

MT

2018 ____ 1100

MT - SCIENCE & TECHNOLOGY -I (72) - SEMI PRELIM - I : PAPER - 5

Time : 2 Hours

(Model Answer Paper)

Max. Marks : 40

A.1.	(A) Solve the following questions :	
(1)	During transformation of liquid phase to solid phase, the latent heat is called latent heat of fusion .	1
(2)	Copper reacts with moist carbon dioxide in air and slowly loses its shine to gain a green coat of copper carbonate .	1
(3)	False - At 4°C, the volume of water is minimum.	1
(4)	False - Saturated hydrocarbons burn with non-smoky flame.	1
(5)	It will be maximum when the direction of motion of the electric conductor is perpendicular to the magnetic field.	1
A.1.	(B) Choose the correct alternative and rewrite the sentences :	
(1)	Silver articles become black on prolonged exposure to air. This is due to the formation of Ag₂S .	1
(2)	The deflection of the pointer of Galvanometer is on either side of zero mark.	1
(3)	When water boils and is converted into steam, then heat is taken in and temperature remains constant .	1
(4)	Ethanol is used as an additive to increase the efficiency of petrol such a fuel is called gasohol .	1
(5)	If temperature of water is lowered from 4°C to 3°C, its volume increases .	1
A.2.	Solve the following questions : (Any 5)	
(1)	(i) Ionic compounds are formed when an atom of a combining metal element transfers its electrons to the atom of another non - metallic element.	2

- (ii) Thus ionic bonds are formed between the ions during compound formation.
- (iii) Due to presence of ions, there is a strong electrostatic attraction between the molecules.
- (iv) Hence to break these inter - molecular bonds a lot of energy is needed.
- (v) Hence ionic compounds have high melting points.

(2) **Given:** $R = 9 \Omega$
 $H = 400 \text{ J}$
 $t = 1 \text{ s}$

To find: $V = ?$

Formula: $H = \frac{V^2 t}{R}$

Solution: $H = \frac{V^2 t}{R}$
 $400 = \frac{V^2 \times 1}{9}$

$$3600 = V^2$$

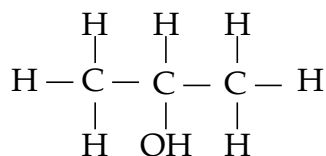
$$V = \sqrt{3600}$$

$$V = 60 \text{ V}$$

The potential difference applied across the resistance is 60 V.

(3) **Propan - 2 ol : Molecular formula- C_3H_7OH**

Structural formula :



(4) **Heat and temperature :**

Heat	Temperature
(i) It is a form of energy.	(i) It is a measure of degree of hotness or coldness of an object.
(ii) SI unit is joule (J)	(ii) SI unit is kelvin (K)
(iii) Two bodies having same quantity of heat can be at different temperatures	(iii) Two bodies at same temperature can have different quantities of heat.

2

2

2

(5)	<p>When Ferric oxide reacts with aluminium, aluminium oxide and iron are formed. This reaction is known as “Thermit Reaction”.</p> $\text{Fe}_2\text{O}_3 + 2\text{Al} \rightarrow 2\text{Fe} + \text{Al}_2\text{O}_3 + \text{heat}$ <p style="text-align: center;"> Ferric Oxide Aluminium Iron Aluminium Oxide </p>	2										
(6)	<p>Ethanol and Ethanoic acid (physical properties) :</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%; text-align: center;">Ethanol</th> <th style="width: 50%; text-align: center;">Ethanoic Acid</th> </tr> </thead> <tbody> <tr> <td>(i) It has a specific smell.</td> <td>(i) It has vinegar like smell.</td> </tr> <tr> <td>(ii) It has burning taste.</td> <td>(ii) It is sour in taste.</td> </tr> <tr> <td>(iii) It does not freeze in winters.</td> <td>(iii) It freezes in winters.</td> </tr> <tr> <td>(iv) Boiling point is 78°C.</td> <td>(iv) Boiling point is 118°C.</td> </tr> </tbody> </table>	Ethanol	Ethanoic Acid	(i) It has a specific smell.	(i) It has vinegar like smell.	(ii) It has burning taste.	(ii) It is sour in taste.	(iii) It does not freeze in winters.	(iii) It freezes in winters.	(iv) Boiling point is 78°C.	(iv) Boiling point is 118°C.	2
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(7)	<p>Given : $P = 1100 \text{ W}$</p> $= \frac{1100}{1000} \text{ kW} = \frac{11}{10} \text{ kW}$ <p>$t = 2 \times 30 = 60 \text{ h}$</p> <p>Unit cost = ₹ 5</p> <p>To find : Total cost = ?</p> <p>Formula : $H = P \times t$</p> <p>Solution : $H = P \times t$</p> $= \frac{11}{10} \times 60$ <p>$\therefore H = 66 \text{ kWh}$</p> <p>Total cost = 66×5</p> <div style="border: 1px solid black; padding: 2px; display: inline-block;">Total cost = ₹ 330</div>	2										
A.3.	Solve the following questions : (Any 5)											
(1)	<p>Given : $h = 35780 \text{ km}$</p> <p>$V = 3.08 \text{ km/s}$</p> <p>$M = 4 \text{ M}$</p> <p>$R = 6400 \text{ km}$</p>	3										

To find : $T = ?$

Formula : $V = \sqrt{\frac{GM}{R+h}}$, $V = \frac{2\pi r}{T}$

Solution : $V = \sqrt{\frac{GM}{R+h}}$... (i)

$$V_n = \sqrt{\frac{GM_n}{R+h}} \sqrt{\frac{GM_n}{R+h}}$$

$$V_n = \sqrt{\frac{G \times 4M}{R+h}}$$

$$V_n = \sqrt{4 \times \frac{GM}{R+h}}$$

$$V_n = 2 \times \sqrt{\frac{GM}{R+h}}$$

$$V_n = 2V \quad \text{[from (i)]}$$

Also, $V_n = \frac{2\pi r}{T_n}$

$$T_n = \frac{2\pi r}{V_n}$$

$$T_n = \frac{2\pi r}{2V}$$

$$T_n = \frac{3.14}{3.08} \times (35780 + 6400)$$

$$T_n = \frac{3.1}{3.1} \times 42180$$

$$T_n = 42180 \text{ s}$$

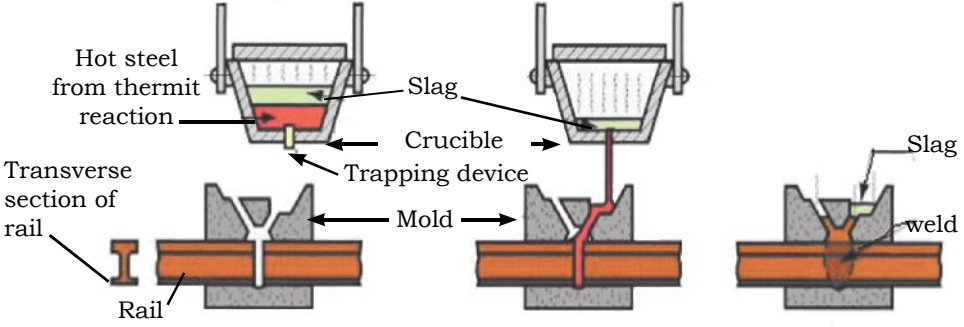
Note: 3.14 \approx 3.1

3.08 \approx 3.1

$$\text{or } T_n = \frac{42180}{3600} = 11.71 \text{ hrs} \sim 12 \text{ hrs}$$

\therefore This taken would be \sim 12 hrs.

(2)	<p>Given: $P_1 = 1100 \text{ W}$ $P_2 = 330 \text{ W}$ $V = 220 \text{ V}$</p> <p>To find: $I_1 = ?$, $I_2 = ?$, $R_1 = ?$, $R_2 = ?$,</p> <p>Formulae: $P = VI$, $P = \frac{V^2}{R}$</p> <p>Solution:</p> $P_1 = VI_1$ $I_1 = \frac{P_1}{V} = \frac{1100}{220}$ $I_1 = 5 \text{ A}$ $I_2 = \frac{P_2}{V} = \frac{330}{220} = \frac{3}{2}$ $I_2 = 1.5 \text{ A}$ $P_1 = \frac{V^2}{R_1}$ $\therefore R_1 = \frac{V^2}{P_1} = \frac{(220)^2}{1100} = \frac{220 \times 220}{1100} = 2 \times 22$ $R_1 = 44 \Omega$ $R_2 = \frac{V^2}{P_2} = \frac{(220)^2}{330} = \frac{220 \times 220}{330} = \frac{440}{3}$ $R_2 = 146.67 \Omega$	3
(3)	<p>(i) When the temperature of water decreases from 4°C to 2°C, water expands and therefore water will rise in the cylinder.</p> <p>(ii) T_2 will show temperature of 0°C first.</p> <p>(iii) Pipelines crack in winter season due to anomalous behaviour of water.</p>	3
(4)	<p>(a) $\text{CH}_3\text{-CH}_3 + \text{Cl}_2 \rightarrow \text{CH}_3\text{-CH}_2\text{-Cl} + \text{HCl}$ Substitution reaction</p>	1

	<p>(b) Esterification reaction : Substances having ester as the functional group are formed by reaction between a carboxylic acid and an alcohol. Ethanoic acid reacts with ethanol in presence of an acid catalyst and ester, ethyl ethanoate is formed.</p> $\text{CH}_3\text{-COOH} + \text{CH}_3\text{-CH}_2\text{-OH} \xrightarrow[\text{Catalyst}]{\text{Acid}} \text{CH}_3\text{-COO-CH}_2\text{-CH}_3 + \text{H}_2\text{O}$ <p>(Ethanoic Acid) (Ethanol) (Ethyl Ethanoate) (Water)</p>	2
(5)	<p>(i) When the current is downwards, the force experienced by the conductor will be outwards. (ii) If the conductor experiences a force inwards the direction of current would be upwards. (iii) Fleming's Left Hand Rule.</p>	3
(6)	<p>(a) Thermit welding :</p>  <p>(b) Metallurgy : The science and technology regarding the extraction of metals from ores and their purification for the use is called metallurgy.</p>	2
(7)	<p>Catalyst : A substance which increases the rate of reaction without causing any disturbance is called a catalyst. Vegetable oils are converted into vegetable ghee by passing hydrogen in presence of nickel as catalyst.</p> $\text{Vegetable oil} + \text{H}_2 \xrightarrow{\text{Ni}} \text{vegetable ghee}$	3

<p>A.4.</p> <p>(1)</p> <p>(2)</p>	<p>Solve the following questions : (Any 1)</p> <p>Corrosion of metals can be prevented by coating the metal with something which does not react with moisture and oxygen.</p> <p>(i) To fix a layer of some substance on the metal surface so that the contact of the metal with moisture and oxygen in the air is prevented and no reaction would occur between them.</p> <p>(ii) Metals can be coated with paints , oils, grease or varnish.</p> <p>(iii) Another method of preventing corrosion is by coating a corrosive metal with a non - corrosive metal. This can be done by following methods:</p> <p>(a) Galvanizing : It is done by coating the metal with a thin coating of Zinc or iron or steel.</p> <p>(b) Tinning is a process where a layer of molten tin is coated over another metal e.g. copper, brass, etc.</p> <p>(c) Electroplating : In this method, the corrosive metal is coated with another metal by electrolysis. e.g. silver plated spoon.</p> <p>(d) Alloying : A homogeneous mixture of two or more metals with other metals or non-metals in certain proportion is called as alloy. This prevents corrosion.</p> <p>(e) Anodizing : It is done to prevent corrosion of aluminium. Aluminium is coated with a strong film of its oxide electrically.</p> <p>(a) The device that converts Electrical energy into mechanical energy is Electric motor.</p> <p>(b) Principle of working : Electric motor works on the principle that a current carrying conductor placed in a magnetic field experiences force.</p> <p>(c) Armature coil, Strong magnet, Split ring, Carbon brushes, Battery.</p> <p>(d) Working of the electric motor :</p> <p>(i) When the circuit is completed, the current flows in the branch AB of the loop from A to B through the carbon brushes E and F.</p> <p>(ii) Since the direction of the magnetic field is from north pole to south pole, according to the Fleming's left hand rule, a force is exerted on the branch AB in downward direction and CD in upward direction.</p>	<p>5</p> <p>5</p>
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- (iii) Thus, the loop and the axle start rotating in an anticlockwise direction.
- (iv) After half rotation, the current in a loop starts flowing in the direction DCBA.
- (v) Therefore, a force is exerted on the branch CD in downward direction and on the branch AB in the upward direction, and the loop continues to rotate in the anticlockwise direction.
- (vi) Thus, the current in the loop is reversed after each half rotation and the loop and the axle continue to rotate in the anticlockwise direction.

