Sample Paper

Max. Marks: 80 **Duration:3 hours**

General Instructions:

1. This question paper contains two parts A and B.
2. Both Part A and Part B have internal choices.

Part – A:

1. It consists of two sections- I and II
2. Section I has 16 questions. Internal choice is provided in 5 questions.
3. Section II has four case study-based questions. Each case study has 5 case-based sub-parts. An examinee is to attempt any 4 out of 5 sub-parts.

Part – B:

1. Question No 21 to 26 are Very short answer Type questions of 2 mark each,
2. Question No 27 to 33 are Short Answer Type questions of 3 marks each
3. Question No 34 to 36 are Long Answer Type questions of 5 marks each.
4. Internal choice is provided in 2 questions of 2 marks, 2 questions of 3 marks and 1 question of 5 marks.

Section-I

1. Identify A in the following reaction:

   $Zn + H_2SO_4 \rightarrow ZnSO_4 + A$

2. Give four characteristics of ionic compounds.

   The characteristics of ionic compounds are,

   - Ionic compounds are hard solids. They are brittle in nature.
   - They have a high melting and boiling point.

- They are generally soluble in water, but they do not dissolve in solvents like kerosene, petrol etc.

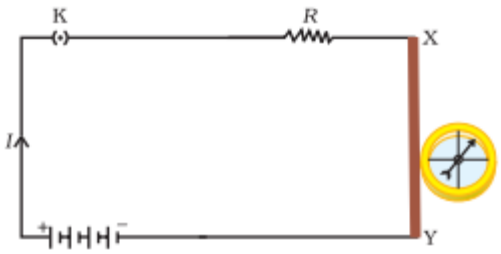
Ionic compounds conduct electricity in their molten/dissolved form. They do not conduct electricity in their solid form.

3. C_3H_8 belongs to the homologous series of _____.

(a) alkynes (b) alkenes

(c) alkanes (d) cycloalkanes

4. A magnetic compass is kept near an electric circuit as shown in the figure down below. The compass needle will



A. remain as it is when the current is allowed to pass through the circuit

B. get deflected when the current is allowed to pass through the circuit

C. deflect or remain stationary based on the direction of current

D. Both B and C

5. If 10^{10} electrons are removed from a neutral body, then what is the charge acquired by the body?

6. When the temperature of a pure metallic conductor is increased, then what happens to its resistance?

OR

Why is the filament of an electric bulb is made of tungsten?

7. An object is placed 40 cm from a concave mirror of focal length 20 cm. What is the position of the image?

8. Viraj assumed that like stars the planets also twinkle during the night. Is he correct?

9. In a nuclear reactor, what material used for making control rods?

OR

What is the temperature difference required up to a water level difference of 1000 m for operating an OTEC system?

10. The autotrophic mode of nutrition requires

(a) carbon dioxide and water (b) chlorophyll

(c) sunlight (d) All of these

11. Name the form in which the energy derived from the food is stored in humans.

OR

What is the information source for making proteins in the cell?

12. Which of the following belong to the same trophic level?

Tree, Crow, Lion, Grass, Deer

OR

In order to ensure that he had pure-breeding plants for his experiments, Mendel:

A. Cross-fertilized each variety with each other

B. Let each variety self-fertilize for several generations

C. Removed the female parts of the plants

D. Removed the male parts of the plants.

13. Name any two natural ecosystems and two artificial ecosystems.

14. In the following Questions, the Assertion and Reason have been put forward. Read the statements carefully and choose the correct alternative from the following:

Assertion: Nitrogen is a non-metal.

Reason: Nitrogen has 5 valence electrons.

A. Both the Assertion and the Reason are correct and the Reason is the correct explanation of the Assertion.

B. The Assertion and the Reason are correct but the Reason is not the correct explanation of the Assertion.

C. The Assertion is true but the Reason is false.

D. The statement of the Assertion is false but the Reason is true.

15. **Assertion:** Acquired trait cannot be passed on from one generation to next generation.

Reason: Acquired trait cannot change the DNA of the germ cells.

A. Both A and R are true and R is the correct explanation of the assertion.

B. Both A and R are true but R is not the correct explanation of the assertion.

C. A is true but R is false.

D. A is false but R is true.

16. **Assertion:** Starch starts to break down as soon as we eat and start to chew the bread.

Reason: Crushing action of teeth helps Ptyalin containing saliva to spread over the chewed food.

A. Both A and R are true and R is the correct explanation of the assertion.

B. Both A and R are true but R is not the correct explanation of the assertion.

C. A is true but R is false.

D. A is false but R is true.

17. Answer question numbers 17 (i) - 17 (v) on the basis of your understanding of the following paragraph and the related studied concepts.

The most obvious outcome of the reproductive process still remains the generation of individuals of similar design. The rules of heredity determine the process by which traits and characteristics are reliably inherited.

17.(i) Which type of reproduction would give rise to exact copies of parents?

17.(ii) The visible characteristic in an organism is known as:

A. Prototype

B. Stereotype

C. Phenotype

D. Genotype

17.(iii) A plant with two 'small' genes breeds with a plant with two 'tall' genes to produce:

A. Small plants and tall plants in the ratio 1:3

B. All small plants

C. All tall plants

D. Tall plants and small plants in the ratio 3:1

17.(iv) What are the “Factors” that Mendel talked about in his experiment?

A. RNA Fragments

B. Protein chains

C. Similar forms of single gene

D. Contrasting forms of single gene

17.(v) Offspring formed as a result of sexual reproduction exhibit more variations because

A. Sexual reproduction is a lengthy process

B. Genetic material comes from a single parent

C. Genetic material comes from two parents of different species

D. Genetic material comes from many parents

18. Answer any four questions from question numbers 18(i) - 18(v) on the basis of your understanding of the following paragraph and the related studied concepts.

The modern periodic table is used to organise all the known elements. Elements are arranged in the table by increasing atomic number. Atomic numbers increase from left to right and from top to bottom in the table. Rows of the periodic table are called periods.

a 3	b 4		c 5	d 6	e 7	f 8	g 9	h 10
i 11	j 12		k 13	l 14	m 15	n 16	o 17	p 18

The following diagram shows a part of the periodic table in which the elements are arranged according to their atomic numbers. (The letters given here are not the chemical symbols of the elements):

18.(i) Which element has a bigger atom, a or f?

18.(ii) Which element has a higher valency, k or o?

18.(iii) Which element is more metallic, i or k?

18.(iv) Which element is more non-metallic, d or g?

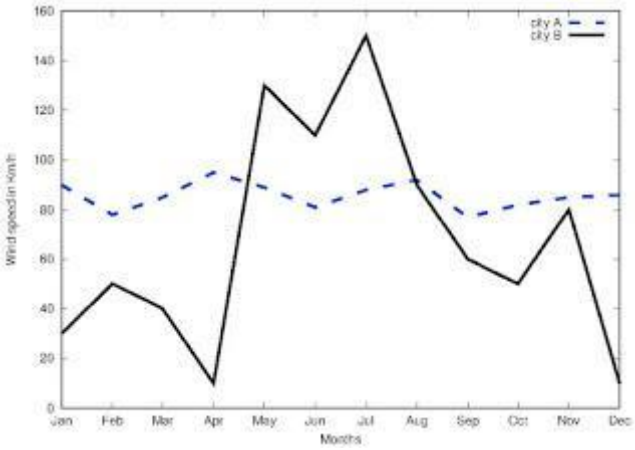
18.(v) Which of the following elements have a noble gas configuration?

19. Answer any four questions from question numbers 19(i) - 19(v) on the basis of your understanding of the following paragraph and the related studied concepts

Renewable energy sources such as wind energy are vital for the Indian economy, not only from the point of view of supply, but also from the perspective of environmental and social benefits. India is the world's fifth largest wind-power producer and the largest windmill facilities in India am installed in Tamil Nadu Muppandal is a small village of Tamil Nadu and one

of the most important sites of wind-farm in the state. It uses wind from the Arabian Sea to produce renewable energy The suitability of Muppandal as a site for wind farms stems from its geographical location as it has access to the seasonal monsoon winds

The electncal generators used on wind turbines in sites like Muppandal, produce an output AC of 240 V and a frequency of 50 Hz even when the wind speed IS fluctuating. A transformer may be required to increase or decrease the voltage so it is compatible with the end usage, distribution or transmission voltage, depending on the type of interconnection



19(i) State the principle behind electric generator.

19(ii) The output frequency of wind turbine is 50 Hz. What is meant by this statement?

19(iii) Why do you think Muppandal is at an advantageous position for this project?

19(iv) Based on the data represented in the graph below, which of the two cities A or B would be an ideal location for establishing a wind-farm and why?

19(v) How do wind turbines generate electricity?

20. Answer any four questions from question numbers 20(i) - 20(v) on the basis of your understanding of the following paragraph and the related studied concepts

Fossil fuels are non-renewable sources of energy. If the demand for energy continues to increase even at the present rate, these might not last for long. To prevent energy crisis in near future, efforts are being

made to find more and more sources of energy, preferably the renewable sources of energy. Sun emits visible, infrared and small amount of ultraviolet radiations. Visible radiation gives light energy and infrared radiation gives heat energy. The combination of light and heat energies of the sunlight have been used for its utilization. Under clear sky conditions, 4-7 kW solar energy falls on one km^2 area in a day. Our country has 250-300 sunny days in a year. Thus, India can harness energy of about 2 MW/km^2 per year through the use of solar technology.

20(i) What term will you give to the combination of light and heat energy as mentioned in the passage:

A. Solar energy

B. Geothermal energy

C. Nuclear energy

D. None of these

20(ii) Name any two devices, through which India make use of solar energy.

20(iii) Which rays emitted by sun can cause harmful effects to the living organisms on earth?

20(iv) Identify any one way by which the radiations from sun has caused harm to us?

20(v) Which one of the following cannot be employed in utilizing solar energy?

A. Water Heater

B. Rainwater Harvesting

C. Solar Cooking

D. Photovoltaic cell

Section-II

21. What is the function of prostate glands and seminal vesicles?

OR

What is the function of pancreas in the human digestive system?

22. Why do fishes die when taken out of water?

23. The pH of an aqueous solution of potassium hydroxide at 298 K temperature is 11.65. The initial volume of this solution is made diluted 6 times by the addition of water. What will be the pH of the diluted solution?

OR

Identify the oxidising agent (oxidant) in the following reactions: (2)

(i) $V_2O_5 + 5Ca \rightarrow 2V + 5CaO$

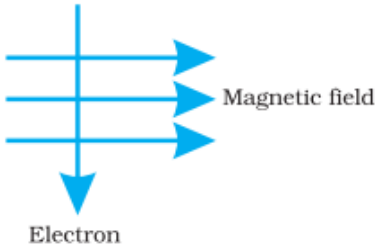
(ii) $3Fe + 4H_2O \rightarrow Fe_3O_4 + 4H_2$

24. (a) In the following set of elements, one element does not belong to the set. Select this element and explain why it does not belong: Magnesium, Sodium, Beryllium, Calcium (1)

(b) Give any two limitations of Newland's law of octaves? (1)

25. Determine the resistance of a hollow cylindrical copper conductor of length 10m and inner and outer radius as 2cm and 3cm.

26. An electron enters a magnetic field at right angles to it, as shown in the figure. What is the direction of force acting on the electron?



Section-III

27. Why is transpiration important for plants?

OR

Why did Mendel choose the pea plant for his experiments?

28. Why does bread mold grow profusely on a moist slice of bread rather than on a dry slice of bread?

29. Why are biodegradable substances considered better than non-biodegradable ones?

30. What is meant by corrosion? How corrosion is caused? How can it be prevented? What is the effect of corrosion on

(a) Copper? (b) Silver?

31. (a) Mention the formula, name and physical state of the products of following reactions:

1. $CO_2(g) + H_2O(l)$ 2. $Li_2O(s) + H_2O(l)$

3. $H_2SO_4(aq) + 2KOH(aq)$

32. Define the following: (1×3)

(a) Amalgam (b) Ore

(c) Mineral

33. An object 5 cm in length is placed at a distance of 20 cm in front of a convex mirror of radius of curvature 30 cm. The position of the image, its nature and size respectively is

Section-IV

34. An element Y is in the second period and group 16 of the periodic table: **(1×5)**

(i) Is it a metal or nonmetal?

(ii) What is the number of valence electrons in its atom?

(iii) What is its valency?

(iv) What is the name of the element?

(v) What will be the formula of the compound formed by Y with sodium?

OR

Equal length of magnesium ribbon is taken in two test tubes 'A' and 'B. H_2SO_4 is added to test tube 'A' and H_2CO_3 in the test tube 'B' in equal amounts:

(a) Identify the test tube showing a vigorous reaction.

(b) Give a reason to support your answer.

(c) Name the gas liberated in both the tubes. How will you prove its liberation?

(d) Write chemical equations for both reactions.

(e) Out of the two acids taken above

(i) which one will have lower pH value.

(ii) lower H^+ concentration respectively.

35. Describe the flow of blood through the heart of human beings with the help of a labelled diagram.

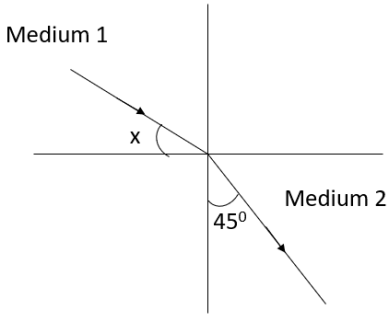
36. (a) The domestic electric supply of a house is through a 15 A fuse. Along with a 2000 W heater, how many 100 W bulbs can be used simultaneously in the house without causing overload? The domestic supply is 220 V and all appliances are rated for 220 V.

(b) What is meant by one cycle of alternating current?

(c) In a typical lightning strike, 2.5 C flows from the cloud to the ground in 0.20 milli-seconds. What is the current during the strike?

OR

(a) The figure shows a ray of light as travels from medium 1 to medium 2. If reflective index of medium 1 with respect to medium 2 is $\sqrt{2}/\sqrt{3}$, then what is the value of angle x?



(b) If the refractive indices for water and diamond relative to air are 1.33 and 2.4 respectively, then what is the refractive index of diamond relative to water?

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Hints & Solutions

Section-I

1. Solution : Hydrogen gas is usually liberated when an acid reacts with a metal.

   For example: When Zinc granules react with dilute Sulphuric acid, then hydrogen gas is liberated and Zinc Sulphate solution is formed.

   The evolved hydrogen gas can be tested by taking a burning candle near gas-filled bubbles. If the candle burns with a pop sound, it confirms the evolution of hydrogen gas.

   OR

   Solution: The colour of litmus paper changes only in the presence of ions like hydrogen (H^+) or hydronium (H_3O^+) ions.

   - HCl can produce these ions only in the form of an aqueous solution.
   - Hence dry HCl gas does not change the colour of dry litmus paper

2. Solution : The characteristics of ionic compounds are,

   - Ionic compounds are hard solids. They are brittle in nature.
   - They have a high melting and boiling point.
   - They are generally soluble in water, but they do not dissolve in solvents like kerosene, petrol etc.
   - Ionic compounds conduct electricity in their molten/dissolved form. They do not conduct electricity in their solid form.

3. Answer: C

   C_3H_8 belongs to the homologous series of alkanes

4. Answer: B

   Solution: An electric current-carrying wire behaves like a magnet. The compass needle is deflected on passing an electric current through a metallic conductor. This phenomenon describe the magnetic effect produced by electric current. Thus we can say that electricity and magnetism are linked to each other.

5. Solution: The charge always occurs in integral multiples of the fundamental charge:

$$Q = ne$$
$$Q = 10^{10} \times 1.6 \times 10^{-19} = +\ 1.6 \times 10^{-9}\ C$$

Since, the charge is moved, there is a loss of electron. Hence a positive sign.

6. Solution: When the temperature of a pure metallic conductor is increased, the resistance of the conductor also increases. The resistance of a pure metallic conductor is directly proportional to the change in the temperature.

OR

The filament of the bulb is made of tungsten because its melting point is high. An element with a high melting point will withstand high range of temperature without melting. Consequently, the bulb will function adequately.

7. Solution:

The object is placed at 40 cm i.e. $R = 2f \Rightarrow 2 \times 20 = 40$ cm.

The nature of the image formed is real, inverted and of the same size as the object when the object is placed at the center of curvature of the mirror.

8. Solution:

Unlike stars, the planet is not situated at a very large distance from the planet. Therefore, it cannot be considered as a point source instead of an extended source. A large number of rays originated from the surface of the planets enters the earth's atmosphere, gets refracted. The resulting refraction nullifies each other's effect, and thus the average intensity of the light rays coming from the planets are constant. Hence no twinkle.

9. Solution: The elements used to make control rods are cadmium and boron. The function of control rods is to control the rate of fission reaction occurring in the nuclear power plant.

OR

A plant where electricity is created from this source is called as OTEC- ocean thermal energy conversion plant. The minimum temperature difference required for an OTEC to function is 20°

10. Answer: D

    Solution: The autotrophic mode of nutrition requires CO_2, H_2O, sunlight and chlorophyll in higher plants as a requisite for photosynthesis.

11. Answer: Chemical energy (ATP).

    OR

    Answer: Gene or DNA (Deoxyribonucleic Acid)

12. Answer: Tree and Grass belong to the same trophic level (Producers). Deer is an herbivore; Crow is an omnivore; while the Lion is the top consumer.

    OR

    Answer: B
    Solution: Letting plants undergo self-fertilization for many generations led to homogeneity in the genes of the plants and led to production of pure-lines or pure homozygous plants.

13. Answer: Natural Ecosystems - Grassland and Forests

    Artificial Ecosystems - Aquariums and Parks

14. Answer: B

    Explanation:

    (b) The Assertion and the Reason are correct but the Reason is not the correct explanation of the Assertion.

15. Answer: A

    Solution: Acquired traits are those traits that the individual attain during his/her lifetime. For example, deposition of fat and bulk of muscles in the body is acquired through lifestyle changes and can be modified during the person's lifetime as well. This is because these traits do not alter the genes and hence cannot be passed to the next generation.

16. Answer: B

Solution: Breakdown of starch in the mouth is the function of salivary amylase or Ptyalin. Chewing helps in spreading the food so that the amylase can work efficiently. Both the statements are correct but the reason is not the correct explanation of the assertion.

17(i) Answer: Asexual Reproduction

17(ii) Answer: C

Solution: Phenotype constitutes the visible characteristics of an individual which occur from the interaction of its genotype with the environment.

17(iii) Answer: C

Solution: When two small genes plant 'tt' breeds with two tall genes plant 'TT' they result in four combinations of all 'Tt' genes, where T is dominant and it suppresses the recessive gene t; so all the plants will be tall.

17(iv) Answer: D

Solution: "Factors" or Alleles, as they were known later on, are the contrasting forms of a single gene that may contribute to two or more different traits of a character.

17(v) Answer: C

Solution: In sexual reproduction, offspring has lot of variation because DNA of both individuals (male and female) get combine. Due to lot of variations, sexual reproduction allows species to change to more advanced forms from one generation to the next and speed up evolution.

18.(i) Solution: (i) A has a bigger atom because when we move left to right the size of the atom decreases.

18.(ii) Solution: (ii)The valency of o element is 1 and k element is 3.

18.(iii) Solution: (iii) When we move from left to right the metallic character decreases, so element i is more metallic.

18.(iv) Solution: (iv) When we move left to right in the period then the non-metallic character increases, so element g is more non-metallic.

18.(v) Solution: h and i are the elements which are noble.

19.(i) Solution: The principle behind electric generator is Electromagnetic Induction- the phenomenon of producing current in a coil by changing the magnetic field associated with it

19(ii) Solution: The polarity of the output alternating current changes every 1/100 seconds. OR In 1 second the output (AC) completes 50 cycles

19(iii) Solution: The suitability of Muppandal as a site for wind farms sterns from its geographical location as it has access to the seasonal monsoon winds

19(iv) Solution: City A. It is more suitable for a wind-tans as there is consistently high wind-speed in that city throughout the year

19(v) Solution: In wind turbines, winds rotate the blades of the turbine, which are mounted on a shaft. The shaft rotates an electric generator and generates electricity.

20.(i) Answer: A

Solution: Solar energy consists of sun rays which contain both light and heat energy

20(ii) Name any two devices, through which India make use of solar energy.

Solution: Solar cooker and solar panel/solar cell

20(iii) Solution: Ultraviolet rays are harmful for living organisms

20(iv) Solution: Deforestation due to forest fires/ CFC gases released from refrigerator and AC break down ozone layer in presence of ultraviolet radiations from sun.

20(v) Answer: B

Solution: Rainwater harvesting cannot utilize solar energy.

Section-II

21. Answer: The secretions of seminal vesicle and prostate gland provides fluid medium and nutrition to the sperms to make their transport easy.

OR

Answer: Pancreas secrete insulin, glucagon and pancreatic juice. Insulin and glucagon function to control the blood sugar levels of

our body. The pancreatic enzymes help in digestion of protein, fat and carbohydrates present in the food.

22. Answer: Fishes do not have lungs which can take oxygen from air. Hence, they die when taken out of water. They have gills which can only take oxygen dissolved in water.

23. Solution:

(a) pH = 11.65

Therefore, pOH = 14 – 11.65 = 2.35

Using, $pOH = -\log_{10}[OH^-]$

Putting the value of pOH in above equation:

$2.35 = -\log_{10}[OH^-]$

$\log_{10}[OH^-] = -2.355$

$\log_{10}[OH^-] = -3 + 0.65$

$\log_{10}[OH^-] = + 0.65$

$[OH^-] = \text{antilog}_{10}[0.65]$

$[OH^-] = 4.46 \times 10^{-3}$

Now if volume is made diluted 6 times then the concentration will decrease 6 times. So the new concentration is $= 4.46\times 10^{-3}/6$

$= 7.44 \times 10^{-4}$

So new $pOH = -\log_{10}[OH^-]$

$= -\log_{10}[7.44 \times 10^{-4}]$

$= 4-\log_{10}[7.44]$

$= 4- 0.871$

$= 3.129$

Therefore, new pH is 14 – 3.129 = 10.871

OR

Solution: Oxidising agent: An oxidising agent is an element that gains electrons. Since the oxidizing agent means to gain electrons; it is said to have been reduced.

The element which undergoes reduction (gets reduced) is called an oxidising agent.

(i) V_2O_5 is oxidising agent

$V_2O_5 + 5Ca \rightarrow 2V + 5CaO$

In the given reaction, V_2O_5 is reduced to V by losing oxygen atoms. Thus, V_2O_5 is an oxidizing agent as it undergoes reduction.

(ii) H_2O is an oxidising agent

$3Fe + 4H_2O \rightarrow Fe_3O_4 + 4H_2$

In the given reaction, H_2O is reduced to H_2 by losing oxygen atoms. Thus, H_2O is an oxidizing agent as it undergoes reduction.

24. Solution: (a) In the above elements sodium does not belong to this group because Sodium belongs to the group of alkali metals and the rest three belong to the alkaline earth metals group.

(b) Limitations of Newland's law of octaves are listed as below:

(i) This law was applicable only for lighter elements. It did not hold true for the classification of elements after calcium. After calcium, not every eighth element has properties similar to the first element.

(ii) He thought that only 56 elements existed in nature and that no more would ever be discovered. However, later many new elements were discovered and their properties did not fit into Newland's law of octaves.

He put two elements in one slot even in the column of unlike elements having different properties. For example, he put cobalt Cobalt(Co) and nickel (Ni) in a single slot with elements like fluorine, chlorine and bromine with which their properties do not match at all.

25. Solution: The resistance of a conductor is given as

$$R = \frac{\rho l}{A}$$

$$R = \frac{\rho l}{A} = 2 \times 10^{-8} \times \frac{10}{\pi\left[\left(\frac{3}{100}\right)^2 - \left(\frac{2}{100}\right)^2\right]} = \frac{2}{5\pi} \times 10^{-3}\ \Omega$$

26. Solution: The direction of force is perpendicular to the direction of magnetic field and current as given by Fleming's left hand rule. We know that the direction of current is taken opposite to the direction of motion of electrons. The force is therefore directed into the page.

Section-III

27. Answer: The loss of water in the form of vapour from the aerial parts of the plant is known as transpiration. Transpiration helps in the upward movement of water and dissolved minerals from the roots to the leaves through the stem. Moreover, transpiration is a way through which plants get rid of excess water. So, transpiration is important for plants.

OR

Answer: Mendel chose pea plant for his experiments due to following reasons:

(a) Pea plant was easy to cultivate and had a short life span, hence faster generation of progenies.

(b) Presence of contrasting variations in features (7 contrasting characteristics)

(c) Carrying out cross pollination is quite easy in a pea plant by cutting the stamen at an early stage in the bisexual flowers of Pea.

28. Answer: Moisture is necessary for the growth of bread mold. The bread mold grows profusely on moist slices of bread because it provides both moisture and nutrients for growth. The dry slice of bread provides nutrients but no moisture. So, bread mold does not grow on the dry slice of bread.

29. Answer: 1. Biodegradable substances are those which can be degraded or broken down with the help of biological processes whereas biodegradable substances cannot be broken down with the help of biological processes into organic substances.

2. Biodegradable substances are friendly to the environment as they don’t provide any harm to the environment whereas non-biodegradable substances are not environment friendly and can prove hazardous to nature.

3. Examples of biodegradable substances are paper, fruit peels, cloth bags etc. Examples of non-biodegradable substances are: plastic cans, glass and polybags.

30. Solution: Corrosion refers to the destruction or deterioration of a substance due to its interactions with the surrounding environment. Corrosion is a natural process and occurs when the substance is in contact with air, water, chemicals like acid etc. Corrosion can damage metals causing it to lose properties such as strength and conductivity of heat/electricity.

    Corrosion can be prevented by various techniques like painting the surface of the material, galvanizing, oiling, greasing etc.

    (a) Copper when in contact with moist carbon dioxide in air gains a green coloured coat over copper. This coat is nothing but copper carbonate formed by the reaction of copper and moist carbon dioxide.

    (b) Silver reacts with the sulphur present in the air to form a black coating of silver sulphide over the surface of the silver.

31. Solution:

    (a) 1. $CO_2(g) + H_2O(l) \rightarrow H_2CO_3$ (aq)

    (Carbonic acid)

    2. $Li_2O(s) + H_2O(l) \rightarrow 2LiOH$ (aq)

    (Lithium hydroxide)

    3. $H_2SO_4(aq) + 2KOH(aq) \rightarrow K_2SO_4$ (aq) + $2H_20(l)$

    (Potassium Sulphate)

32. Solution: (a) An alloy of mercury with another metal is called amalgam.

    (b) Mineral which contains a very high percentage of metal and from which the metal can be economically extracted is called an ore.

    (c) An element or compound which occurs naturally in the earth's crust is called a mineral.

33. Solution:

    H_o = 5 cm, u =-20 cm, R = 30 cm

    Now,

$$f = \frac{R}{2} = \frac{30}{2} = 15 \text{ cm}$$

    According to mirror formula,

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

$$\frac{1}{v}+\frac{1}{-20}=\frac{1}{15}$$

$$\frac{1}{v}=\frac{1}{15}+\frac{1}{20}=\frac{20+15}{300}=\frac{35}{300}$$

$$v=\frac{300}{35}=\frac{60}{7}=+8.57\ \text{cm}$$

The position of the image is at a distance of 8.57cm from the pole of the mirror behind the mirror (as v is positive). The image is virtual and erect and smaller in size.

According to the magnification formula.

$$m=\frac{h'}{h}=-\frac{v}{u}=0.42$$

$$h'=0.42\times 5=2.14\ \text{cm}$$

Section-IV

34. Solution :

(i) This element is surely non-metal because metals are represented in the left side of the periodic table.

(ii) Its electronic configuration is (2,6), so it has 6 valence electrons.

(iii) It has 6 electrons in its valence shell therefore the valency is 2.

(iv) The element with the configuration (2,6) is Oxygen.

(v) The formula with sodium is Na_2Y.

OR

Solution:

(a) A will show a vigorous reaction.

(b) It is because H2SO4 is a strong acid.

(c) Hydrogen gas will be formed. Bring a burning splinter near the gas. It will burn with a 'pop' sound. It shows gas liberated is hydrogen.

(*d*) $Mg + H_2SO_4 \longrightarrow MgSO_4 + H_2$

$Mg + H_2CO_3 \longrightarrow MgCO_3 + H_2$

(*e*) 'A' (H_2SO_4) will have lower pH.

'B' (H_2CO_3) will have lower concentration of H^+

35. Answer: Following steps are included in the flow of blood through the heart of human beings:

(i) The pulmonary vein brings the oxygenated blood from the lungs in the left atrium of the heart.

(ii) Left atrium contracts and pumps blood into the left ventricle through the bicuspid valve.

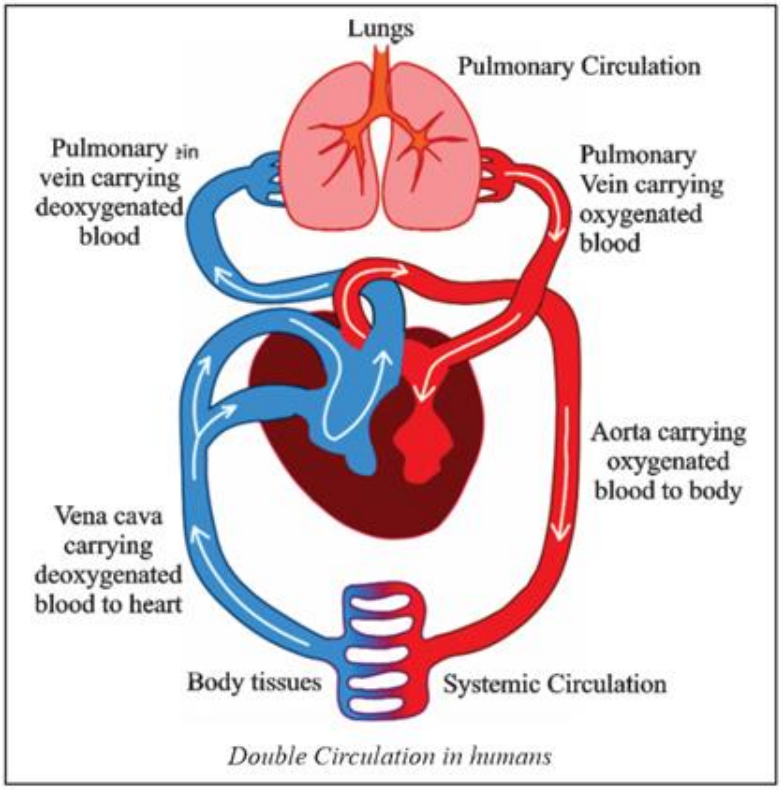
(iii) When the left ventricle contracts, the oxygenated blood enters the main artery called aorta. The blood travels from the main artery to larger and smaller arteries into the capillary network.

(iv) The aorta transports the blood to all the organs of the body **(Systemic Circulation).** The oxygenated blood releases oxygen, nutrients and other substances and takes on carbon dioxide and waste substances. The deoxygenated blood enters the vena cava which carries it to the right atrium of the heart.

(v) Right atrium pumps deoxygenated blood into the right ventricle through the tricuspid valve.

(vi) When the right ventricle contracts, the deoxygenated blood enters the lungs **(Pulmonary Circulation)** through the pulmonary artery and releases carbon dioxide and absorbs fresh oxygen from air. The blood becomes oxygenated again and is sent to the left atrium of the heart by the pulmonary vein for circulation in the body.

This whole process of double circulation of blood is repeated continuously.



36. Solution:

(a) The current through the heater can be calculated as

$$I = \frac{P}{V} = \frac{2000}{220} = \frac{100}{11}$$

Now the current rating through one bulb can be calculated in a similar way

$$i = \frac{P}{v} = \frac{100}{220} = \frac{5}{11}A$$

Now if there are n bulbs, then for the fuse the total current should be

$$15 = I + ni$$

$$15 = \frac{100}{11} + n\frac{5}{11}$$

$$15 \times 11 - 100 = 5n$$

$$n = \frac{165 - 100}{5} = 13$$

Therefore, a total of 13 bulbs can be used simultaneously.

(b) In one cycle, the current flow from the zero to positive maximum, then from positive maximum to zero again followed by going from zero to negative maximum and negative maximum to zero. Thus, completing the one complete cycle.

(c) The expression for the current during the strike is given by

$$I = \frac{q}{t}$$

Substituting the values in the above equation as

$$I = \frac{2.5}{0.2 \times 10^{-3}}$$

$$I = 12500\ A$$

Thus, the current during the strike is approximately equal to 12.5 kA

OR

Solution:

(a) Let n_1 and n_2 be the refractive indices of the mediums, then from Snell's law

$$n_1 \sin i = n_2 \sin r$$

$$\frac{n_1}{n_2}\sin x = \sin 45°$$

$$\frac{\sqrt{2}}{\sqrt{3}}\sin x = \frac{1}{\sqrt{2}}$$

$$\sin x = \frac{\sqrt{3}}{2}$$

$$x = 60°$$

(b) The absolute refractive index of water and air is 1.33 and 2.4 respectively.

Refractive index of Diamond with respect to water (relative refractive index):

$$n_{DW} = \frac{2.4}{1.33} = 1.80$$

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