Time: 3 Hours

SCIENCE

Max. Marks: 80

CBSE Class-X (2024)
Answers & Solutions

GENERAL INSTRUCTIONS

Read the following instructions very carefully and strictly follow them :

(i)   This question paper comprises **39** questions. **All** questions are compulsory.

(ii) The question paper is divided into **FIVE** sections – **A, B, C, D** and **E**.

(iii) **Section-A** - Question Nos. **1** to **20** are multiple choice questions (MCQs). Each question carries **1** mark.

(iv) **Section-B** - Question Nos. **21** to **26** are very short answer (VSA) type questions. Each question carries **2** marks. Answer to these questions should be in the range of 30 to 50 words.

(v)   **Section-C** - Question Nos. **27** to **33** are short answer (SA) type questions. Each question carries **3** marks. Answer to these questions should be in the range of 50 to 80 words.

(vi) **Section-D** - Question Nos. **34** to **36** are long answer (LA) type questions. Each question carries **5** marks. Answer to these questions should be in the range of 80 to 120 words.

(vii) **Section-E** - Question Nos. **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

Multiple Choice Type Questions : **[16×1=16]**

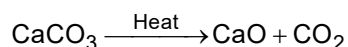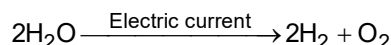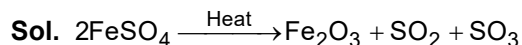**Select and write the most appropriate option out of the four options given for each of the questions 1-20. There is no negative mark for the incorrect response.**

1. Select from the following a decomposition reaction in which source of energy for decomposition is light: **[1]**

   (a) $2FeSO_4 \rightarrow Fe_2O_3 + SO_2 + SO_3$
   (b) $2H_2O \rightarrow 2H_2 + O_2$

   (c) $2AgBr \rightarrow 2Ag + Br_2$
   (d) $CaCO_3 \rightarrow CaO + CO_2$

Answer (c) **[1]**

Sol. $2FeSO_4 \xrightarrow{\text{Heat}} Fe_2O_3 + SO_2 + SO_3$

$2H_2O \xrightarrow{\text{Electric current}} 2H_2 + O_2$

$2AgBr \xrightarrow{\text{Sunlight}} 2Ag + Br_2$

$CaCO_3 \xrightarrow{\text{Heat}} CaO + CO_2$

2. When 2 mL of sodium hydroxide solution is added to few pieces of granulated zinc in a test tube and then warmed, the reaction that occurs can be written in the form of a balanced chemical equation as: **[1]**

   (a) $NaOH + Zn \rightarrow NaZnO_2 + H_2O$
   (b) $2NaOH + Zn \rightarrow Na_2ZnO_2 + H_2$

   (c) $2NaOH + Zn \rightarrow NaZnO_2 + H_2$
   (d) $2NaOH + Zn \rightarrow Na_2ZnO_2 + H_2O$

Answer (b) **[1]**

Sol. When zinc reacts with sodium hydroxide solution, sodium zincate and hydrogen gas are produced.

$2NaOH + Zn \longrightarrow Na_2ZnO_2 + H_2$
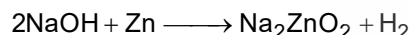
3. $MnO_2 + 4HCl \rightarrow MnCl_2 + 2H_2O + Cl_2$ **[1]**

   The reaction given above is a redox reaction because in this case :

   (a) MnO_2 is oxidised and HCl is reduced
   (b) HCl is oxidised

   (c) MnO_2 is reduced
   (d) MnO_2 is reduced and HCl is oxidised

Answer (d) **[1]**

Sol.
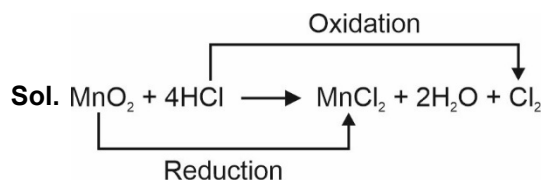
4. Consider the following compounds :

   $FeSO_4$; $CuSO_4$; $CaSO_4$; Na_2CO_3

   The compound having maximum number of water of crystallisation in its crystalline form in one molecule is : **[1]**

   (a) $FeSO_4$
   (b) $CuSO_4$

   (c) $CaSO_4$
   (d) Na_2CO_3

Answer (d) **[1]**

Sol.

Compound	Crystalline form
$FeSO_4$	$FeSO_4 \cdot 7H_2O$ (Green vitriol)
$CuSO_4$	$CuSO_4 \cdot 5H_2O$ (Blue vitriol)
$CaSO_4$	$CaSO_4 \cdot 2H_2O$ (Gypsum)
Na_2CO_3	$Na_2CO_3 \cdot 10H_2O$ (Washing soda)

5. In a nerve cell, the site where the electrical impulse is converted into a chemical signal is known as: **[1]**

   (a) Axon (b) Dendrites

   (c) Neuromuscular junction (d) Cell body

Answer (c) **[1]**

Sol. Neuromuscular junction is the site where the electrical impulse is converted into a chemical signal for onward transmission.

6. A metal and a non-metal that exists in liquid state at the room temperature are respectively: **[1]**

   (a) Bromine and Mercury (b) Mercury and Iodine

   (c) Mercury and Bromine (d) Iodine and Mercury

Answer (c) **[1]**

Sol. Mercury is a metal which exists in liquid state at the room temperature whereas bromine is a non-metal which exists in liquid state at the room temperature.

7. At what distance from a convex lens should an object be placed to get an image of the same size as that of the object on a screen? **[1]**

   (a) Beyond twice the focal length of the lens

   (b) At the principal focus of the lens

   (c) At twice the focal length of the lens

   (d) Between the optical centre of the lens and its principal focus

Answer (c) **[1]**

Sol. When object is placed at twice the focal length of a convex lens, an image of the same size as that of the object is formed.

8. Carbon compounds : **[1]**

   (i) are good conductors of electricity.

   (ii) are bad conductors of electricity.

   (iii) have strong forces of attraction between their molecules.

   (iv) have weak forces of attraction between their molecules.

   The correct statements are:

   (a) (i) and (ii) (b) (ii) and (iii)

   (c) (ii) and (iv) (d) (i) and (iii)

Answer (c) **[1]**

Sol. Carbon compounds are bad conductors of electricity as they contain covalent bonds. Force of attraction between their molecules are not very strong.

9. Oxides of aluminium and zinc are: **[1]**

   (a) acidic   (b) basic

   (c) amphoteric   (d) neutral

Answer (c) **[1]**

Sol. Al_2O_3 and ZnO are amphoteric in nature because they react with both acids and bases.

10. Chromosomes : **[1]**

    (i) carry hereditary information from parents to the next generation.

    (ii) are thread like structures located inside the nucleus of an animal cell.

    (iii) always exist in pairs in human reproductive cells.

    (iv) are involved in the process of cell division.

    The correct statements are :

    (a) (i) and (ii)   (b) (iii) and (iv)

    (c) (i), (ii) and (iv)   (d) (i) and (iv)

Answer (c) **[1]**

Sol. Chromosomes are thread-like structures which carry hereditary information and are involved in the process of cell division.

11. Consider the following statements : **[1]**

    (i) The sex of a child is determined by what it inherits from the mother.

    (ii) The sex of a child is determined by what it inherits from the father.

    (iii) The probability of having a male child is more than that of a female child.

    (iv) The sex of a child is determined at the time of fertilisation when male and female gametes fuse to form a zygote.

    The correct statements are :

    (a) (i) and (iii)   (b) (ii) and (iv)

    (c) (iii) and (iv)   (d) (i), (iii) and (iv)

Answer (b) **[1]**

Sol. A child who inherits an X chromosome from her father will be a girl and one who inherits a Y chromosome from him will be a boy.

12. Which one of the following organ is NOT a part of human female reproductive system? **[1]**

    (a) Ovary   (b) Uterus

    (c) Vas deferens   (d) Fallopian tube

Answer (c) **[1]**

Sol. Vas deferens is a part of the male reproductive system.

13. In which of the following organisms, multiple fission is a means of asexual reproduction? **[1]**

    (a) Yeast   (b) Leishmania

    (c) Paramoecium   (d) Plasmodium
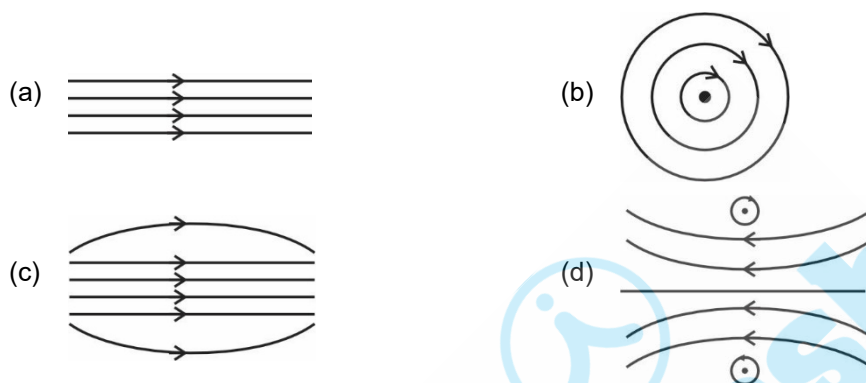
Answer (d) **[1]**

Sol. *Plasmodium*, divides into many daughter cells simultaneously by multiple fission.

14. In bifocal lenses used for the correction of presbyopia: **[1]**

(a) the upper portion is of convex lens for the near vision and lower part is of concave lens for the distant vision.

(b) the upper portion is of convex lens for the distant vision and lower part is of concave lens for the near vision.

(c) the upper portion is of concave lens is for the near vision and lower part is of convex lens for the distant vision.

(d) the upper portion is of concave lens for the distant vision and lower part is of convex lens for the near vision.

Answer (d) **[1]**

Sol. The upper portion of the bifocal lens is a concave lens so as to focus the distant objects and the lower portion of the bifocal lens is a convex lens so as to focus the nearby objects

15. The pattern of the magnetic field produced inside a current carrying solenoid is : **[1]**

Answer (a) **[1]**

Sol. The magnetic field is nearly uniform inside the solenoid hence, the field lines are parallel straight lines inside the solenoid.

16. Identify the food chain in which the organisms of the second trophic level are missing: **[1]**

(a) Grass, goat, lion

(b) Zooplankton, Phytoplankton, small fish, large fish

(c) Tiger, grass, snake, frog

(d) Grasshopper, grass, snake, frog, eagle

Answer (c) **[1]**

Sol. The herbivores or the primary consumers occupy the second trophic level which is missing in the food chain *i.e.*, tiger, grass, snake, frog.

Assertion & Reason Type Questions : **[4×1=4]**

For Q. Nos. **17 to 20,** two statements are given – One labelled as **Assertion (A)** and the other 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 Assertion (A).

(b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of 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) :** The rainbow is a natural spectrum of sunlight in the sky. **[1]**

Reason (R) : Rainbow is formed in the sky when the sun is overhead and water droplets are also present in air.

Answer (c) **[1]**

Sol. A rainbow is always formed in a direction opposite to that of the sun.

18. **Assertion (A) :** Hydrogen gas is not evolved when zinc reacts with nitric acid. **[1]**

Reason (R) : Nitric acid oxidises the hydrogen gas produced to water and itself gets reduced.

Answer (a) **[1]**

Sol. Hydrogen gas is not evolved when zinc reacts with nitric acid as HNO_3 being oxidising agent oxidises the hydrogen gas produced to water and itself gets reduced to any of the nitrogen oxides.

19. **Assertion (A) :** Accumulation of harmful chemicals is maximum in the organisms at the highest trophic level of a food chain. **[1]**

Reason (R) : Harmful chemicals are sprayed on the crops to protect them from diseases and pests.

Answer (b) **[1]**

Sol. Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).

20. **Assertion (A) :** The rate of breathing in aquatic organisms is much faster than in terrestrial organisms. **[1]**

Reason (R) : The amount of oxygen dissolved in water is very high as compared to the amount of oxygen in air.

Answer (c) **[1]**

Sol. Amount of dissolved oxygen is fairly low in water as compared to the amount of oxygen in the air.

SECTION-B

Very Short Answer Type Questions : **[6×2=12]**

21. (A) (i) Write the significance of peripheral nervous system in human beings. **[2]**

(ii) How is human brain protected from mechanical injuries and shocks?

OR

(B) Name one directional growth movement each in response to chemicals and water in plants. Write an example for each of them. **[2]**

Sol. (A) (i) Peripheral nervous system plays key role in both sending information from different areas of the body back to the CNS, as well as carrying out commands from the CNS to various parts of the body. **[1]**

(ii) **Protection of human brain :**

- Brain lies inside a bony box, called cranium, such bony structures protect the brain from mechanical injury and shock.

- Cerebrospinal fluid present in the brain which serves as a pad to cushion the central nervous system from shocks. **[1]**

OR

(B) Chemotropism and hydrotropism are the directional growth movement each in response to chemicals and water respectively. **[1]**

Chemotropism : Example – growth of pollen tube towards ovule. **[½]**

Hydrotropism : Example – growth of roots towards water. **[½]**

22. (i) Give reason why herbivorous animals have longer, small intestine than carnivorous animals? **[2]**

(ii) Although 'Pepsin' and 'Trypsin' are both protein digesting enzymes yet they differ from each other. Justify this statement by giving one difference between them.

Sol. (i) Herbivorous animals have longer, small intestine than carnivorous animals because they eat grass which contain cellulose and the digestion of cellulose takes a longer time. **[1]**

(ii) (a) Pepsin is secreted from stomach whereas trypsin is secreted from pancreas.
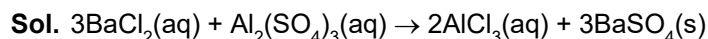
(b) Pepsin acts in acidic medium and trypsin acts in alkaline medium. **(Any one) [1]**

23. Translate the following statement into a balanced chemical equation.

    "When barium chloride reacts with aluminium sulphate, aluminium chloride and barium sulphate are formed."

    State the type of this reaction giving reason to justify your answer. **[2]**

Sol. $3BaCl_2(aq) + Al_2(SO_4)_3(aq) \rightarrow 2AlCl_3(aq) + 3BaSO_4(s)$ **[1]**

This reaction is an example of double displacement (precipitation) reaction. **[½]**

Since exchange of ions takes place between both the reactants leading to the formation of a precipitate, it is an example of double displacement (precipitation) reaction. **[½]**

24. (i) Two magnetic field lines do not intersect each other. Why? **[2]**

    (ii) How is a uniform magnetic field in a given region represented?

    Draw a diagram in support of your answer.

Sol. (i) The magnetic field lines never cross each other. If they do so, then at the point of intersection there will be two tangents which give two directions of magnetic field at the same point which is not possible. **[1]**
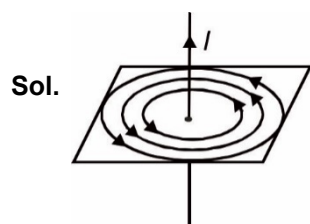
(ii) A uniform magnetic field in a region is represented by parallel and equidistant lines. **[1]**

25. Draw the pattern of the magnetic field lines due to a straight current carrying conductor indicating the direction of current in the conductor and the direction of the corresponding magnetic field lines. **[2]**

Sol. **[2]**

26. An object is placed at a distance of 10 cm from a convex mirror of focal length 15 cm. Find the position of the image formed by the mirror. **[2]**

Sol. Focal length (f) = +15 cm

Object distance (u) = −10 cm

From mirror formula

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

$$\frac{1}{v} = \frac{1}{f} - \frac{1}{u} = \frac{1}{15} - \frac{1}{(-10)} = \frac{2+3}{30}$$ **[1]**

⇒ v = 6 cm *i.e.*, Image formed at 6 cm behind the mirror **[1]**

SECTION-C

Short Answer Type Questions : **[7×3=21]**

27. (A) Plants → Deer → Lion

    In the given food chain, what will be the impact of removing all the organisms of second trophic level on the first and third trophic level? Will the impact be the same for the organisms of the third trophic level in the above food chain if they were present in a food web? Justify. **[3]**

OR

(B) A gas 'X' which is a deadly poison is found at the higher levels of atmosphere and performs an essential function.

Name the gas and write the function performed by this gas in the atmosphere. Which chemical is linked to the decrease in the level of this gas? What measures have been taken by an international organization to check the depletion of the layer containing this gas? **[3]**

Sol. (A) Plants → Deer → Lion

If we remove deer from the second trophic level, the population of plants will drastically increase while the population of lion will decrease. **[2]**

No, the impact will not be same because a food web contains many other alternatives which increase the stability of the ecosystem. It is easy to overcome a disturbance in it. **[1]**

OR

(B) Ozone gas is present in the stratum of atmosphere called stratosphere. At higher levels of atmosphere, it absorbs most of harmful ultraviolet radiations coming from the Sun. **[1]**

Chlorofluorocarbons, halogen, carbon tetrachloride, methylbromide, etc. are linked to the decrease in the level of ozone. **[1]**

**Preventive measures :**

(i) Use alternative sources of energy instead of fossil fuels.

(ii) Use of CFCs in refrigerators and air-conditioners should be banned. Rather, CFCs should be replaced with alternatives such as hydrofluorocarbons (HFCs) and hydrochlorofluorocarbons (HCFC's).

(iii) The products which contain chlorine and harmful ozone-depleting chemicals should be banned.

(iv) Use of eco-friendly biopesticides, bioinsecticides, etc., instead of chlorinated insecticides and pesticides to control various pests and diseases.

(v) Increase public awareness about the issue. **(Any one) [1]**

28. Name and state the rule to determine the direction of a : **[3]**

    (i) magnetic field produced around a current carrying straight conductor.

    (ii) force experienced by a current carrying straight conductor placed in a magnetic field which is perpendicular to it.

Sol. (i) The direction of magnetic field due to straight current carrying wire can be obtained by **'Right Hand Thumb Rule'.** **[½]**
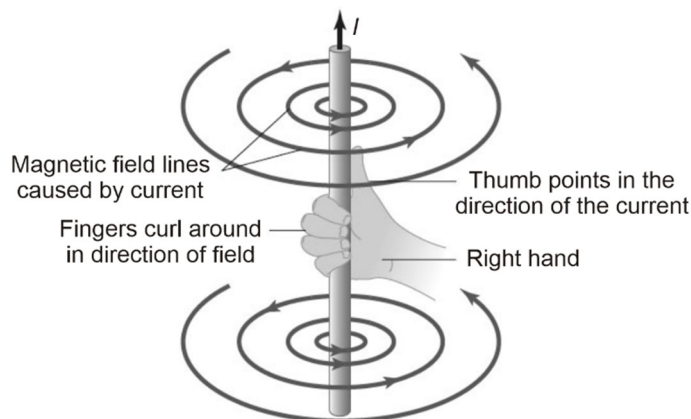
Right-hand thumb rule : Imagine yourself grasping a current-carrying conductor with your right-hand, so that the thumb lies along the conductor in the direction of the current, then the fingers of your hand will be encircling the conductor in the direction of the magnetic field lines caused by the current. **[1]**

(ii) The direction of force experienced by a current currying straight conductor placed in a magnetic field which is perpendicular to it is given by Fleming's left hand rule. **[½]**
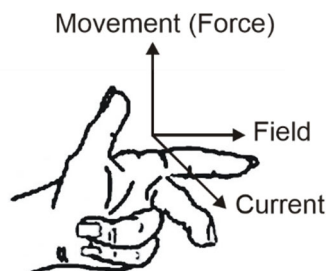
If the forefinger, the second finger and the thumb of the left hand are stretched at right angles to each other, with the forefinger pointing in the direction of the field and the second finger in the direction of the current then the thumb indicates the direction of the force. **[1]**

29. Study the diagram given below and answer the questions that follow : **[3]**
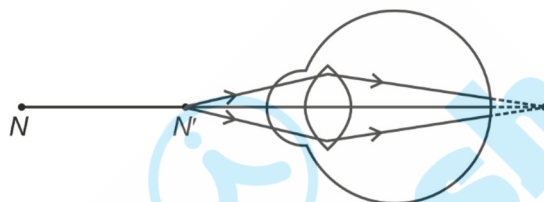
(i) Name the defect of vision represented in the diagram. Give reason for your answer.

(ii) List two causes of this defect.

(iii) With the help of a diagram show how this defect of vision is corrected.

Sol. (i) Hypermetropia

Because, the light rays from the nearby objects are focussed at a point behind the retina of the eye. **[1]**

(ii) 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]**

(iii)
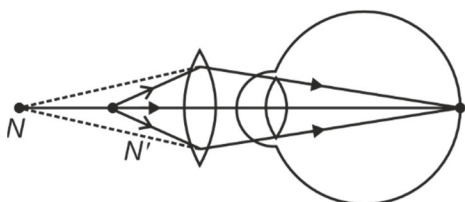
[1]

30. Define reflex action. With the help of a flow chart show the path of a reflex action such as sneezing. **[3]**

Sol. Reflex action is defined as the rapid automatic response to a stimulus which is not under the voluntary control of the brain. **[1]**

[2]

31. (i) Which organisms have a three-chambered heart? Why do they have three-chambered hearts? **[3]**

(ii) List two functions of lymph.
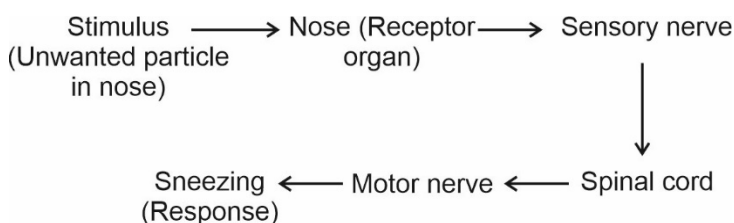
Sol. (i) Amphibians and many reptiles have three chambered heart because they can tolerate some mixing of the oxgenated and de-oxygenated blood. **[1]**

(ii) **Functions of lymph :**

(a) It acts as an accessory circulatory system for transport of excretory products and large sized digested food particles particularly fats.

(b) It helps in maintenance of blood volume.

(c) It destroys the invading microorganisms and foreign particles in the lymph nodes.

(d) Lymph nodes produces lymphocytes. Lymph carries lymphocytes and antibodies from the lymph nodes to the blood **(Any two) [2×1]**

32. A compound which is prepared from gypsum has the property of hardening when water is mixed in right quantity with it: **[3]**

(i) Write common name and the chemical name of this compound.

(ii) Give chemical equation for its preparation.

(iii) List its two uses.

Sol. (i) Common name – Plaster of Paris **[½]**

Chemical name – Calcium sulphate hemihydrate **[½]**

(ii) $CaSO_4 \cdot 2H_2O \xrightarrow{373K} CaSO_4 \cdot \frac{1}{2}H_2O + 1\frac{1}{2}H_2O$ **[1]**

(iii) • It is used in making toys, materials for decoration, etc. **[½]**

• It is used as plaster for supporting fractured bones in the right position. **(or any other) [½]**

33. (i) Define a decomposition reaction. Write chemical equation for the reaction that occurs when lead nitrate is heated strongly in a boiling tube. **[2]**

(ii) In electrolytic decomposition of water two gases are liberated at the electrodes. Give the mass ratio of the gas liberated at the cathode and at the anode. **[1]**

Sol. (i) The reactions in which a single reactant breaks down to give simpler products in presence of heat, light or electricity are known as decomposition reactions. **[1]**

$$2Pb(NO_3)_2(s) \xrightarrow{Heat} 2PbO(s) + 4NO_2(g) + O_2(g)$$
Lead nitrate   Lead oxide   Nitrogen   Oxygen
            (Yellow)   dioxide
                    (Brown) **[1]**

(ii) $2H_2O(l) \xrightarrow{Electricity} 2H_2(g) + O_2(g)$
                       Cathode   Anode
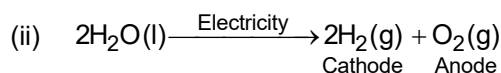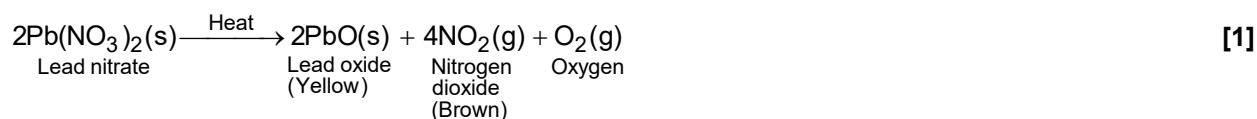
Mass of H_2 evolved at cathode = 2 × 2 = 4 g

Mass of O_2 evolved at anode = 1 × 32 = 32 g

∴ Mass of H_2 : Mass of O_2 = 4 : 32 = 1 : 8 **[1]**

SECTION-D

Long Answer Type Questions : [3×5=15]

34. (A) (i) State whether the currents and potential difference in all the bulbs will be same or different when in a circuit three bulbs of: [5]

    (a) same wattage are connected in series.

    (b) same wattage are connected in parallel.

    (c) different wattage are connected in series.

    (d) different wattage are connected in parallel.

  (ii) Two identical resistors of 24 Ω each are connected to a battery of 6 V. Calculate the ratio of the power consumed by the resulting combinations with (a) minimum resistance and (b) maximum resistance.

OR

(B) Draw a schematic diagram of a circuit consisting of a battery of six 2 V cells, a 6 Ω resistor, a 12 Ω resistor and a 18 Ω resistor and a plug key all connected in series. Calculate the following (when key is closed): [5]

  (i) Electric current flowing in the circuit.

  (ii) Potential difference across 18 Ω resistor.

  (iii) Electric power consumed in 18 Ω resistor.

Sol. (A) (i) (a) All the three bulbs have same current and same potential difference [½]

    (b) All the three bulbs have same current and same potential difference [½]

    (c) All the three bulbs have same current but different potential differences [½]

    (d) All the three bulbs have different currents but same potential difference [½]

  (ii) Here

$$R_{max} = 24 + 24 = 48 \ \Omega$$ [1]
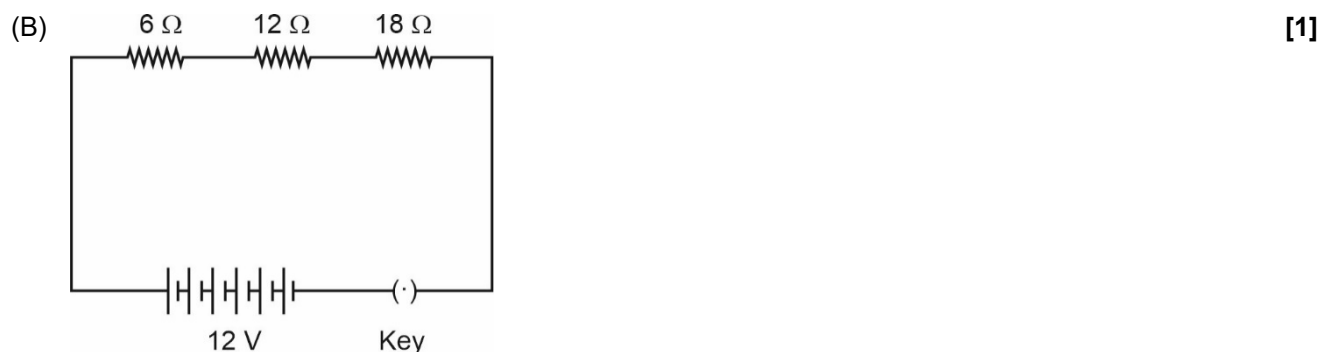
$$R_{min} = \frac{24 \times 24}{24 + 24} = 12 \ \Omega$$ [1]

Now, we have

$$P = \frac{V^2}{R}$$

Therefore,

$$\frac{P_p}{P_s} = \frac{\dfrac{(6)^2}{12}}{\dfrac{(6)^2}{48}} = 4 : 1$$ [1]

OR

(B) [1]

6 Ω   12 Ω   18 Ω

12 V   Key

R_{eq} = 6 + 12 + 18 = 36 Ω **[1]**

(i) $I = \dfrac{V}{R_{eq}} = \dfrac{12}{36} = \dfrac{1}{3}$ A **[1]**

(ii) $V_{18} = IR = \dfrac{1}{3} \times 18 = 6$ V **[1]**

(iii) $P_{18} = I^2 R = \left(\dfrac{1}{3}\right)^2 \times 18 = 2$ W **[1]**

35. (A) (i) Define a homologous series of carbon compounds. **[5]**

    (ii) Why is the melting and boiling points of C_4H_8 higher than that of C_3H_6 or C_2H_4?

    (iii) Why do we **NOT** see any gradation in chemical properties of a homologous series compounds?

    (iv) Write the name and structures of (i) aldehyde and (ii) ketone with molecular form C_3H_6O.

OR

   (B) (i) Write the name and structure of an organic compound "X" having two carbon atoms in its molecule and its name is suffixed with -ol", **[5]**

    (ii) What happens when 'X' is heated with excess concentrated sulphuric acid at 443 K? Write chemical equation for the reaction stating the conditions for the reaction. Also state the role played by concentrated sulphuric acid in the reaction.

    (iii) Name and draw the electron dot structure of hydrocarbon produced in the above reaction.

Sol. (A) (i) A homologous series is a series of compounds with the same general formula and same functional group. **[1]**

    (ii) C_2H_4, C_3H_6 and C_4H_8 belong to the same homologous series. As the molecular mass increases in any homologous series, gradation in physical properties is seen. Melting and boiling points increase with increasing molecular mass. **[1]**

    (iii) Since the functional group remains the same in all the members of a homologous series, any gradation in their chemical properties is not seen. **[1]**

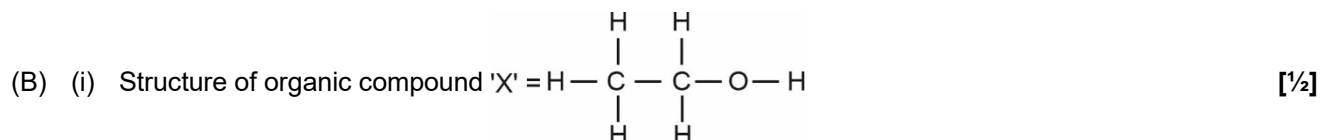   (iv)

    Aldehyde :

    Propanal **[½]** **[½]**

    Ketone :

    Propanone **[½]** **[½]**

OR

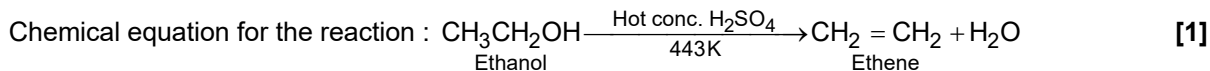   (B) (i) Structure of organic compound 'X' =


    [½]

    Name of organic compound 'X' = Ethanol **[½]**

(ii) When ethanol is heated with excess concentrated sulphuric acid at 443 K, it loses water and gives ethene as a product. **[1]**

Chemical equation for the reaction : $\underset{\text{Ethanol}}{CH_3CH_2OH} \xrightarrow[\text{443K}]{\text{Hot conc. } H_2SO_4} \underset{\text{Ethene}}{CH_2 = CH_2} + H_2O$ **[1]**

The concentrated sulphuric acid can be regarded as a dehydrating agent which removes water from ethanol. **[1]**

(iii) Hydrocarbon produced in the above reaction is ethene. **[½]**

Electron dot structure:
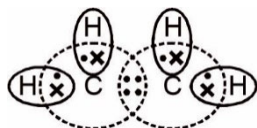
[½]

36. (A) (i) Name three techniques/devices used by human females to avoid pregnancy. Mention the side effects caused by each. **[5]**

(ii) What will happen if in a human female (a) fertilisation takes place, (b) an egg is not fertilised?

OR

(B) (i) Draw a diagram showing spore formation in Rhizopus and label the (a) reproductive and (b) non-reproductive parts. Why does Rhizopus not multiply on a dry slice of bread? **[5]**

(ii) Name and explain the process by which reproduction takes place in Hydra.

Sol. (A) (i) The three techniques/devices used by human females to avoid pregnancy are :

(a) Cervical Cap and Diaphragm

Side effects : If not fitted properly, it can lead to sexually transmitted infections and can cause vaginal irritation.

(b) Loop and Copper-T

Side effects : They can cause irritation of the uterus, excess menstrual bleeding, pain and risk of infection.

(c) Tubectomy

Side effects : If not performed properly, it can cause infections and other problems. **[3×1]**

(ii) (a) If fertilization takes place, it will stop menstruation in females. **[1]**

(b) If an egg is not fertilised, the overgrown lining of the uterus breaks down and comes out along with the unfertilized egg through the vagina with blood and mucus. **[1]**

OR

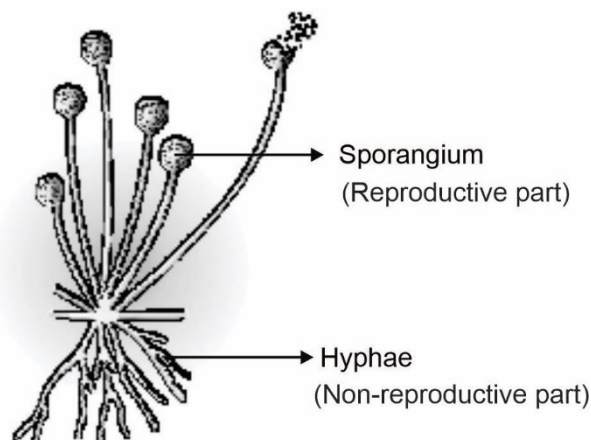(B) (i)

$$\begin{bmatrix} \textbf{Diagram-1} \\ \textbf{Labellings-2 × ½} \end{bmatrix}$$

Sporangium (Reproductive part)

Hyphae (Non-reproductive part)

Rhizopus does not multiply on a dry slice of bread due to the lack of moisture. **[1]**

(ii) *Hydra* reproduces by the process of budding. **[1]**

Hydra produce small buds, which gradually grows, ultimately acquiring the characteristic form of the parent organism. It uses regenerative cells for reproduction in the process of budding. It has a bud that develops as an outgrowth due to repeated cell division at one specific site. Then, this bud grows into a tiny individual and when fully mature, it detaches from the parent body and becomes an independent individual. **[1]**

SECTION-E

Source-based/Case-based Units of Assessment Type Questions : **[3×4=12]**

Q. No. 37-39 are source-based/case-based questions with 2 to 3 short sub-parts. Internal choice is provided in one of these sub-parts :

37. Mendel worked out the rules of heredity by working on garden pea using a number of visible contrasting characters. He conducted several experiments by making a cross with one or two pairs of contrasting characters of pea plant. On the basis of his observations he gave some interpretations which helped to study the mechanism of inheritance.

   (i) When Mendel crossed pea plants with pure tall and pure short characteristics to produce F_1 progeny, which two observations were made by him in F_1 plants? **[1]**

   (ii) Write one difference between dominant and recessive trait. **[1]**

   (iii) (A) In a cross with two pairs of contrasting characters

   RRYY × rryy
   (Round Yellow) (Wrinkled Green)

   Mendel observed 4 types of combinations in F_2 generation. By which method did he obtain F_2 generation? Write the ratio of the parental combinations obtained and what conclusions were drawn from this experiment. **[2]**

   OR

   (iii) (B) Justify the statement :

   "It is possible that a trait is inherited but may not be expressed". **[2]**

Sol. (i) **Observations made by Mendel in F_1 progeny of monohybrid cross :**

   The F_1 generation consists of only tall plants that means only one of the parental traits was seen, not some mixture of the two. **[1]**

   (ii) **Differences between dominant and recessive traits are :**

Dominant traits	Recessive traits	
• They can be expressed in both homozygous and heterozygous conditions.	• They cannot be expressed in heterozygous condition, i.e., they are only expressed in homozygous condition.	
• It is represented by capital (upper caselet) letter.	• It is represented by a lower caselet.	**(Any one)** **[1]**

(iii) (A) • Mendel took two pure breeding plants, one having round and yellow seeds (RRYY) and the other having wrinkled and green seeds (rryy).

• Parents were cross pollinated and F_1 generation was raised in which all the plants produced had round and yellow seeds.

• By selfing the F_1 plants when F_2 generation was raised, he found four combinations of phenotypes as given below :   **[½]**

Dihybrid phenotypic ratio $\Rightarrow$ 9 : 3 : 3 : 1

Dihybrid genotypic ratio $\Rightarrow$

RRYY – 1   RrYY – 2   rrYY – 1

RRYy – 2   RrYy – 4   rrYy – 2

RRyy – 1   Rryy – 2   rryy – 1   **[½]**

Conclusions from dihybrid cross

• This law states that any pair of unit factors or genes controlling different characters can segregate or separate independently of all other unit factors, during the formation of gametes.

• For one pair, whichever unit factor is received, it does not influence the outcome of segregation of any other pair.   **(Any one) [1]**

OR

(iii) (B) Yes, it is possible that a trait is inherited but may not be expressed.

For example, when pure tall pea plants are crossed with pure dwarf pea plants only tall pea plants are obtained in F_1 generation but when members of F_1 generation are selfed then the dwarf trait disappeared in F_1 generation reappeared.

Hence, we can say it is possible that a trait is inherited but may not be expressed.   **[2]**

38. Study the data given below showing the focal length of three concave mirrors A, B and C and the respective distances of objects placed in front of the mirrors:

Case	Mirror	Focal Length (cm)	Object Distance (cm)
1	A	20	45
2	B	15	30
3	C	30	20

(i) In which one of the above cases the mirror will form a diminished image of the object? Justify your answer.   **[1]**

(ii) List two properties of the image formed in case 2.   **[1]**

(iii) (A) What is the nature and size of the image formed by mirror C?

Draw ray diagram to justify your answer.   **[2]**

OR

(iii) (B) An object is placed at a distance of 18 cm from the pole of a concave mirror of focal length 12 cm. Find the position of the image formed in this case.   **[2]**

Sol. (i) In case-1 object distance is greater than radius of curvature of the mirror *i.e.*, object is placed beyond centre of curvature of the mirror. Hence image formed by the mirror is diminished, real and inverted. **[1]**

(ii) Centre of curvature $R = 2f$

$R = 2 \times 15$

$\quad = 30$ cm

Hence, object is placed on the centre of curvature of the mirror.

Size of image → Same as that of the object

Nature of image → Real and inverted **[1]**

(iii) (A) In case-3

$u = -20$ cm

$f = -30$ cm

By mirror formula

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

$\dfrac{1}{v} + \dfrac{1}{(-20)} = \dfrac{1}{-30}$

$v = 60$ cm

Nature of the image → Virtual and erect **[1]**

Size of the image → Magnified
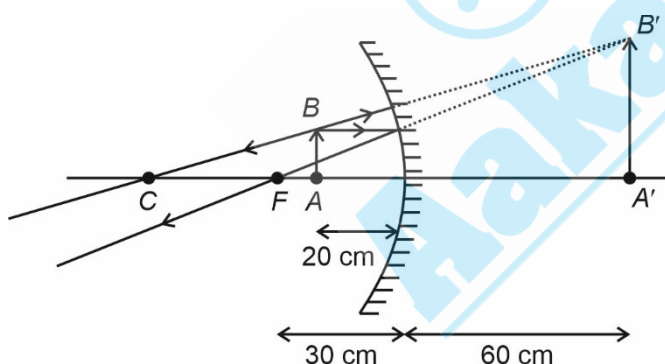
[1]

OR

(iii) (B) Here,

$u = -18$ cm

$f = -12$ cm

From mirror formula

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

$\dfrac{1}{v} = \dfrac{1}{f} - \dfrac{1}{u} = \dfrac{1}{(-12)} - \dfrac{1}{(-18)}$ **[1]**

$\dfrac{1}{v} = -\dfrac{1}{36} \Rightarrow v = -36$ cm **[1]**

39. The metals produced by various reduction processes are not very pure. They contain impurities, which must be removed to obtain pure metals. The most widely used method for refining impure metals is electrolytic refining.

   (i)   What is the cathode and anode made of in the refining of copper by this process?   **[1]**

   (ii) Name the solution used in the above process and write its formula.   **[1]**

   (iii) (A) How copper gets refined when electric current is passed in the electrolytic cell?   **[2]**

<div align="center">**OR**</div>

   (iii) (B) You have two beakers 'A' and 'B' containing copper sulphate solution. What would you observe after about 2 hours if you dip a strip of zinc in beaker 'A' and a strip of silver in beaker 'B'? Give reason for your observations in each case.   **[2]**

Sol. (i)   In the refining of copper anode is made of impure copper whereas, cathode is made of the thin strip of pure copper.   **[½+½]**

   (ii) The solution used is acidified copper sulphate having chemical formula $CuSO_4$.   **[½+½]**

   (iii) (A) When electric current is passed through the electrolyte, copper sulphate solution, the pure metal from the anode dissolves into the solution. An equivalent amount of pure metal from the electrolyte is deposited on the cathode. The soluble impurities go into the solution and the insoluble impurities settle down at the bottom of the anode as anode mud.   **[2]**

<div align="center">**OR**</div>

   (iii) (B) When the zinc strip is dipped in copper sulphate solution (beaker 'A') the blue colour of solution becomes colourless because zinc being more reactive displaces copper from its salt solution.

$$CuSO_4(aq) + Zn(s) \longrightarrow ZnSO_4(aq) + Cu(s)$$
$$\text{(Blue)} \qquad\qquad\qquad \text{(Colourless)}$$
   [1]

   When silver strip is dipped in copper sulphate solution (beaker 'B') no reaction takes place as silver is less reactive than copper.

$$CuSO_4(aq) + Ag(s) \longrightarrow \text{No reaction}$$
   [1]

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