CBSE
Class X Science

Time: 3 hrs **Total Marks: 80**

General Instructions:

1. The question paper comprises of two **Sections, A** and **B**. You are to attempt both the sections.
2. All questions are compulsory.
3. All questions of **Section A** and **Section B** are to be attempted separately.
4. There is an internal choice in **three** questions of **three** marks each, **two** questions of **five** marks each in Section A and in **one** question of **two** marks in Section B.
5. Question numbers**1**and**2** in **Section A** are **one mark** questions. These are to be answered in one word or in **one** sentence.
6. Question numbers **3** to **5** in **Section A** are **two marks** questions. These are to be answered in about **30 words each**.
7. Question numbers **6** to **15** in **Section A** are **three marks** questions. These are to be answered in about **50 words each**.
8. Question numbers **16** to **21** in **Section A** are **five marks** questions. These are to be answered in about **70 words each**.
9. Question numbers **22** to **27** in **Section B** are based on practical skills. Each question is a **two** marks question. These are to be answered in brief.

Section A

1. Name two tissues which provide control and coordination in multicellular animals.(1)

2. Name the energy possessed by moving and stationary currents of water. (1)

3. How can you differentiate saturated and unsaturated hydrocarbons on the basis of burning behaviour? (2)

4. Will geographical isolation be a major factor in the speciation of an organism which reproduces asexually? Give reason for your answer. (2)

5. The refractive index of water is 1·33 and the speed of light in air is 3×10^8 ms^{-1}. Calculate the speed of light in water. (2)

6. (3)

(a) Draw a schematic labelled diagram of a domestic wiring circuit which includes

(i) A main fuse

(ii) A power meter

(iii) One light point

(iv) A power output socket

(b) On which wire in the circuit is the mains on/off switch connected?

7. What is translocation? Why is it essential for plants? Where in plants are the following synthesised: (i) Sugars, (ii) Hormones (3)

8. Differentiate between 'self-pollination' and 'cross pollination.' Describe 'double fertilisation' in plants. (3)

9. What happens when

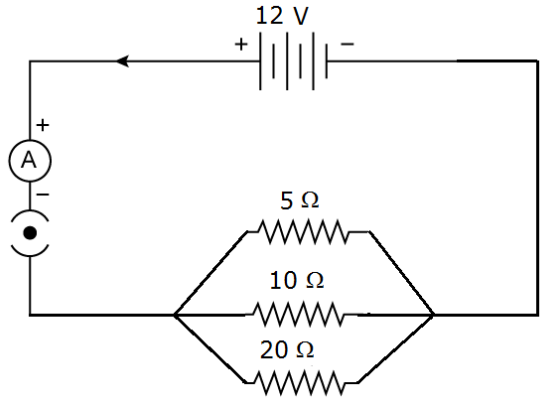
(a) Zinc reacts with copper sulphate?

(b) Magnesium reacts with HCl?

(c) Sodium reacts with water? (3)

10. Explain Mendel's experiment on inheritance of characters considering only one visible contrasting character in pea plant. (3)

11. In the circuit given below, three resistors of 5 Ω, 10 Ω and 20 Ω, respectively, are connected across a battery of 12 V. (3)



Calculate:

(a) Current through each resistor

(b) Total current in the circuit

(c) Total resistance of the circuit

OR

An electrical appliance is rated 200 V–100 W. What is the resistance of the appliance? Five such appliances run simultaneously for 4 hours. What is the energy consumed? Calculate the cost of running these appliances if the per unit cost is Rs 4.60.

12. What is ozone? How and where is it formed in the atmosphere? Explain how it affects an ecosystem.

OR

What is meant by biological magnification? With the help of a food chain, explain how biological magnification of harmful chemicals can occur. (3)

13. Corrosion is a serious problem. Every year an enormous amount of money is spent to replace damaged iron. What steps can be taken to prevent this damage? (3)

14. Answer the following: (3)

(a) What according to you happens to the eyes when you enter a darkened room from bright sunlight?

(b) Suggest how the iris helps protect the retina from damage by bright light.

(c) How do you compare the defect of a person wearing spectacles of +1.5 D to the one wearing spectacles of –1.5 D?

15. You are provided with three test tubes A, B and C which contain distilled water, acidic and basic solutions. If you are given blue litmus paper only, how will you identify the nature of the solutions in the three test tubes? (3)

OR

Write word equations and then balanced equations for the reaction taking place when -

(a) Dilute sulphuric acid reacts with zinc granules.

(b) Dilute hydrochloric acid reacts with Iron fillings.

(c) Dilute sulphuric acid reacts with aluminium powder.

16. (5)

(a) What are magnetic field lines? How is the direction of the magnetic field at a point determined?

(b) Draw two field lines around a bar magnet along its length on its two sides and mark the field directions on them by showing arrows.

(c) List any three properties of magnetic field lines.

17. A quiz contest was being held in the school for chemistry students. The quiz-master said:

An element has the electronic configuration 2, 8, 7.

(a) What is the atomic number of this element?

(b) Is it a metal, non-metal or metalloid?

(c) Which of the elements N, F, P and Ar shows similarity with this element?

(d) We use a compound of this element in our food. Identify that compound.

(e) A compound of this element causes hardness of water. Identify that compound.(5)

18. What is speciation? List four factors which could lead to speciation. Which of these cannot be a major factor in the speciation of a self-pollinating plant species? Explain.

OR

(a) Name the human male reproductive organ which produces sperms and secretes hormones. Write the functions of the hormone secreted.

(b) Name the parts of the human female reproductive system where
(i) fertilisation and (ii) implantation occur, respectively.
Explain how the embryo gets nutrition inside the mother's body.

(5)

19. An organic compound A is widely used as a preservative in pickles and has molecular formula $C_2H_4O_2$. This compound reacts with ethanol to form a sweet smelling compound B.

(a) Identify compound A.

(b) Write the chemical equation for its reaction with ethanol to form compound B.

(c) How can we get compound A back from B?

(d) Name the process.

(e) Which gas is produced when compound A reacts with washing soda? (5)

OR

(a) Why does micelle formation take place when soap is added to water? Will a micelle be formed in other solvents such as ethanol also?

(b) Explain the formation of scum when hard water is treated with soap.

20.

(a) Why is it necessary to separate oxygenated and deoxygenated blood in mammals and birds?

(b) Explain how lungs are designed in human beings to maximise the area for exchange of gases. Why does the air passage not collapse when there is no air in it? (5)

21. Name the type of mirrors used in (a) solar furnace and (b) rear-view mirror. Draw labelled diagrams to show the formation of image in each of the above two cases. Which of these mirrors could also form a magnified and virtual image of an object? Illustrate with the help of a ray diagram. (5)

Section B

22. What happens if NaOH is added to ferrous ammonium sulphate solution and warmed? What is the inference?

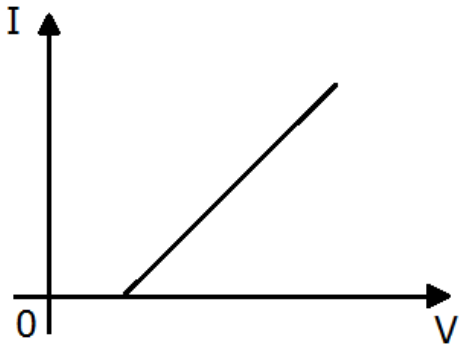
OR

What is observed when a solution of sodium sulphate is added to a solution of barium chloride taken in a test tube? Write equation for the chemical reaction involved and name the type of reaction in this case. (2)

23. What would a well-stained leaf peel preparation when focused under a high power of the microscope show? (2)

24. An iron knife kept dipped in a blue copper sulphate solution turns the blue solution light green. Why? (2)

25. The plot showing the dependence of the current (I) on the potential difference (V) across a resistor R is shown below. Identify the error and state the dependence mathematically. (2)



26. What is exosmosis? Where does it take place? (2)

27. For performing an experiment, a student was asked to choose one concave mirror and one convex lens from a bunch of mirrors and lenses of different kinds. How will he identify these optical devices? (2)

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Solution

Section A

1. Muscle tissues and nervous tissues provide control and coordination in multicellular animals.

2. Moving water possesses kinetic energy, while stationary water possesses potential energy.

3. On heating, saturated hydrocarbons give a clean flame, whereas unsaturated hydrocarbons give a yellow flame with lots of black smoke.

4. No, geographical isolation will not be the major factor in the speciation of asexually reproducing organisms. This is because there is no exchange of genetic material with the other species in such organisms. They pass on the parent DNA to the offspring which leaves no chance of speciation.

5. Refractive index of a medium is

$$\mu = \frac{c}{v}$$

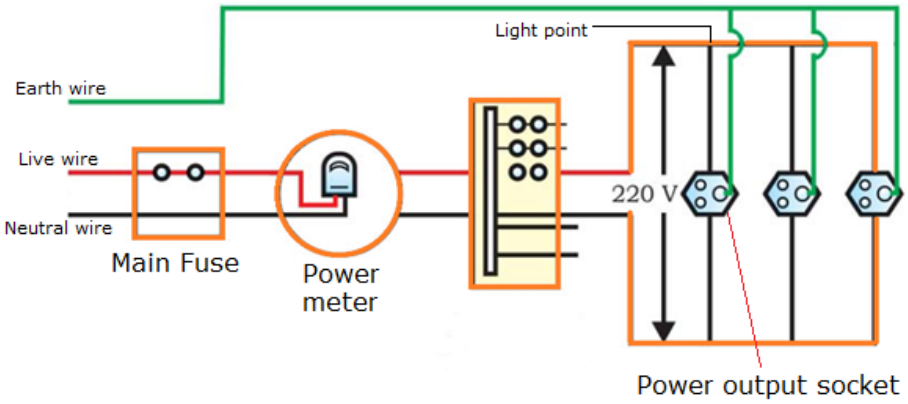
$$\therefore \mu_w = \frac{c}{v_w}$$

$$\therefore v_w = \frac{c}{\mu_w} = \frac{3\times10^8}{1.33}$$

$$\therefore v_w = 2.26\times10^8 \text{ m/s}$$

6.

(a) Domestic wiring circuit:



(b) The on/off switch of the mains is connected to the live wire.

7. Translocation is the movement of materials from leaves to other parts of the plant body.

During photosynthesis, carbohydrates from leaves are transported to non-photosynthetic parts of plants such as roots, stem and other organs. This process is performed by translocation. Therefore, translocation is essential in plants.

Sugars are synthesised in the leaves of plants. Plant hormones are not secreted by any gland. However, each plant cell can produce hormones.

8. Self-pollination is the process of transferring the pollen from the anther to the stigma in the same flower. Cross pollination is the transfer of pollen grains from the anther of a flower to the stigma of another flower in a different plant of the same or different species.

Double fertilisation is the process in angiosperms (flowering plants) during reproduction, in which two sperm nuclei from each pollen tube fertilise two cells in an ovary. The pollen grain adheres to the stigma of the carpel (female reproductive structure) and grows a pollen tube which penetrates the ovum through a tiny pore called a micropyle. Two sperm cells are released into the ovary through this tube. One of the two sperm cells fertilises the egg cell (at the bottom of the ovule near the micropyle), forming a diploid (2n) zygote. The other sperm cell fuses with two haploid polar nuclei (contained in the central cell) in the centre of the embryo sac (or ovule). The resulting cell is the triploid (3n) primary endosperm nucleus. This triploid cell divides through mitosis and forms the endosperm, a nutrient-rich tissue, inside the seed.

9.

(a) Zinc reacts with copper sulphate to give zinc sulphate and copper metal.

$CuSO_{4(aq)} + Zn_{(s)} \rightarrow ZnSO_{4(aq)} + Cu_{(s)}$

(b) Magnesium reacts with HCl to give magnesium chloride and hydrogen gas.

$Mg_{(s)} + 2HCl_{(aq)} \rightarrow MgCl_2 + H_{2(g)}$

(c) Sodium reacts with water to give sodium hydroxide and hydrogen gas.

$2Na_{(s)} + 2H_2O_{(l)} \rightarrow 2NaOH_{(aq)} + H_{2(g)}$

10. Mendel's experiment can be studied in the following ways:

(i) Mendel first crossed pure-bred tall pea plants with pure-bred short pea plants and found that tall pea plants were produced in the F_1 generation.

(ii) Mendel crossed the tall pea plants of the F_1 generation and found that tall plants and dwarf plants are in the ratio 3:1. Mendel observed that the dwarf trait of the pea plant which had disappeared in the F_1 generation progeny reappeared in the F_2 generation. He concluded by saying that traits are inherited independently.

11.

(a) As the resistors are connected in parallel, the voltage across each resistor is the same. Hence, current through each resistor is

$$I_5 = \frac{V}{5} = \frac{12}{5} = 2.4 \text{ A}$$

$$I_{10} = \frac{V}{10} = \frac{12}{10} = 1.2 \text{ A}$$

$$I_{20} = \frac{V}{20} = \frac{12}{20} = 0.6 \text{ A}$$

(b) Total current in the circuit is

$$I = I_5 + I_{10} + I_{20}$$

$$\therefore I = 2.4 + 1.2 + 0.6$$

$$\therefore I = 4.2 \text{ A}$$

(c) Total resistance in the circuit is

$$V = IR_{eq}$$

$$\therefore R_{eq} = \frac{V}{I} = \frac{12}{4.2}$$

$$\therefore R_{eq} = 2.85\ \Omega$$

OR

Rating of the electrical appliance is 200 V–100 W.
Therefore, the resistance of the appliance is

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

$$\therefore R = \frac{V^2}{P} = \frac{200^2}{100}$$

$$\therefore R = 400\ \Omega$$

Total power consumed by 5 bulbs will be 500 W.
Hence, for a four-hour operation, the energy consumed is

$$E = Pt$$

$$\therefore E = 500 \times 4 = 2000 \text{ Wh} = 2 \text{ kWh}$$

Cost of electricity per unit is Rs 4.60.
Hence, the total cost is

$$\text{Cost} = 2 \times 4.60 = \text{Rs. } 9.2$$

12. Ozone is a molecule formed by three atoms of oxygen. The ozone layer forms a thick layer in the stratosphere, encircling the Earth. In the first step, solar ultraviolet radiation breaks apart one oxygen molecule (O_2) to produce two oxygen atoms (2O). In the second step, each of these highly reactive atoms combines with an oxygen molecule to produce an ozone molecule (O_3).

It may affect an ecosystem in the following ways:

i. At the surface of the Earth, it is a deadly poison for all lower forms of life.

ii. If this layer gets depleted, then it may cause cancer in human beings.

OR

Biomagnification is the increasing concentration of a substance, such as a toxic chemical, in the tissues of organisms at successively higher levels in a food chain.
In the food chain,

Grass ----> Grasshopper ----> Frog ----> Snake ----> Peacock

Peacock occurs at the highest trophic level (on the extreme right); therefore, it will have the maximum concentration of harmful chemicals in its body.

13. Rusting of iron can be prevented by painting, oiling, greasing, galvanizing, chrome plating or making alloys.

- Galvanisation is a method of protecting rusting of steel and iron by coating them with a thin layer of zinc.
- Alloying is also a very good method of improving properties of metals. When iron is mixed with chromium and nickel, we get stainless steel which does not rust.
- When moisture comes in contact with the metal surface, it oxidises and forms a coating of rust on it. As oil and water do not mix with each other, oiling forms a protective layer on the metal surface and hence, prevents rusting.
- Painting is yet another cost effective method of preventing corrosion.

14.

(a) When we enter a darkened room from bright sunlight, we are unable to see at first. This is because the size of the pupil is small. When we enter the dark room, the pupil expands and more light enters the eye enabling us to see.

(b) The iris controls the size of the pupil. So, when our eye encounters bright light, the iris contracts the pupil and protects the retina from damage.

(c) A person is wearing spectacles of power +1.5 D. So, the lens has a positive focal length which indicates that he is wearing a convex lens. Hence, he is suffering from hypermetropia or long-sightedness. For a person wearing spectacles of power −1.5 D, the lens has a negative focal length which indicates that he is wearing a concave lens. Hence, he is suffering from myopia or short-sightedness.

15.

(a) Test the three solutions with blue litmus paper; one solution will change blue litmus red. This solution is acidic.

(b) Test the remaining two solutions with the red litmus paper [which changed in activity (a)]; one solution will change it again to blue. This solution is basic.

(c) So, the third solution is distilled water.

OR

(a) Sulphuric acid + Zinc → Zinc sulphate + Hydrogen

$H_2SO_{4\,(aq)} + Zn_{(s)} \rightarrow ZnSO_{4\,(aq)} + H_{2\,(g)}$

(b) Hydrochloric acid + Iron→ Ferric chloride+ Hydrogen

$6HCl_{\,(aq)} + 2Fe_{\,(s)} \rightarrow 2FeCl_{3\,(aq)} + 3\,H_{2\,(g)}$

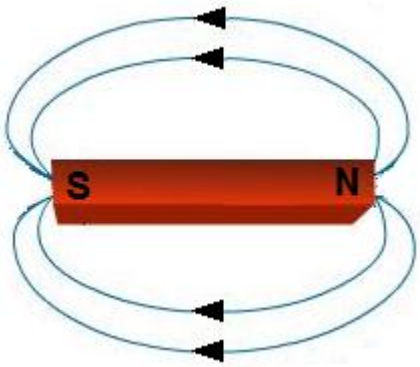
(c) Sulphuric acid + Aluminium → Aluminium sulphate + Hydrogen

$3\,H_2SO_{4\,(aq)} + 2\,Al_{(s)} \rightarrow Al_2(SO_4)_{3\,(aq)} + 3\,H_{2\,(g)}$

16.

(a) The space around a magnet in which the force of attraction and repulsion due to the magnet can be detected is called the magnetic field. The direction of the magnetic field is taken to be the direction in which a North Pole of the compass needle moves inside it.

(b) Magnetic field lines around a magnet:



(c) Properties of magnetic field lines:

(i) Field lines originate from the North Pole and end at the South Pole.

(ii) Magnetic field lines come closer to one another near the poles of a magnet, but they are widely separated at other places.

(iii) Field lines do not intersect each other.

17. From the electronic configuration, it is clear that the compound is chlorine (Cl).

(a) Atomic number: 17

(b) Chlorine is a non-metal.

(c) F, as it belongs to the same group as the element chlorine.

(d) Compound is sodium chloride (NaCl) also known as common salt.

(e) Compound is calcium bicarbonate $Ca(HCO_3)_2$ which causes temporary hardness of water.

18. The process by which a new species develops from the existing species is known as speciation.

Factors which lead to speciation:

i. Geographical isolation
ii. Genetic drift
iii. Natural selection
iv. Reduction in gene flow

Geographical isolation cannot be a major factor in speciation of a self-pollinating plant as it does not depend on another plant for reproduction.

OR

(a) Testis produces sperms and secretes the hormone testosterone which helps in the development of the testes and secondary sexual characters.

(b)

i. Fertilisation takes place in the fallopian tube.
ii. Implantation occurs in the uterus.

The embryo gets nourishment from the mother's blood by a special disc-shaped tissue embedded in the uterine wall called the placenta. It contains villi on the embryo's side and blood vessels surrounding the villi on the mother's side. Glucose and oxygen pass from the mother to the embryo through the placenta. Also, waste substances are removed through the placenta and enter the mother's blood.

19.

(a) Compound A with molecular formula $C_2H_4O_2$ is ethanoic acid, also called acetic acid. Its structural formula is CH_3COOH. A dilute solution of acetic acid called vinegar is used as a preservative of pickles.

(b) Compound A reacts with ethanol to form compound B which is an ester and has a pleasant smell. The reaction is called esterification reaction.

$$CH_3COOH + C_2H_5OH \rightarrow CH_3COOC_2H_5 + H_2O$$

Ethanoic acid Ethyl ethanoate

(c) Compound A can be obtained from ethyl ethanoate by reacting with water in the presence of dilute hydrochloric acid acting as a catalyst.

$$CH_3COOC_2H_5 + H_2O \rightarrow CH_3COOH + C_2H_5OH$$

Ethyl ethanoate Ethanoic acid

(d) Process is ester hydrolysis.

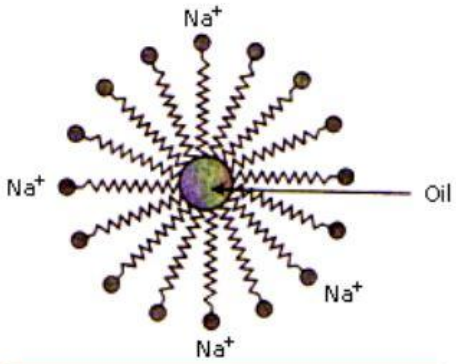
(e) Carbon dioxide is evolved with effervescence when compound A reacts with washing soda.

OR

(a) A soap is a sodium or potassium salt of long chain fatty acids.
A soap molecule has two parts namely the non-polar (hydrocarbon) hydrophobic chain and polar (ionic) hydrophilic head, COO-Na+.

The long hydrocarbon chain being hydrophobic is insoluble in water but soluble in oil and grease. On the other hand, the ionic part of soap being hydrophilic is soluble in water but insoluble in oil and grease.

When soap is added to water, soap molecules arrange them in a cluster to keep the non-polar hydrophobic tail are towards the interior of the cluster and the polar hydrophilic head towards water. Since the dirt present on clothes is organic in nature and insoluble in water, the hydrophobic ends of the clusters attach themselves to the dirt. This cluster formation in which the dirt is entrapped is the micelle. The micelles stay in solution as a colloid and does not come together to precipitate because of ion-ion repulsion.



Formation of Micelles

Micelle formation does not occur in alcohol because the alkyl chain of soap becomes soluble in alcohol.

(b) Soap does not work properly when the water is hard. A soap is a sodium or potassium salt of long chain carboxylic acids. Hard water contains salts of calcium and magnesium. When soap is added to hard water, calcium and magnesium ions, which are present in hard water, readily react with the carboxylate ion of the soap to form insoluble substance called scum. A lot of soap is wasted in the process.

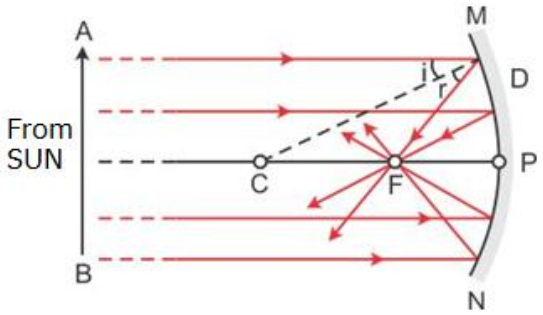
20.

(a) Separation of oxygenated and deoxygenated blood allows a highly efficient supply of oxygen to the body. This is especially important in birds and mammals which have high energy needs and constantly use energy to maintain their body.

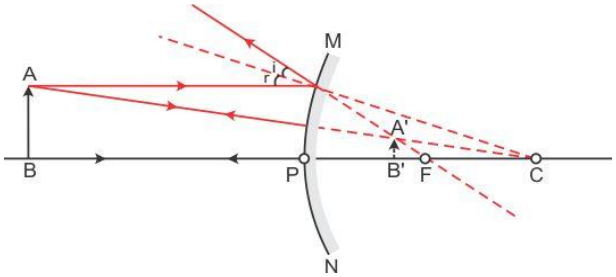
(b) The lungs contain millions of alveoli which provide a surface for the exchange of gases. An extensive network of blood vessels is present in the wall of the alveoli. By lifting our ribs and flattening the diaphragm, the chest cavity becomes spacious. Air is sucked into the lungs and alveoli. The oxygen from the breath diffuses into the blood and carbon dioxide from the blood (brought from all over the body) diffuses out to the air.

Trachea has rings of cartilage around it. These rings of cartilage prevent the trachea from collapsing when we breathe out.

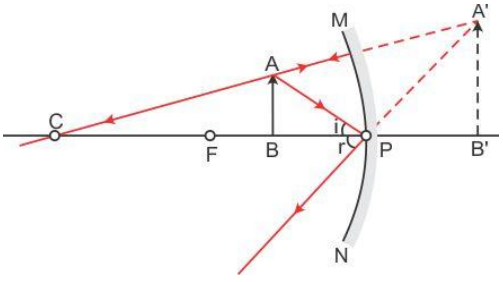
21. The mirror used in a solar furnace is a concave mirror. Image formed by the concave mirror when placed inside a solar furnace:



The mirror used as a rear-view mirror is a convex mirror. Image formed by the convex mirror:



A concave mirror can form a magnified and virtual image. A convex mirror cannot form an enlarged image. When the object is placed between the pole and the focus of the mirror, the image formed is virtual, enlarged and erect.



Section B

22. When NaOH is added to ferrous ammonium sulphate solution and warmed, both ferrous ion and ammonium ion separate and exhibit their individual properties. A green precipitate of $Fe(OH)_2$ is formed and the smell of NH_3 gas from $(NH_4)^+$ ion is observed. Hence, it is an example of the formation of a double salt.

OR

Baking powder ($NaHCO_3$),

When sodium sulphate is added to the barium chloride it gives white ppt of barium sulphate which is insoluble in water and sodium chloride which dissolved in water. This is a double displacement type of reaction.

$$Na_2SO_4 + BaCl_2 \longrightarrow 2NaCl + BaSO_4 \downarrow$$

23. A well-stained leaf peel shows nuclei in a high power microscope. The leaf peel possesses stomata, guard cells and epidermal cells. The nuclei are present in both epidermal and guard cells, but stomata do not possess any nucleus.

24. Iron is more reactive than copper. So, it displaces Cu from $CuSO_4$ solution and forms light green ferrous sulphate.

$$CuSO_4 + Fe \rightarrow FeSO_4 + Cu$$

Blue colour Light green colour

25. The graph does not begin from the origin. According to Ohm's law, the current flowing through the circuit is directly proportional to the voltage applied. So, $I \propto V$. Hence, the graph should begin from the origin.

26. Exosmosis is the transfer of solvent from the inside to the outside of the cell through a plasma membrane when the cell is placed in a hypertonic solution with more solute and less solvent.

27. A concave mirror and a convex lens both can form enlarged and erect images. So, the student should choose them by forming an image on a wall and check whether the device forms an enlarged and erect image.