# 1ˢᵗ Prelim - Model Answer Paper   | Red 1 |

**Time : 2 Hrs.**      **Science and Technology (Part 1)**      **Marks : 40**
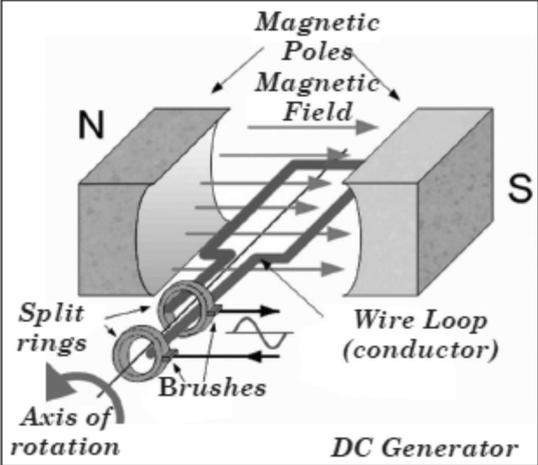
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|---|---|---|
| **A.1.** | **(A)  Write the correct alternative.** | |
| 1. | Heat is measured in **Joule and Calorie**. | **1** |
| 2. | The reason for the twinkling of stars is **changing refractive index of the atmospheric gases**. | **1** |
| 3. | The structural formula belongs to **Benzene** carbon compound. | **1** |
| 4. | The distance of distinct vision for normal human eye is **25 cm**. | **1** |
| 5. | **Tinning** is the process to be carried out to avoid the formation of greenish layer on brass vessels due to corrosion. | **1** |
| | | |
| **A.1.** | **(B)  Answer the following question.** | |
| 1. | Calcium. It belongs to the 4ᵗʰ period while others belongs to the third period. | **1** |
| 2. | NiO undergoes reduction to form Ni. | **1** |
| 3. | Calorimeter | **1** |
| 4. | Propan – 2 – ol | **1** |
| 5. | 1. - (b), 2. - (c) | **1** |
| | | |
| **A.2.** | **(A)  Give scientific reasons.** | |
| 1. | i.   In the process of dilution of concentrated sulphuric acid with water, very large amount of heat is liberated. | **2** |
| | ii.  As a result, water gets evaporated instantaneously, if it is poured into the concentrated sulphuric acid, it may cause an accident. | |
| | iii. To avoid this, required amount of water is taken in a glass container and small quantity of concentrated sulphuric acid at a time is added with constant stirring and only small amount of heat is liberated. | |
| | iv.  Therefore, concentrated sulphuric acid is added slowly to water with constant stirring. | |

| | | | |
|---|---|---|---|
| 2. | i. | Electric equipments producing heat make use of heating effect of electric current. | 2 |
| | ii. | Electrical conductors having higher resistivity are used here. | |
| | iii. | Nichrome is an alloy has a higher resistivity than pure metals. | |
| | iv. | Hence, nichrome is used to get higher amount of heat. | |
| 3. | i. | Carbon dioxide present in moist air reacts with the surface of copper vessel. | 2 |
| | ii. | Due to which, a greenish layer of copper carbonate ($CuCO_3$) gets formed on its surface and copper looses its lustre. | |
| | iii. | Lemon or tamarind is used for cleaning them because, the acid present in them dissolves the green coloured basic copper carbonate present on the corroded copper vessels and makes them look shiny. | |

**A.2.** **(B)** **Answer the following questions:**

1. i. The formula to find the maximum electron capacity of shell is $2n^2$ Therefore the maximum number of electrons that can be accomodated in a shell is 32 i.e. for N shell n = 4, $2n^2 = 2(4)^2 = 2 \times 16 = 32$  **2**

ii.

| Shell | n | $2n^2$ | Electron capacity |
|---|---|---|---|
| K | 1 | $2 \times 1^2$ | 2 |
| L | 2 | $2 \times 2^2$ | 8 |
| M | 3 | $2 \times 3^2$ | 18 |

2.

| AC generator | DC generator | |
|---|---|---|
| i. In AC generator, current flows out in different directions. | i. In DC generator, current flows out in the same direction. | **2** |
| ii. It converts mechanical energy into electrical energy in the form of alternating current. | ii. It converts mechanical energy into electrical energy in the form of direct current. | |
| iii. In AC generator, the rings used are not split rings. | iii. In DC generator, the rings used are split rings. | |
| iv. In AC generator, the coil changes its direction after every half rotation. | iv. In DC generator, the coil rotates continously in the same direction. | |

| | | | |
|---|---|---|---|
| 3. | (a) | Satellite carrying signals for telephone, television, radio etc. | 2 |
| | (b) | Height = 2000 km to 35780 km | |
| | (c) | International Space Station and Hubble telescope. | |

| 4. | i. | **Free fall:** Whenever an object moves under the influence of the force of gravity alone, it is said to be falling freely. Such a fall is called free fall. | 2 |
| | ii. | **Acceleration due to gravity:** The acceleration which is gained by an object because of the gravitational force is called its acceleration due to gravity. | |

| 5. | Given: Power = +1.5 D | 2 |

To find: Focal length, Type of lens and Defect of the eye

Soln.: $\text{Power} = \dfrac{1}{f \text{ (in meter)}}$

$+ 1.5 = \dfrac{1}{f}$

$\therefore \quad f = \dfrac{1}{1.5}$

$\therefore \quad f = \dfrac{1}{1.5} \times 100 \text{ cm}$

$\therefore \quad f = + 66.67 \text{ cm}$

$\therefore \quad f = + 0.67 \text{ m}$

Type of lens = Convex lens

Defect in eye = Hypermetropia or farsightedness

**A.3.** **Attempt the following questions.**

1. While going down a **group** a new shell gets added, resulting in an increase in the **distance** between the nucleus and the **valence electrons**. This results in **lowering** the effective nuclear charge and thereby lowering the **attractive force** on the valence electrons. As a result of this, the tendency of the atom to **lose** electrons increases. Those elements, which have a tendency to lose their valence electrons and form **positive** ions are considered as **metals**. Hence, metallic character **increases** down the group. — **3**

2. 

| No. | Name | Structural formula | Examples |
|-----|------|--------------------|----------|
| 1. | Halo (chloro/bromo /iodo) | $- X$ $(- Cl, - Br, - I)$ | $CH_3 - Cl$ Chloromethane, $CH_3 - Br$ Bromomethane, $CH_3 - I$ Iodomethane |
| 2. | Alcohol | $- O - H$ | $CH_3 - H_2C - OH$ Ethanol |
| 3. | Amines | $- N - H$ $\quad \vert$ $\quad H$ | $H_3C - NH_2$ Methanamine |

— **3**

| | | | |
|---|---|---|---|
| 3. | i. | In general, when a liquid is heated upto a certain temperature, it expands, and when cooled it contracts. | 3 |
| | ii. | Water, however, shows a special and exceptional behaviour. If we heat water from $0^oC$ upto $4^oC$, it contracts instead of expanding. As shown in graph, volume decreases from $0^oC$ to $4^oC$. | |
| | iii. | At $4^oC$ its volume is minimum. It means that the density of water is maximum at $4^oC$. | |
| | iv. | If water is heated further, it expands and its volume increases. As shown in graph, volume increases from $4^oC$ onwards. | |
| | v. | The behaviour of water between its temperature from $0^oC$ to $4^oC$ is called anomalous behaviour of water. | |
| 4. | i. | Since, the focal length is positive, convex lens is used in her spectacles. | 3 |
| | ii. | Surabhi is suffering from Hypermetropia or farsightedness. | |
| | iii. | Focal length (f) = $\dfrac{1}{\text{Power (P)}} = \dfrac{1}{0.5} = 2$ m | |

5. Both the images shows the ways of prevention of corrosion :   **3**
**i. Anodizing**      **ii. Electroplating**
i. (a) In anodizing, metals like copper, aluminium are coated with a thin and strong layer of their oxides by means of electrolysis.
   (b) For this the copper or aluminium article is used as anode.
   (c) As this oxide layer is strong and uniform all over the surface, it is useful for prevention of the corrosion of the metal.
ii. (a) In electroplating, a less reactive metal is coated on a more reactive metal by electrolysis.
   (b) Silver plated spoons, gold plated ornaments are the examples of electroplating.

6. In 1$^{st}$ Case, r = d and F = $x$   **3**

We know, F = $\dfrac{GMm}{r^2}$

$\therefore$   $x = \dfrac{GMm}{d^2}$   ........ (i)

In 2$^{nd}$ Case, r = 2d

F = $\dfrac{GMm}{r^2} = \dfrac{GMm}{(2d)^2} = \dfrac{GMm}{4d^2}$

$\therefore$   F = $\dfrac{1}{4}\dfrac{GMm}{4d^2} = \dfrac{1}{4}x$   [from eqn. (i)]

$\therefore$   F = $\dfrac{x}{4}$

| | | |
|---|---|---|
| 7. | Given: Mass of the planet $(M_P)$ = 8 × Mass of the earth $(M_E)$<br>Radius of the planet $(R_P)$ = 2 × Radius of the earth $(R_E)$<br>To find : Escape velocity $(V_{esc_P})$ of the planet.<br><br>Formula: $V_{esc_P} = \sqrt{\dfrac{2GM_P}{R_P}}$<br><br>Soln. $V_{esc_P} = \sqrt{\dfrac{2GM_P}{R_P}} = \sqrt{\dfrac{2G8M_E}{2R_E}}$<br><br>$= \sqrt{\dfrac{8}{2}} \times \sqrt{\dfrac{2GM_E}{R_E}} = \sqrt{4} \times V_{esc_E}\ \left(\because V_{esc_E} = \sqrt{\dfrac{2GM_E}{R_E}}\right)$<br><br>$= 2 \times 11.2\ \text{km/s}\ \left(\because V_{esc_E} = 11.2\ \text{km/s}\right)$<br>$V_{esc_P} = 22.4\,\text{km/s}$<br>The escape velocity of the planet is 22.4 km/s | **3** |
| 8. | <br><br>i.   Electric generator (DC) is the device which is used to produce electricity.<br>ii.  This device converts mechanical energy into electrical energy.<br>iii. This device works on the principle of Faraday's Law of electromagnetic induction.<br>iv. This can be harnessed for the use of mankind to produce large current.<br>v.  When the coil of electric generator rotates in the magnetic field, the magnetic field induces a current in this coil.<br>vi. This induced current then flows into the circuit connected to the coil with the help of the mechanical energy. | **3** |

| A.4. | **Answer the following questions.** | 5 |
|---|---|---|
| 1. | i. Advanced sunrise and delayed sunset is explained in the figure. | |
| | ii. (a) Atmospheric layers      (b) Apparent position | |
| |     (c) Horizon                 (d) Real position | |
| | iii. (a) Advanced sunrise and delayed sunset are the effects of atmospheric refraction | |
| |     (b) By sunrise, we mean the appearance of the Sun above the horizon. | |
| |     (c) But when the Sun is somewhat below the horizon, its light rays are able to reach us along a curved path due to their refraction through Earth's atmosphere. | |
| |     (d) Thus, we see the Sun even before it emerges above the horizon. | |
| |     (e) This is known as advanced sunrise. | |
| |     (f) Same thing happens at the time of sunset and we keep seeing the Sun for a short while even after it goes below the horizon. | |
| |     (g) This is known as delayed sunset. | |
| | iv. Due to advanced sunrise and delayed sunset, duration of a day increases by 4 minutes. The sunrise is advanced or sunset is delayed by about 2 minutes. | |
| 2. | i. The rust on iron does not form by a simple reaction of oxygen with iron surface. It is formed by an **electrochemical** reaction. Different regions on the surface of iron become cathode and anode. | 5 |
| | ii. Fe is oxidised to $Fe^{2+}$ in the anode region. $\textbf{Fe}_{(s)} \rightarrow \textbf{Fe}^{2+}{}_{(aq)} + \textbf{2e}^{-}$ | |
| | iii. $O_2$ is reduced to form water in the cathode region. $$\textbf{O}_{2\,(g)} + \textbf{4H}^{+}{}_{(aq)} + \textbf{4e}^{-} \rightarrow \textbf{2H}_2\textbf{O}_{(l)}$$ | |
| | iv. When $Fe^{2+}$ ions migrate from the anode region they react with **water** and further get oxidised to form $Fe^{3+}$ ions. | |
| | v. A reddish coloured hydrated oxide is formed from $\textbf{Fe}^{3+}$ ions. It is called rust. It gets collected on surface. $$\textbf{2Fe}^{3+}{}_{(aq)} + \textbf{4H}_2\textbf{O}_{(l)} \rightarrow \textbf{Fe}_2\textbf{O}_3.\textbf{H}_2\textbf{O}_{(s)} + \textbf{6H}^{+}{}_{(aq)}$$ | |
| | vi. Due to various components of atmosphere, oxidation of iron takes place, consequently resulting in their damage. This is called corrosion. Iron ruts and a reddish coloured layer gets collected on it. This is called as corrosion of iron. | |
| | vii. Corrosion can be prevented by colouring with acrylic paints, Zn plating, galvanizing, anodizing, alloying, etc. | |

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