WHY MasterMind Question Bank?

- MasterMind Question bank is prepared chapter-wise to facilitate systematic study of the whole syllabus for students.
- MasterMind CHAPTER-WISE Question bank can be referred any time during the session.
- Three sample papers for Self-Evaluation as well as a previous year board examination paper have been given in MasterMind CHAPTER-WISE Question bank.
- The student can assess his/her understanding after completing the syllabus through sample papers given in MasterMind CHAPTER-WISE Question bank. The student can opt to prepare the chapters with weak points through questions strictly following the exam pattern and can attain the highest possible marks.
- Truly, MasterMind CHAPTER-WISE Question bank is the best choice so far for students to have an exhaustive preparation for exams.

The **Salient Features** of the Question Bank are:

⊕ CHAPTER-WISE
MasterMind Question bank has been prepared Chapter-wise, so that a student can prepare the entire sllabus chronologically

⊕ 2019 EXAMINATION PAPER
This will help a student to understand the pattern of the question paper and assess his/her difficulty level

⊕ FAST TRACK REVISION
A quick recall of the chapter is gained through this

⊕ KNOWLEDGE BOOSTERS
These are designed to provide additional knowledge to the students

⊕ PREVIOUS 10+ YEARS' QUESTIONS
CBSE examination questions (2008 onwards) acquaint the students with the pattern of questions asked in Board Examination

⊕ CATEGORISATION OF QUESTIONS
The questions as per the pattern prescribed by CBSE *viz.* Objective Type Questions (1Mark), VSAQs (1 Mark), SAQs (3 Marks) and LAQs (5 Marks) have been categorised systematically

⊕ STEP-MARKING
All answers are indicated by step-marking to have a clear view about the distribution of marks

⊕ QR CODES
Chapter-wise QR codes are given to have instant access to visual presentation of experiments as well as Concept Maps highlighting the salient topics concerned to the chapters.

⊕ SAMPLE PAPERS
Sample papers (80 Marks each) according to the latest blueprint specified by CBSE have been embedded

Science Class 10

Sample Paper (Solved)

Time: 3 hrs.   **Max. Marks: 80**

General Instructions

(i) The question paper comprises three sections-A, B and C. Attempt all the sections.

(ii) All questions are compulsory.

(iii) Internal choice is given in each section.

(iv) All questions in **Section A** are one-mark questions comprising MCQ, VSA type and assertion-reason type questions. They are to be answered in one word or in one sentence.

(v) All questions in **Section B** are three-marks, short-answer type questions. These are to be answered in about 50-60 words each.

(vi) All questions in **Section C** are five-marks, long-answer type questions. These are to be answered in about 80-90 words each.

(vii) This question paper consists of a total of 30 questions.

SECTION-A

1. Define the term natural resources.

2. Find the power of concave lens of focal length 25 cm.

3. **Answer Q.Nos. 3**(a)**-3**(d) *on the basis of your understanding of the following paragraph and the related studied concepts:*

A dry pellet of a common base *B* when kept in open absorbs moisture and turns sticky. The compound is also a by-product of chlor-alkali process.

(a) Identify *B*.

(b) What type of reaction occurs when *B* is treated with an acid?

(c) Write the balanced chemical equation for the reaction of *B* with CO_2.

(d) Which gas is evolved when *B* reacts with Zn.

4. **For Q.Nos. 4**(i)**-4**(iv) *are based on the information given below. Study these information related to answer the questions that follow*:

In tissue culture, the callus is transferred to a medium that contains hormones for growth and differentiation.

(i) From which part of the plant are the cells extracted for tissue culture?

(a) Growing tip (b) Leaves (c) Bark (d) Pith

(ii) The cells placed in the nutrient medium for tissue culture grow rapidly to form.

(a) Thallus (b) Callus (c) Hyphae (d) Protonema

(iii) Give two advantages of tissue culture.

(iv) What is meant by vegetative propagation?

5. Earth wire in electrical circuit is used to protect from

(a) overloading   (b) short circuiting

(c) open circuiting   (d) electrical shock

6. The cross between a heterozygous tall plant and a dwarf plant would yield plants in the ratio of

(a) two tall and two dwarf

(b) one homozygous tall, one homozygous dwarf and two heterozygous tall.

(c) all homozygous dwarf

(d) all heterozygous tall

7. Which of the following colour of white light has maximum wavelength?

(a) Violet   (b) Red

(c) Blue   (d) Green

OR

Which of the following has highest sight area?

(a) Plane mirror   (b) Convex mirror

(c) Concave mirror   (d) Concave lens

8. What can be done to increase the generation of electric power in a hydroelectric power plant?

(a) Water should be boiled then allowed to fall from a greater height

(b) Electricity should be passed into water and height of dam should be reduced

(c) Water should fall from a greater height

(d) Kinetic energy of water should be lowered before falling from a greater height

9. Fertilisation results in the formation of a
(a) eight celled zygote   (b) sixteen called zygote
(c) double celled zygote   (d) single celled zygote

OR

Tissue culture techniques can be used for
(a) multiplication of sterile plants
(b) rapid multiplication of plants
(c) growing disease free plants
(d) All of these

10. For which of these the image produced is always virtual, erect and smaller than the object?
(a) Concave lens   (b) Convex lens
(c) Concave mirror   (d) Plane mirror

11. Which of the following metal will not give $H_2(g)$ with H_2O?
(a) $Na(s) + 2H_2O \rightarrow$ (b) $Mg(s) + H_2O \rightarrow$
(c) $Zn(s) + H_2O \rightarrow$ (d) $Cu(s) + H_2O \rightarrow$

Which of the following is not a neutral oxide?
(a) H_2O (b) CO
(c) Na_2O (d) N_2O

12. When air is blown from mouth into a test tube containing limewater, the limewater turns milky due to the presence of
(a) nitrogen   (b) water vapour
(c) carbon dioxide   (d) oxygen

Assertion-Reason Type Questions (Q. Nos. 13-14)

In each of the following questions, a statement of Assertion (A) is given by the corresponding statement of Reason (R). Of the statements, mark the correct answer as

(a) If both Assertion and Reason are true and Reason is the correct explanation of Assertion.
(b) If both Assertion and Reason are true, but Reason is not the correct explanation of Assertion.
(c) If Assertion is true, but Reason is false.
(d) If Assertion is false, but Reason is true.

13. Assertion : The magnetic field produced by a current carrying solenoid is independent of its length and corss-sectional area.
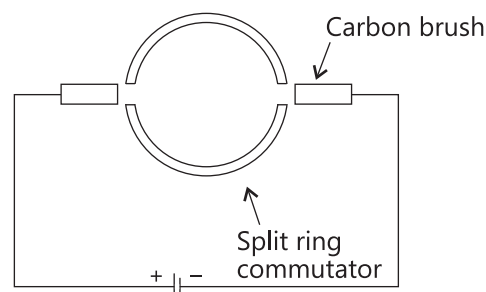
Reason: The magnetic field inside the solenoid is uniform.

14. Assertion : Graphite is slippery to touch.

Reason : Various layers of carbon atoms in graphite are held together by weak van der Waals' forces.
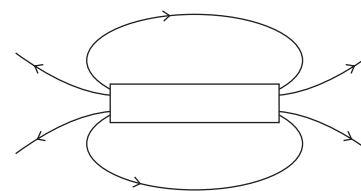
SECTION-B

15. (i) The figure shows the split ring commutator and the two carbon brushes in their respective positions.

What can you say about carbon brush and split ring commutator?

(ii) Identify the poles of a magnet in the figure.

OR

(i) In the phenomenon of electromagnetic induction, the change in current flowing in the primary coil produces an emf in the secondary coil. How the current flowing in the secondary is affected by that in primary coil?

(ii) How will the magnetic force get affected on
(a) doubling the magnitude of current,
(b) reversing the direction of current flow?

16. Consider the figure given below.
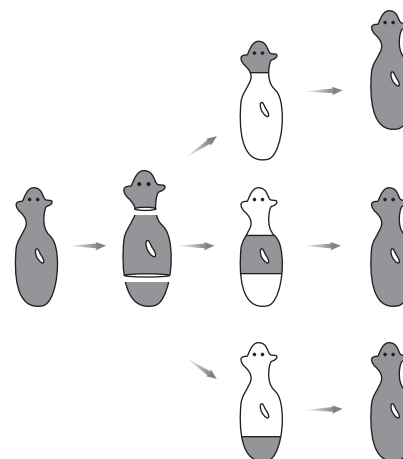
Analyse the figure and name the process that is being depicted. Describe the process in your own words.

17. P, Q and R are 3 elements which undergo chemical reactions according to the following equations.

(a) $P_2O_3 + 2Q \rightarrow Q_2O_3 + 2P$

(b) $3RSO_4 + 2Q \rightarrow Q_2(SO_4)_3 + 3R$

(c) $3RO + 2P \rightarrow P_2O_3 + 3R$
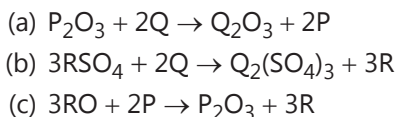
Answer the following questions:

  (i) Which element is most reactive?

  (ii) Which element is least reactive?

  (iii) State the type of reaction listed above.

18.   (i) Name the process by which autotrophs prepare their own food.

  (ii) Name the pigment, its location and function involved in photosynthesis.

  (iii) Name the element which is taken up in the form of inorganic nitrates or nitrites.

OR

Explain the functions of the following in the digestive process.

(i) Mucus   (ii) HCl   (iii) Pancreatic lipase

19. An electric bulb is labelled at 100 W-200 V. The bulb is connected to a supply of 120 V. The heat produced by the bulb for 2 min.

20. An element *M* with electronic configuration (2, 8, 2) combines separately with $(NO_3)^-$, $(SO_4)^{2-}$ and $(PO_4)^{3-}$ radicals. Compile the information and write the formula of the three compounds so formed. To which group and period of the modern periodic table does the elements *M* belong? Will *M* form covalent or ionic compound?

21. Why is it more appropriate to compare the process of evolution with branches of a tree rather than with a ladder?

22. Lithium (Li), sodium (Na) and potassium (K) were put in the same group on the basis of similar properties.

  (i) What is the similarity in their properties?

  (ii) If atomic mass of lithium and potassium are 7 and 39 respectively, what is the atomic mass of sodium?

OR

Taking the example of an element of atomic number = 16, explain how the electronic configuration of the atom of an element relates to its position in the modern periodic table and how valency of an element is calculated on the basis of its atomic number?

23. Define hormones and list their characteristics.

24. State the laws of refraction of light. Explain the term absolute refractive index of a medium and write an expression to relate it with the speed of light in vacuum.

SECTION-C

25. 'Energy from various sources is considered to have been derived from the Sun' Analyse the above statement and validate it with examples.

26.   (i) A 6 cm tall object is placed perpendicular to the principal axis of a convex lens of focal length 25 cm. The distance of the object from lens is 40 cm. Determine

(a) position,

(b) size and nature of the image formed.

  (ii) Consider a spherical mirror and a thin spherical lens each having focal length of −15 cm, then what are mirror and lens likely to be?

OR

A person cannot see objects nearer than 75 cm from his eyes while a person with normal vision can see objects upto 25 cm from his eyes. Find the nature, the focal length and the power of the correcting lens used for the defective vision.

List two possible causes of this defect. Also, draw a ray diagram to show how this defect can be corrected by using a lens of appropriate focal length.

27. Describe the electrolytic refining process. Explain it by using an example.

28. *X*, *Y* and *Z* are three animals. The animals *X* can fly, but animals *Y* can only run on ground or walls. The forelimbs of animals *X* and *Y* have the same basic design, but they are used for different purposes, such as flying and running, respectively. The animal *Z* became extinct a long time ago. The study of fossils of *Z* tell us that it had some features like those of *X* and some like those of *Y*. In fact, *Z* is said to form a connecting link in the evolutionary chain of *X* and *Y*.

  (i) What would the animal *Z* be?

  (ii) Name the animal groups to which *X* and *Y* belong.

  (iii) What name is given to the forelimbs-like those of *X* and *Y*, which have the same basic design, but different functions?

  (iv) Name one feature in which *Z* resembled *X*.

  (v) Name one feature in which *Z* resembled *Y*.

  (vi) Which is the correct evolutionary chain involving *X*, *Y* and $Z \rightarrow X \rightarrow Y$ or $Y \rightarrow Z \rightarrow X$?

OR

Briefly, state Mendel's findings with regard to the

  (i) Dominant and recessive characters

  (ii) Law of segregation

  (iii) Law of independent assortment.

29. A circuit diagram is given below, answer the following questions based on the diagram:
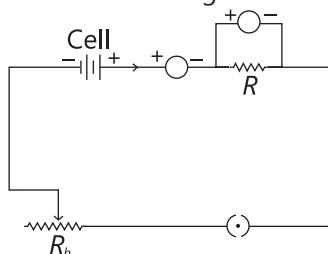
(i) Name the device which is connected in series in the circuit and the component which controls the amount of current in the circuit.

(ii) State and explain Ohm's law.

(iii) Name a device that helps to measure the potential difference across a conductor.

(iv) Why does the connecting cord of an electric heater not glow while the heating element does?

30. (i) Answer the following:

(a) Two solution A and B have pH values of 3.0 and 9.5, respectively. Which of these will turn litmus solution from blue to red and which will turn phenolphthalein from colourless to pink?

(b) Water is a neutral substance. What colour will you get, when you add a few drops of universal indicator to a test tube containing distilled water?

(ii) Why dry HCl gas does not change the colour of the dry litmus paper?

OR

(i) Name the raw materials that are required for the manufacture of washing soda starting from sodium chloride.

(ii) Describe the chemical reaction involved in the process.

(iii) A substance (X) upon treatment with chlorine gives bleaching powder. Name the substance (X) and write the chemical equation involved.

Answers

1. Natural resources are the living or non-living substances available in the environment which are being exploited for supporting life and meeting human requirements, e.g. forests, wildlife, solar radiation, air, etc. **1**

2. Focal length of concave lens,

$$f = -25\,\text{cm} = \frac{-25}{100}\,\text{m} = \frac{-1}{4}\,\text{m}$$ **½**

∴ Power of concave lens,

$$P = \frac{1}{f\,(\text{in meter})} = \frac{1}{-1/4} = -4\text{D}$$ **½**

3. 3. (a) B is sodium hydroxide (NaOH). **1**

3. (b) Neutralisation reaction occurs when B is treated with an acid. **1**

3. (c) The chemical reaction is

$$2\text{NaOH} + \text{CO}_2 \rightarrow \text{Na}_2\text{CO}_3 + \text{H}_2\text{O}$$ **1**

3. (d) The chemical reaction is,

$$2\text{NaOH} + \text{Zn} \rightarrow \text{Na}_2\text{ZnO}_2 + \text{H}_2$$ **1**

∴ H_2 gas is evolved when NaOH reacts with Zn.

4. 4. (i) (a) In tissue culture, new plants are grown by removing tissues or separating cells from the growing tip of plant. **1**

4. (ii) (b) The cells placed is artificial medium containing nutrients for tissue culture, grow rapidly

to form a small group of cells which are called callus. Callus is transferred to another medium containing hormones for growth and differentiation. **1**

4. (iii) The advantages of tissue culture are

• Many plants can be grown from one parent in a disease free condition. **1**

• Rapid production of ornamental plants like carnations, etc is possible. **1**

4. (iv) Vegetative propagation is a type of asexual plant reproduction in which new plants are obtained from a part of the parent plant. **1**

5. (d) To avoid risk of electrical shock, earth wire is connected to electric appliance, so that it gets a low resistance conducting path for current to flow to earth. **1**

6. (a) The cross between a heterozygous tall plant and a dwarf plant yields two tall and two dwarf plants as shown in the cross below
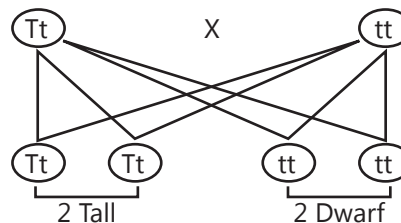
Here, tallness is the dominant trait and dwarfness is the recessive trait. **1**

7. (b) The wavelength of red colour is maximum and that of violet colour is minimum. **1**

Or

(b) The sight area of convex mirror is the highest, as it is curved outwards. **1**

8. (c) In a hydroelectric power plant, more electric power can be generated if water falls from a greater height because the rise in water level causes an increase in the potential energy of the water.

Thus, when water flows from, a higher position,more amount of kinetic energy is formed by conversion of the high amount of potential energy. The kinetic energy of the moving water can thus, produce more electric power. **1**

9. (d) Fertilisation results in the formation of a single celled zygote. Then, the zygote undergoes repeated cell divisions to form a multicellular embryo. **1**

Or

(d) Tissue culture techniques can be used for growing disease free plants, multiplying sterile plants and for rapid multiplication of plants. These techniques involve the removal of cells from the growing tip of a plant and then allowing them to form callus. The formed callus grows and differentiates to form plantlets that are grown into new mature plants. **1**

10. (a) A concave lens always produces on image, which is virtual, erect and smaller than the object. **1**

11. (d) Metals placed below the hydrogen in reactivity series will not evolve $H_2(g)$ with water (H_2O).

Decreasing order of reactivity of metals in

Na> Mg > Zn > [H] > Cu

Hence, Cu metal will not give $H_2(g)$ with H_2O. **1**

Or

(c) Na_2O is a basic acid. **1**

12. (c) Carbon dioxide gas turns limewater milky. When air is blown from mouth into the test tube, the limewater turns milky because the air we breathe out has more amount of CO_2 which converts lime into calcium carbonate ($CaCO_3$). **1**

13. (b) As magnetic field *B* is directly proportional to number of turns of coil and current flowing through the solenoid, hence it is independent of length and diameter of the solenoid as well as its area. It is uniform inside the solenoid because field lines are parallel to each other. **1**

14. (a) Graphite structure consists of various layers of carbon atoms in which each carbon atom is joined to three other atoms by strong covalent bonds. The various layers of carbon atoms in graphite are held

together by weak van der Waals' forces making it slippery to touch. **1**

15. (i) When the gaps of the split ring commutator are in alignment with the carbon brushes, then contacts are broken and the current is temporarily cut-off. However, the coil keeps on rotating in the same direction due to its inertia until the split ring commutator and the carbon brushes are in contact again. **1½**

(ii) Since, the magnetic, lines of force originate from the North-pole and merge at the South-pole, thus the poles of a magnet can be marked as shown in the figure below: **1½**
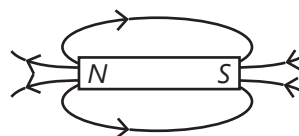
Or

(i) When current flowing in primary coil changes, the magnetic lines of forces also changes. Due to this net change in field lines, current in the secondary coil is induced. **1½**

(ii) (a) On doubling the magnitude of the current,magnetic force gets doubled, as $F \propto l$.

(b) On reversing the direction of current, direction of magnetic force also gets reversed. **1½**

16. The process being depicted is regeneration in *Planaria*. Regeneration is the type of asexual reproduction in which a new organism develops from either a broken or a cut part of the parent organism. This is carried out by specialised cells which proliferate and make a mass of cells. From this mass of cells, different cells now undergo differentiation and many cycles of cell division to form various cell types and tissues. When the body of a *Planaria* is cut into pieces, the cells of each of those piece divide and form mass of cells. These cells undergo further differentiation and form various types of cells and tissues. Ultimately, a new individual is formed. **3**

17. (i) Most reactive metal is *Q* as it has replaced both *P* and *R* from their compounds.

(ii) Element *R* is least reactive as it has been replaced by both *P* and *Q*.

(iii) The above reaction is a displacement reaction as the more reactive element is displacing the less reactive element from its solution and forming a new products. **1 × 3 = 3**

18. (i) **Photosynthesis** is the process by which autotrophs prepare their own food.

(ii) **Chlorophyll** is the pigment involved in photosynthesis. This green pigment is found in the chloroplast present in the leaves. It is capable of trapping light energy which is essential raw material for photosynthesis.

(iii) **Nitrogen** is taken up in the form of inorganic nitrates or nitrites. It is an essential element used in the synthesis of proteins and other compounds. **3**

Or

(i) **Mucus** protects the lining of the stomach from the action of the hydrochloric acid produced under normal conditions. **1**

(ii) **Hydrochloric acid** (HCl) kills the bacterial ingested with food. It creates an acidic medium of pH about 2, facilitating the action of pepsin enzyme. **1**

(iii) **Pancreatic lipase** helps in the breakdown of emulsified fats. **1**

19. Given, $P = 100$ W and $V = 220$ V

∴ Resistance of bulb,

$$R = \frac{V^2}{P} = \frac{220 \times 220}{100} = 484\,\Omega \qquad \textbf{1½}$$

When the bulb is connected to 120 V supply, then heat produced in 2 min, i.e. $t = 120$ s

$$H = \frac{V^2}{R} \times t = \frac{120 \times 120}{484} \times 120 = 3570.2\,\text{J} = 3.57\text{ kJ} \qquad \textbf{1½}$$

Alternate Solution

Given, power of bulb, $P = 100$ W and $V = 220$ V

∴ Resistance of the bulb, $R = \dfrac{V^2}{P} = \dfrac{220 \times 220}{100} = 484\,\Omega$ **1**

When the bulb is connected to 120 V supply, then current flowing through bulb is given by

$$I = \frac{V'}{R} = \frac{120}{484} \Rightarrow I = \frac{30}{121}\text{A} \qquad \textbf{1}$$

Heat produced by the bulb in 2 min $= 120$ s

$$H = I^2 Rt = \left(\frac{30}{121}\right)^2 \times 484 \times 120 = 3570.2\text{ J} = 3.57\text{ kJ} \qquad \textbf{1}$$

20. Element M with electronic configuration,

$$K\ L\ M$$
$$2,\ 8,\ 2$$

Total number of electrons $= 2 + 8 + 2 = 12$ which means the given element has atomic number 12, i.e. magnesium (Mg). Formula of compound formed, when element M (Mg) combines separately with $(NO_3)^-$, $(SO_4)^{2-}$ and $(PO_4)^{3-}$ radicals are as follows:

(i)   Mg NO_3

Charge $= +2$ -1

Formula of compound $= Mg\,(NO_3)_2$. **1**

(ii)   Mg SO_4

Charge $= +2$ -2

Formula of compound $= MgSO_4$. **1**

(iii)   Mg PO_4

Charge $= +2$ -3

Formula of compound $Mg_3\,(PO_4)_2$.

M will belong to group 2 and period 3 of the periodic table.

M will form ionic compound with all given radicals. **1**

21. For preparing the family tree of any species, we must consider certain things. Firstly, there are multiple branches possible at each and every state of this process. So, it is not as if one species is eliminated to give rise to a new one. Also, it is not as if the newly generated species are in any way better than the older ones, e.g. it is not true that human beings have evolved from chimpanzees. Rather, both human beings and chimpanzees had a common ancestor a long time ago. They probably evolved in their own separate way to give rise to their current forms. Therefore, it is more appropriate to compare the process of evolution with branches of a tree which shows parallel evolution rather than with a ladder which may represent the step-wise evolution. **3**

22. (i) Li, Na and K have one electron in their outermost shell, so they belong to group I of the periodic table.

	K	L	M	N
Li (atomic number = 3)	2	1		
Na (atomic number = 11)	2	8	1	
K (atomic number = 19)	2	8	8	1

They are very reactive and react with water to form an alkali and hydrogen gas.

(ii) Atomic mass of sodium

$$= \frac{\text{Atomic mass of Li} + \text{Atomic mass of K}}{2}$$

$$= \frac{7 + 39}{2} = \frac{46}{2} = 23 \qquad \textbf{3}$$

Or

The element with atomic number 16 (sulphur) has the following electronic configuration:

$$K\ L\ M$$
$$_{16}S = 2,\ 8,\ 6$$

Since, it has 6 electrons in its outermost shell, hence it is placed in group 16 (VIA) of modern periodic table. Valency of an element is calculated considering nearest noble gas (He, Ne, Ar, etc.). As in this gas nearest noble

gas is argon (Ar), hence sulphur needs 2 more electrons to attain stable configuration. Therefore, its valency is 2. **3**

23. Hormones are the chemical substances which act as messengers and are secreted by the endocrine glands. These messengers reach their distant target organs through the circulatory system. Hormones control and coordinate physiological and behaviour aspects of an organsim. **2**

Characteristic of hormones are as follows

• They are poured directly into the blood stream and act only on the specific target organs.

• They are required in small quantities and are chemically proteins. **1**

24. Laws of Refraction

(i) The incident ray, the refracted ray and the normal to the interface of the two transparent media at the point of incidence, all lie in the same plane.

(ii) The ratio of sine of angle of incidence to the sine of angle of refraction for light of given colour is constant for a given a pair of media (Snell's law). It is expressed as

$$\frac{\sin i}{\sin r} = \mu \text{(constant)}$$

where μ (constant value) is called the refractive index of the second medium with respect to the first. **1½**

Absolute Refractive Index

If the refractive index of a medium is considered with respect to vacuum, then it is called absolute refractive index of the medium.

Absolute refractive index

$$= \frac{\text{Speed of light in vacuum}}{\text{Speed of light in medium}} \text{ or } \mu = \frac{c}{v}$$

This is the required expression. **1½**

25. Yes, Sun is the ultimate source of energy (directly or indirectly). All the forms of energy are derived from solar energy, because of the following reasons **1½**

(i) **Non-renewable sources of energy** like fossil fuels (coal, petroleum and natural gas) are formed due to burial of large plants and ancient creatures whose ultimate source of energy is the Sun. **1½**

(ii) **Renewable sources of energy** are indirectly derived from solar energy such as

(a) **Energy from flowing water** Clouds are formed when water in lakes, rivers, seas, etc., evaporate due to solar energy. They bring rainfall and snowfall. The rain and melting snow feed rivers, streams, etc. This flowing water can be used for generating hydroelectricity. **1½**

(b) **Wind energy** It arises due to uneven heating of the Earth's surface by the Sun rays at two different adjoining places. Due to this, a pressure difference is created and wind possesses kinetic energy. **1½**

(c) **Bio-energy** Plants through the process of photosynthesis convert solar energy into food (chemical energy). This food is consumed by animals. Thus, the animal wastes and remains of the plants constitute biomass which can be utilised as a source of energy. **1½**

(d) **Ocean thermal energy** Sun is responsible for the temperature difference between the water at the surface and the water at depth in seas and oceans, which can be used to generate ocean thermal energy. **1½**

(iii) **Solar heating devices** derive their energy directly from solar energy and convert it into other usable forms of energy.

Thus, the energy from various sources are considered to have been derived from the Sun. **1**

26. (i) Given, height of object, $h_0 = 6$ cm

Focal length, $f = 25$ cm

Distance of object, $u = -40$ cm

(a) Using lens formula,

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u} \quad \Rightarrow \quad \frac{1}{v} = \frac{1}{f} + \frac{1}{u} = \frac{1}{25} + \frac{1}{(-40)}$$

$$= \frac{8-5}{200} = \frac{3}{200}$$

$$v = \frac{200}{3} = 66.67 \text{ cm} \qquad \textbf{1}$$
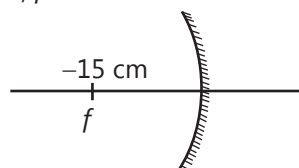
(b) Magnification, $m = \dfrac{h_i}{h_o} = \dfrac{v}{u}$

$$h_i = \frac{v}{u} \times h_0 = \frac{200}{3 \times (-40)} \times 6 = -10 \text{ cm}$$

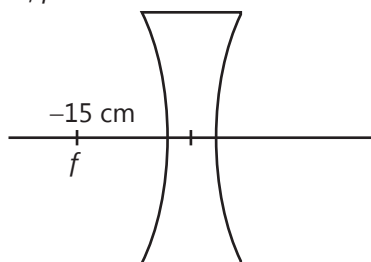Hence, the image is magnified, inverted and real. **2**

(ii) For mirror, $f = -15$ cm

Hence, the mirror is concave mirror according to cartesian system. **1**

For lens, $f = -15$ cm

Hence, it is concave lens.　　　　　　　**1**

Or

As the person cannot see nearby objects clearly, hence he is suffering from hypermetropia.

Given, $u = -25$ cm, $v = -75$ cm

Using lens formula, $\dfrac{1}{f} = \dfrac{1}{v} - \dfrac{1}{u}$

$\Rightarrow \quad \dfrac{1}{f} = -\dfrac{1}{75} + \dfrac{1}{25} = +\dfrac{2}{75}$ or $f = \dfrac{75}{2} = 37.5$ cm

1

Power of lens, $\quad P = \dfrac{1}{f\,(\text{in metre})} = \dfrac{100}{37.5} = +\dfrac{8}{3}$

$= +2.67$ D　　**1**

Here, positive sign tells that the corrective lens is a convex lens.

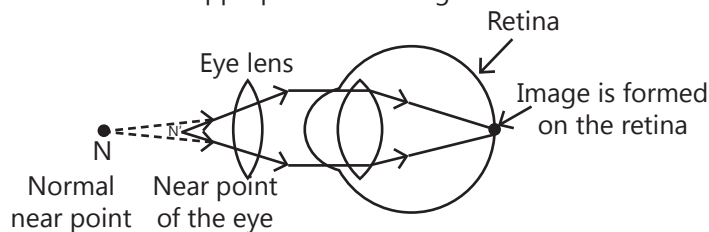The two possible causes of hypermetropia defect are as follows:

(i) The eyeball of the person is too small.

(ii) The focal length of eye lens is too large.　**1**

The image is formed beyond retina for this person.

Hypermetropia can be corrected by using a convex lens of appropriate focal length as shown below:

2

27. Electrolytic Refining The method used for refining impure metals is electrolytic refining. In this process, a thick block of impure metal is used as anode and a thin strip of pure metal is used as cathode. A solution of metal salt (to be refined) is used as an electrolyte. When electric current is passed, metal ions from the electrolyte are reduced as metal which get deposited on the cathode. An equivalent amount of pure metal from the anode gets oxidised to metal ion and goes into the electrolyte and from there it goes to cathode and deposits.　**2**
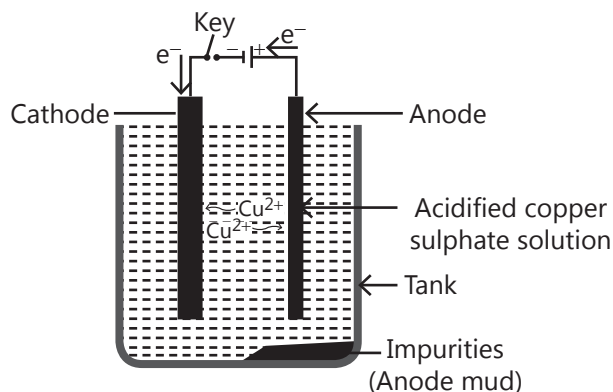
Electrolytic refining of copper　　**1**

This cycle is repeated until whole of the metal ion from impure block is dissolved and deposited on cathode. The soluble impurities go into the solution, whereas the insoluble impurities settle down below at anode and are known as anode mud. Many metals like Cu, Zn, Ni, Ag, Au, etc., are refined electrolytically, e.g. in electrolytic refining of crude copper. Here, anode is impure copper whereas cathode is a strip of pure copper. The electrolyte is a solution of acidified $CuSO_4$. On passing electric current, pure copper is deposited on the cathode.　　**2**

28. (i) The animal Z should be *Archaeopteryx*.　　**½**

(ii) Animal X could belong to the group of birds. Animal Y could belong to the group of reptiles.　**1**

(iii) The forelimbs like those of X and Y which have the same basic design, but different functions are called homologous organs. Homologous organs are the organs having the same basic structural design and developmental origin but different appearance and function.　　**2**

(iv) Both Z and X had feathered wings like those of birds.　**½**

(v) Both Z and Y had tail like those of reptiles.　**½**

(vi) The correct evolutionary chain involving X, Y and Z is as follows:

$$Y \rightarrow Z \rightarrow X \qquad \textbf{½}$$

Or

The results of Mendel's experiments showed the following

• Whenever two traits of a character are crossed, the F_1 plants showed only one of the traits, the other trait never appeared. It did not matter whether the trait came from the pollen or the egg.

• The trait that did not appear in F_1 reappeared in F_2, but in one-fourth of the total number of progeny plants.　　**2**

On the basis of monohybrid and dihybrid crosses, Mendel's findings are as follows

(i) In F_1-generation, only one character was expressed which was called as the dominant character by Mendel. The character which was not expressed termed the recessive character.

This phenomenon of appearance of only one of two contrasting traits in F_1-generation, is termed as dominance. **1**

(ii) There are a pair of unit factors controlling each character, one inherited from each parent.

At the time of reproduction, when gametes are formed, these factors segregate, so that each gamete receives only one factor of each character. This is called the law of segregation. Fertilisation brings these two factors again together in the offspring. **1**

(iii) From the F_1-generation of a hybrid cross, Mendel postulated that inheritance of factors controlling a particular trait in an organism are independent of the other. This is called the law of independent assortment. **1**

29. (i) The name of the device which is connected in series in the circuit is ammeter. It measures the current that is connected in series in the circuit. Rheostat is the component of circuit which controls the amount of current in the circuit. **1**

(ii) According to this law, the electric current flowing through a conductor is directly proportional to the potential difference applied across its ends, providing the physical conditions (such as temperature) remain unchanged.

If V is the potential difference applied across the ends of a conductor through which current/flows, then according to Ohm's law,

$$V \propto I \quad \text{(at constant temperature)}$$

or $\qquad V = IR$

or $\qquad I = \dfrac{V}{R}$

where, R is the constant of proportionality called resistance of the conductor at a given temperature.

(iii) The potential difference across a conductor is measured by means of an instrument called voltmeter. **1**

(iv) The electric power P is given by

$$P = I^2 R$$

where, I is the current in the circuit and R is the resistance of heating element. **1**

The resistance of the heating element is very high, thus large amount of heat is generated in the heating element due to which it glows. **1**
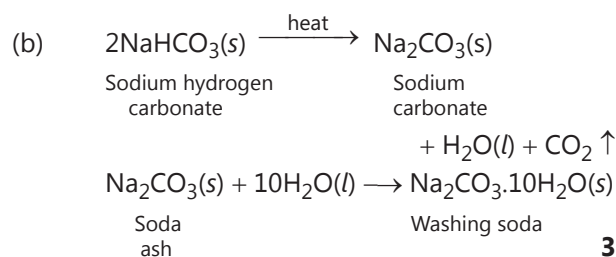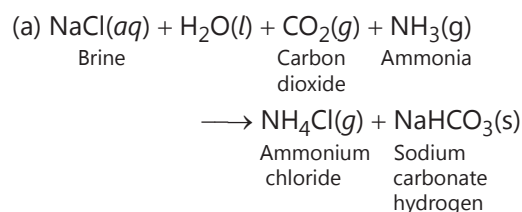
On the other hand connecting cord or wires are usually made up of metals like copper, silver or aluminium. Hence, the resistance of connecting cord is very low, thus negligible heat is generated in it and it does not glow. **1**

30. (i) (a) As the pH value of solution A is 3.0, i.e. acidic in nature, hence, it turns litmus solution from blue to red and phenolphthalein indicator in solution change from colourless to pink in solution as its pH is 9.5 which means it is basic in nature. **2**

(b) It turns the universal indicator solution green as its pH value is 7. **1**

(ii) Dry HCl gas does not release any H^+ ions which means that it is not acidic. It fails to change the colour of the dry litmus paper which has also no moisture present. **2**
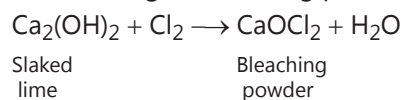
Or

(i) Sodium chloride (NaCl), ammonia (NH_3) and carbon dioxide (CO_2) are raw materials used for the manufacture of washing soda. **1**

(ii) Reactions involved are as follows:

(a) $\underset{\text{Brine}}{NaCl(aq)} + H_2O(l) + \underset{\substack{\text{Carbon} \\ \text{dioxide}}}{CO_2(g)} + \underset{\text{Ammonia}}{NH_3(g)}$

$\longrightarrow \underset{\substack{\text{Ammonium} \\ \text{chloride}}}{NH_4Cl(g)} + \underset{\substack{\text{Sodium} \\ \text{carbonate} \\ \text{hydrogen}}}{NaHCO_3(s)}$

(b) $\underset{\substack{\text{Sodium hydrogen} \\ \text{carbonate}}}{2NaHCO_3(s)} \xrightarrow{\text{heat}} \underset{\substack{\text{Sodium} \\ \text{carbonate}}}{Na_2CO_3(s)}$

$+ H_2O(l) + CO_2 \uparrow$

$\underset{\substack{\text{Soda} \\ \text{ash}}}{Na_2CO_3(s)} + 10H_2O(l) \longrightarrow \underset{\text{Washing soda}}{Na_2CO_3.10H_2O(s)}$ **3**

(iii) The substance (x) is slaked lime which reacts with chlorine to give bleaching powder.

$\underset{\substack{\text{Slaked} \\ \text{lime}}}{Ca_2(OH)_2} + Cl_2 \longrightarrow \underset{\substack{\text{Bleaching} \\ \text{powder}}}{CaOCl_2} + H_2O$ **1**