

CBSE Science – Class 10th
Solution for 2023-24 Examination

Question paper Code: 31/2/1

विज्ञान
SCIENCE

निर्धारित समय : 3 घण्टे

Time allowed : 3 hours

अधिकतम अंक : 80

Maximum Marks : 80

नोट	NOTE
(I) कृपया जाँच कर लें कि इस प्रश्न-पत्र में मुद्रित पृष्ठ 27 हैं ।	(I) Please check that this question paper contains 27 printed pages.
(II) कृपया जाँच कर लें कि इस प्रश्न-पत्र में 39 प्रश्न हैं ।	(II) Please check that this question paper contains 39 questions.
(III) प्रश्न-पत्र में दाहिने हाथ की ओर दिए गए प्रश्न-पत्र कोड को परीक्षार्थी उत्तर-पुस्तिका के मुख-पृष्ठ पर लिखें ।	(III) Q.P. Code given on the right hand side of the question paper should be written on the title page of the answer-book by the candidate.
(IV) कृपया प्रश्न का उत्तर लिखना शुरू करने से पहले, उत्तर-पुस्तिका में प्रश्न का क्रमांक अवश्य लिखें ।	(IV) Please write down the serial number of the question in the answer-book before attempting it.
(V) इस प्रश्न-पत्र को पढ़ने के लिए 15 मिनट का समय दिया गया है । प्रश्न-पत्र का वितरण पूर्वाह्न में 10.15 बजे किया जाएगा । 10.15 बजे से 10.30 बजे तक छात्र केवल प्रश्न-पत्र को पढ़ेंगे और इस अवधि के दौरान वे उत्तर-पुस्तिका पर कोई उत्तर नहीं लिखेंगे ।	(V) 15 minute time has been allotted to read this question paper. The question paper will be distributed at 10.15 a.m. From 10.15 a.m. to 10.30 a.m., the students will read the question paper only and will not write any answer on the answer-book during this period.

General Instructions:

Read the following instructions very carefully and strictly follow them:

- (i) This question paper comprises **39** questions. **All** questions are compulsory.
- (ii) This question paper is divided into **five** sections **A, B, C, D, and E**.
- (iii) **Section A** - Questions No. **1 to 20** are multiple-choice questions. Each question carries **1** mark.
- (iv) **Section B**-Questions No. **21 to 26** are very short answer type questions. Each question carries **2** marks. Answers to these questions should be in the range of 30 to 50 words.
- (v) **Section C** - Questions No. **27 to 33** are short answer type questions. Each question carries **3** marks. Answers to these questions should be in the range of 50 to 80 words.
- (vi) **Section D** - Questions No. **34 to 36** are long answer-type questions. Each question carries **5** marks. Answers to these questions should be in the range of 80 to 120 words.
- (vii) **Section E** - Questions No. **37 to 39** are of 3 source-based/case-based units of assessment carrying **4** marks each with sub-parts.
- (viii) There is no overall choice. However, an internal choice has been provided in some sections. Only one of the alternatives has to be attempted in such questions.

SECTION A

Select and write the most appropriate option out of the four options given for each of the questions no. **1 to 20**. **20×1=20**

- 1.** Solid Calcium oxide reacts vigorously with water to form Calcium hydroxide accompanied by the liberation of heat. From the information given above it may be concluded that this reaction [1]
- (A) is endothermic and pH of the solution formed is more than 7.
 - (B) is exothermic and pH of the solution formed is 7.
 - (C) is endothermic and pH of the solution formed is 7.
 - (D) is exothermic and pH of the solution formed is more than 7.

Solution: (D) is exothermic and pH of the solution formed is more than 7.

Explanation: Liberation of heat indicates exothermic reaction the resulting compound, $\text{Ca}(\text{OH})_2$ is basic in nature and thus, its pH of the solution is more than 7.

2. Juice of tamarind turns blue litmus to red. It is because of the presence of an acid called : [1]
- (A) methanoic acid
 - (B) acetic acid
 - (C) tartaric acid
 - (D) oxalic acid

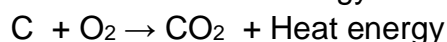
Solution: (C) tartaric acid

Explanation: Tartaric acid is found in tamarind and hence it turns blue litmus to red.

3. Select from the following a process in which a combination reaction is involved: [1]
- (A) Black and White photography
 - (B) Burning of coal
 - (C) Burning of methane
 - (D) Digestion of food

Solution: (B) Burning of coal

Explanation: The burning of coal is a combination reaction. Coal(carbon) burns in air to produce carbon dioxide and heat energy.



4. The oxide which can react with HCl as well as KOH to give corresponding salt and water is [1]
- (A) CuO
 - (B) Al_2O_3
 - (C) Na_2O
 - (D) K_2O

Solution: (B) Al_2O_3

Explanation: Al_2O_3 is an amphoteric oxide which can react with both acids and bases to give their respective salts and water.

5. Consider the following cases: [1]
- (a) $\text{CaSO}_4 + \text{Al} \rightarrow$
 - (b) $\text{CuSO}_4 + \text{Ca} \rightarrow$
 - (c) $\text{FeSO}_4 + \text{Cu} \rightarrow$
 - (d) $\text{ZnSO}_4 + \text{Mg} \rightarrow$

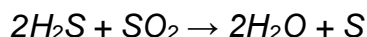
The cases in which new products will be formed are:

- (A) (a) and (b)
- (B) (b) and (c)
- (C) (c) and (d)
- (D) (b) and (d)

Solution: (D) (b) and (d)

Explanation: Calcium and Magnesium being more reactive than copper and zinc respectively can displace them from their salt solutions whereas aluminium and copper being less reactive than calcium and iron respectively will not be able to displace them.

6. Identify the correct statement about the following reaction:



[1]

- (A) H_2S is oxidising agent and SO_2 , is reducing agent.
- (B) H_2S is reduced to sulphur.
- (C) SO_2 is oxidising agent and H_2S is reducing agent.
- (D) SO_2 , is oxidised to sulphur.

Solution: (C) SO_2 is oxidising agent and H_2S is reducing agent

Explanation: SO_2 is oxidising agent because it loses oxygen atom and get reduced to S. H_2S is a reducing agent because it has gained oxygen atom and oxidised to H_2O

7. Consider the following statements about homologous series of carbon compounds

:

[1]

- (a) All succeeding members differ by - CH_2 unit.
- (b) Melting point and boiling point increases with increasing molecular mass.
- (c) The difference in molecular masses between two successive members is 16 u.
- (d) C_2H_2 and C_3H_4 are **NOT** the successive members of alkyne series.

The cases in which new products will be formed are:

- (A) (a) and (b)
- (B) (b) and (c)
- (C) (a) and (c)
- (D) (c) and (d)

Solution: (A) (a) and (b)

Explanation: All succeeding members differ by - CH_2 unit. Ex- CH_4 and C_2H_6

As the number of C-atoms increases gradually, the molecules get bigger hence the melting and boiling point increases.

8. Which of the following statement(s) is (are) true about the human heart.
- (a) Right atrium receives oxygenated blood from lungs through pulmonary artery.
 - (b) Left atrium transfers oxygenated blood to the left ventricle which sends it to various parts of the body.
 - (c) Right atrium receives deoxygenated blood through vena cava from upper and lower body.
 - (d) Left atrium transfers oxygenated blood to the aorta which sends it to different parts of the body.
- [1]

- (A) (a)
- (B) (a) and (d)
- (C) (b) and (c)
- (D) (b) and (d)

Solution: (C) (b) and (c)

Explanation: Oxygen-rich blood from the lungs comes to the left atrium. The left atrium relaxes when it is collecting this blood. It then contracts, while the left ventricle relaxes, so that the blood is transferred to it. When the muscular left ventricle contracts in its turn, the blood is pumped out to the body. Deoxygenated blood comes from the body to the right atrium, as it relaxes. As the right atrium contracts, the corresponding lower chamber, the right ventricle, dilates. This transfers blood to the right ventricle, which in turn pumps it to the lungs for oxygenation.

9. Select out of the following a gland which does NOT occur as a pair in the human body:
- [1]
- (A) Pituitary
 - (B) Ovary
 - (C) Testis
 - (D) Adrenal

Solution: (A) Pituitary

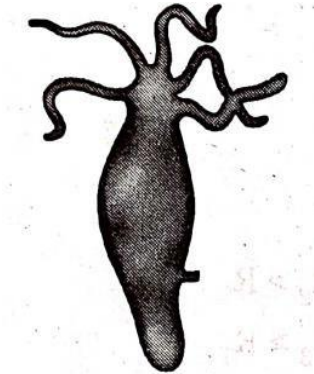
Explanation: The pituitary gland does not occur in pairs, while the adrenal gland, testis (in male) and ovary (in female) do.

10. In human respiratory system, when a person breathes in, the position of ribs and diaphragm will be :
- [1]
- (A) lifted ribs and curved/dome shaped diaphragm.
 - (B) lifted ribs and flattened diaphragm.
 - (C) relaxed ribs and flattened diaphragm.
 - (D) relaxed ribs and curve/dome shaped diaphragm.

Solution: (B) lifted ribs and flattened diaphragm.

Explanation: When we breathe in, we lift our ribs and flatten our diaphragm, and the chest cavity becomes larger as a result. Because of this, air is sucked into the lungs and fills the expanded alveoli.

11. Identify the mode of asexual reproduction in the following organism : [1]



- (A) Fragmentation
- (B) Multiple fission
- (C) Budding
- (D) Binary fission

Solution: (C) Budding

Explanation: Hydra can reproduce asexually through budding. Budding in Hydra appears to be a common method of reproduction and occurs at any time of the year.

12. A cross made between two pea plants produces 50% tall and 50% short pea plants. The gene combination of the parental pea plants must be [1]
- (A) Tt and Tt
 - (B) TT and Tt
 - (C) Tt and tt
 - (D) TT and tt

Solution: (C) Tt and tt

Explanation: The observed ratio of 50% tall and 50% short pea plants suggests that the cross involves a heterozygous tall plant (Tt) crossed with a homozygous short plant (tt). This would result in a 1:1 ratio of tall to short offspring.

13. Consider the following statements in the context of human eye:

- (a) The diameter of the eyeball is about 2.3 cm.
- (b) Iris is a dark muscular diaphragm that controls the size of the pupil.
- (c) Most of the refraction for the light rays entering the eye occurs at the crystalline lens.

(d) While focusing on the objects at different distances the distance between the crystalline lens and the retina is adjusted by ciliary muscles.

The correct statements are-

(A) (a) and (b)

(B) (a), (b) and (c)

(C) (b), (c) and (d)

(D) (a), (c) and (d)

Solution: (A) (a) and (b)

Explanation: The eyeball is spherical in shape with a diameter of about 2.3 cm.

The iris is a dark muscular diaphragm that controls the size of the pupil. The pupil is a hole located in the center of the iris that allows light to enter the eye.

Most of that refraction in the eye takes place at the first surface, i.e., the cornea since the transition from the air into the cornea is the largest change in the refractive index which the light experiences.

While focusing on the objects at different distances the distance between the crystalline lens and the retina is NOT adjusted by ciliary muscles. This distance doesn't change. Instead, the focal length of the lens is changed by the ciliary muscles.

14. The maximum resistance of a network of five identical resistors of $\frac{1}{5} \Omega$ each

can be

(A) 1Ω

(B) 0.5Ω

(C) 0.25Ω

(D) 0.1Ω

Solution: (A) 1Ω

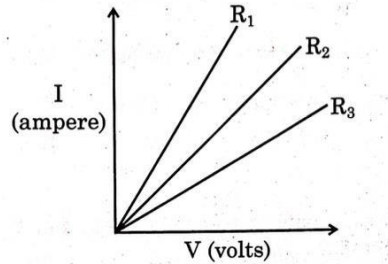
Explanation: The maximum resistance which can be obtained from a given set of resistors is when they are all connected in series.

So, $R_{\max} = R_1 + R_2 + R_3 + R_4 + R_5$

$$= \left(\frac{1}{5} + \frac{1}{5} + \frac{1}{5} + \frac{1}{5} + \frac{1}{5}\right) \Omega$$

$$= 1 \Omega$$

15. Study the I-V graph for three resistors of resistances R_1 , R_2 , and R_3 and select the correct statement from the following:



[1]

- (A) $R_1 = R_2 = R_3$
- (B) $R_1 > R_2 > R_3$
- (C) $R_3 > R_2 > R_1$
- (D) $R_2 > R_3 > R_1$

Solution: (C) $R_3 > R_2 > R_1$

Explanation: From the graph, it is clear that for a fixed value of voltage, the value of current for R_1 is greater than R_2 , which is in turn greater than R_3 . We know that for a fixed value of voltage, current is inversely proportional to resistance. Hence R_3 has the highest resistance and R_1 has the least resistance.

16. Strength of magnetic field produced by a current-carrying solenoid **DOES NOT** depend upon : [1]
- (a) number of turns in the solenoid
 - (b) direction of the current flowing through it
 - (c) radius of solenoid
 - (d) material of core of the solenoid

Solution: (b) direction of the current flowing through it.

Explanation: The strength of the magnetic field depends upon the number of turns in the solenoid, strength of the current, radius of the coil, and the nature of the core-material used in making solenoid.

However, it doesn't depend on the direction of the current flowing through it. If we change the direction of current, the magnetic field simply changes its direction.

For Question number 17 to 20, two statements are given- one labeled as Assertion (A) and the other labeled 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 and 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.

17. Assertion (A): Different metals have different reactivities with water and dilute acids.

Reason (R): Extraction of a metal from its ore depends on its position in the reactivity series. [1]

Solution: Both Assertion (A) and Reason (R) are true and Reason (R) is **not** the correct explanation of the Assertion (A).

Explanation: Different metals have different reactivities with water and dilute acids. The reactivity of a metal depends on its position in the reactivity series.

18. Assertion (A): Human females have a perfect pair of sex chromosomes.

Reason (R) : Sex chromosomes contributed by the human male in the zygote decides the sex of a child. [1]

Solution: Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).

Explanation: The fact that the male's contribution of the sex chromosome (X or Y) determines the sex of the offspring is directly related to the concept of females having a "perfect pair" of sex chromosomes (XX) for determining female sex.

19. Assertion (A): Myopic eye cannot see distant objects distinctly.

Reason (R) : For the correction of myopia converging lenses of appropriate power are prescribed by eye-surgeons. [1]

Solution: Option (C) - (A) is true but (R) is false.

Explanation: Myopic eye cannot see distant objects clearly. For the correction of myopia, concave lenses are prescribed. As converging lenses are convex, the reason is false.

20. Assertion (A): The deflection of a compass needle placed near a current carrying wire decreases when the magnitude of an electric current in the wire is increased.

Reason (R): Strength of the magnetic field at a point due to a current carrying conductor increases on increasing the current in the conductor. [1]

Solution: Option (D) - (A) is false but (R) is true.

Explanation: The deflection of the compass needle depends on the strength of the magnetic field at that point. So, if the current in the conductor increases, the magnetic strength at that point also increases. Thus, the magnetic needle deflects more.

SECTION B

Questions no. 21 to 26 are very short answer type questions.

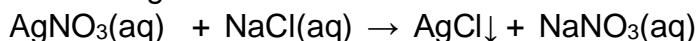
21.(a) "No precipitation reaction can occur without exchange of ions between the two reactants." Justify this statement giving a balanced chemical equation for the reaction.

[2]

OR

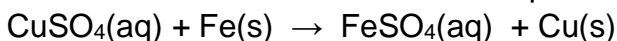
(b) Giving one example of each, differentiate between a displacement reaction and a double displacement reaction.

Solution: (a) Precipitation reactions occur when cations and anions in aqueous solution combine to form an insoluble ionic solid called a precipitate. There is no precipitate form, if there is no exchange of ions.

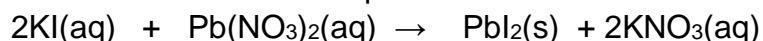


OR

(b) Displacement reaction: A displacement reaction is one in which a more active element displaces a less active element from its compound.



Double displacement reaction: The reaction in which there is an exchange of ions between the reactants is called a double displacement reaction.



22. *Photosynthesis takes place in the leaves and the food prepared by it reaches other parts of the plants. Name the process involved and explain it.*

[2]

Solution: The process by which the soluble products of photosynthesis are transported from the leaves to other parts of the plant is called *translocation*. This process is carried out by the phloem tissue, which is a vascular complex tissue.

23. *"Stability of DNA in a species is ensured during sexual reproduction." Justify the statement.*

[2]

Solution: The result of sexual reproduction is the origin of new species. Sexual reproduction involves division in the sex organs and reduces the DNA matter to half. Zygote formed after fusion has the same amount of DNA as the parents. Hence it maintains DNA in a species.

24. (A) State two laws of refraction of light.
[2]

OR

(B) Define the term absolute refractive index of a medium. A ray of light enters from vacuum to glass of absolute refractive index 1.5. Find the speed of light in glass. The speed of light in vacuum is $3 \times 10^8 \text{ m/s}$: [2]

Solution:

(A) Laws of refraction:

1. The incident ray, the refracted ray and the normal to the surface at the point of incidence all lie in the same plane.
2. For any two given pairs of media, the ratio of the sine of the angle of incidence to the sine of the angle of refraction is a constant .

$\frac{\sin i}{\sin r} = \eta$, where η is the refractive index of second medium w.r.t. the first medium

(B) Absolute refractive index (η) of a medium is defined as the ratio of the velocity of light in vacuum to the velocity of light in the medium.

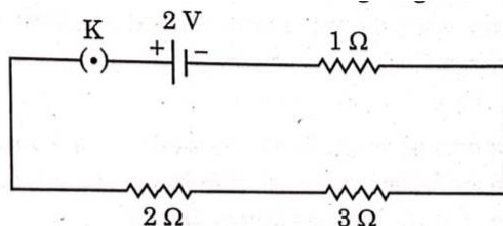
If c is the velocity of light in vacuum and v is the velocity of light in the medium, then $\eta = \frac{c}{v}$.

As per the question, $c = 3 \times 10^8 \text{ m/s}$ and $\eta = 1.5$

Therefore, the speed of light in glass will be

$$v = \frac{c}{\eta} = \frac{3 \times 10^8 \text{ m/s}}{1.5} = 2 \times 10^8 \text{ m/s}$$

25. Use Ohm's law to determine the potential difference across the 3Ω resistor in the circuit shown in the following diagram when key is closed : [2]



Solution:

Here the resistors are in series, so the equivalent resistance will be the sum of the individual resistances, i.e.,

$$\text{Total resistance, } R_{net} = R_1 + R_2 + R_3 = 1\ \Omega + 2\ \Omega + 3\ \Omega = 6\ \Omega$$

Potential difference, $V = 2\ V$

$$\text{Using Ohm's law, current in the circuit, } I = \frac{V}{R_{net}} = \frac{2\ V}{6\ \Omega} = \frac{1}{3}\ A$$

$$\text{Therefore, the potential difference across the } 3\ \Omega \text{ resistor } = IR_3 = \frac{1}{3} \times 3 = 1\ V$$

26. Name the term used for the materials which cannot be broken down by biological processes. Give two ways by which they harm various components of an ecosystem. [1]

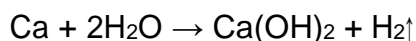
Solution: Substances that are not broken down by biological processes are said to be non-biodegradable. These substances may be inert and simply persist in the environment for a long period of time or may harm the various members of the ecosystem, e.g. plastic.

SECTION C

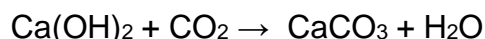
Questions no. 27 to 33 are short answer type questions.

27. It is observed that Calcium on reaction with water floats on its surface. Explain why it happens. Also write a balanced chemical equation for the reaction that occurs. What happens when the aqueous solution of the product of this reaction reacts with Carbon dioxide gas? Write a balanced chemical equation for the reaction [3]

Solution: On reaction with water calcium starts floating because the bubbles of hydrogen gas evolved during the reaction stick to its surface and makes it float on the surface of water.



Carbon dioxide reacts with Ca(OH)_2 (limewater), to form a white precipitate of calcium carbonate, CaCO_3 .

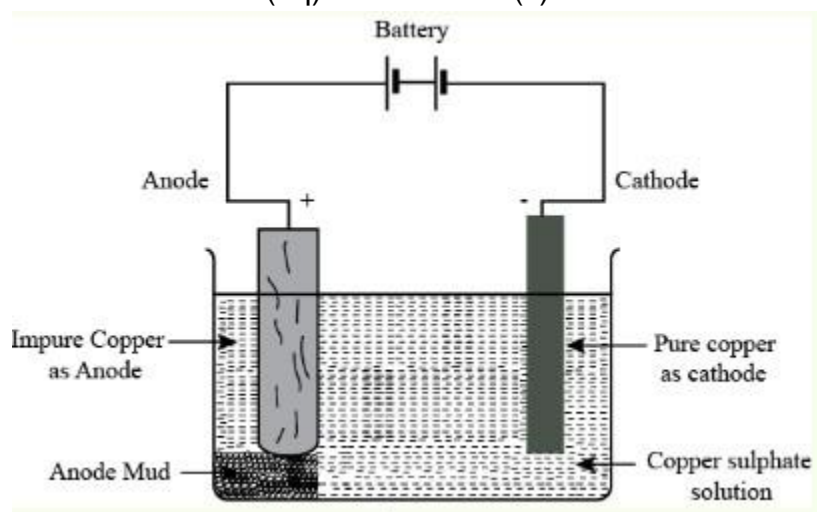
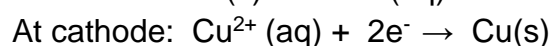
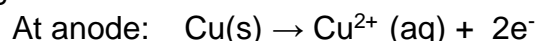


28. Draw a labelled diagram to show electrolytic refining of copper. State what happens when electric current is passed through the electrolyte taken in this case.

[3]

Solution: In the electrolytic purification of copper, impure copper is made into an anode and a thin line of pure copper is made into a cathode, a copper salt solution is used as an electrolyte.

The following reactions occur at anode and cathode:



29. (a) Give reasons for the following:

(i) Alveoli in lungs are richly supplied with blood capillaries.

(ii) Respiratory pigment in the blood takes up oxygen and not carbon dioxide.

(iii) During anaerobic respiration, a 3-carbon molecule is formed as an end product instead of CO_2 in human beings.

[3]

OR

(b) (i) Name the movements that occur all along the gut in the human digestive system. How do they help in digestion?

(ii) Where is bile juice stored in the human body? List two roles of bile, juice. [3]

Solution: (a)

(i) Alveoli are covered with blood capillaries so that the exchange of gases takes place between the membrane of alveoli and the surrounding capillaries. The blood capillaries

covering alveoli have low oxygen and high CO₂ concentration. This allows O₂ to diffuse into the blood and CO₂ out of the blood.

(ii) The respiratory pigment hemoglobin has high affinity for oxygen and therefore oxygen is transported in our body by it. Carbon dioxide is more soluble in water than oxygen is and hence is mostly transported in the dissolved form in our blood.

(iii) In anaerobic respiration, the breakdown of glucose is incomplete. The end product of anaerobic respiration is lactic acid instead of carbon dioxide and water. This process occurs in oxygen debt. Hence, the amount of oxygen required to oxidize lactic acid to carbon dioxide and water is not present.

(b)

(i) Peristalsis is a series of wave-like muscle contractions that move food through the digestive tract. It starts in the esophagus where strong wave-like motions of the smooth muscle move balls of swallowed food to the stomach.

(ii) Bile is a fluid that is made and released by the liver and stored in the gallbladder. Bile helps with digestion. It breaks down fats into fatty acids, which can be taken into the body by the digestive tract.

30. *Explain the events that take place once a sperm reaches the oviduct till it becomes a foetus. Write the role of placenta in pregnancy.*

[3]

Solution: During fertilization, the sperm and egg unite in one of the fallopian tubes to form a zygote. Then the zygote travels down the fallopian tube, where it becomes a morula. Once it reaches the uterus, the morula becomes a blastocyst. The blastocyst then burrows into the uterine wall — a process called implantation. The placenta is an organ that develops in the uterus during pregnancy. This structure provides oxygen and nutrients to a growing baby. It also removes waste products from the baby's blood.

31. *(A) Define the term power of accommodation of human eye. Write the name of the part of eye which plays a major role in the process of accommodation and explain what happens when human eye focuses (i) nearby objects and (ii) distant objects.*

[3]

OR

(B) Draw a ray diagram to show the formation of a rainbow in the sky. On this diagram mark A - where dispersion of light occurs, B - where internal reflection of light occurs and C - where refraction of light occurs. List two necessary conditions to observe

a rainbow.

[3]

Solution:

(A) The power of accommodation of the human eye refers to its ability to adjust the focal length of the lens, allowing clear vision of objects at various distances. This adjustment is essential for obtaining a sharp image on the retina, enabling the eye to focus on objects at different distances.

The ciliary muscles are the main part of the eye responsible for accommodation because these muscles change the focal length of the eye lens depending on the position of the object.

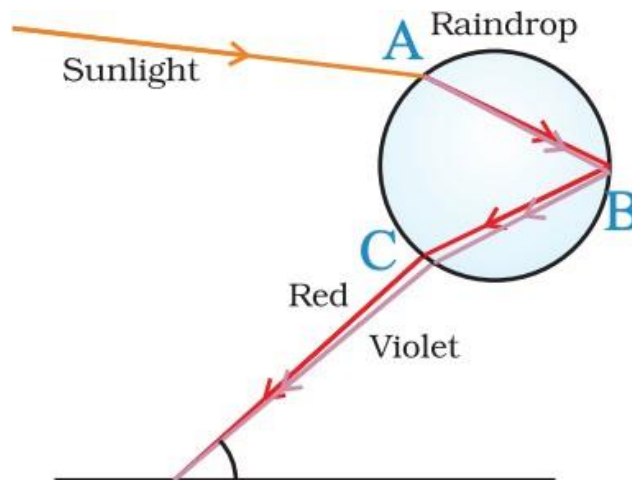
(i) Nearby objects:

The ciliary muscles, which are attached to the crystalline lens, contract. This causes the lens to become more rounded and thicker. The increased curvature of the lens allows it to bend incoming light more sharply, facilitating the focus on nearby objects.

(ii) Distant objects:

To focus on distant objects, the ciliary muscles relax. This results in the flattening of the crystalline lens. The flatter lens allows light to be focused directly onto the retina without over-bending, ensuring clear vision of distant objects.

(B)



Conditions to observe a rainbow:

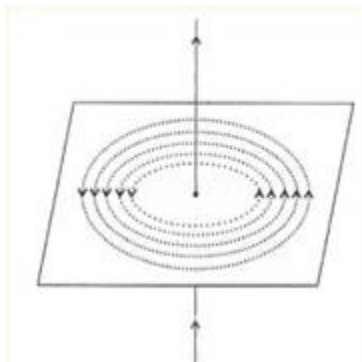
- There must be a source of light (e.g., sunlight or some other bright light source) to create the necessary conditions for dispersion, internal

reflection, and refraction within raindrops. The sun needs to be behind the viewer. It needs to be low in the sky, at an angle of less than 42° above the horizon.

- There must be suspended raindrops in the atmosphere to act as prisms. These raindrops serve as the medium through which dispersion, internal reflection, and refraction occur, leading to the formation of a rainbow. Rain, fog or some other source of water droplets must be in front of the viewer.

32. Draw a diagram to show the pattern of magnetic field lines on a horizontal sheet of paper due to a straight conductor passing through its centre and carrying current vertically upwards. Mark on it (i) the direction of current in the conductor and (ii) the corresponding magnetic field lines. State the right hand thumb rule and check whether the directions marked by you are in accordance with this rule or not. [3]

Solution: The diagram of the pattern of field lines is as follows:



The direction of magnetic field lines can be found using the right-hand thumb rule. The magnetic field lines will be directed by the fingers wrapped around the current-carrying conductor if the conductor is held in the right hand with the thumb pointing in the direction of the current.

Using the right hand thumb rule, we can see that the direction of magnetic field lines is in its accordance.

33. Use of pesticides to protect our crops affect organisms at various trophic levels, especially human beings. Name the phenomenon involved and explain how does it happen. [3]

Solution:

Some harmful chemicals enter our bodies through the food chain. One of the reasons is the use of several pesticides and other chemicals to protect our crops from diseases and pests. These chemicals are either washed down into the soil or into the water

bodies. From the soil, these are absorbed by the plants along with water and minerals, and from the water bodies these are taken up by aquatic plants and animals. This is one of the ways in which they enter the food chain. As these chemicals are not degradable, these get accumulated progressively at each trophic level. As human beings occupy the top level in any food chain, the maximum concentration of these chemicals gets accumulated in our bodies. This phenomenon is known as biological magnification or biomagnification.

SECTION D

Questions no. 34 to 36 are very short answer type questions.

34. (a) (i) Give reason why carbon can neither form C^{4+} cations nor C^{4-} anions but form covalent compounds.

(ii) What is homologous series of carbon compound? Write the molecular formula of any two consecutive members of homologous series of aldehydes.

(iii) Draw the structure of the molecule of cyclohexane (C_6H_{12}). [5]

OR

34. (b) (i) Name a commercially important carbon compound having functional group -OH and write its molecular formula.

(ii) Write chemical equation to show its reaction with

(1) Sodium metal

(2) Excess conc. sulphuric acid

(3) Ethanoic acid in the presence of an acid catalyst

(4) Acidified potassium dichromate

Also write the name of the product formed in each case. [5]

Solution: (a)

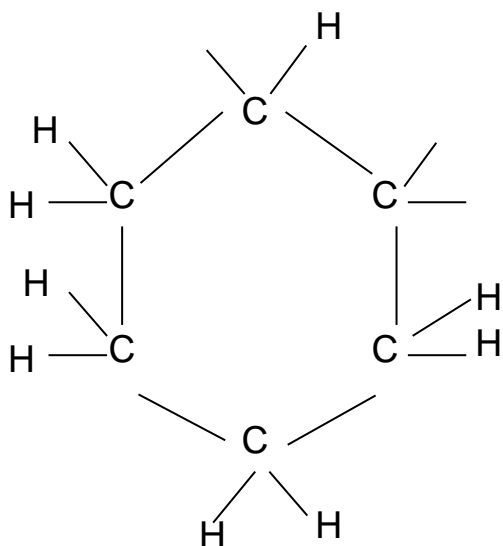
(i) Carbon cannot gain or lose electrons. Carbon cannot form C^{4-} because if it gains 4 electrons, it would be difficult for the nucleus with six protons to hold on to ten electrons, that is, four extra electrons.

Carbon cannot form C^{4+} because if it loses 4 electrons, it would require a large amount of energy to remove 4 electrons leaving behind a carbon cation with six protons in its nucleus holding on to just 2 electrons.

(ii) A homologous series is a series of organic compounds which belong to the same family i.e. possess the same functional group and show similar chemical properties. The members of this series are called homologous and differ from each other by the number of CH_2 units.

The molecular formula of two consecutive members of homologous series of aldehydes is CH_3CHO and CH_3CH_2CHO .

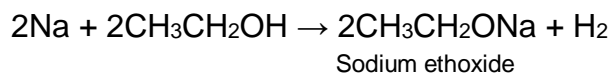
(iii) Cyclohexane C₆H₁₂



OR

(b) (i) Ethanol, its molecular formula is CH₃CH₂OH

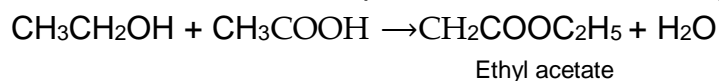
(ii) (1) Reaction with sodium metal



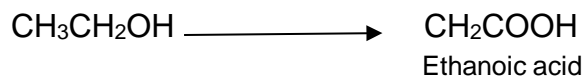
(2) Reaction with excess conc. sulphuric acid



(3) Reaction with ethanoic acid in the presence of an acid catalyst



(4) Reaction with acidified potassium dichromate



35. (a) (i) Distinguish between hormonal coordination in plants and animals.

(ii) Which part of the brain is responsible for -

- (1) intelligence
- (2) riding a bicycle
- (3) vomiting
- (4) controlling hunger

(iii) How is the brain and spinal-cord protected against mechanical injuries? [5]

OR

- (b) (i) What are tropic movements? Give an example of a plant hormone which (1) inhibits growth and (2) promotes cell division.
- (ii) Explain directional movement of a tendril in a pea plant in response to touch. Name the hormone responsible for this movement. [5]

Solution: (i)

Plant hormones	Animal hormones
1. Secreted from specific cells in the plant body.	1. Secreted always from the endocrine glands present in the body.
2. Diffuses through the xylem and phloem as they are the vascular structure.	2. Diffuses through the blood present in blood vessels.
3. Generally acts on a nearby target organ structure,	3. The animal hormones generally act at a distant region from where it is secreted.

- (ii) (1) cerebrum in the human brain is the center for intelligence
 (2) Requires balance, hence controlled by Cerebellum which controls balance and equilibrium of the body. It is part of the hindbrain.
 (3) The reflex action during vomiting is controlled by the vomit center in the Medulla oblongata.
 (4) The hypothalamus is the portion of your brain that controls hunger.
- (iii) The brain is protected by the bones of the skull and by a covering of three thin membranes called meninges. The brain is also cushioned and protected by cerebrospinal fluid.

OR

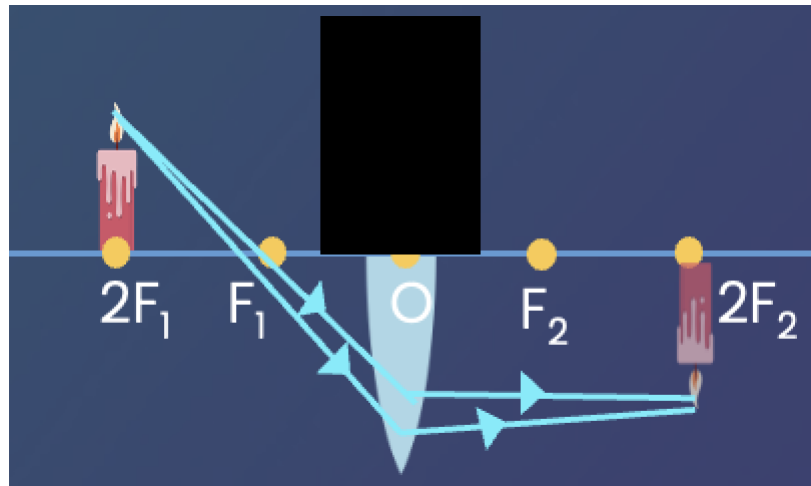
- (b) (i) Tropic movement is the movement of the plant in response to the stimulus present in the environment, this movement is in response to root and shoot growth. Auxins are the plant hormones that promote growth. They promote stem elongation, stimulate branching in roots and inhibit the growth of lateral buds in plants. Abscisic acid and ethylene inhibit plant growth.
- (ii) The directional growth movement of a plant in response to the touch of an object is called Thigmotropism. Example: In response to the touch of the support stick auxin is produced in the tendrils of a redvine and auxin is transferred from touching cells to non-touching cells.

36. (A) Upper half of a convex lens is covered with a black paper. Draw a ray diagram to show the formation of image of an object placed at a distance of $2F$ from such a lens. Mention the position and nature of the image formed. State the observable difference in the image obtained if the lens is uncovered. Give reason to justify your answer.

(B) An object is placed at a distance of 30 cm from the optical centre of a concave lens of focal length 15 cm. Use lens formula to determine the distance of the image from the optical centre of the lens. [5]

Solution:

(A)



The image will be formed at $2F$ on the other side of the lens. The image will be real, inverted and of the same size as the object.

If the upper half of the lens is left uncovered, still a real and inverted image of the same size as the object will be obtained. However, the image will be comparatively brighter as more rays (from the upper half of the lens as well) would converge to form the image.

(B) Given:

Object distance, $u = -30$ cm

Focal length, $f = -15$ cm (-ve because it is a concave lens)

Let 'v' be the image distance.

From the lens formula, $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

$$\Rightarrow \frac{1}{(-15)} = \frac{1}{v} - \frac{1}{(30)}$$

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

$$\Rightarrow v = -10 \text{ cm}$$

SECTION E

Questions no. 37 to 39 are case-based/data-based questions with 3 short sub-parts. Internal choice is provided in one of these sub-parts.

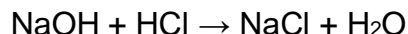
37. Salts play a very important role in our daily life. Sodium chloride which is known as common salt is used almost in every kitchen. Baking soda is also a salt used in faster cooking as well as in baking industry. The family of salts is classified on the basis of cations and anions present in them. [4]

- (a) Identify the acid and base from which Sodium chloride is formed. [1]
- (b) Find the cation and the anion present in Calcium sulphate. [1]
- (c) "Sodium chloride and washing soda both belong to the same family of salts." Justify this statement. [2]

OR

(c) Define the term pH scale. Name the salt obtained by the reaction of Potassium hydroxide and Sulphuric acid and give the pH value of its aqueous solution.

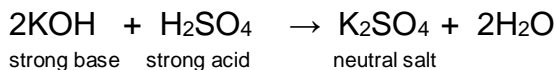
Solution: (a) NaCl is formed by the reaction of hydrochloric acid and sodium hydroxide



- (b) In the CaSO_4 compound, Ca^{2+} is cation and SO_4^{2-} is anion.
- (c) NaCl(sodium chloride) and $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$ (washing soda) both belong to the same family of salts because both salts contain Na^+ cation.

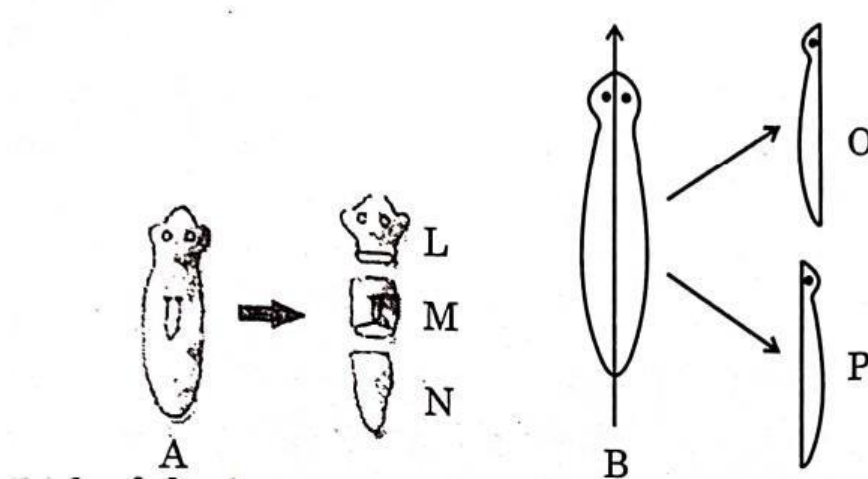
OR

(c) A pH scale is a tool for measuring acids and bases. The scale ranges from 0-14. When potassium hydroxide (KOH) reacts with sulphuric acid it produces potassium sulphate.



The solution is neutral with a pH value of 7.

38. Asexual reproduction involves a single parent to produce offspring without the formation of gametes. It occurs by the following ways: Fission, Budding, Fragmentation, Spore formation and Regeneration. In one of the methods like regeneration, Planaria A is cut horizontally into three pieces - L, M and N and Planaria B is cut vertically into two equal halves - O and P.



- (a) Which of the cut pieces of the two Planaria could regenerate to form a complete organism? [1]
 (b) Give an example of another organism which follows the same mode of reproduction as Planaria. [1]
 (c) What is the meaning of 'development' in regeneration? [2]

OR

- (c) Differentiate between regeneration and fragmentation. [2]

Solution: (a) L, M, N, O, and P regenerate to form a complete organism.

(b) Amoeba

(c) Regeneration is one of the processes in which if an organism is cut into several pieces, each of its parts regrows to the original state. This process is carried out by specialized cells called stem cells. It takes place in organisms that have a very simple structure with very few specialized cells.

OR

(c)

Fragmentation	Regeneration

Organisms that are fragmented result in each fragment growing into an individual organism	Regeneration occurs when an organism only regrows a lost limb or any other part of the body.
A new individual emerges from each fragment	No new organisms are formed
Only a few organisms can fragment and form new individuals	All organisms exhibit the ability to regenerate (Only to some degree)
Fragmentation is observed in organisms such as flatworms and sponges	Lizards can regenerate their amputated tails

39. When electric current flows in a purely resistive circuit electrical energy gets fully converted into heat energy. The amount of heat produced (H) in the circuit is found to be directly proportional to (i) the square of current (I^2) (ii) the resistance (R) of the conductor and (iii) the time (t) for which current flows. In other words $H = I^2 R t$. Electrical devices such as an electric fuse, electric heater, electric iron etc. are all based on this effect called heating effect of electric current. [4]

(a) List two properties of heating elements. [1]

(b) List two properties of electric fuse. [1]

(c) Name the principle on which an electric fuse works. Explain how a fuse wire is capable of saving electrical appliances from getting damaged due to accidentally produced high currents. [2]

OR

(c) The power of an electric heater is 1100 W. If the potential difference between the two terminals of the heater is 220 V, find the current flowing in the circuit. What will happen to an electric fuse of rating 5 A connected in this circuit?. [2]

Solution: (a) Two properties of heating elements are:

- (i) High melting point
- (ii) High resistivity

(b) Two properties of an electric fuse are:

- It is made of a metal or an alloy with appropriate melting point so that it melts when a current higher than rated current flows through it.
- It should be connected in series with the electrical appliance.

(c) An electrical fuse works on the principle of heating effect of electric current. When a current more than the rated amount passes through a fuse, it melts due to excessive heating and breaks the circuit and the current stops flowing. Thus, it saves the electrical appliances from damage.

OR

Given:

Power, $P = 1100 \text{ W}$

Voltage, $V = 220 \text{ V}$

We know that, $P = VI$

$$\Rightarrow 1100 = 220 I$$

$$\Rightarrow I = \frac{1100}{220} = 5 \text{ A}$$

If a current larger than the specified value flows through the circuit, the temperature of the fuse wire increases. This melts the fuse wire and breaks the circuit. Here, as rated current is only flowing, the fuse will not melt.