through placenta.

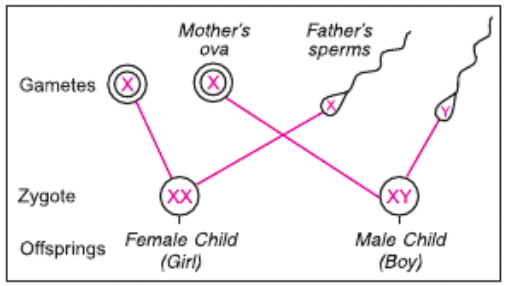
14. "It is a matter of chance whether a couple will have a male or a female child." Justify this statement by drawing a flow chart.

Ans. There are 23 pairs of chromosomes present in human beings. Out of these 23 pairs, one pair is sex chromosome. There are two type of sex chromosomes found in human being, X and Y. A female has 2 nos of X chromosomes and a male has one X and one Y chromosome.

Sex of a child depends on what happens during fertilization:

(*i*) The female gamete, ova always contributes an X chromosome during fertilization.

(*ii*) The male gamete, sperm contributes either X or Y chromosome during fertilization. But whether sperm will contribute the X chromosome or Y chromosome is a matter of chance and the man donot have any control on it.



Determination of Sex in Humans

(*iii*) If a sperm carrying X chromosome fertilizes an ova which always carries an X chromosome, then the child born will be a girl. But if a sperm carrying Y chromosome fertilizes an egg which always carries X chromosome, then the child born will be a boy.

(*iv*) Thus, sex of a newborn child is a matter of chance and none of the parents may be considered responsible for it.

15. "It is possible that a trait is inherited but may not be expressed." Give a suitable example to justify this statement.

Ans. The statement "It is possible that a trait is inherited but may not be expressed" can be explained with the help of Mendel's experiment on Pea plant with one visible contrasting character.

Mendel took pure breed pea plant with one visible contrasting character viz. tall and short plant. The pure breed tall and short plant were crossed and found that all the plants in the F_1 progeny are tall. Mendel then allows the F_1 progeny plants for self pollination. It was found that all the F_2 progeny plants are not tall and some are short. This indicates that both tallness and shortness traits were inherited separately in the F_1 progeny but shortness trait was not expressed in the F_1 progeny.

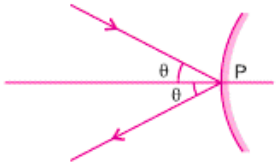
16. Draw a ray diagram to show the path of the reflected ray in each of the following cases. A ray of light incident on a convex mirror.

(*a*) strikes at its pole making an angle θ from the principal axis.

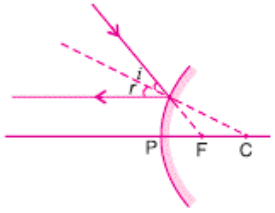
(*b*) is directed towards its principal focus.

(*c*) is parallel to its principal axis.

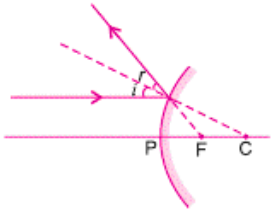
Ans. (*a*)



(*b*)



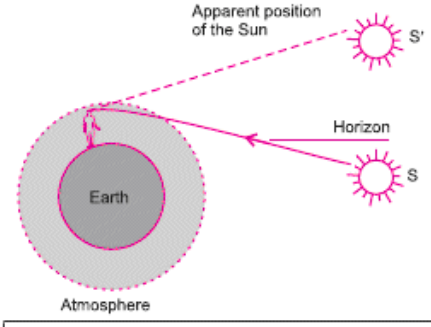
(*c*)



17. What is meant by advance sunrise and delayed sunset? Draw a labelled diagram to explain these phenomena.

Ans. Sun is visible 2 minutes before sunrise and 2 minutes after sunset because of atmospheric refraction. This can be explained as below:

Figure shows the actual position of sun S at the time of sunrise or sunset, just below the horizon and apparent position S′, above the horizon as appear to us.



Atmospheric refraction effects at sunset or sunrise

The sunrays coming from the sun, when it is slightly below the horizon passes through varying refractive index of different layers of the air, bends towards the normal and appear to come from S′, which is the apparent position of the sun. That is why sun is visible to us when it has actually set. So, due to the atmospheric refraction, the phenomenon of advance sunrise and delayed sunset is observed.

18. What is ozone? How and where is it formed in the atmosphere? Explain how does it affect ecosystem.

Ans. Ozone is an isotope of oxygen, *i.e* it is a molecule formed by 3 atoms of oxygen.

$$O_2 \longrightarrow O + O$$

$$O_2 + O \longrightarrow O_3 \text{ (Ozone)}$$

Ozone exists in the ozone layer of stratosphere. At higher level of atmosphere, O_2 molecule breaks down to 2 oxygen atom. The oxygen atom then combines with the oxygen molecule to form ozone.

Ozone layer in the atmosphere prevents UV rays from reaching earth. Exposure to excess UV rays causes skin cancer, cataract and damages eye and immune system. It also decreases crop yield and reduces population of phytoplankton, zooplankton and certain fish larvae which are an important constituent of aquatic food chain. It also disturbs rainfall, causing ecological disturbance and reduces global food production.

Thus, it affect the ecosystem.

19. Elements forming ionic compounds attain noble gas electronic configuration by either gaining or losing electrons from their valence shells. Explain giving reason why carbon cannot attain such a configuration in this manner to form its compounds. Name the type of bonds formed in ionic compounds and in the compounds formed by carbon. Also explain with reason why carbon compounds are generally poor conductors of electricity.

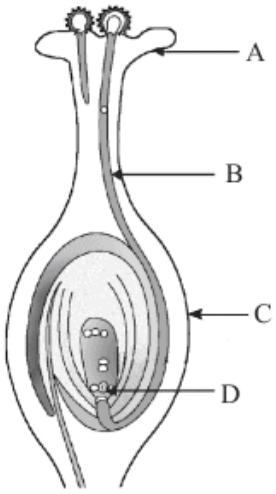
Ans. Carbon cannot lose four electrons because very high amount of energy is required to remove four electrons.

Carbon cannot gain four electrons easily because 6 protons cannot hold 10 electrons.

Carbon can share four electrons to form covalent bonds.

Carbon compounds are poor conductor of electricity because they do not form ions in aqueous solution.

20. (*a*) Identify A, B, C and D in the given diagram and write their names.



(*b*) What is pollination? Explain its significance.

(*c*) Explain the process of fertilisation in flowers. Name the parts of the flower that develop after fertilisation into

(*i*) seed,

(*ii*) fruit.

Ans. (*a*) A = Stigma

B = Pollen tube

C = Ovary

D = Embryo Sac

(*b*) It is the transfer of pollen grain from the anther of a flower to the stigma of a carpel.

Significance of pollination:

(*i*) It is necessary for seed formation and thus, perpetuation of species.

(*ii*) It stimulates the development of fruits.

Cross-pollination brings about genetic recombination of traits.

(*c*)
- After the pollen lands on a suitable stigma, it has to reach the female germ cells in the ovary.
- The pollen tube grows out of the pollen grain through the style to reach the ovary.
- Male germ cell travels through the pollen tube to reach the female germ cell and fertilizes it.
- After fertilisation, the zygote divides several times to form an embryo within the ovule.

(*i*) Ovule becomes seed.

(*ii*) Ovary becomes fruit.

21. What is speciation? List four factors that could lead to speciation. Which of these cannot be a major factor in the speciation of a self-pollinating plant species? Explain.

Ans. **Speciation:** Speciation is the evolution of reproductive isolation among once interbreeding population.

Factors which can lead to speciation are:

(*i*) **Genetic drift:** Over generation, genetic drift may accumulate which lead to speciation.

(*ii*) **Natural selection:** Natural selection may work differently in different location which may give rise to speciation.

(*iii*) Severe DNA change

(*iv*) A variation may occur which does not allow sexual act between two groups.

Severe DNA change may not occur in self pollinating plant species.

22. A student has focused the image of a candle flame on a white screen using a concave mirror. The situation is as given below:

Length of the flame = 1.5 cm

Focal length of the mirror = 12 cm

Distance of flame from the mirror = 18 cm

If the flame is perpendicular to the principal axis of the mirror, then calculate the following:

(*a*) Distance of the image from the mirror

(*b*) Length of the image.

If the distance between the mirror and the flame is reduced to 10 cm, then what would be observed on the screen? Draw ray diagram to justify your answer for this situation.

Ans. Given: $h_0 = +1.5$ cm, $f = -12$ cm, $u = -18$ cm

(*a*) For concave mirror, using mirror formula

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u} \text{ we get}$$

$$\frac{1}{v} = \frac{1}{f} - \frac{1}{u} = \frac{1}{-12} - \frac{1}{-18} = -\frac{1}{12} + \frac{1}{18} = \frac{-3+2}{36}$$

or $$\frac{1}{v} = -\frac{1}{36}$$

or $$v = -36 \text{ cm}$$

So, distance of image from the mirror = 36 cm, negative sign indicate that image is formed on the same side of object.

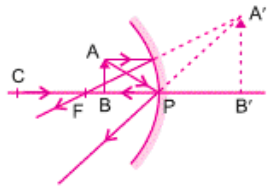
(*b*) Using, $$m = \frac{h_i}{h_0} = -\frac{v}{u}$$

or $$h_i = -\frac{v}{u} \times h_0$$

$$= -\frac{-36}{-18} \times 1.5 = -3.0 \text{ cm}$$

So, length of image is 3.0 cm.

If the distance between the mirror and the flame is reduced to 10 cm, no image is formed on the screen as object lies in between focus and pole of the mirror. So virtual image behind the mirror is obtained as shown in figure.



23. What is meant by the power of a lens? What is its S.I. unit? Name the type of lens whose power is positive.
The image of an object formed by a lens is real, inverted and of the same size as the object. If the image is at a distance of 40 cm from the lens, what is the nature and power of the lens? Draw ray diagram to justify your answer.

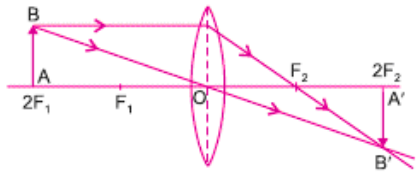
Ans. (*a*) **Power of a Lens:** The ability of a lens to converge or diverge the ray of light after refraction is called power (P) of the lens. It is defined as the reciprocal of the focal length (*i.e.,*) $P = \frac{1}{f}$.

(*b*) The SI unit of power of a lens is 'dioptre'. A lens of focal length 100 cm has a power of 1 dioptre (*i.e.,*)
1 dioptre = 1 m^{-1}.

The power of convex lens is positive as its focal length is positive.

(*c*) The image of an object formed by a lens is real, inverted and of the same size as the object. This indicates that $| v | = | u | = 2f = 40$ cm. So, nature of lens = convex and $f = +20$ cm.

Power of lens, $P = \frac{100}{f(\text{in cm})} = \frac{100}{20} = +5$ D



24. State the function of each of the following parts of the human eye:

(*i*) Cornea

(*ii*) Iris

(*iii*) Pupil

(*iv*) Retina

Millions of people of the developing countries are suffering from corneal blindness. The disease can be cured by replacing the defective cornea with the cornea of a donated eye. Your school has organised a campaign in the school and its neighbourhood in order to create awareness about this fact and motivate people to donate their eyes after death. How can you along with your classmates contribute in this noble cause? State the objectives of organising such campaigns in schools.

Ans. (*i*) Function of Cornea: It provides the refraction of light rays entering the eye and act as a primary lens.

(*ii*) Function of Iris: It control the size of pupil.

(*iii*) Function of pupil: It regulate and control the amount of light entering the eye.

(*iv*) Function of Retina:

- Retina is a delicate film containing rod and cone photoreceptor cells on which real, inverted and diminished image is formed.
- It converts refracted light ray through the eye lens into electrical impulses that are sent to the brain by way of optic nerve for further processing.

We along with our classmates can contribute in the corneal blindness campaign by

- propagating the eye donation among other friends and neighbours.
- motivate the next of kin of deceased person to donate his/her eye.
- making it a family tradition of donating the eye.

The objective of organising corneal blindness campaign in the school are

- Motivate and educating others about eye donation.
- Help removing all the myths about eye donation and explain how one can get opportunity to restore someone's sight.

SECTION-B

25. A student puts a drop of acetic acid first on a blue litmus paper and then on a red litmus paper. He would observe that

(*a*) the red litmus paper turns colourless and there is no change in the blue litmus paper.

(*b*) the red litmus paper turns blue and the blue litmus paper turns red.

(*c*) there is no change in the red litmus paper and the blue litmus paper turns red.

(*d*) there is no change in the blue litmus paper and the red litmus paper turns blue.

Ans. (*c*) Acetic acid turns blue litmus red but does not affect red litmus paper.

26. While studying saponification reactions, the following comments were noted down by the students:

(*i*) Soap is a salt of fatty acids.

(*ii*) The reaction mixture is basic in nature.

(*iii*) In this reaction heat is absorbed.

(*iv*) This reaction is not a neutralisation reaction.

Which of these are the correct comments?

(*a*) I and III only

(*b*) I, II and III

(*c*) II, III and IV

(*d*) I and II only.

Ans. (*d*) Soap is salt of fatty acid and the reaction mixture is basic in nature.

27. A student takes 4 mL of distilled water in each of four test tubes I, II, III and IV, and then dissolves and equal amount of four different salts namely NaCl in I, $CaCl_2$ in II, $MgCl_2$ in III and KCl in IV. He then adds 8 drops of the given soap solution to each test tube and shakes the contents of the test tube 10 times. In which test tubes will enough lather (foam) be formed?

(*a*) I and II

(*b*) II and III

(*c*) I and IV

(*d*) III and IV

Ans. (*c*) NaCl and KCl do not cause hardness of water, therefore soap will form good lather in their presence also.

28. A student is asked to study the different parts of an embryo of pea seeds. Given below are the essential steps for the experiment:

(*i*) Soak the pea seeds in plain water and keep them overnight.

(*ii*) Cut open the soaked seed and observe its different parts.

(*iii*) Take some pea seeds in a petri dish.

(*iv*) Drain the excess water. Cover the seeds with a wet cotton cloth and leave them as it is for a day.

The correct sequence of these steps is

(*a*) III, I, IV, II

(*b*) III, IV, I, II

(*c*) III, I, II, IV

(*d*) III, II, I, IV

Ans. (*a*) This is the correct sequence.

29. In a class, student were asked to observe the models/slides/pictures of the skeletons of forelimbs and wings of different organisms. After the observations the students made the following groups of homologous structures. Select the correct group:

(*a*) Wings of a bird and a butterfly

(*b*) Wings of a pigeon and a bat

(*c*) Wings of a butterfly and bat

(*d*) Forelimbs of a cow, a duck and a lizard

Ans. (*d*) They have the same structure but different functions.

30. A student obtained on a screen the sharp image of a candle flame placed at the farther end of laboratory table using a concave mirror. For getting better value of focal length of the mirror, the teacher suggested to him to focus the sun. What should the student do?

(*a*) Should move the mirror away from the screen.

(*b*) Should move the mirror towards the screen.

(*c*) Should move the mirror and screen both towards the sun.

(*d*) Should move only the screen towards the sun.

Ans. (*b*) When an object is at between centre of curvature and infinity, image is formed between C and F. The sun can be considered at infinity. So, its image is formed at the focus of a concave mirror.

31. While determining the focal length of a convex lens, you try of focus the image of distant object formed by the lens on the screen. The image formed on the screen, as compared to the object, should be

(*a*) erect and highly diminished

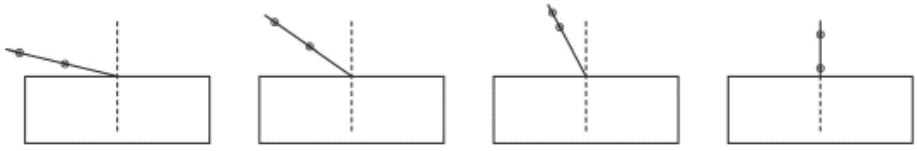
(*b*) erect and enlarged

(*c*) inverted and enlarged

(*d*) inverted and highly diminished.

Ans. (*d*) Parallel rays from a distant object after refraction through a convex lens form a real, inverted and highly diminished, point size image at its focus.

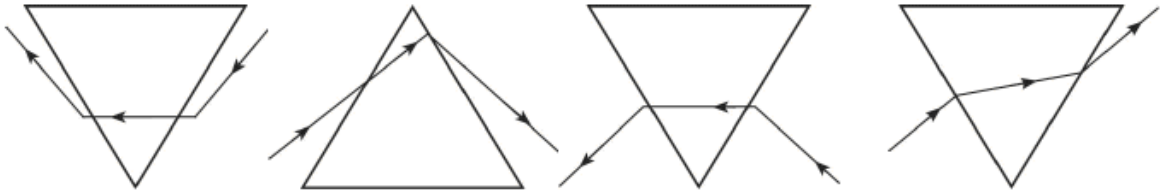
32. Which of the following is the best experimental set-up out of the four shown for tracing the path of a ray of light passing through a rectangular glass slab?



(*a*) (*b*) (*c*) (*d*)

Ans. (*b*) For better result, angle of incidence should be in the range 30° – 60° and larger separation between the pins will give better collinearity of the pins and accuracy of the result.

33. In which of the following four diagrams is the correct path of a ray of light passing through a glass prism shown?



(*a*) (*b*) (*c*) (*d*)

Ans. (*a*) Emergent ray is the ray that emerges out of the glass prism at the glass-air boundary interface and bends towards the base of the prism.

34. A student is studying the properties of acetic acid. List two physical properties of acetic acid he observes. What happens when he adds a pinch of sodium hydrogen carbonate to this acid? write any two observations.

Ans. **Physical properties:**

(*i*) Acetic acid has vinegar like smell.

(*ii*) Acetic acid is soluble in water.

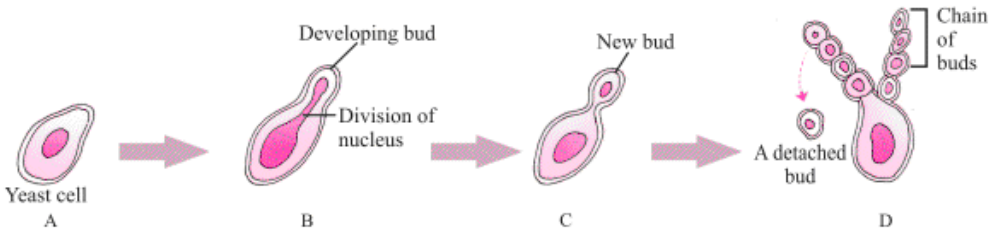
Observations:

(*i*) When sodium hydrogen carbonate is added to acetic acid brisk effervescence due to CO_2 gas are observed.

(*ii*) The gas formed is colourless, odourless and non-supporter of combustion.

35. A student is viewing under a microscope a permanent slide showing various stages of asexual reproduction by budding in yeast. Draw diagrams of what he sees (in proper sequence).

Ans.

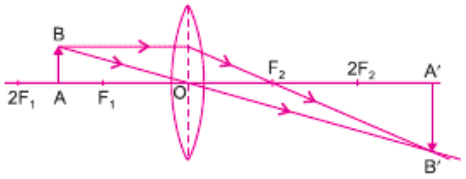


Budding in *yeast*

36. A student places a 8-0 cm tall object perpendicular to the principal axis of a convex lens of focal length 20 cm. The distance of the object from the lens is 30 cm. He obtains a sharp image of the object on a screen placed on the other side of the lens. What will be the nature (inverted, erect, magnified, diminished) of the image he obtains on a screen? Draw ray diagram to justify your answer.

Ans. According to the given condition, object is placed between F_1 and $2F_1$, the image formed by the convex lens is beyond $2F_2$ on other side of convex lens.

Nature of image formed: Real, inverted and magnified.



Set-II (*Uncommon Questions to Set-I*)

1. Write the name of each of the following functional groups:

(*a*) —OH

(*b*) —C(=O)—

Ans. (*a*) —OH is alcohol (*b*) —C(=O)— is ketone

2. Name the parts of a bisexual flower that are not directly involved in reproduction.

Ans. Parts of a bisexual flower which are not directly involved in reproduction are (*i*) Petal, (*ii*) Sepal and (*iii*) Stem.

3. Write the full name of the group of compounds mainly responsible for the depletion of ozone layer.

Ans. CFC → Chloroflurocarbon

4. Explain why the plants do not twinkle.

Ans. **Planets do not twinkle:** The Planets are much nearer to the earth as compared to the star so they can be treated as a collection of large number of point size source of light. Due to varying condition of atmosphere, the darkest part of the twinkling effect from one point source may be overlapped by focussed light from the point source of other region of planet, so total amount of light entering into the eye remains constant. Thus planets look steady and do not appear twinkle.

5. List two problems that may arise by planting trees of single variety over vast tracts of a forest.

Ans. The two problems that may arise are:

(*i*) If a disease occur to that variety, it may affect a vast area.

(*ii*) Different organisms depend on different trees for food. If only one variety is planted, many organisms may not get the food.

6. Building of big dams gives rise to some problems. List three main problems that may arise. Suggest a solution to any one of these problems.

Ans. Three problems that may arise due to building of large dams are:

(*i*) Social problems as they displace large number of people.

(*ii*) Economic problem as they consume huge amount without proportionate benefit.

(*iii*) Environmental problem as they cause deforestation and loss of biodiversity.

One solution to the problem is:

(*i*) Construction of smaller dams than large dams.

7. Why is homologous series of carbon compounds so called? Write the chemical formula of two consecutive members of any homologous series and state the part of these compounds that determines their (*i*) physical and (*ii*) chemical properties.

Ans. Homologous series means members of same family because they have similar chemical properties.

CH_3OH and CH_3CH_2OH are two consecutive members of 'alcohol' homologous series. Alkyl group determines physical properties.

Functional group-OH determines chemical properites.

10. An element 'X' is placed in the 3rd group and 3rd period of the Modern Periodic Table. Answer the following questions starting reason for your answer in each case:

(*a*) Write the electronic configuration of the element 'X'.

(*b*) Write the formula of the compound formed when the element 'X' reacts with another element 'Y' of atomic number 17.

(*c*) Will the oxide of this element be acidic or basic?

Ans. (*a*) 'X' has electronic configuration 2, 8, 3.

(*b*) 'X' has valency equal to 3. 'Y' has electronic configuration 2, 8, 7, so valency = 1.

X^3 Y^1

XY_3 is formula of compound formed.

(*c*) Oxide of this element will be basic.

11. Why is DNA copying an essential part of the process of reproduction? What are the advantage of sexual reproduction over asexual reproduction?

Ans. DNA copying is an essential part of the process of reproduction because:

(*i*) DNA copying provides cellular apparatus in the daughter cells.

(*ii*) DNA in daughter cells will be able to control the functioning of daughter cells.

(*iii*) DNA copies will retain the traits.

Advantages of Sexual Reproduction:

(*i*) Sexual reproduction gives rise to variation.

(*ii*) Offsprings born out of sexual reproduction have better survival chance in case of adverse situation.

12. Draw longitudinal section of a bisexual flower and label the following parts on it:

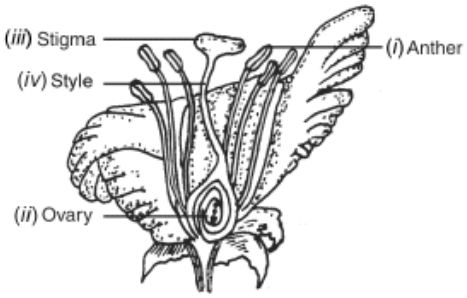
(*i*) Anther

(*ii*) Ovary

(*iii*) Stigma

(*iv*) Style

Ans.



14. (*a*) Cite the evidence on the basis of which it is concluded that birds have evolved from reptiles.

(*b*) Insects, Octopus, Planaria and Vertebrates also possess eyes. Can these animals be grouped together on the basis of the eyes they possess. Why or why not? Give reason to justify your answer.

Ans. (*a*) Dinosaur is a type of reptile which has wings. Birds also have wings, so it can be opined that birds have evolved from reptiles

(*b*) Yes, based on type eyes can be grouped together, which have evolved over generation from imperfect eyes in *Planaria* to perfect eyes in vertebrates.

16. State the laws of refraction of light. If the speed of light in vacuum is 3×10^8 m/s, find the absolute refractive index of a medium in which light travels with a speed of 1.4×10^8 m/s.

Ans. Law of refraction

(*i*) The incident ray, the normal and the refracted ray at the point of incidence all lies in the same plane for the two given transparent medium.

(*ii*) The ratio of sine of angle of incidence (*i.e.*, sin *i*) to the sine of angle of refraction (*i.e.*, sin *r*) is always constant for the light of given colour and for the given pair of media.

Mathematically,

$$\frac{\sin i}{\sin r} = \text{constant} = n_{21}$$

The constant 'n_{21}' is called refractive index of the second medium with respect to the first medium.

Absolute refractive index of the medium is given by

$$n_m = \frac{\text{Speed of light in a vacuum } (c)}{\text{Speed of light in medium } (v)}$$

i.e.,
$$n_m = \frac{c}{v}$$

Given:
$$c = 3 \times 10^8 \text{ m/s}, v$$
$$= 1.4 \times 10^8 \text{ m/s}$$

$\therefore$
$$\eta_m = \frac{c}{v}$$
$$= \frac{3 \times 10^8}{1.4 \times 10^8} = \frac{3}{1.4} = 2.14$$

17. Explain giving reason why the sky appears blue to an observer from the surface of the Earth. What should the appearance of the sky be during the day for an astronaut staying in the international space station orbiting the Earth? State reason to justify your answer.

Ans. Blue colour has a shorter wavelength than red. So, according to Rayleigh scattering law, blue colour of sunlight is scattered more strongly by the large number of molecules present in the earth's atmosphere. Hence, the sky appears blue.

Sky appears dark.

Reason: In the absence of atmosphere, there would have been no scattering of sunlight at all.

Set-III (*Uncommon Questions to Set-I and Set-II*)

SECTION-A

1. Write the name and molecular formula of the first member of the homologous series of alkynes.

Ans. $HC \equiv CH (C_2H_2)$ Ethyne is first member of alkynes.

2. What is DNA.

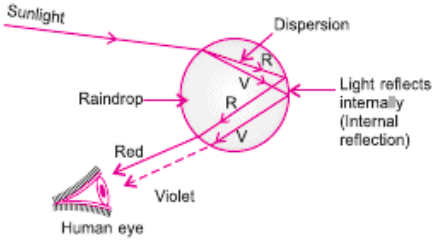
Ans. DNA lies in the cell nucleus which is the information source for making proteins and different proteins lead to different designs.

3. List two examples of natural ecosystem.

Ans. Two examples of natural ecosystem are forest and pond.

4. Draw a labelled diagram to explain the formation of a rainbow in the sky.

Ans.



Formation of primary rainbow

5. Write two advantages of sustainable management of natural resources. Out of the two — reuse and recycle — which is better and why?

Ans. Two advantages of sustainable management of natural resources are:

(*i*) natural Resources can last for longer time.

(*ii*) future generation can also enjoy the benefit from natural resources.

Out of reuse and recycle, reuse is better as it does not consume any energy.

6. List four advantages of conserving water in the form of ground water.

Ans. Four advantages of conserving water at ground level are:

(*i*) It recharges the ground water level.

(*ii*) It provides drinking water.

(*iii*) It provides irrigation water.

(*iv*) It reduces storm water discharge.

7. Write the name and structural formula of the compound formed when ethanol is heated at 443 K temperature with excess of conc. H_2SO_4. What is the role of conc. H_2SO_4 in this reaction? Also give the chemical equation for the reaction.

Ans. $CH_3CH_2OH \xrightarrow[443\ K]{\text{conc. } H_2SO_4} CH_2{=}CH_2 + H_2O$

Ethanol — Ethene

H—C=C—H is structural formula and ethene is its name. Conc. H_2SO_4 acts as dehydrating agent.

9. Four elements P, Q, R and S belong to the third period of the Modern Periodic Table and have respectively 1, 3, 5 and 7 electrons in their outermost shells. Write the electronic configuration of Q and R and determine their valences. Write the molecular formula of the compound formed when P and S combine.

Ans. Q (13) 2, 8, 3

R (15) 2, 8, 5

Valency of Q is 3 as it can lose 3 electrons to become stable. Valency of R is also 3 as it can gain 3 electrons to become stable. 'P' has 1 valence electron so its valency is equal to 1 as it can lose 1 electron to become stable. 'S' has 7 valence electrons, it can gain one electron to become stable. So its valency is equal to 1.

P^1 S^1

PS is formula of compound.

10. In the following table, the positions of six elements A, B, C, D, E and F are given as they are in the Modern Periodic Table:

Group → / Period ↓	1	2	3–12	13	14	15	16	17	18
2	A			B		C			D
3					E				F

On the basis of the above table, answer the following questions:

(*i*) Name the element which forms only covalent compounds.

(*ii*) Name the element which is a metal with valency three.

(*iii*) Name the element which is a non-metal with valency three.

(*iv*) Out of B and C, whose atomic radius is bigger and why?

(*v*) Write the common name for the family to which the elements D and F belong.

Ans. (*i*) 'E' forms only covalent bonds.

(*ii*) 'B' is metal with valency three.

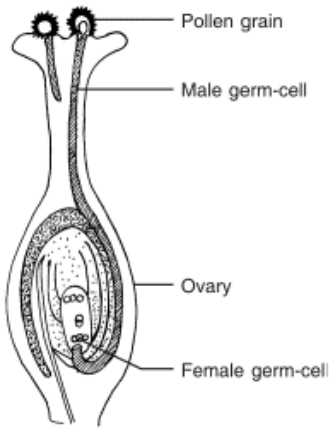
(*iii*) 'C' is non-metal with valency 3.

(*iv*) 'B' is bigger due to less effective nuclear charge.

(*v*) D and F belong to noble gases.

11. Draw a diagram of the longitudinal section of a flower exhibiting germination of pollen on stigma and label (*i*) ovary, (*ii*) male germ-cell, (*iii*) female germ-cell and (*iv*) ovule on it.

Ans.



Fertilisation in a flowering plant

12. Explain any three advantages of vegetative propagation.

Ans. (*i*) Vegetative propagation is a cheaper, easier and more rapid method of propagation in plants than growing plants from their seeds.

(*ii*) The traits or characters of the parent plant are preserved by vegetative propagation.

(*iii*) It results in propagation of those plants which do not produce viable seeds or produce seeds with prolonged period of dormancy.

16. A student wants to project the image of a candle flame on a screen 80 cm in front of a mirror by keeping the candle flame at a distance of 20 cm from its pole.

(*i*) Which type of mirror should the student use?

(*ii*) Find the magnification of the image produced.

(*iii*) Find the distance between the object and its image.

(*iv*) Draw a ray diagram to show the image formation in this case and mark the distance between the object and its image.

Ans. (*i*) Concave mirror

(*ii*) Magnification = $m = -\frac{v}{u} = -\frac{-80}{-20} = -4$

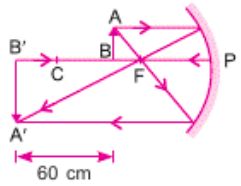
(*iii*) Distance between the object and its image = 80 – 20 = 60 cm.

(*iv*) Focal length of the concave mirror is

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u} = \frac{1}{-80} + \frac{1}{-20} = -\frac{5}{80} = -\frac{1}{16}$$

$\therefore$ $f = -16$ cm, $R = 2f = -32$ cm

Since $u = -20$ cm, it implies that object lies in between F and C.



18. "Energy flow in food chains is always unidirectional." Justify this statement. Explain how the pesticides enter a food chain and subsequently get into our body.

Ans. The energy flow through different steps in the food chain is unidirectional. The energy captured by autotrophs does not revert back to the solar system and it passes to the herbivores, *i.e.* it moves progressively through various trophic levels. Thus energy flow from Sun through producers to omnivores is in single direction only.

Pesticides are sprayed to kill pests on food plants. The food plants are eaten by harbivores and alongwith the food, pesticides are also eaten by the harbivores. Harbivores are eaten by carnivores and alongwith the herbivore animal, pesticide also enters the bode of the carnivore. Man eat both plant and animals and pesticide alongwith food enters the body of human. Concentration of pesticides increases as it moves upward in the food chain and the process is called bio magnification.