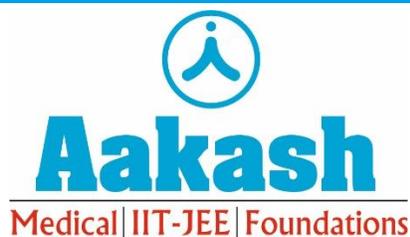


Date: 25/02/2026



SET~3
CODE 31/1/3

Corporate Office : AESL, 3rd Floor, Incuspaze Campus-2, Plot-13, Sector-18, Udyog Vihar,
Gurugram, Haryana-122015

Time: 3 Hours

Max. Marks: 80

Class-X

SCIENCE

CBSE Class-X (2026)

Answers & Solutions

GENERAL INSTRUCTIONS

Read the following instructions carefully and follow them :

- (i) This question paper comprises **39** questions. **All** questions are **compulsory**.
- (ii) Question paper is divided into **THREE** sections – **A, B** and **C**.

Section A : Biology (30 Marks)

Section B : Chemistry (25 Marks)

Section C : Physics (25 Marks)

- (iii) The question paper has MCQs, VSAs, SAs, LAs and C/S-BQs. Marks are given against each question.
- (iv) There are **case based** questions (CBQs) with three sub-questions and are of **4 marks** each.
- (v) **Divide your answer sheet into three sections as per question paper - Section A (Biology), Section B (Chemistry) and Section C (Physics). It is compulsory to answer each question in its respective section. Do not mix answers of one section into the other section.**
- (vi) Instructions are given with each section and question, wherever necessary.
- (vii) **Kindly note that a separate question paper has been provided for visually impaired candidates.**
- (viii) There is no overall choice in the question paper. However, an internal choice has been provided in few questions. **Only one** the choices in such questions must be attempted.

SECTION-A

1. Identify the correct statement for *spirogyra*, *leishmania* and *hydra* : [1]
- (A) they reproduce sexually. (B) they are unicellular.
(C) they are multicellular. (D) they reproduce asexually.

Answer (D)

Sol. *Spirogyra* reproduces by fragmentation, *Leishmania* reproduces by binary fission, while *Hydra* reproduces by means of regeneration. [1]

2. Which structure in a leaf is mainly responsible for gaseous exchange? [1]
- (A) Xylem (B) Stomata
(C) Phloem (D) Cuticle

Answer (B)

Sol. Stomata are the sites for gaseous exchange in plants. [1]

3. Pancreas secretes pancreatic juice which contain certain enzyme that helps in digestion of food. [1]
Choose the correct option from the following :
- (A) Trypsin digests emulsified fats and lipase digests proteins.
(B) Trypsin digests proteins and lipase digests emulsified fats.
(C) Trypsin and lipase both digests fats.
(D) Trypsin digests proteins and lipase digests carbohydrates.

Answer (B)

Sol. Pancreatic juice contains trypsin that helps in digestion of protein, while lipase helps in digestion of emulsified fats. [1]

4. From the given situations, identify 'Chemotropic' and 'Geotropic' movements in parts of plants, respectively : [1]
- (i) Growth of pollen tube towards ovule.
(ii) Movement of sunflower towards sunlight.
(iii) Movement of root towards Earth/Gravity.
(iv) Movement of leaves due to breeze.

Choose the correct option :

- (A) (i) and (iii) respectively (B) (iii) and (i) respectively
(C) (i), (ii) and (iii), (iv) respectively (D) (i), (iii) and (ii), (iv) respectively

Answer (A)

Sol. The growth of a pollen tube towards the ovule is an example of chemotropic movement. [1]

Roots growing downwards towards the Earth/gravity is positive geotropic movement.

5. Which of the following group is not 'biodegradable' ? [1]
- (A) Vegetable peels, dead leaves, paper
(B) Cow dung, leather bag, water
(C) Polythene bag, rubber band, ball pen
(D) Paper, fruits, bones

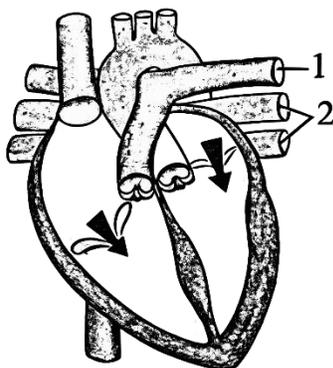
Answer (C)

Sol. Polythene bags, rubber bands and ball pens are made of non-biodegradable materials that cannot be easily decomposed by microbes. [1]

6. Study the given diagram of the heart, with blood vessels marked '1' and '2'.

[1]

From the following statements, establish the relationship between heart and/or the two blood vessels :



- (i) Blood vessel 1 - It carries carbon dioxide rich blood to the lungs.
- (ii) Blood vessel 2 - It carries oxygen rich blood from the lungs.
- (iii) Blood vessel 2 - Left atrium relaxes as it receives blood from this blood vessel.
- (iv) Blood vessel 1 - Right atrium has thick wall as it has to pump blood to this vessel.

The option with correct statements is :

- (A) (i) and (ii)
- (B) (ii) and (iii)
- (C) (ii), (iii) and (iv)
- (D) (i), (ii) and (iii)

Answer (D)

Sol. Left ventricle has thick wall as it has to pump blood into the aorta.

[1]

7. Plants use variety of techniques to get rid of their waste materials. Some are mentioned below. Identify the incorrect one :

[1]

- (A) Excess water is given out by transpiration.
- (B) Gums and Resins are wastes that are stored.
- (C) Roots secrete some wastes into the soil.
- (D) Flowers can store some waste products.

Answer (D)

Sol. Flowers cannot store some waste products.

[1]

Directions : Question numbers 8 and 9 are Assertion and Reason based questions. Two statements are given, one labelled as Assertion (A) and the other is labelled as Reason (R). Select the correct answer to these questions from the codes (A), (B), (C) and (D) as given below :

- (A) Both, Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
- (B) Both, Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
- (C) Assertion (A) is true, but Reason (R) is false.
- (D) Assertion (A) is false, but Reason (R) is true.

8. **Assertion (A) :** Reflex actions do not involve thinking.

Reason (R) : Most reflex actions are controlled by the spinal cord.

[1]

Answer (A)

Sol. Reflex actions are automatic and rapid responses. Since they are mainly controlled by the spinal cord, the brain's thinking centers are not involved at the time of action.

[1]

9. **Assertion (A)** : Ozone at higher levels of atmosphere is a product of UV radiation acting on oxygen molecule.
Reason (R) : The higher energy of UV splits apart some molecular O_2 . [1]

Answer (A)

Sol. UV radiation breaks O_2 into free oxygen atoms, which then combine with O_2 to form ozone (O_3) in the upper atmosphere. [1]

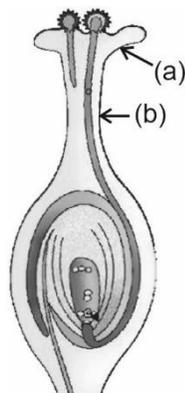
10. (a) Why is bile juice considered to be very important for digestion, even though it doesn't contain any digestive enzymes? [1]
(b) Name some substances present in initial filtrate and subsequently selectively reabsorbed in the tubules of nephron. [1]

Sol. (a) Bile juice is important for digestion because it helps in the emulsification of fats and provides an alkaline medium for enzymatic action. [1]
(b) The initial filtrate in the nephron also known as the glomerular filtrate as it contain water, salts, glucose, amino acids and urea. [1]

11. Draw a neat diagram to show germination of pollen on the female reproductive part of the flower. Name and label only the following parts : [2]

- (a) The part that receives the pollen grain.
(b) The structure that carries the male germ cell to reach the female germ cell.

Sol.



[Diagram-1, Labellings-2×½=1]

Germination of pollen on stigma

12. (a) State two differences between the act of chewing food and salivation on sight of food. [2]
OR
(b) State two differences between pollination and fertilization. [2]

Sol. (a) • Chewing is primarily a voluntary action, while salivation at the sight of food is an involuntary action. [1]
• Chewing is a mechanical process where the teeth and jaws breakdown food, while salivation is a chemical response which is a part of reflex action. [1]

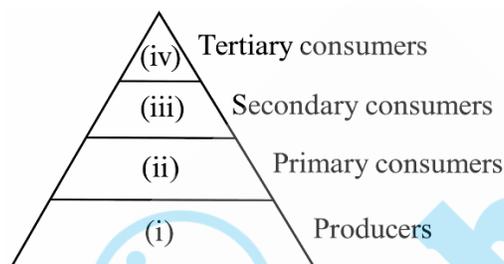
OR

- (b) **Differences between pollination and fertilization are:**

	Pollination	Fertilization
(i)	The act of transferring pollen grains from anther to the stigma of a flower is known as pollination.	It involves fusion of male and female gametes.
(ii)	It takes place before fertilization.	It occurs after pollination.
(iii)	Pollen tube is not required.	Pollen tube is required.

(Any two) [2×1]

13. Give differences between the following : [3]
- (a) Nephron and neuron
 - (b) Sensory nerve and motor nerve
 - (c) Consumers and decomposers
- Sol.** (a) Nephron is the structural and functional unit of kidney while, neuron is the structural and functional unit of brain. [1]
- (b) Sensory nerve carries impulses from receptors to the central nervous system, while motor nerve carries impulses from central nervous system to the effector organs. [1]
- (c) Consumers feed on other organisms for their food as they obtain energy by eating living organisms, while decomposers obtain energy by breaking down dead organic matter and waste. [1]
14. Given below is a pyramid showing various trophic levels in an ecosystem : [3]



- (a) From the organisms listed below, identify which one is to be placed at which trophic level :
Deer, Grass, Lion, Snake, Rabbit
 - (b) Discuss the reason why primary consumers will have more energy as compared to secondary consumers?
 - (c) Why is the base of the pyramid broad?
- Sol.** (a) Deer - Primary consumer.
Grass - Producer.
Lion/Snake - Tertiary consumers/Secondary consumers.
Rabbit - Primary consumer. [1]
- (b) Primary consumers have more energy because they feed directly on producers receiving a higher percentage of initial energy captured through photosynthesis. At each trophic level, there is 10% loss of energy. [1]
- (c) As producers have the maximum amount of energy compared to other trophic levels, hence the base of pyramid is broad. [1]
15. Mendel took garden pea plants with different characteristics, such as height to study the inheritance pattern of factors (genes). He crossed tall pea plant with short pea plant and obtained all the tall plants in the F_1 generation.
- Answer the following questions :
- (a) Why only tall pea plants were observed in F_1 progeny? [1]
 - (b) By which method did Mendel obtain F_2 progeny? [1]
 - (c) (i) Write one difference between dominant and recessive trait. [2]
- OR**
- (c) (ii) Write two observations made by Mendel about F_1 progeny. [2]

Sol. (a) Only tall plants were seen in F_1 generation progeny because the trait for tallness is dominant over the trait for dwarfness. When Mendel crossed pure tall (TT) plants with pure dwarf (tt) plants, all F_1 plants had genotype (Tt). Since tallness (T) is dominant, so all plants appeared tall. [1]

(b) Mendel obtained F_2 progeny by selfing of F_1 hybrids. [1]

(c) (i)

Dominant trait	Recessive trait
Expressed in F_1 generation even when present in single form.	Expressed only when present in pure form.

[2]

OR

(c) (ii) **Two observations made by Mendel about F_1 progeny :**

1. All F_1 progeny showed only one parental trait.

2. The recessive trait did not appear in F_1 generation. [2]

16. (a) Given below are certain situations. Analyse each and describe its possible impact: [5]

(i) A population of bacteria living in temperate waters whose temperature increased by global warming.

(ii) The sperm encounters the egg when it reaches the oviduct in human females.

(iii) Self pollination does not occur in a flower that contains only pistil.

(iv) Egg does not get fertilised in a human female.

(v) When the seed is placed under appropriate condition of water and air in the soil?

Sol. (i) In a population of bacteria living in temperate waters, a sudden increase in temperature due to global warming leads to death of non heat-resistant bacteria and other aquatic lives. [1]

(ii) Fertilization will occur and leads to the formation of zygote. This zygote moves towards the uterus for implantation. [1]

(iii) Self pollination will not occur because the flower lacks the male reproductive parts (stamen) to produce pollen grains. [1]

(iv) The egg disintegrates and the uterine lining along with the blood vessels are shed through menstruation. [1]

(v) The seed will germinate and develop into a seedling. Appropriate conditions trigger the process of germination. [1]

OR

(b) Given below are certain situations. Analyse and describe what would happen when :

(i) Spores are liberated from blob-like structures of the bread mould?

(ii) Leaves of bryophyllum fall on wet soil?

(iii) A pollen from different species land on the stigma of totally unrelated species?

(iv) Copper-T is placed in the uterus of a human female?

(v) *Spirogyra* breaks into smaller fragments upon maturation?

- Sol.**
- (i) When these spores liberated into the air and land on a suitable moist organic substrate, they will germinate and grow into a new fungal mycelium. [1]
 - (ii) New *Bryophyllum* plant will grow from the leaf margins. [1]
 - (iii) The pollen will not germinate or grow a pollen tube as they belong to different species. [1]
 - (iv) Copper-T is a contraceptive device ,so it will prevent pregnancy. [1]
 - (v) Each fragment will grow into a new, individual *Spirogyra* filament. [1]

SECTION-B

17. The gases evolved on heating lead (II) nitrate crystals are: [1]
- (A) NO and O₂
 - (B) N₂ and NO₂
 - (C) NO₂ and H₂
 - (D) NO₂ and O₂

Answer (D)



18. (i) $\text{AgNO}_3 + \text{NaCl} \longrightarrow \text{NaNO}_3 + \text{AgCl}$ [1]
- (ii) $\text{K}_2\text{SO}_4 + \text{BaCl}_2 \longrightarrow \text{BaSO}_4 + 2\text{KCl}$

Which of the following options clearly describes both the reactions?

- (A) (i) is double displacement, (ii) is displacement reaction.
- (B) Both, (i) and (ii) are displacement reactions and precipitation reactions.
- (C) Both, (i) and (ii) are double displacement reactions and precipitation reactions.
- (D) (i) is displacement, (ii) is double displacement reaction.

Answer (C)

Sol. In both reactions exchange of ions takes place, so they are examples of double displacement reaction. In both reactions precipitate are formed (AgCl and BaSO₄), hence they are examples of precipitation reaction. [1]

19. Which one of the following can be used as an acid-base indicator by a visually impaired (blind) student? [1]
- (A) Turmeric
 - (B) Vanilla essence
 - (C) Methyl orange
 - (D) Litmus

Answer (B)

Sol. Vanilla essence is used as olfactory indicator

20. The hydrocarbons with general formula C_nH_{2n} represents: [1]
- (A) alkane
 - (B) alkene
 - (C) alkyne
 - (D) cyclic compounds

Answer (B)

Sol. General formula of alkene is C_nH_{2n} [1]

21. When an element 'X' reacts with water, it starts floating. Identify the element 'X' [1]
- (A) Potassium
 - (B) Calcium
 - (C) Sodium
 - (D) Iron

Answer (B)

Sol. Calcium starts floating when reacts with water. [1]

22. Which of the following is a poor conductor of electricity [1]
- (A) Pb (B) Cu
(C) Ag (D) Al

Answer (A)

Sol. Lead is a poor conductor of electricity. [1]

23. The natural sources of oxalic acid, lactic acid and methanoic acid respectively are: [1]
- (A) tomato, curd, ant-sting
(B) tomato, orange, nettle-stings
(C) orange, milk, ant-sting
(D) orange, sour milk, nettle-sting

Answer (A)

Sol. Tomato– Oxalic acid [1]

Curd– Lactic acid

Ant–Sting– Methanoic acid

Directions : For question number 24, two statements are given, one labelled as Assertion (A) and the other is labelled as Reason (R). Select the correct answer to this question from the codes (A), (B), (C) and (D) as given below :

- (A) Both, Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
(B) Both, Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
(C) Assertion (A) is true, but Reason (R) is false.
(D) Assertion (A) is false, but Reason (R) is true.
24. **Assertion (A) :** Carbon shares its valence electrons with other atoms of carbon or with atoms of other elements.
Reason (R) : The shared electrons belong to the outermost shells of both the atoms and lead to both atoms attaining the noble gas configuration. [1]

Answer (A) [1]

25. Why does one feels pain and irritation when stung by honey-bee? Rubbing of baking soda on the stung area gives relief. How? [2]

Sol. Honey bee-sting injects and leaves an acid called methanoic acid which causes pain and irritation. [1]

As baking soda is a mild base it neutralises methanoic acid on rubbing the stung area. [1]

26. What happens when :

- (a) An iron nail is dipped in copper (II) sulphate solution?
(b) Potassium iodide solution is mixed with lead nitrate solution?
(c) Silver chloride is exposed to sunlight?

Write balanced chemical equations to support your answer. [3]

Sol. (a) A reddish-brown deposit of copper forms on the iron nail and the blue solution turns green due to formation of iron (II) sulphate. [½]



(b) A yellow precipitate of lead iodide is formed. [½]



(c) White silver chloride turns grey in sunlight due to its decomposition into silver and chlorine. [½]



27. (a) Explain chlor-alkali process with chemical equation. Name the products formed at anode and cathode. [3]

OR

(b) Write the preparation of following compounds with balanced chemical equation : [3]

(i) Baking soda

(ii) Bleaching powder

(iii) Plaster of Paris

Sol. (a) **Chlor-Alkali Process:** It is the process of electrolysis of aqueous sodium chloride solution (brine) to produce sodium hydroxide, chlorine and hydrogen. [1]

Chemical equation:



Product formed at anode is chlorine gas. [½]

Product formed at cathode is hydrogen gas. [½]

Sodium hydroxide solution is formed near the cathode.

OR

(b) (i) Baking soda is prepared by passing carbon dioxide gas through a concentrated solution of sodium chloride saturated with ammonia. [1]



(ii) Bleaching powder is prepared by passing chlorine gas over dry slaked lime.



(iii) Plaster of Paris is prepared by heating gypsum at about 373 K.



28. **Read the following passage and answer the questions given below :**

Most of metals occur in combined state in form of ores. Carbonate ores are converted into oxides by calcination and sulphide ores by roasting. Oxides are reduced with suitable reducing agent like carbon to get free metal. Highly reactive metals like – Al, Mg are also used as reducing agents to obtain metal from their oxides. Most reactive metals are obtained by electrolytic reduction of their molten ores. Alloying is a very good method of improving the properties of a metal. We can get desired properties by this method. The electrical conductivity and melting point of an alloy is less than that of pure metals.

- (a) Why carbonate or sulphide ores are converted to oxides before extraction of metal from it? [1]
 (b) Write a reaction in which Aluminium is used as a reducing agent to obtain metal from its oxide. [1]
 (c) (i) How is copper obtained from its ore (Cu_2S)? Give equations of the reactions. [2]

OR

- (c) (ii) (I) Why highly reactive metals cannot be obtained from their oxides by using carbon as a reducing agent? [1]
 (II) Why solder, an alloy of lead and tin, is used for welding electrical wires together? [1]

Sol. (a) Metal oxides are easier to reduce into metal than carbonates or sulphides ores. [1]

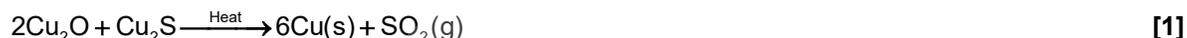


- (c) (i) Copper is obtained from its ore (Cu_2S) by roasting followed by self-reduction.

Step I: Roasting



Step II: Self reduction



OR

- (c) (ii) (I) Highly reactive metals cannot be obtained from their oxides by using carbon as reducing agent because highly reactive metals (like K, Na, Ca, Mg) have greater affinity for oxygen than carbon. [1]
 (II) Solder is used for welding electrical wires because it has a low melting point. [1]

29. (a) (i) Give reasons for the following : [3]

- (I) Covalent compounds are poor conductor of electricity.
 (II) Soap does not form lather in hard water.
 (III) Carbon shows catenation but silicon does not.

(ii) Write chemical equations for the following: [2]

- (I) Oxidation of ethanol by acidified $\text{K}_2\text{Cr}_2\text{O}_7$.
 (II) Hydrogenation of ethene.

OR

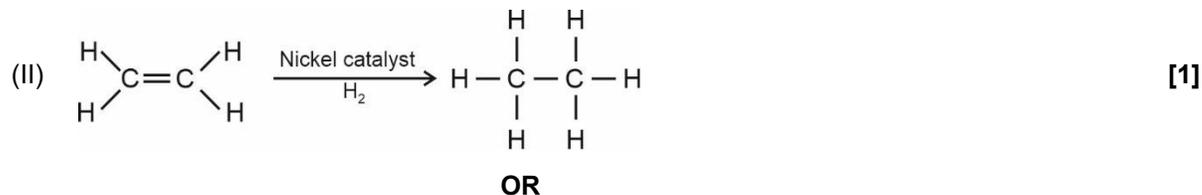
(b) Mohan heated ethanol with a compound 'X' in the presence of a few drops of conc. H_2SO_4 and observed a sweet smelling compound 'Y' is formed. When 'Y' is treated with sodium hydroxide it gives back ethanol and a compound 'Z'. [5]

- (i) Identify 'X', 'Y' and 'Z'.
 (ii) Write the role of conc. H_2SO_4 in the reaction.
 (iii) Write the chemical equations involved and name the reactions.

Sol. (a) (i) (I) Covalent compounds do not have free electron(s) so they are poor conductors of electricity. [1]

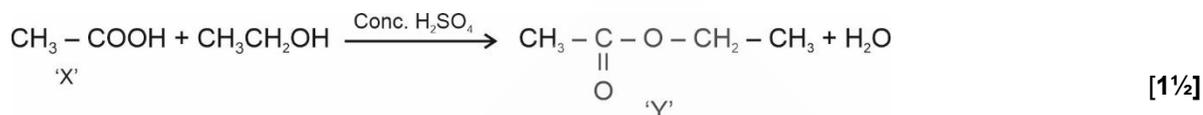
(II) Soap does not forms lather in hard water because Ca^{2+} and Mg^{2+} ions present in hard water react with soap to form insoluble, curdy white precipitate known as scum. [1]

(III) Carbon shows catenation due to its small size and high bond energy but silicon has larger size. [1]

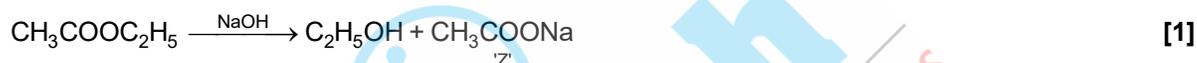


(ii) Presence of conc. H_2SO_4 catalyses the reaction. [1]

(iii) **Esterification reaction :**



Saponification reaction :



SECTION-C

30. A convex lens of focal length 15 cm, is forming a real image. If the size of image is same as the size of object, then position of object and position of image will be, respectively : [1]

- (A) -15 cm and -15 cm from lens
- (B) -15 cm and +15 cm from lens
- (C) -30 cm and +30 cm from lens
- (D) -30 cm and -30 cm from lens

Answer (C) [1]

Sol. A convex lens forms a real image of same size that of object when it is placed at 2F.

Therefore,

$$u = -2f = -2 \times 15 = -30 \text{ cm}$$

$$v = 2f = 2 \times 15 = 30 \text{ cm}$$

31. When you look at an object very close to your eyes, the : [1]

- (A) Ciliary muscles of your eye contract and the eye lens becomes thick
- (B) Ciliary muscles of your eye get relaxed and the eye lens becomes thick
- (C) Ciliary muscles of your eye contract and the eye lens becomes thin
- (D) Ciliary muscles of your eye get relaxed and the eye lens becomes thin

Answer (A) [1]

Sol. Ciliary muscles of your eye contract and the eye lens becomes thick.

Directions : For question number 32, two statements are given, one labelled as Assertion (A) and the other is labelled as Reason (R). Select the correct answer to this question from the codes (A), (B), (C) and (D) as given below :

- (A) Both, Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A)
- (B) Both, Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A)
- (C) Assertion (A) is true, but Reason (R) is false
- (D) Assertion (A) is false, but Reason (R) is true

32. **Assertion (A) :** When rays of white light pass through a prism, on emerging they give spectrum of seven colours.

Reason (R) : It is due to the scattering of light that red light bends minimum and violet light bends the maximum.

[1]

Answer (C)

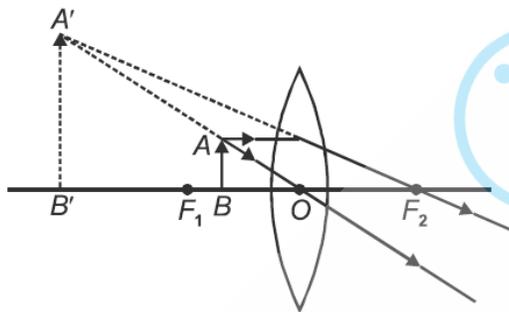
[1]

Sol. It is due to refraction (dispersion) of light that red light bends minimum and violet light bends the maximum.

33. Draw the ray diagram for the image formation by a lens which shows a magnification of +2.

[2]

Sol. When the object is between F_1 and O



For image,

Position : On the same side of lens as the object

Nature : Virtual, erect and sign of magnification is positive

Size : Enlarged $|m| > 1$

[2]

34. (a) The resistance of a wire of 0.01 cm radius and 1.0 cm length is 7Ω . Calculate its resistivity.

[2]

OR

(b) An electric heater is rated 220 V; 11 A. Calculate the power consumed if the heater is operated at 200 V.

[2]

Sol. (a) $R = \frac{\rho l}{A}$

$$\Rightarrow \rho = \frac{RA}{l}$$

$$= \frac{7 \times \frac{22}{7} (10^{-4})^2}{10^{-2}}$$

$$= 22 \times 10^{-6} \Omega \text{ m}$$

$$= 2.2 \times 10^{-5} \Omega \text{ m}$$

[2]

OR

(b) $V = IR$

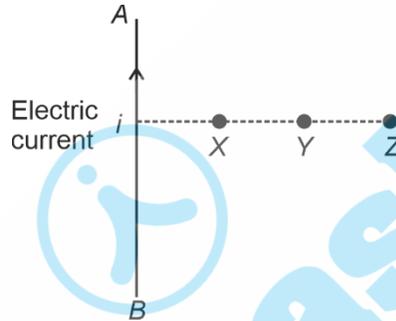
$$\therefore R = \frac{220}{11} = 20 \Omega$$

$$P = \frac{V^2}{R} = \frac{(200)^2}{20}$$

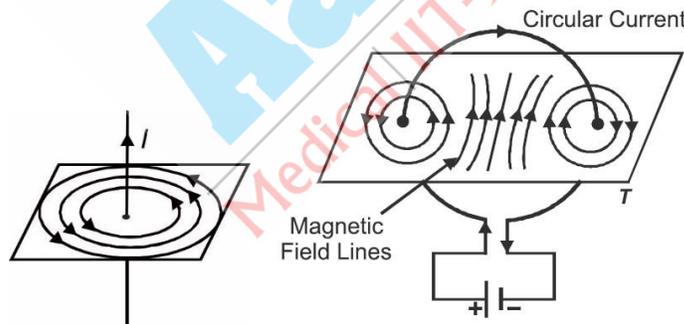
$$= 2000 \text{ W}$$

[2]

35. (a) The pattern of magnetic field due to a current carrying wire depends upon the shape made by that wire. Justify.
- (b) A current carrying straight wire AB is shown in the given diagram. Out of X , Y and Z on which point will the strength of magnetic field be maximum and why? [3]

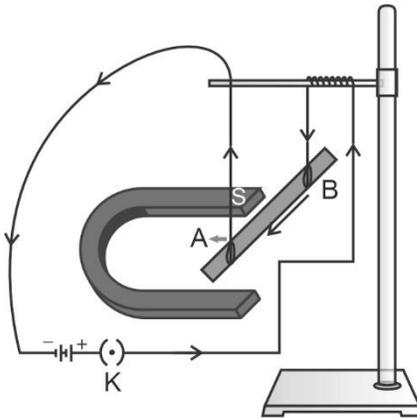


- Sol.** (a) The pattern of magnetic field due to a current carrying wire depends upon the shape made by that wire. The magnetic field around a straight wire are concentric circle when this wire is bend to a circle, the field lines are concentric near the wire and becomes nearly uniform straight inside the loop. [1½]



- (b) The strength of magnetic field will be maximum at point X because the magnetic field produced by a given current in the conductor decreases as the distance from it increases. [1½]
36. (a) Describe an activity to show that a current carrying conductor, placed in an external magnetic field experiences a force. [3]
- (b) Imagine that you are sitting in a chamber with your back to one wall. An electron beam, moving horizontally towards the front wall from the back wall, is deflected by a strong magnetic field to your right side. Find the direction of the magnetic field.

Sol. (a)



- Take a small aluminium rod AB (of about 5 cm). Using two connecting wires suspend it horizontally from a stand.
- Place a strong horse-shoe magnet in such a way that the rod lies between the two poles with the magnetic field directed upwards. For this put the north pole of the magnet vertically below and south pole vertically above the aluminium rod.
- Connect the aluminium rod in series with a battery, a key and a rheostat.
- Now pass a current through the aluminium rod from end B to end A.
- It is observed that the rod is displaced towards the left. You will notice that the rod gets displaced.
- The displacement of the rod in the above activity suggests that a force is exerted on the current-carrying aluminium rod when it is placed in a magnetic field. [2]

(b) Using Fleming's left-hand rule, the direction of magnetic field will be vertically downward. [1]

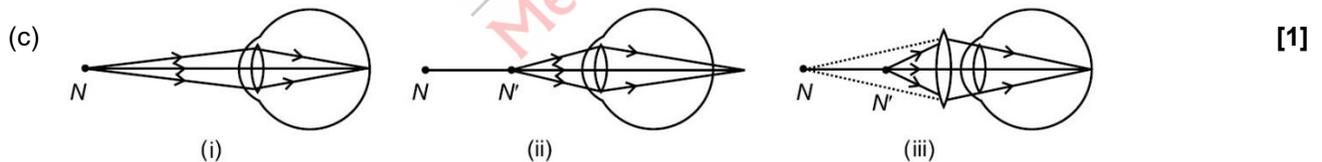
37. (a) What is hypermetropia? [3]

(b) Write any one cause of hypermetropia.

(c) With the help of a suitable ray diagram, explain how hypermetropia is corrected?

Sol. (a) In this defect, a person is not able to see the nearby objects clearly, however he can see the distant objects clearly. [1]

(b) This defect arises due to decrease in the curvature of the eye lens or increase in focal length of the eye lens or the eyeball has become too small. [1]



(i) Near point of a hypermetropic eye, (ii) Hypermetropic eye and
(iii) Correction for hypermetropic eye

38. Read the following passage and answer the questions given below:

Lenses can form different types of images depending upon their focal length and position of object. A convex lens can create real, inverted or virtual, erect images, while a concave lens forms only virtual and diminished images. The focal length determines the power of lens. Convex lenses have positive focal length while concave lenses have negative focal length by convention. When lenses are placed together, their combined power is determined by the sum of their individual powers. Ray diagrams help to visualize how light converges or diverges through lens to form an image.

- (a) A convex lens of focal length 20 cm is used to form an image. If an object is placed at 40 cm from the lens, what will be the position and nature of image? [1]
- (b) Illustrate the formation of image with the help of ray diagram, when the object is placed between the optical centre and principal focus of concave lens. [1]
- (c) (i) A lens combination consists of a convex lens of focal length 30 cm and a concave lens of focal length 15 cm placed together. Find the equivalent focal length and power of this lens combination. [2]

OR

- (c) (ii) Two lenses are placed in contact. One is a concave lens with focal length 2 m and the other is a convex lens with focal length 1.5 m. What type of lens will the combination behave as (convex or concave)? Give reason. [2]

Sol. (a) Given

$$f = +20 \text{ cm}$$

$$u = -40 \text{ cm}$$

By lens formula

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

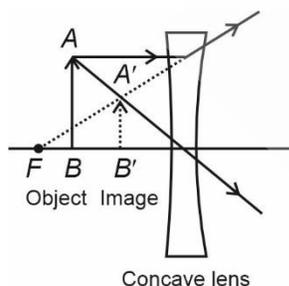
$$\frac{1}{v} = \frac{1}{f} + \frac{1}{u}$$

$$\frac{1}{v} = \frac{1}{20} + \frac{1}{(-40)}$$

$$v = +40 \text{ cm}$$

Nature of image : Real, inverted and same size of the object. [1]

(b)



(c) (i) Given :

$$f_1 = +30 \text{ cm}$$

$$f_2 = -15 \text{ cm}$$

Equivalent focal length

$$\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2}$$

$$\frac{1}{f} = \frac{1}{30} + \frac{1}{(-15)}$$

$$\frac{1}{f} = -\frac{1}{30}$$

$$f = -30 \text{ cm}$$

Power of the combination

$$P = \frac{100}{f(\text{cm})}$$

$$= \frac{100}{-30}$$

$$= -\frac{10}{3} \text{ D} \approx -3.33 \text{ D}$$

[2]

OR

(c) (ii) Given

$$f_1 = -2 \text{ m} = -200 \text{ cm}$$

$$f_2 = +1.5 \text{ m} = 150 \text{ cm}$$

Equivalent focal length

$$\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2}$$

$$\frac{1}{f} = \frac{1}{-200} + \frac{1}{150}$$

$$\frac{1}{f} = \frac{-3+4}{600} = \frac{1}{600}$$

$$f = 600 \text{ cm}$$

$$P = \frac{100}{f(\text{cm})}$$

$$= \frac{100}{600} = \frac{1}{6} \text{ D}$$

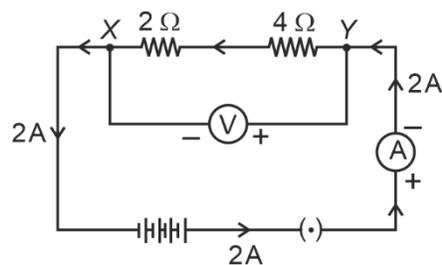
Here power of the combination is positive.

Hence, this combination will behave as convex lens.

[2]

39. (a) Study the given electric circuit in which 2 A electric current is flowing between points X and Y.

[5]



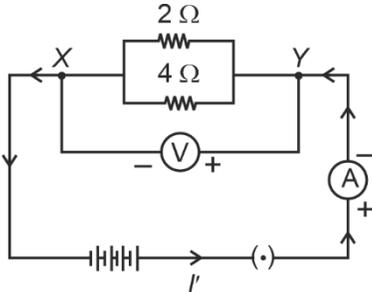
(i) Using the battery, key, voltmeter and ammeter in this given electric circuit, redraw a circuit diagram in which 2 Ω and 4 Ω resistors are connected between X and Y in parallel combination.

(ii) Circuit drawn by you, in which resistors are connected in parallel combination, calculate the electric current flowing through 4 Ω resistor.

OR

- (b) (i) Two lamps 'A' and 'B' of rating 50 W; 220 V and 100 W, 220 V are connected in series combination. Find out the ratio of the resistances ($R_A : R_B$) of these lamps.
- (ii) Derive the expression for the equivalent resistance of three resistors R_1, R_2 and R_3 connected in parallel combination. [5]

Sol. (a) (i) [2]



- (ii) When resistors were connected in series.

$$R_{eq} = R_1 + R_2$$

$$= 2 \Omega + 4 \Omega = 6 \Omega$$

[1]

Voltage of battery

$$V = IR_{eq}$$

$$= 2 \times 6$$

$$[\because I = 2 \text{ A}]$$

$$= 12 \text{ V}$$

[1]

Current flowing through 4 Ω resistor.

$$I' = \frac{V}{R}$$

$$= \frac{12}{4}$$

$$[\because \text{Potential difference across } 4 \Omega \text{ resistor is } 12 \text{ V}]$$

$$= 3 \text{ A}$$

[1]

OR

- (b) (i) Resistance of lamp A

$$R_A = \frac{V_A^2}{P_A}$$

$$= \frac{(220)^2}{50} = 968 \Omega$$

[½]

Resistance of lamp B

$$R_B = \frac{V_B^2}{P_B}$$

$$= \frac{(220)^2}{100}$$

$$= 484 \Omega$$

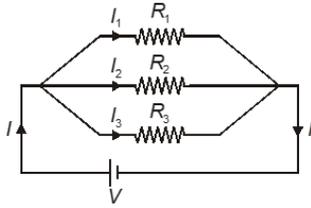
[½]

$$\frac{R_A}{R_B} = \frac{968}{484} = 2$$

$$R_A : R_B = 2 : 1$$

[1]

- (ii) Consider three resistors R_1 , R_2 & R_3 connected in parallel with a battery as shown in the figure.



[1]

The potential difference across each of the resistor is same as the applied voltage, but the value of current across each resistor is different.

Let I_1 , I_2 & I_3 be the current flowing through R_1 , R_2 and R_3 respectively.

$$\therefore I = I_1 + I_2 + I_3 \quad \dots(i)$$

Let the effective resistance of this parallel combination be R_P , then using, Ohm's law

$$I = \frac{V}{R_P} \quad \dots(ii)$$

As V is same for all resistor, therefore

$$I_1 = \frac{V}{R_1}, I_2 = \frac{V}{R_2}, I_3 = \frac{V}{R_3} \quad \dots(iii)$$

[1]

Hence, from equations (i), (ii) and (iii), we get

$$\frac{V}{R_P} = \frac{V}{R_1} + \frac{V}{R_2} + \frac{V}{R_3} = V \left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \right)$$

$$\boxed{\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}}$$

i.e., the reciprocal of effective resistance in parallel combination is equal to the sum of reciprocals of all the individual resistances.

[1]

