Date: 04/03/2023

Question Paper Code

31/4/1

Corporate Office : Aakash Tower, 8, Pusa Road, New Delhi-110005 | Ph.: 011-47623456

Time: 3 Hrs.

Class-X

Max. Marks: 80

SCIENCE (Theory)

(CBSE 2022-23)

Answers & Solution

GENERAL INSTRUCTIONS

Read the following instructions very carefully and follow them:

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

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

(iii) In **Section-A -** question number **1 to 20** are multiple choice questions (MCQs) carrying **1** mark each.

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

(v) In **Section-C -** question number **27 to 33** are short answer (SA) type questions carrying **3** marks each. Answer to these questions should be in the range of 50 to 80 words.

(vi) In **Section-D -** question number **34 to 36** are long answer (LA) type questions carrying **5** marks each. Answer to these questions should be in the range of 80 to 120 words.

(vii) In **Section-E** – question number **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 questions.

SECTION-A

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

1. When Sodium bicarbonate reacts with dilute hydrochloric acid, the gas evolved is **[1]**

   (a) Hydrogen; it gives pop sound with burning match stick.

   (b) Hydrogen; it turns lime water milky.

   (c) Carbon dioxide; it turns lime water milky.

   (d) Carbon dioxide; it blows off a burning match stick with a pop sound.

Answer (c) **[1]**

Sol. $NaHCO_3(s) + HCl(aq) \rightarrow NaCl(aq) + H_2O(l) + CO_2(g)$

Carbon dioxide gas is evolved which turns lime water milky.

2. When aqueous solutions of potassium iodide and lead nitrate are mixed, an insoluble substance separates out. The chemical equation for the reaction involved is **[1]**

   (a) $KI + PbNO_3 \rightarrow PbI + KNO_3$

   (b) $2KI + Pb(NO_3)_2 \rightarrow PbI_2 + 2KNO_3$

   (c) $KI + Pb(NO_3)_2 \rightarrow PbI + KNO_3$

   (d) $KI + PbNO_3 \rightarrow PbI_2 + KNO_3$

Answer (b) **[1]**

Sol. $2KI(aq) + Pb(NO_3)_2(aq) \rightarrow PbI_2(s) + 2KNO_3(aq)$

3. A metal ribbon 'X' burns in oxygen with a dazzling white flame forming a white ash 'Y'. The correct description of X, Y and the type of reaction is **[1]**

   (a) X = Ca; Y = CaO; Type of reaction = Decomposition

   (b) X = Mg; Y = MgO; Type of reaction = Combination

   (c) X = Al; Y = Al_2O_3; Type of reaction = Thermal decomposition

   (d) X = Zn; Y = ZnO; Type of reaction = Endothermic

Answer (b) **[1]**

Sol. $\underset{'X'}{2Mg(s)} + O_2(g) \rightarrow \underset{'Y'}{2MgO(s)}$

The type of reaction involved is combination reaction.

4. Acid present in tomato is : **[1]**

   (a) Methanoic acid

   (b) Acetic acid

   (c) Lactic acid

   (d) Oxalic acid

Answer (d) **[1]**

Sol. Oxalic acid is present in tomato.

5. Sodium hydroxide is termed an alkali while Ferric hydroxide is not because : **[1]**

(a) Sodium hydroxide is a strong base, while Ferric hydroxide is a weak base.

(b) Sodium hydroxide is a base which is soluble in water while Ferric hydroxide is also a base but it is not soluble in water.

(c) Sodium hydroxide is a strong base while Ferric hydroxide is a strong acid.

(d) Sodium hydroxide and Ferric hydroxide both are strong base but the solubility of Sodium hydroxide in water is comparatively higher than that of Ferric hydroxide.

Answer (b) **[1]**

Sol. Bases which are soluble in water are called alkalis. Sodium hydroxide is a base which is soluble in water while ferric hydroxide is also a base but it is not soluble in water.

6. The name of the salt used to remove permanent hardness of water is : **[1]**

(a) Sodium hydrogen carbonate ($NaHCO_3$)

(b) Sodium chloride (NaCl)

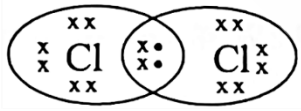
(c) Sodium carbonate decahydrate ($Na_2CO_3 \cdot 10H_2O$)

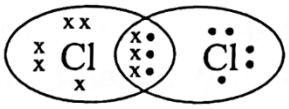
(d) Calcium sulphate hemihydrate ($CaSO_4 \cdot \frac{1}{2}H_2O$)

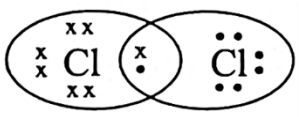
Answer (c) **[1]**

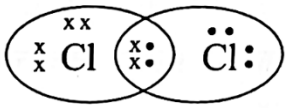
Sol. Sodium carbonate decahydrate ($Na_2CO_3 \cdot 10H_2O$) is used for removing permanent hardness of water.

7. The electron dot structure of chlorine molecule is: **[1]**

(a) 

(b) 

(c) 

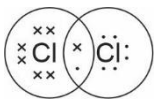
(d) 

Answer (c) **[1]**

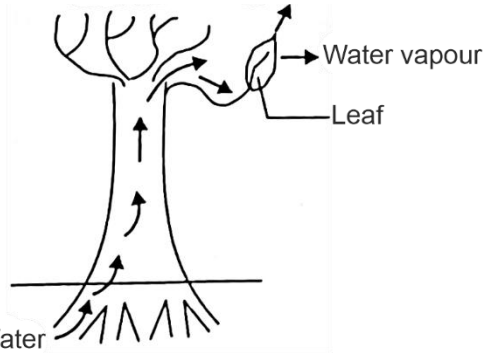
Sol. Atomic number of chlorine = 17

Electronic configuration = 2, 8, 7

Electron dot structure of chlorine molecule:



8. Observe the following diagram and identify the process and its significance from the following options: **[1]**



(a) Evaporation : maintains water contents in leaf cells.

(b) Transpiration : creates a suction force which pulls water inside the plant.

(c) Excretion : helps in excreting out waste water from the plant.

(d) Translocation : helps in transporting materials from one cell to another.

Answer (b)

Sol. The given process is transpiration which creates a suction force which pulls water inside the plant. **[1]**

9. Opening and closing of stomata is due to : **[1]**

(a) High pressure of gases inside the cells.

(b) Movement of water in and out of the guard cells.

(c) Stimulus of light in the guard cells.

(d) Diffusion of CO_2 in and out of the guard cells.

Answer (b)

Sol. Opening and closing of stomata is due to movement of water in and out of the guard cells. **[1]**

10. A cross between pea plant with white flowers (vv) and pea plant with violet flowers (VV) resulted in F_2 progeny in which ratio of violet (VV) and white (vv) flowers will be : **[1]**

(a) 1 : 1 (b) 2 : 1

(c) 3 : 1 (d) 1 : 3

Answer (c)

Sol.

Parents : ♀ VV (Violet flowered plant) × ♂ vv (White flowered plant)

Gametes : (V) (v)

F_1 generation : Vv (All violet flowered plants)

F_2 generation : Selfing

♂ \ ♀	(V)	(v)
(V)	VV	Vv
(v)	Vv	vv

Phenotypic ratio : 3 (Violet) : 1 (White) **[1]**

11. In plants the role of cytokinin is : **[1]**

(a) Promote cell division (b) Wilting of leaves

(c) Promote the opening of stomatal pore (d) Help in the growth of stem

Answer (a)

Sol. In plants, the role of cytokinin is to promote cell division. **[1]**

12. The number of chromosomes in parents and offsprings of a particular species undergoing sexual reproduction remain constant due to: **[1]**

(a) doubling of chromosomes after zygote formation

(b) halving of chromosomes after zygote formation

(c) doubling of chromosomes before gamete formation

(d) halving of chromosomes at the time of gamete formation

Answer (d)

Sol. The number of chromosomes in parents and offsprings of a particular species undergoing sexual reproduction remains constant due to halving of chromosomes at the time of gamete formation. **[1]**

13. Two LED bulbs of 12 W and 6 W are connected in series. If the current through 12 W bulb is 0.06 A the current through 6 W bulb will be : **[1]**

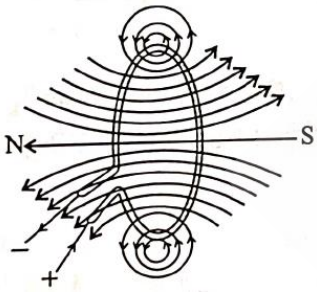
(a) 0.04 A (b) 0.06 A

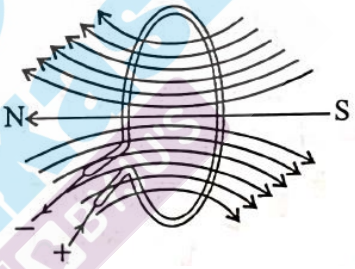
(c) 0.08 A (d) 0.12 A

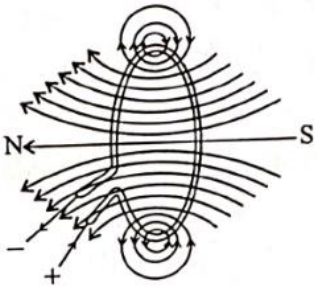
Answer (b) **[1]**

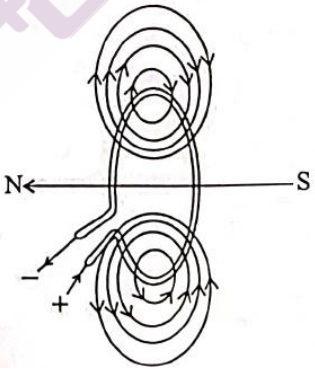
Sol. Same current flows through resistors connected in series.

14. The correct pattern of magnetic field lines of the field produced by a current carrying circular loop is: **[1]**

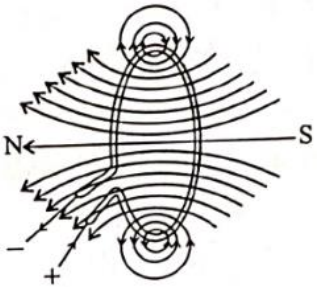
(a) 

(b) 

(c) 

(d) 

Answer (c) **[1]**

Sol. 

15. The resistance of a resistor is reduced to half of its initial value. If other parameters of the electrical circuit remain unaltered, the amount of heat produced in the resistor will become: **[1]**

(a) Four times (b) Two times

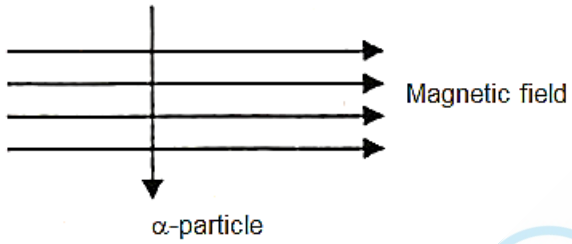
(c) Half (d) One fourth

Answer (b) **[1]**

Sol. $H = \frac{V^2}{R}t$

$\Rightarrow \quad H \propto \frac{1}{R}$

16. An alpha particle enters a uniform magnetic field as shown. The direction of force experienced by the alpha particle is: **[1]**



(a) Towards right (b) Towards left

(c) Into the page (d) Out of the page

Answer (d) **[1]**

Sol. Using Fleming's left hand rule.

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

Q.No. 17 to 20 are Assertion – Reasoning based questions.

These consist of two statements – Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below.

(a) Both (A) and (R) are true and (R) is the correct explanation of (A)

(b) Both (A) and (R) are true but (R) is not the correct explanation of (A)

(c) (A) is true but (R) is false

(d) (A) is false but (R) is true

17. A : Reaction of Quicklime with water is an exothermic reaction. **[1]**

R : Quicklime reacts vigorously with water releasing a large amount of heat.

Answer (a) **[1]**

Sol. $\underset{\text{Quicklime}}{CaO(s)} + \underset{\text{Water}}{H_2O(l)} \longrightarrow \underset{\substack{\text{Calcium}\\\text{hydroxide}}}{Ca(OH)_2(aq)} + Heat$

18. A : In humans, if gene (B) is responsible for black eyes and gene (b) is responsible for brown eyes, then the colour of eyes of the progeny having gene combination Bb, bb or BB will be black only. **[1]**

R : The black colour of the eyes is a dominant trait.

Answer (d) **[1]**

Sol. Progeny having gene combination bb will have brown eyes.

19. A : The inner walls of the small intestine have finger like projections called villi which are rich in blood. **[1]**

R : These villi have a large surface area to help the small intestine in completing the digestion of food.

Answer (c) **[1]**

Sol. Villi increase the surface area for absorption of food and the absorbed food is sent to each and every cell of the body.

20. A : A current carrying straight conductor experiences a force when placed perpendicular to the direction of magnetic field. **[1]**

R : The net charge on a current carrying conductor is always zero.

Answer (b)

SECTION-B

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

21. (A) A student took a small amount of copper oxide in a conical flask and added dilute hydrochloric acid to it with constant stirring. He observed a change in colour of the solution. **[2]**

(i) Write the name of the compound formed and its colour.

(ii) Write a balanced chemical equation for the reaction involved.

OR

(B) The industrial process used for the manufacture of caustic soda involves electrolysis of an aqueous solution of compound 'X'. In this process, two gases 'Y' and 'Z' are liberated. 'Y' is liberated at cathode and 'Z', which is liberated at anode, on treatment with dry slaked lime forms a compound 'B'. Name X, Y, Z and B. **[2]**

Sol. (A) (i) The compound formed is copper (II) chloride and its colour is blue-green **[½+½]**

(ii) $CuO(s) + 2HCl(aq) \rightarrow CuCl_2(aq) + H_2O(l)$ **[1]**

OR

Sol. (B) X = Sodium chloride ($NaCl$) **[½]**

Y = Hydrogen (H_2) **[½]**

Z = Chlorine (Cl_2) **[½]**

B = Bleaching powder ($CaOCl_2$) **[½]**

22. (A) Name the part of brain which is responsible for the following actions: **[2]**

(i) Maintaining posture and balance

(ii) Beating of heart

(iii) Thinking

(iv) Blood pressure

OR

(B) Where are auxins synthesized in a plant ? Which organ of the plant shows: **[2]**

(i) Positive phototropism

(ii) Negative geotropism

(iii) Positive hydrotropism

Sol. (A) (i) Maintaining posture and balance – Cerebellum **[½]**

(ii) Beating of heart – Medulla oblongata **[½]**

(iii) Thinking – Cerebrum **[½]**

(iv) Blood pressure – Medulla oblongata **[½]**

OR

(B) Auxins are synthesized at shoot and root tips in plants. **[½]**

The plant organs which show the following types of movement are :

(i) Positive phototropism – Stem / shoot **[½]**

(ii) Negative geotropism – Stem / shoot **[½]**

(iii) Positive hydrotropism – Root **[½]**

23. Write one specific function each of the following organs in relation with excretion in human beings : **[2]**

(i) Renal Artery

(ii) Urethra

(iii) Glomerulus

(iv) Tubular part of nephron

Sol. (i) Renal Artery : It carries oxygenated blood containing waste from aorta to the kidneys for filtration. **[½]**

(ii) Urethra : It starts from the neck of the urinary bladder and opens outside the body, urine is released through the urethra. **[½]**

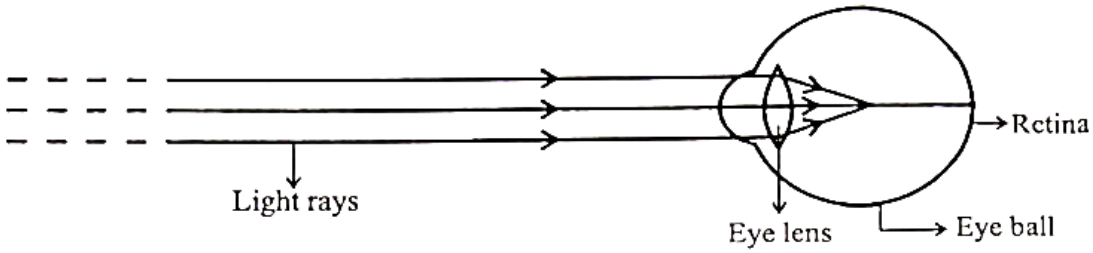
(iii) Glomerulus : Blood is filtered out from the blood capillaries (glomerulus) into Bowman's capsule. **[½]**

(iv) Tubular part of nephron : When blood filtrate passes through the tubular part of nephron useful products like glucose, amino acids, Na^+, Cl^-, K^+ , ions and a large amount of water are selectively reabsorbed by the tubular part of nephron. **[½]**

24. Two green plants are kept separately in oxygen free containers, one in the dark and other in sunlight. It was observed that plant kept in dark could not survive longer. Give reason for this observation. **[2]**

Sol. The plant kept in dark could not survive longer than the plant kept in sunlight because it could not perform photosynthesis as it is a process by which green plants convert light energy into chemical energy and use this energy to survive. The process of photosynthesis releases oxygen which can be utilized by the plant for respiration. So, in the absence of sunlight the plant will not survive. **[2]**

25. (A) Observe the following diagram and answer the questions following it : **[2]**



(i) Identify the defect of vision shown.

(ii) List its two causes.

(iii) Name the type of lens used for the correction of this defect.

OR

(B) The colour of clear sky from the earth appears blue but from the space it appears black. Why? **[2]**

Sol. (A) (i) Myopia **[½]**

(ii) (a) Due to increase in the curvature of the eye lens.

(b) Due to decrease in the focal length of the eye lens.

(c) Due to elongation of the eyeball. **(Any two) [1]**

(iii) Concave (diverging) lens. **[½]**

OR

(B) The sky appears dark to the astronauts in space, as the space does not have atmosphere, so the scattering of light does not take place at such heights in the space. **[2]**

26. Use of several pesticides which results in excessive accumulation of pesticides in rivers or ponds, is a matter of deep concern. Justify this statement. **[2]**

Sol. Pesticides are sprayed over crop plants to protect them from pests and diseases. 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.

In this way, they enter the food chain. Since pesticides are non-biodegradable so they get accumulated progressively at each trophic level. As human beings occupy the top level in any food chain, so their maximum concentration get accumulated in the human body and causes softening of brain, cerebral haemorrhage, liver damage, hypertension and cancer. **[2]**

SECTION-C

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

27. (i) While electrolysing water before passing the current some drops of an acid are added. Why? Name the gases liberated at cathode and anode. Write the relationship between the volume of gas collected at anode and the volume of gas collected at cathode. **[3]**

(ii) What is observed when silver chloride is exposed to sunlight? Give the type of reaction involved.

Sol. (i) Some drops of an acid are added to water while electrolysing water in order to enhance the conductivity of solution. **[½]**

The gas liberated at cathode is hydrogen and the gas liberated at anode is oxygen. **[½+½]**

The volume of gas collected at cathode is double in volume of gas collected at anode. **[½]**

(ii) When silver chloride is exposed to sunlight its colour changes from white to grey. **[½]**

The type of reaction involved is photochemical decomposition reaction. **[½]**

28. (i) Suggest a safe procedure of diluting a strong concentrated acid. **[3]**

(ii) Name the salt formed when sulphuric acid is added to sodium hydroxide and write its pH.

(iii) Dry HCl gas does not change the colour of dry blue litmus paper. Why?

Sol. (i) For diluting a strong concentrated acid, acid should always be added slowly to water with constant stirring. **[1]**

(ii) When sulphuric acid is added to sodium hydroxide, sodium sulphate is formed. **[½]**

pH of sodium sulphate solution is 7. **[½]**

(iii) Dry HCl gas does not change the colour of dry blue litmus paper because separation of H^+ ion from HCl molecules cannot occur in the absence of water. **[1]**

29. (A) (i) How does *Paramecium* obtain its food? **[3]**

(ii) List the role of each of the following in our digestive system:

(a) Hydrochloric acid

(b) Trypsin

(c) Muscular walls of stomach

(d) Salivary amylase

OR

(B) (i) What is double circulation? **[3]**

(ii) Why is the separation of the right side and the left side of the heart useful? How does it help birds and mammals?

Sol. (A) (i) *Paramecium* has a definite shape. It ingests the food by a definite cell mouth lying at the bottom of the buccal cavity. The food is moved to this spot by the movement of cilia which cover the entire surface of the cell. Ingested food is digested in food vacuole and the undigested food is egested from the anal spot. **[1]**

(ii) **Role of each of the following in our digestive system :-**

(a) **Hydrochloric acid:** It kills most of the harmful bacteria that enter along with the food and makes the medium acidic. Acidic medium facilitates activation of proenzyme pepsinogen and action of enzyme pepsin. **[½]**

(b) **Trypsin:** It is an enzyme secreted by the pancreas. It helps in the digestion of proteins. **[½]**

(c) **Muscular walls of stomach:** The muscles of the stomach wall contract periodically and thereby help in the churning and mixing of food with the digestive enzymes and hydrochloric acid. It helps in chemical digestion. **[½]**

(d) **Salivary amylase:** It acts on starch which is a complex molecule to form maltose sugar. **[½]**

OR

(B) (i) **Double circulation:** A mechanism in which blood circulates twice through the heart in one complete cycle is known as double circulation. One is pulmonary circulation and the other is systemic circulation. **[1]**

(ii) Separation of the right side and left side of heart allows a highly efficient supply of oxygen to the body as it prevents mixing of oxygenated and deoxygenated blood. It is useful for birds and mammals, that have high energy needs, which constantly use energy to maintain their body temperature. **[2]**

30. (A) Define the following terms in the context of a diverging mirror : **[3]**

(i) Principal focus

(ii) Focal length

Draw a labelled ray diagram to illustrate your answer.

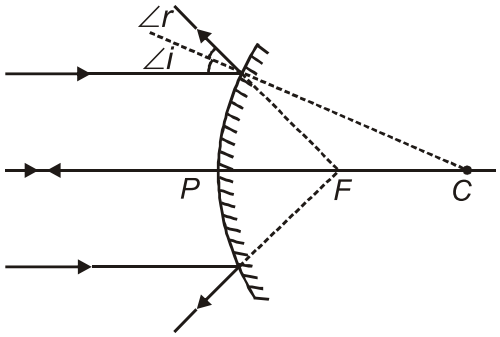
OR

(B) An object of height 10 cm is placed 25 cm away from the optical centre of a converging lens of focal length 15 cm. Calculate the image-distance and height of the image formed. **[3]**

Sol. (A) (i) **Principal Focus (*F*) :** If rays close and parallel to the principal axis are incident on a diverging mirror, then after reflection they seem to come from a point on the principal axis. This point is called as the principal focus. **[1]**

(ii) **Focal Length :** It is the distance from the pole (P) of the mirror to the principal focus (F) of the mirror.

[1]



[1]

OR

(B) h_o = 10 cm, u = – 25 cm and f = 15 cm

Using lens formula, $\frac{1}{v}-\frac{1}{u}=\frac{1}{f}$ **[1]**

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

$$=\frac{(-25)(15)}{-25+15}=37.5 \text{ cm}$$ **[1]**

Also,

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

$$\Rightarrow \quad \frac{h_i}{10}=\frac{37.5}{-25}$$

$$\Rightarrow \quad h_i = -15 \text{ cm}$$ **[1]**

31. The power of a lens is +4 D. Find the focal length of this lens. An object is placed at a distance of 50 cm from the optical centre of this lens. State the nature and magnification of the image formed by the lens and also draw a ray diagram to justify your answer. **[3]**

Sol. P = +4 D

$$\Rightarrow \quad f=\frac{1}{4}\text{ m}=25 \text{ cm}$$ **[1]**

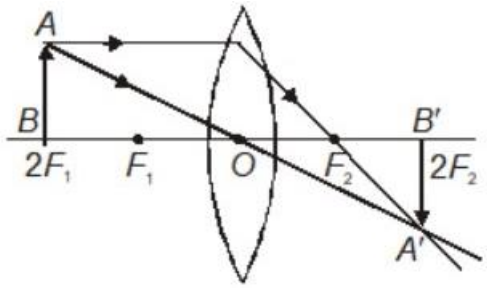
Here, u = – 50 cm

Therefore, v = 50 cm

Since object is placed at centre of curvature of the lens. So, image formed will be of same size as that of the object.

$$m=\frac{v}{u}=\frac{50}{-50}=-1$$

Image formed is real and inverted **[1]**



[1]

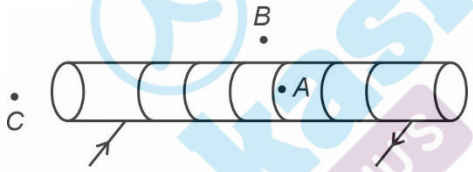
32. (A) (i) Why is an alternating current (A.C.) considered to be advantageous over direct current (D.C.) for the long distance transmission of electric power? **[3]**

(ii) How is the type of current used in household supply different from the one given by a battery of dry cells?

(iii) How does an electric fuse prevent the electric circuit and the appliances from a possible damage due to short circuiting or overloading.

OR

(B) For the current carrying solenoid as shown, draw magnetic field lines and give reason to explain that out of the three points *A*, *B* and *C*, at which point the field strength is maximum and at which point it is minimum? **[3]**



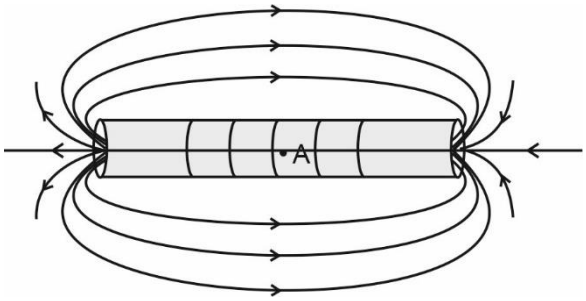
Sol. (A) (i) Alternating current (A.C.) can be transmitted over long distance with a very low loss of energy in comparison to Direct current (D.C.). **[1]**

(ii) The type of current used in household supply is alternating current which continuously vary in direction and magnitude whereas the current given by the battery of dry cells is direct current which is of constant magnitude and direction. **[1]**

(iii) A fuse is a safety device having a short length of a thin wire made of tin-lead alloy which has a lower melting point. This wire melts and breaks the circuit if the current exceeds the safe value. This saves costly electric appliances and buildings from damage. **[1]**

OR

(B)



[1]

Field strength is maximum at point *A* as it lies inside the solenoid where field lines are most dense. Field strength is minimum at point *B* as it lies outside the solenoid. **[2]**

33. Write one difference between biodegradable and non-biodegradable wastes. List two impacts of each type of the accumulated waste on environment if not disposed off properly. **[3]**

Sol. Difference between biodegradable and non-biodegradable wastes :

Biodegradable Wastes	Non-biodegradable Wastes
These can be broken down into simple, non-poisonous substances by the action of micro-organisms in nature.	These cannot be broken down into simple, non-poisonous substances by the action of micro-organisms in nature.

[1]

Impact of accumulation of biodegradable wastes :

(a) Foul smell comes out as a result of decomposition of biodegradable substances.

(b) These wastes may block the drains, sewage system ets. which then become breeding places of flies and mosquitoes.

Impact of accumulation of non-biodegradable wastes : **[2×½]**

(a) Excessive use of fertilisers, pesticides and dumping of industrial wastes affect the soil fertility and subsequently reduce the crop yield.

(b) Some harmful non-biodegradable chemicals like pesticides, DDT and heavy metals enter the bodies of organisms through food chain and get concentrated at each trophic level. **[2×½]**

SECTION-D

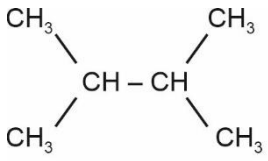
Long Answer Type Questions : **[3×5=15]**

34. (A) (i) Draw the structure of the following compounds : **[5]**

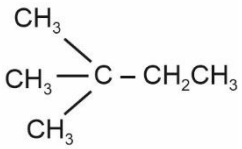
(a) Butanoic acid

(b) Chloropentane

(ii) How are structure (i) and structure (ii) given below related to one another? Give reason to justify your answer.



Structure (i)



Structure (ii)

Draw one more possible structure for above case.

(iii) Differentiate between saturated and unsaturated carbon compounds on the basis of their general formula.

OR

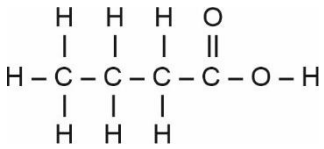
(B) (i) What happens when a small piece of sodium is dropped in ethanol? Write the equation for this reaction. **[5]**

(ii) Why is glacial acetic acid called so?

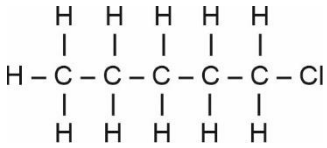
(iii) What happens when ethanol is heated at 443 K in the presence of conc. H_2SO_4? Write the role of conc. H_2SO_4 in this case.

(iv) Write an equation showing saponification.

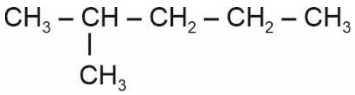
Sol. (A) (i) (a) Butanoic acid :

 **[1]**

(b) Chloropentane :

 **[1]**

(ii) Both the structures are structural isomers of each other (hexane) as both have same molecular formula but different structures. **[1]**

 (Or any other) **[1]**

(iii)

Saturated carbon compounds	Unsaturated carbon compounds
General formula : C_nH_{2n+2} (alkanes) (n = Number of C atoms)	General formula : C_nH_{2n} (alkenes) or C_nH_{2n-2} (alkynes) (n = Number of C atoms)

[1]

OR

(B) (i) Ethanol reacts with sodium leading to evolution of H_2 gas and formation of sodium ethoxide. **[1]**

$$\underset{\text{(Ethanol)}}{2CH_3CH_2OH} + \underset{\text{(Sodium)}}{2Na} \longrightarrow \underset{\text{(Sodium ethoxide)}}{2CH_3CH_2O^-Na^+} + \underset{\text{(Hydrogen)}}{H_2\uparrow}$$ **[1]**

(ii) Melting point of pure ethanoic acid is 290 K and hence it often freezes during winters forming white crystals resembling glaciers. This gave rise to its name glacial acetic acid. **[1]**

(iii) Heating ethanol at 443 K with concentrated sulphuric acid gives ethene on dehydration. **[½]**

Concentrated H_2SO_4 acts as a dehydrating agent. **[½]**

(iv) $CH_3COOC_2H_5 + NaOH \longrightarrow C_2H_5OH + CH_3COONa$ **[1]**

35. (i) Name and explain the two modes of asexual reproduction observed in hydra. **[5]**

(ii) What is vegetative propagation? List two advantages of using this technique.

Sol. (i) The two modes of asexual reproduction observed in *Hydra* are budding and regeneration.

Budding- Budding is a method of asexual reproduction in which a new organism develops from a bud of an existing organism. **[1]**

Regeneration- Regeneration is the process of renewal or restoration of any lost part of the body or the formation of the whole body of an organism from a small fragment. **[1]**

(ii) **Vegetative propagation :** Vegetative propagation is a mode of asexual reproduction in which new plants are obtained from the vegetative parts such as roots, stems and leaves of plants. **[1]**

Advantages of vegetative propagation are :

(a) Vegetative propagation is usually a means of propagating plants which do not produce viable seeds or produce very few seeds or have long dormant period of seeds. Examples : banana, pineapple, orange, grape, rose and jasmine.

(b) It helps in producing disease free plants.

(c) All plants produced by vegetative propagation are genetically similar to the parent plants.

(d) Plants raised by vegetative propagation can bear flowers and fruits earlier than those which are produced from seeds. **(Any two) [2×1]**

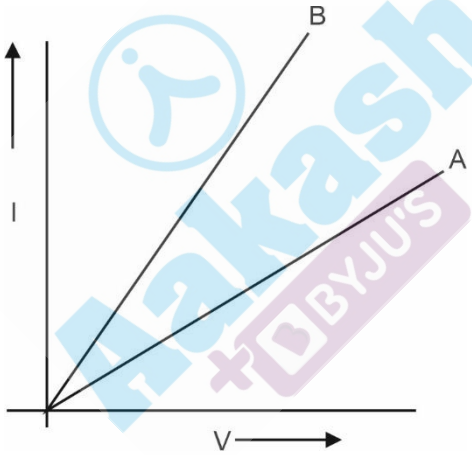
36. (i) How is electric current related to the potential difference across the terminals of a conductor? **[5]**

Draw a labelled circuit diagram to verify this relationship.

(ii) Why should an ammeter have low resistance?

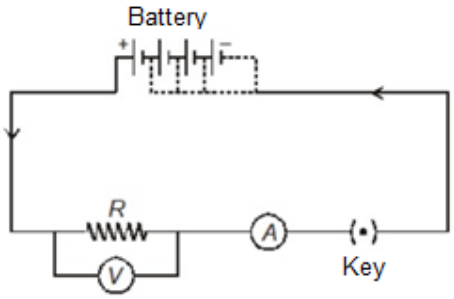
(iii) Two V - I graphs A and B for series and parallel combinations of two resistors are as shown. Giving reason state which graph shows

(a) series, (b) parallel combination of the resistors.



Sol. (i) If the physical conditions remain unchanged (such as temperature), the potential difference across the two ends of a conductor is directly proportional to the electric current flowing through it.

$V \propto I$ **[1]**



[1]

(ii) An ammeter is a current measuring device, which is always connected in series in a circuit. Hence, its resistance adds to the total resistance of the circuit. If the resistance of the ammeter would be high, the total resistance would be high. This would decrease the amount of current flowing through the circuit. Hence in order to avoid the change of current flowing in a circuit, the resistance of an ammeter should be low. **[1]**

(iii) By Ohm's law

$V = IR$

$I = \left(\frac{1}{R}\right)V$

Hence, slope of the I-V graph is $\frac{1}{R}$

Slope of B > slope of A **[1]**

$\frac{1}{R_B} > \frac{1}{R_A}$

$\therefore \quad R_B < R_A$

$\because$ Combination of two resistors in series is greater than combination of two resistors in parallel.

Hence, $A \rightarrow$ Series combination

$B \rightarrow$ Parallel combination **[1]**

SECTION-E

Source Based / Case-Based Questions: **[3×4=12]**

37. The melting points and boiling points of some ionic compounds are given below:

Compound	Melting Point (K)	Boiling Point (K)
NaCl	1074	1686
LiCl	887	1600
$CaCl_2$	1045	1900
CaO	2850	3120
$MgCl_2$	981	1685

These compounds are termed ionic because they are formed by the transfer of electrons from a metal to a non-metal. The electron transfer in such compounds is controlled by the electronic configuration of the elements involved. Every element tends to attain a completely filled valence shell of its nearest noble gas or a stable octet.

(i) Show the electron transfer in the formation of magnesium chloride. **[1]**

(ii) List two properties of ionic compounds other than their high melting and boiling points. **[1]**

(iii) (A) While forming an ionic compound say sodium chloride how does sodium atom attain its stable configuration? **[2]**

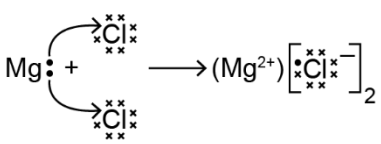
OR

(iii) (B) **Give reason :** **[2]**

(i) Why do ionic compounds in the solid state not conduct electricity?

(ii) What happens at the cathode when electricity is passed through an aqueous solution of sodium chloride?

Sol. (i) Electron transfer in the formation of $MgCl_2$



[1]

(ii) Ionic compounds :

(a) Are generally soluble in water and insoluble in organic solvents such as kerosene, petrol etc. **[½]**

(b) Conduct electricity in molten or aqueous state. **[½]**

(iii) (A) Sodium atom has one electron in its outermost shell. After losing one electron from the valence shell, it attains the stable noble gas configuration of neon as shown below: **[1]**

$$\underset{\substack{2,8,1\\ \text{Sodium atom}}}{Na} \longrightarrow \underset{\substack{2,8\\ \text{Sodium cation}}}{Na^+} + e^- \quad \textbf{[1]}$$

OR

(iii) (B) (a) Ionic compounds do not conduct electricity in the solid state because movement of ions in the solid is not possible due to their rigid structure. **[1]**

(b) When electricity is passed through an aqueous solution of NaCl, hydrogen gas is released at cathode. **[1]**

38. The most obvious outcome of the reproductive process is the generation of individuals of similar design, but in sexual reproduction they may not be exactly alike. The resemblances as well as differences are marked. The rules of heredity determine the process by which traits and characteristics are reliably inherited. Many experiments have been done to study the rules of inheritance.

(i) Why an offspring of human being is not a true copy of his parents in sexual reproduction? **[1]**

(ii) While performing experiments on inheritance in plants, what is the difference between F_1 and F_2 generation? **[1]**

(iii) (A) Why do we say that variations are useful for the survival of a species over time? **[2]**

OR

(iii) (B) Study Mendel's cross between two plants with a pair of contrasting characters. **[2]**

RRYY × rryy

Round Yellow Wrinkled Green

He observed 4 types of combinations in F_2 generation. Which of these were new combinations? Why do new features which are not present in the parents, appear in F_2 generation?

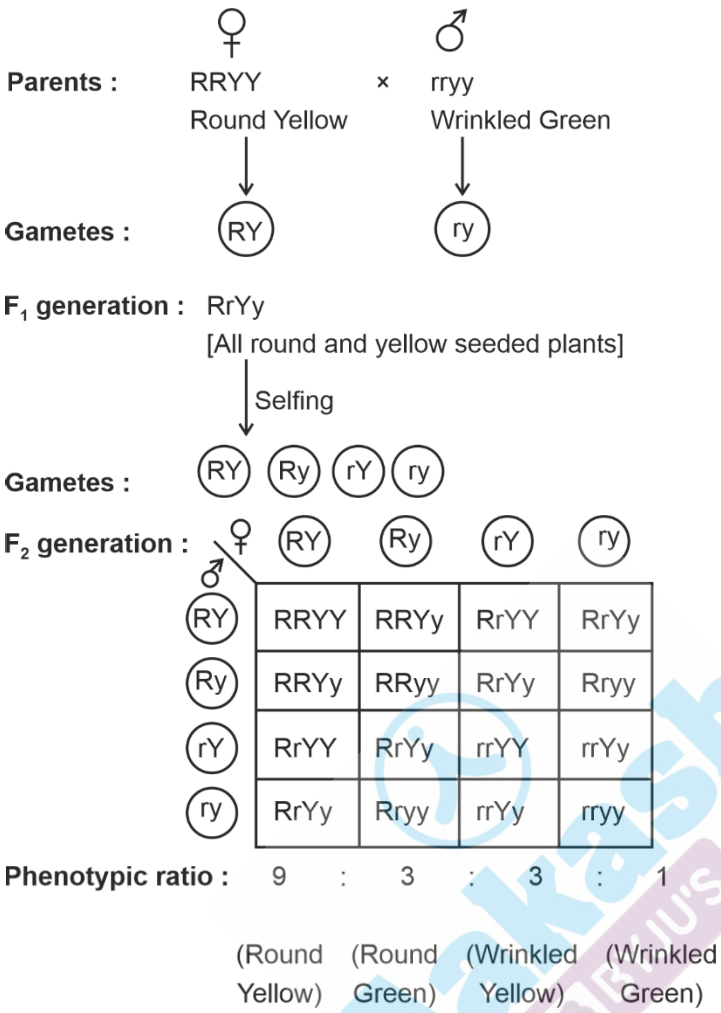
Sol. (i) In sexual reproduction, the offsprings produced are not identical to parents because two parents are involved and there is fusion of male and female gametes which introduces variations in offsprings and hence, offsprings are not true copy of the parents. **[1]**

(ii) F_1 generation is the first filial generation obtained by crossing two different parents whereas F_2 generation is the second filial generation obtained by self crossing the F_1 generation. **[1]**

(iii) (A) Variations make species more adapted to survive and grow in the changing environmental conditions. The variant species helps the species overcome extreme conditions in surroundings. Therefore, they can survive better and reproduce to pass the genes to the offsprings. Variations occur during meiosis which causes gamete formation in the organism. It maintains the population and hence variations occur in genetic material in every generation. **[2]**

OR

(iii) (B)



[1]

The new combinations obtained were round green and wrinkled yellow seeds.

The appearance of new combinations appeared in F_2 generations can be explained by the 'Law of independent assortment'. It states that when two pairs of traits are combined in a hybrid, one pair of character segregates independent of the other pair of character.

In dihybrid cross, four types of gametes were produced and each of these segregate independent of each other, each having frequency of 25% of the total gametes produced. **[1]**

39. The ability of a medium to refract light is expressed in terms of its optical density. Optical density has a definite connotation. It is not the same as mass density. On comparing two media, the one with the large refractive index is optically denser medium than the other. The other medium with a lower refractive index is optically rarer. Also the speed of light through a given medium is inversely proportional to its optical density.

(i) Determine the speed of light in diamond if the refractive index of diamond with respect to vacuum is 2.42. Speed of light in vacuum is 3×10^8 m/s. **[1]**

(ii) Refractive indices of glass, water and carbon disulphide are 1.5, 1.33 and 1.62 respectively. If a ray of light is incident in these media at the same angle (say θ), then write the increasing order of the angle of refraction in these media. **[1]**

(iii) (A) The speed of light in glass is 2×10^8 m/s and in water is 2.25×10^8 m/s. **[2]**

(a) Which one of the two is optically denser and why?

(b) A ray of light is incident normally at the water-glass interface when it enters a thick glass container filled with water. What will happen to the path of the ray after entering the glass? Give reason.

OR

(iii) (B) The absolute refractive indices of water and glass are 4/3 and 3/2 respectively. If the speed of light in glass is 2×10^8 m/s, find the speed of light in (i) vacuum and (ii) water. **[2]**

Sol. (i) $v_{\text{diamond}} = \dfrac{c}{\mu_{\text{diamond}}}$

$= \dfrac{3 \times 10^8}{2.42}$

$= 1.24 \times 10^8$ m/s **[1]**

(ii) $\angle r_{CS_2} < \angle r_g < \angle r_w$

A medium having greater absolute refractive index has less angle of refraction. **[1]**

(iii) (A) (a) Glass, because it has less speed of light. **[1]**

(b) There will be no bending in its path, because angle of incidence is zero degree. **[1]**

OR

(iii) (B) Here,

$\mu_w = \dfrac{4}{3}$ and $\mu_g = \dfrac{3}{2}$

(a) $c = v_g \times \mu_g = 2 \times 10^8 \times \dfrac{3}{2} = 3 \times 10^8$ m/s **[1]**

(b) $v_w = \dfrac{c}{\mu_w} = \dfrac{3 \times 10^8}{\left(\frac{4}{3}\right)} = 2.25 \times 10^8$ m/s **[1]**

❑ ❑ ❑