

MT

2018 ____ 1100

MT - SCIENCE & TECHNOLOGY -I (72) - SEMI PRELIM - I : PAPER - 1

Time : 2 Hours

(Model Answer Paper)

Max. Marks : 40

A.1.	(A) Solve the following questions :	
(1)	The device which converts electrical energy into mechanical energy is called Electric motor .	1
(2)	Cassiterite is a tin ore.	1
(3)	False - The escape velocity is responsible to launch a rocket in space which can overcome the earth's gravitational force. Hence, its velocity should be more than the escape velocity.	1
(4)	False - It is propanoic acid.	1
(5)	Hope's Appartus.	1
A.1.	(B) Choose the correct alternative and rewrite the sentences :	
(1)	Substance used to decrease the melting point of alumina in Hall - Haroult process Cryolite .	1
(2)	If the potential difference across a wire is 2 V and the current through the wire is 1 A, the electric power 2W .	1
(3)	Ice is such a substance which contracts on heating .	1
(4)	Monomer of polythene is CH₂=CH₂ .	1
(5)	Geostationary satellite is a High Earth Orbit (HEO) satellite.	1
A.2.	Solve the following questions : (Any 5)	
(1)	(i) Nitric acid is a strong oxidizing agent. It oxidizes hydrogen (H ₂) to water. (ii) Hence, it oxidizes completely to form any of the nitrogen oxide and water. (iii) Hence, these metals do not produce H ₂ gas when they react with dilute HNO ₃ . E.g. $\text{Cu}_{(s)} + 4\text{HNO}_{3(aq)} \rightarrow \text{Cu}(\text{NO}_3)_2 + 2\text{NO}_{2(g)} + 2\text{H}_2\text{O}$	2

(2)	<p>The electric bulb works on the principle of heating effect of electric current.</p> <p>(i) The intensity of light emitted by the filament of an electric bulb depends on the temperature of the filament.</p> <p>(ii) When electric current is passed through the filament, a large amount of heat is generated and filament becomes hot, then emits light.</p> <p>(iii) The melting point of Tungsten is very high (3380°C), so that the filament can be heated to a high temperature without melting it.</p> <p>(iv) Hence, the filament of an electric bulb is made up of Tungsten</p>	2										
(3)	<p>Ethanamine: Molecular formula $C_2H_5NH_2$</p> <p>Structural formula :</p> $ \begin{array}{c} \text{H} \quad \text{H} \\ \quad \\ \text{H} - \text{C} - \text{C} - \text{N} - \text{H} \\ \quad \quad \diagdown \quad / \\ \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \end{array} $	2										
(4)	<p>The temperature range of 14.5°C to 15.5°C is chosen while defining the unit for heat. If we heat 1 kg of water by 1°C in different temperature range than 14.5°C to 15.5°C, the amount of heat required will be slightly different.</p>	2										
(5)	$ \text{Cu}_{(s)} + 4\text{HNO}_{3(aq)} \rightarrow \text{Cu}(\text{NO}_3)_{2(aq)} + 2\text{NO}_{2(g)} + 2\text{H}_2\text{O}_{(l)} $ <p>Copper Nitric Copper Nitrogen Water acid nitrate dioxide (concentrated)</p>	2										
(6)	<p>Ethanol and Ethanoic acid :</p> <table border="1" data-bbox="303 1344 1300 1747"> <thead> <tr> <th data-bbox="303 1344 774 1400">Ethanol</th> <th data-bbox="774 1344 1300 1400">Ethanoic acid</th> </tr> </thead> <tbody> <tr> <td data-bbox="303 1400 774 1489">(i) It does not react with NaHCO_3.</td> <td data-bbox="774 1400 1300 1489">(i) It gives CO_2 with NaHCO_3.</td> </tr> <tr> <td data-bbox="303 1489 774 1579">(ii) It burns with blue flame.</td> <td data-bbox="774 1489 1300 1579">(ii) It does not burn with blue flame.</td> </tr> <tr> <td data-bbox="303 1579 774 1668">(iii) It does not affect blue litmus.</td> <td data-bbox="774 1579 1300 1668">(iii) It turns blue litmus red.</td> </tr> <tr> <td data-bbox="303 1668 774 1758">(iv) The general formula is $\text{C}_n\text{H}_{2n+2}$</td> <td data-bbox="774 1668 1300 1758">(iv) The general formula is $\text{C}_n\text{H}_{2n-2}$ or C_nH_{2n}</td> </tr> </tbody> </table>	Ethanol	Ethanoic acid	(i) It does not react with NaHCO_3 .	(i) It gives CO_2 with NaHCO_3 .	(ii) It burns with blue flame.	(ii) It does not burn with blue flame.	(iii) It does not affect blue litmus.	(iii) It turns blue litmus red.	(iv) The general formula is $\text{C}_n\text{H}_{2n+2}$	(iv) The general formula is $\text{C}_n\text{H}_{2n-2}$ or C_nH_{2n}	2
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(7)	<p>Specific heat capacity :</p> <p>The quantity of heat required to raise the temperature of a unit mass of substance through 1°C is called specific heat capacity. Its unit is J/kg°C.</p>	2										

A.3. Solve the following questions : (Any 5)

- (1) (i) When the current is downwards, the force experienced by the conductor will be outwards. **3**
 (ii) If the conductor experiences a force inwards, the direction of current would be upwards.
 (iii) Fleming's Left Hand Rule.

- (2) **Given:** $h = 35780 \text{ km}$
 $V = 3.08 \text{ km/s}$
 $M = 4 M$
 $R = 6400 \text{ km}$
To find: $T = ?$ **3**

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

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

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

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

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

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

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

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

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

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

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

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

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

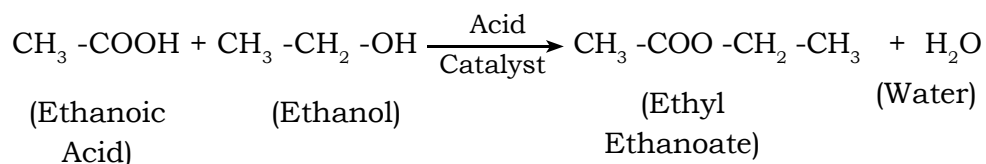
Note: $3.14 \approx 3.1$
 $3.08 \approx 3.1$

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

∴ **The satellite would take ~ 12 hrs.**

- (3) (a) AB **3**
 (b) BC
 (c) Latent heat of vaporisation : The heat energy absorbed at constant temperature during transformation of liquid into gas is called Latent heat of vapourization.

- (4) (a) $\text{CH}_3\text{COOC}_2\text{H}_5 + \text{NaOH} \rightarrow \text{CH}_3\text{COONa} + \text{C}_2\text{H}_5\text{OH}$ **1**
Saponification
 (b) Substances having ester as the functional group are formed by reaction between a carboxylic acid and an alcohol. **2**
 Ethanoic acid reacts with ethanol in presence of an acid catalyst and ester, ethyl ethanoate is formed.



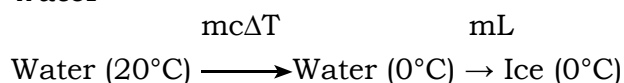
- (5) **Given:**
- | | Q_A | Q_B |
|-------|-------------|-------------------------|
| | Water/Ice | Ammonia |
| (m) | 2kg | m_1 |
| (c) | 1 kcal/kg°C | - |
| t_1 | 20°C | - |
| t_2 | 0°C | - |
| L | 80 kcal/kg | 341 kcal/g |
- 3**

To find: $m_1 = ?$

Formulae: $Q_A = Q_B$
 $Q = mc\Delta T, Q = mL$

Solution:

(1) Water



$$Q_A = mc\Delta T + mL \dots\dots\dots (1)$$

(2) Ammonia

$$Q_B = m_1 L_1 \dots\dots\dots (2)$$

from (1) and (2)

$$Q_A = Q_B$$

$$mc\Delta T + mL = m_1 L_1$$

$$2 \times 1 \times (20 - 0) + (2 \times 80) = m_1 \times 341$$

$$40 + 160 = m_1 \times 341$$

$$200 = m_1 \times 341$$

$$200$$

$$m_1 = \frac{341}{200}$$

$$m_1 = 0.5865 \text{ kg}$$

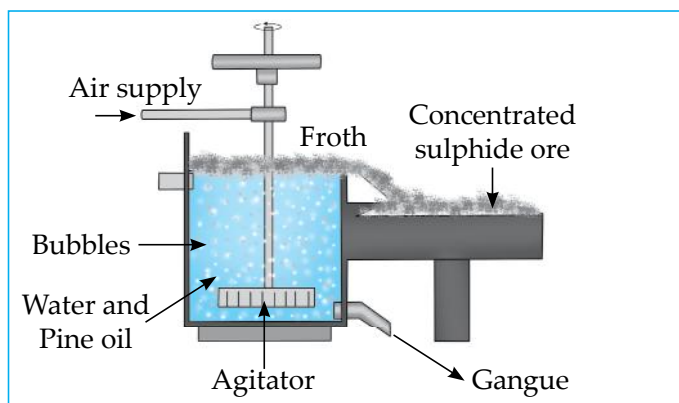
or

$$m_1 = 586.5 \text{ g}$$

Hence, 586.5g of ammonia has to be evaporated.

(6)

(a)



Froth floatation method

(b) **Patination of Copper :**

CO₂ in moist air reacts with surface of copper vessel. Copper loses its lustre due to the formation of greenish layer of copper carbonate CuCO₃ on its surface. This is called Patination of copper.

(7)

Functional group				
Hetero atom	Name	Structural formula	Condensed Structural formula	Example
Halogen (Chlorine, Bromine, Iodine)	Halo (chloro, bromo, iodo)	-X (-Cl, -Br, -I)	-X (-Cl, -Br, -I)	Ethyl Chloride or chloro ethane C ₂ H ₅ -Cl

2

1

3

Oxygen	Ketone	$\begin{array}{c} \text{O} \\ \\ -\text{C}- \end{array}$	- CO-	Propanone $\begin{array}{c} \text{O} \\ \\ \text{CH}_3-\text{C}-\text{CH}_3 \end{array}$
	Alcohol	-O-H	- OH	Methanol CH_3OH
	Aldehyde	$\begin{array}{c} \text{O} \\ \\ -\text{C}-\text{H} \end{array}$	- CHO	Acetaldehyde CH_3CHO
	Carboxylic Acid	$\begin{array}{c} \text{O} \\ \\ -\text{C}-\text{O}-\text{H} \end{array}$	- COOH	Acetic Acid CH_3COOH
	Ether	- O -	- O -	Dimethyl ether $\text{CH}_2-\text{O}-\text{CH}_3$
	Ester	$\begin{array}{c} \text{O} \\ \\ -\text{C}-\text{O}- \end{array}$	-COO-	Methyl ethanoate $\text{CH}_3\text{COOCH}_3$
Nitrogen	Amines	$\begin{array}{c} -\text{N}-\text{H} \\ \\ \text{H} \end{array}$	- NH ₂	Methyl amine $\begin{array}{c} \text{H} \\ \\ \text{H}-\text{C}-\text{N}-\text{H} \\ \quad \\ \text{H} \quad \text{H} \end{array}$

A.4. Solve the following questions : (Any 1)

- (1) (i) In the Hall's process, the ore is powdered and then leached by heating with aqueous sodium carbonate to form water soluble sodium aluminate.
- (ii) Then the insoluble impurities are filtered out.
- (iii) The filtrate is warmed and neutralised by passing carbon dioxide gas through it.
- (iv) This results in the precipitation of aluminium hydroxide.
- (v) $\text{Al}_2\text{O}_3 \cdot 2\text{H}_2\text{O}_{(s)} + \text{Na}_2\text{CO}_{3(aq)} \rightarrow 2\text{NaAlO}_{2(aq)} + \text{CO}_{2(g)} + 2\text{H}_2\text{O}_{(l)}$
- (vi) $2\text{NaAlO}_{2(aq)} + 3\text{H}_2\text{O}_{(l)} + \text{CO}_{2(g)} \rightarrow 2\text{Al}(\text{OH})_3\downarrow + \text{Na}_2\text{CO}_3$
- (vii) The precipitate of $\text{Al}(\text{OH})_3$ obtained in Hall's process is filtered, washed, dried and then calcined by heating at 1000°C to obtain alumina.
- (viii) $2\text{Al}(\text{OH})_3 \rightarrow \text{Al}_2\text{O}_3 + 3\text{H}_2\text{O}$.

(2)	<p>(a) The device that converts Electrical energy into mechanical energy is called 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>(iii) Thus, the loop and the axle start rotating in an anticlockwise direction.</p> <p>(iv) After half rotation, the current in a loop starts flowing in the direction DCBA.</p> <p>(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.</p> <p>(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.</p>	5
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