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. Which plant hormone promotes dormancy of seeds? (1)

2. Name the energy of water which is used in hydroelectric power plants. (1)

3. Give the fermentation reaction for preparing ethanol from sugars. (2)

4. If you take five mice and remove their tails with the help of surgery, will the tailless mice have tailless progeny? Give reason for your answer. (2)

5. The speed of light in air is 3×10^8 m/s and the speed of light in water is 2.26×10^8m/s. Calculate the refractive index of 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) Why is copper wire not suitable to be used as a fuse wire?

7. What do you call the secretion of the stomach? How does the wall of the stomach protect itself from the action of highly acidic HCl? (3)

8. List one sexually transmitted disease caused by bacteria and virus, respectively. How can these diseases be prevented? (3)

9. $Cu + AgNO_3 \rightarrow CuNO_3 + Ag$

$Fe + CuSO_4 \rightarrow FeSO_4 + Cu$

$Zn + FeSO_4 \rightarrow ZnSO_4 + Fe$

From the above information, arrange the given metals in the increasing order of reactivity. Give reason for your choice. (3)

OR

What is thermite reaction? How is it used to join the railway tracks or cracked machine parts? Explain with the help of an example.

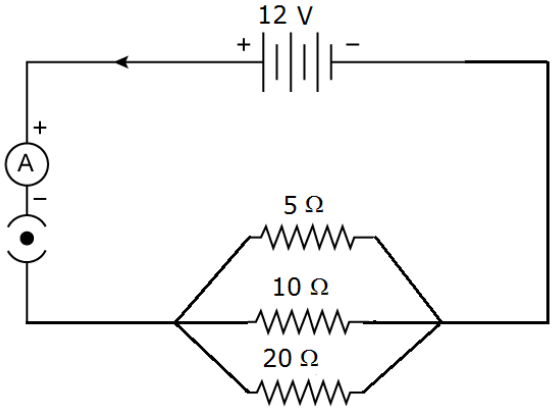
10. A blue-flowered plant denoted by BB is crossbred with a white-flowered plant denoted by bb. (3)

(a) State the colour of the flowers you would expect in the F_1 generation plants.

(b) What must be the percentage of white-flowered plants in the F_2 generation if flowers of F_1 plants are self-pollinated?

(c) State the expected ratio of the genotypes BB and Bb in the F_2 progeny.

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



Calculate:

(a) Current through the 5Ω and 20Ωresistors

(b) Total current in the circuit if another resistor of 15Ω is connected

(c) Compare the resistance of the three resistors connected in series

OR

An electrical appliance is rated 220 V–1kW. What is the resistance of the appliance? If three such appliances run simultaneously for 6 hours, what is the energy consumed? Calculate the cost of running these appliances if the per unit cost is Rs 5.20.

12. What do you mean by ozone depletion? Mention the cause of ozone depletion in brief. (3)

OR

What is biological magnification? Will the levels of this magnification be different at different levels of the ecosystem? Where will the magnification be maximum? (3)

13. Farmers use a large number of pesticides and fertilisers in their fields to increase crop production and to enhance their profits. By doing so they are causing damage to the soil as well as to the environment. Do you agree with this statement? Why should we avoid eating fruits and vegetables without washing them properly? What values do you get from this? (3)

14. Answer the following: (3)

(a) What is the advantage of having two eyes instead of one?

(b) Explain the function of the iris.

(c) What is the difference in the defect of a person wearing spectacles of +1 D to a person wearing spectacles of –1 D?

15. (3)

(a) What change will you observe in the colour of red litmus paper when it is dipped into a solution of sodium sulphate? Give reason to explain your observation.

(b) A bottle filled with concentrated sulphuric acid up to the brim is left open in the atmosphere by mistake. Will there be any change in the level of liquid? Explain your answer with reason.

16. (5)

(a) Define magnetic field lines and write their characteristics.

(b) State the direction of magnetic field lines with a neat labelled diagram.

(c) Is the magnetic field same all around a bar magnet? Explain with reasons.

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, 2.

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

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

(c) Which of the elements Mg, O, P or 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)

OR

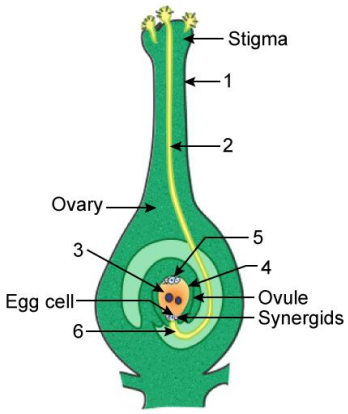
(a) State the Modern Periodic Law. How have the elements been arranged in the modern periodic table? Why is it considered that the position of hydrogen in the periodic table is anomalous?

(b) An element X (2, 8, 2) combines separately with NO_3^- and $(PO_4)^{3-}$ radicals. Write the formulae of the compounds so formed. To which group of the periodic table does the element 'X' belong? Will it form covalent or ionic compounds with these radicals? How?

18. Briefly explain Darwin's theory of evolution. (5)

OR

Study this diagrammatic representation of the process of fertilisation, and answer the questions which follow: (5)



(a) Name the parts labelled 1, 2, 3, 4, 5 and 6.

(b) What happens to Ovary and Ovule after fertilisation

(c) What is the function of the synergids?

(d) What part does the stigma play in the process of fertilisation?

19. An organic compound 'C' (molecular formula $C_2H_4O_2$) reacts with sodium metal to form a compound 'R' and evolves a gas which burns with a pop sound. Compound 'C' on treatment with alcohol 'A' in the presence of an acid forms a sweet smelling compound 'S' (molecular formula $C_3H_6O_2$). Addition of NaOH to 'C' also gives 'R' and water. 'S' on treatment with NaOH solution gives back 'R' and 'A'. Identify 'C', 'R', 'A'and 'S', and write the reactions involved. (5)

20.

(a) What will happen to your throat when you sleep with your mouth open, especially when your nasal passages are plugged as a result of cold? (2)

(b) Why does a person who breathes rapidly and deeply for several seconds experience a short period of time in which respiration does not occur before normal breathing resumes? (3)

21. With a neat labelled diagram, enlist the new sign convention for spherical mirrors.(5)

OR

(a) Which gas is filled in an electric bulb and why?

(b) What do you mean by resistance of a conductor? On what factors do the resistance of a conductor depend and how? Write the SI unit of resistance.

(c) State Ohm's law.

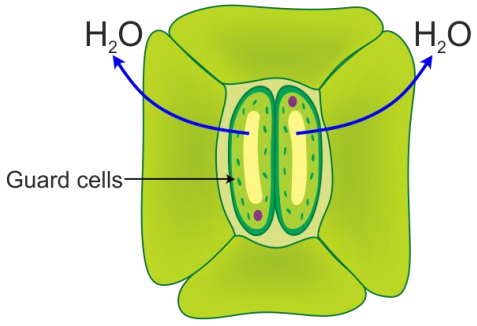
Section B

22. What happens when copper is burned in air? Give the equation. What type of a reaction is it? (2)

OR

Why do we need to clean magnesium ribbon before burning it? Why is it advised to burn magnesium ribbon at a distance far from eyes?

23. Observe the figure carefully and answer the questions based on it. (2)

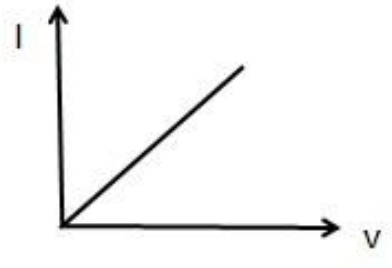


(a) What changes take place in the guard cells?

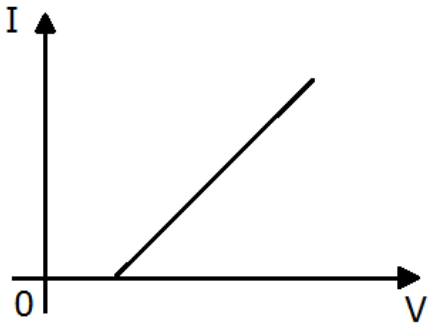
(b) In an experiment to demonstrate the occurrence of stomata, why is it preferred to take an epidermal peel from the lower surface of the leaf?

24. What change will you observe in the colour of red litmus paper when it is dipped into a solution of sodium carbonate? Give reason to explain your observation. (2)

25. Identify and explain with reasons which of the following graphs (i) and (ii) is a correct representation of Ohm's Law. (2)



(i)



(ii)

26. (2)

(a) Why is the proportion of CO_2 more in exhaled air?

(b) Why is the proportion of nitrogen gas same in inhaled as well as exhaled air?

27. From a bunch of mirrors and lenses of different kinds, how will you choose one concave mirror and one convex lens? (2)

CBSE
Class X Science
Solution

Section A

1. Abscisic acid promotes dormancy of seeds in plants.

2. Energy of water which is used in the hydroelectric power plant is
(a) Kinetic energy possessed by moving water
(b) Potential energy possessed by stationary water

3. Ethanol is prepared by the fermentation of sugar (molasses) by the enzymes invertase and zymase.

$$C_{12}H_{22}O_{11} + H_2O \xrightarrow{\text{Invertase Fermentation}} C_6H_{12}O_6 + C_6H_{12}O_6$$

$$C_6H_{12}O_6 \xrightarrow{\text{Zymase Fermentation}} 2C_2H_5OH + 2CO_2$$

4. No, tailless mice produced after surgery will not produce tailless progeny. This is because the traits acquired during the life time of an individual are not inherited as these changes are not in the genes of the reproductive tissues. Changes in the non-reproductive tissues cannot be passed on to the DNA of the germ cells; hence, such acquired changes are not inherited in the progeny.

5. Refractive index of a medium is given by

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

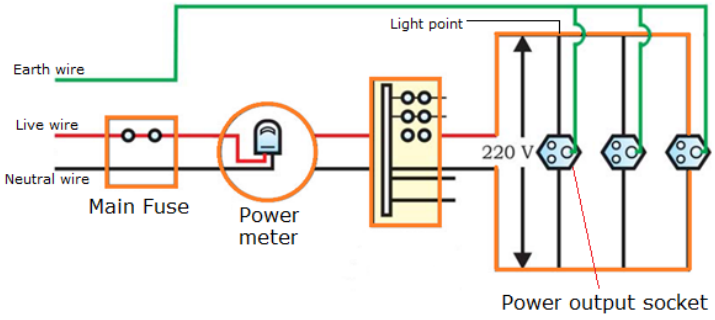
$$\therefore \mu_w = \frac{c}{v_w}$$

$$\therefore \mu_w = \frac{c}{v_w} = \frac{3\times10^8}{2.26\times10^8}$$

$$\therefore \mu_w = 1.33$$

6.

(a) Domestic wiring circuit:



(b) The fuse wire needs to have a very low melting point so that it can disconnect itself when the supply exceeds the standard range of input voltage.
The melting point of copper wire is 1083°C; if copper wire is used as a fuse wire, then it will allow a huge value of voltage to enter the domestic circuit and that will destroy all the electric appliances.
That is why an alloy of lead is used instead of copper wire.

7. Secretion of the stomach is known as gastric juice. It contains hydrochloric acid, enzyme pepsin and mucus. The wall of the stomach releases mucus which helps to protect itself from the action of highly acidic HCl. In the absence of mucus, hydrochloric acid will cause the erosion of the inner lining of the stomach leading to the formation of ulcers in the stomach.

8. Sexually transmitted diseases:
- Bacterial infection: Gonorrhoea and warts
- Viral infection: AIDS (Acquired Immuno Deficiency Syndrome) and syphilis

<u>Sexually transmitted diseases can be prevented by</u>
- Using mechanical barriers such as condoms, cervical caps, diaphragms, etc. during mating
- Spreading awareness through sex education at different levels
- Maintaining healthy sexual habits
- Avoiding the sexual act with multiple partners

9. Because zinc displaces iron, it is more reactive than iron. However, iron displaces copper, so iron comes above copper in the reactivity series. Similarly, copper displaces silver, i.e. silver is least reactive.
Ag < Cu < Fe < Zn

OR

Thermite reaction: The reduction of a metal oxide to form metal by using aluminium powder as a reducing agent is called a thermite reaction.
It is an exothermic reaction in which a large amount of heat is evolved. This reduction property of aluminium is used in thermite welding for joining the broken pieces of heavy iron objects like girders, railway tracks or cracked machine parts.
Example: A mixture of iron (III) oxide and aluminium powder is ignited with a burning magnesium ribbon. Aluminium reduces iron oxide to produce molten iron metal with the evolution of heat.

$$Fe_2O_{3(s)} + 2Al_{(s)} \rightarrow 2Fe_{(l)} + Al_2O_{3(s)} + Heat$$

The molten iron produced is then poured between the broken iron pieces to weld them.

10. The cross between blue-flowered plant (BB) and white-flowered plant (bb) is a monohybrid cross which involves a single trait, i.e. colour of the flower under study.

(a) All the F_1 generation plants would be blue.

(b) If flowers of F_1 plants are self-pollinated, then we would have 75% plants with blue flowers and 25% plants with white flowers in the F_2 generation.

(c) The expected ratio of the genotypes BB and Bb in the F_2 progeny is 1:2.

11.

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

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

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

(b) Total current in the circuit is

$$I = I_5 + I_{10} + I_{20} + I_{15}$$

But,

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

$$I_{15} = \frac{V}{15} = \frac{12}{15} = 0.8 \text{ A}$$

$$\therefore I = 2.4 + 1.2 + 0.6 + 0.8$$

$$\therefore I = 5 \text{ A}$$

(c) The resistance is connected in parallel with each other in the given circuit.

$$\frac{1}{R_P} = \frac{1}{5} + \frac{1}{10} + \frac{1}{20}$$

$$\therefore R_P = 2.85 \ \Omega$$

But when the same value resistors are connected in series, their equivalent resistance is given by

$$R_s = 5 + 10 + 20$$

$$\therefore R_s = 35 \ \Omega$$

Thus, when the resistors are connected in series, the resistance of the entire circuit increases and the amount of current flowing in the circuit decreases.

OR

Rating of the electrical appliance is 220 V–1kW.
Therefore, the resistance of the appliance is

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

$$\therefore R = \frac{V^2}{P} = \frac{220^2}{1000}$$

$$\therefore R = 48.4\ \Omega$$

Total power consumed by 3 bulbs will be 3 kW.
Hence, for a six-hour operation, the energy consumed is

$$E = Pt$$

$$\therefore E = 3000 \times 6 = 18000\ \text{Wh} = 18\ \text{kWh}$$

Cost of electricity per unit is Rs 5.20.
Hence, the total cost is

$$\text{Cost} = 18 \times 5.20 = \text{Rs. } 93.6$$

12. Ozone depletion generally refers to the process in which the ozone layer undergoes thinning continuously over a period of time.
The major cause of depletion of the ozone layer is the release of harmful chlorofluorocarbons such as methane and oxides of nitrogen into the atmosphere. These particles are released from vehicles, air conditioners etc. and produce active chlorine in the presence of UV rays. These rays destroy the ozone and thus cause ozone depletion.

OR

The accumulation or increasing concentration of a substance such as a toxic chemical in the body of living organisms at different trophic levels in a food chain is called biological magnification.
Yes, the concentration of these harmful chemicals will be different at different levels of the ecosystem. It will be maximum at the last trophic level which is mostly occupied by the top carnivores (quaternary consumers).

13. Plants require a specific pH range for their healthy growth. By using a large number of pesticides and fertilisers, pH of the soil changes which make it more acidic or basic. So, in the long run, the soil becomes infertile. This leads to soil erosion causing damage to the environment. So, the use of these pesticides and fertilisers should be restricted.
Fruits and vegetables should be washed properly before eating to wash off any pesticides, fertilisers or harmful chemicals or dust from the surface of the vegetable or fruit.
Associated value: Knowledge of science, awareness

14.

(a) Having two eyes has the following advantages over having just one eye:

i. Reduces the degree of parallax from our field of view

ii. Allows us to see farther into the distance with higher resolution

iii. Provides us with proper eyesight even if one of our eyes is damaged

iv. Gives organisms a wider field of view and depth perception

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

(c) If a person is wearing spectacles of power +1D, the lens has a positive focal length which indicates that he is wearing a convex lens. Hence, it can be concluded that that he is suffering from hypermetropia or long-sightedness.

For a person wearing spectacles of power −1 D, the lens has a negative focal length which indicates that he is wearing a concave lens. Hence, it can be concluded that he is suffering from myopia or short-sightedness.

15.

(a) It will not undergo any colour change because the solution of Na_2SO_4 (sodium sulphate) in water is almost neutral.

(b) Concentrated sulphuric acid is highly hygroscopic. It absorbs moisture from air and gets diluted. Since the volume increases, the acid starts flowing out of the bottle.

16.

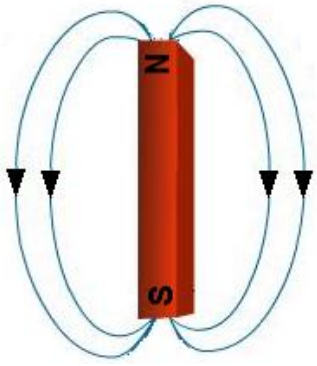
(a) The space around a magnet in which the force of attraction and repulsion due to the magnet can be detected is called the magnetic field. The direction of the magnetic field is taken to be the direction in which a North Pole of the compass needle moves inside it.

(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.

(b) Magnetic Field Lines



The magnetic field lines arise from its North Pole and complete a closed curved path at its South Pole.

(c) No, magnetic field strength varies at every point around it.
Magnetic field strength depends on the number of field lines per unit area.
If the field lines per area is more, then the magnetic strength in that area is strong, and if the field lines per area is less, then the magnetic strength is weak.
As the magnetic field lines per unit area is maximum at their poles, the magnetic strength is also maximum in that region.

17. From the electronic configuration, it is clear that the compound is calcium (Ca).

(a) Atomic number: 12

(b) Sodium is a metal.

(c) Mg, as it belongs to the same group as the element Calcium.

(d) The compound is sodium chloride $Ca(HCO_3)_2$which is also known as baking soda or baking powder.

(e) The compounds are calcium bicarbonate $Ca(HCO_3)_2$ which causes temporary hardness of water and calcium sulphate $CaSO_4$ which causes permanent hardness of water.

OR

(a) Modern Periodic Law states that the properties of elements are periodic functions of their atomic numbers.
The arrangement of elements in the modern periodic table is based on their electronic configuration. The elements are arranged in the order of increasing atomic numbers.
In increasing order of atomic number, hydrogen can be placed in group 1 with alkali metals as well as with halogens in 17^{th} group. Hence, its position is anamalous.

(b) Two compounds formed -
$X(NO_3)_2$, $X_3(PO_4)_2$
X belongs to 2^{nd} group
X will form ionic compound because it is a metal and the radicals are of non-metals.

18. Darwin's theory of evolution:

(a) Within any population, there is natural variation. Some individuals have more favourable variations than the others.

(b) Even though all the species produce a large number of offspring, populations remain fairly constant naturally.

(c) This is due to the struggle between members of the same species and different species for food, space and mates.

(d) Struggle for survival within populations eliminates unfit individuals. The fit individuals possessing favourable variations survive and reproduce. This is called natural selection.

(e) Individuals having favourable variations pass on these variations to their progeny from generation to generation.

(f) These variations when accumulated over a long period of time lead to the origin of a new species.

OR

(a) 1 → Style; 2 → Pollen tube; 3 → Polar nuclei; 4 → Embryo sac; 5 → Antipodal cells; 6 → Micropyle

(b) After fertilisation

- The ovary enlarges to form the fruit and the ovarian wall forms the fruit wall.
- The ovule becomes the seed.

(c) Synergids help in nourishing the egg cell, guiding the pollen tube towards the egg, proper functioning of the pollen tube and release of sperm nuclei.

(d) Pollen grain is transferred to the stigma during pollination. Germination of pollen grain takes place only if it falls on the stigma. After germination, the pollen tube grows through the stigma and reaches the ovary for the fertilisation of the egg cell.

19.

$2CH_3COOH + 2Na \rightarrow 2CH_3COONa + H_2$

C R

$CH_3COOH + CH_3OH \xrightarrow{\text{conc. } H_2SO_4} CH_3COOCH_3$

A S

$CH_3COOH + NaOH \rightarrow CH_3COONa + H_2O$

R

$CH_3COOCH_3 \xrightarrow{NaOH} CH_3COOH + CH_3OH$

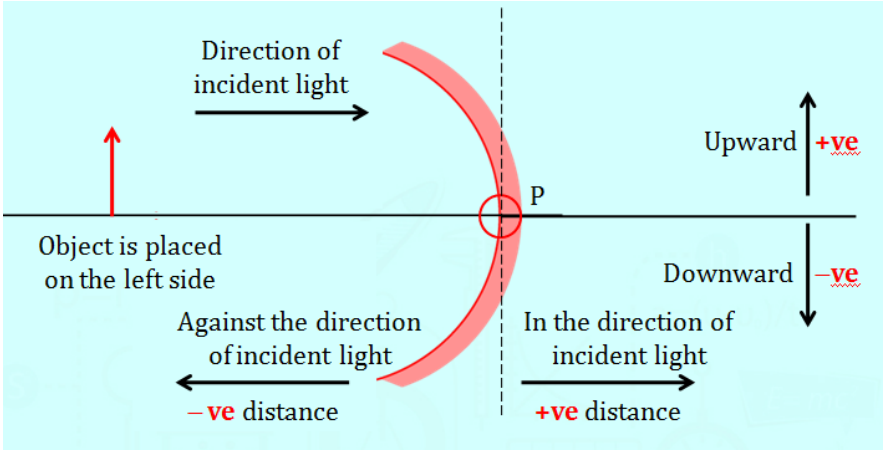
S R A

20.

(a) When you sleep with your mouth open, less air passes through the nasal passages. This is especially true when the nasal passages are plugged because you have a cold. As a consequence, air is not humidified and warmed. The dry air in turn dries the throat and the trachea, thereby irritating them.

(b) When a person breathes rapidly and deeply for several seconds, the carbon dioxide levels in the blood decrease and the blood pH increases. Carbon dioxide is an important regulator of respiratory movements. A decrease in blood CO_2 and an increase in blood pH result in a reduced stimulus to the respiratory centre. As a result, the respiratory movements stop until blood CO_2 level builds up again in the body fluid. This normally requires a short time.

21.



New Cartesian sign conventions for spherical mirrors:

(a) All the distances are measured from the pole (P) of the mirror as origin.

(b) Distances measured in the direction of the incident light are taken as positive measurements.

(c) While distances measured in the direction opposite to the direction of incident light are taken as negative measurements.

(d) Distances measured upward and perpendicular to the principal axis are taken as positive.

(e) Distances measured downward and perpendicular to the principal axis are taken as negative.

OR

(a) Argon or Neon gas is filled in electric bulbs.

These gases are used because they are inactive or inert. This prolongs the life of the filament.

(b)

The property of a conductor because of which it opposes the flow of current through it is called resistance. The resistance of a conductor depends on

(i) Length of the conductor: The resistance of a conductor is directly proportional to the length of the conductor.

(ii) Area of cross-section: The resistance of a conductor is inversely proportional to its area of cross-section.

(iii) Nature of the material of the conductor.

(iv) Temperature of the conductor: Resistance of all pure metals increases with temperature and *vice versa*.

The SI unit of resistance is ohm (Ω).

(c) Ohm's law: At a constant temperature, the current flowing through a conductor is directly proportional to the potential difference across its ends.

Section B

22. When copper metal is heated in air, it gets oxidised to form copper oxide.

$2Cu + O_2 \rightarrow 2CuO$

It is a redox reaction in which copper is oxidised to copper oxide and oxygen is reduced.

OR

We need to clean magnesium ribbon before burning it to remove the protective layer of basic magnesium carbonate which is formed by the reaction of magnesium with moist air.

The bright white light given out during the burning of magnesium ribbon is harmful to the eyes so, the magnesium ribbon is burned by keeping it as far as possible from the eyes.

23.

(a) When guard cells lose water, they shrink and become straight causing the stomatal pore to close.

(b) In monocots, the distribution of stomata on both lower and upper surfaces of the leaf is almost equal. In dicots, the number of stomata is more on the lower surface than on the upper surface of the leaf.

24. It will not undergo any colour change because the solution of Na_2CO_3 (sodium carbonate) in water is almost neutral.

25. Graph (i) is correct.

According to Ohm's law, the current flowing through the circuit is directly proportional to the voltage applied. So, $I \propto V$. That means if the graph does not begin from the origin, it is not correct.

26.

(a) During respiration, when oxygen breaks down the food in the form of glucose, lot of carbon dioxide is produced. As a result, the exhaled air which comes out after respiration contains a much higher proportion of CO_2.

(b) The proportion of nitrogen gas in inhaled as well as exhaled air remains the same (78%) because nitrogen is neither used up nor produced in respiration.

27. A concave lens is curved inwards and a parallel beam of light passing through it diverges. A convex lens bulges outwards and a parallel beam of light passing through it is focused to a single point.