



WINTER – 2012 EXAMINATION

Subject Code: 12020

Model Answer

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Section-II (Applied chemistry)

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
4.	a)	pH: pH of a solution is defined as the negative logarithm to the base ten of hydrogen ion concentration expressed in mole / liter. PH value of extremely acidic solution is Zero (0) pH value of extremely alkaline solution is Fourteen (14)	1 ½ Each	2
	b)	Limitations of permutit process. (any 2 points) 1) If water is turbid, it can not be softened by this process as turbidity clogs / chokes the pores of permutit and flow of water is restricted. 2) If water contains mineral acid, it can not be softened by this process since acid may destroy the permutit material. 3) If water contains manganese ions (Mn^{++}) and ferrous (Fe^{++}) ions, sodium permutit is converted into manganese permutit and ferrous permutit which cannot be regenerated easily. 4) Permutit process replaces cations Ca^{++} or Mg^{++} by Na^+ ions but leaves acidic ions like HCO_3^- , CO_3^{--} , Cl^- and SO_4^{--} in the softened water.	1 mark each	2
	c)	Function of lime in cement :- 1) A high content of lime increases the setting time but gives early strength and make the cement 'unsound' and liable to expand and crack. 2) A very less content of lime reduces the strength of cement and may set quickly that is hardens before the mason has a change to place it in the forms. Hence lime content should be moderate.	1	2
			1	
	d)	Uses of mortar :- (any two points) 1) It is used as a matrix for concrete. 2) It is used for blending and bonding masonry units such as bricks, stones and tiles etc. 3) It is used for plastering and pointing walls to protect joints and exterior surfaces of masonry work from deteriorating effect of water.	1 mark each	2
e)	Four characteristics of good paint. (any 4 points) 1) It should have high covering power. 2) It should form tough, uniform and adherent film. 3) It should have brushing characteristics. 4) It produces glossy film. 5) It should have high hiding power. 6) Its film should be fluid enough to be spread easily over the surface to be protected.	½ mark each	2	



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4.	f)	Enamels: Enamel is a pigmented varnish i.e. it is an intimate dispersion of pigment in varnish. Constituents of enamels: 1) Pigment 2) Vehicle 3) Driers 4) Thinner	1 1	2
	g)	Two functions of pigment. (any 2 points) 1) It protects the paint film by reflecting ultraviolet light, hence prevents the destructive oxidation of painted surface. 2) It gives color to the paint film. 3) It gives aesthetic look to the painted surface. 4) It increases weather resistance of paint film.	1 mark each	2
	h)	Corrosion: - It is a process of chemical or electrochemical destruction of a metal due to action surrounding medium. Types of corrosion: i) Atmospheric or Chemical or Dry corrosion ii) Immersed or Electrochemical or Wet corrosion.	1 $\frac{1}{2} + \frac{1}{2}$	2
	i)	Galvanizing means coating of Zinc. Zinc coating get dissolved in acidic foodstuff, to produce poisonous matter which will poison the foodstuff, hence galvanized container are not used for storing food stuff.	2	2
	j)	Stable non- porous oxide film is more protective against corrosion. Example: Aluminium, Copper, Lead and Tin forms stable non-porous oxide film.	1 1	2
	k)	Factors affecting rate of electrochemical Corrosion. 1) pH value of surrounding solution. 2) Position of metal in electrochemical series. 3) Solubility of corrosion product. 4) Physical difference of the metal surface.	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	2

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5.		<p>Diagram :-</p>	1	
	c)	<p>Sterilisation: The process of destroying disease causing bacteria and microorganism from water is known as sterilization. Sterilization can be carried out by following methods of chlorination. (any one method is for 3 marks)</p> <ul style="list-style-type: none"> i) By using chlorine gas ii) By using bleaching powder iii) By using chloramine <p>i) By using chlorine gas: Chlorine in the form of chlorine gas or chlorine water form can be used for sterilization of municipal water supply. It reacts with water to form hypochlorous acid and nascent oxygen, which are powerful germicides.</p> $\begin{array}{l} \text{Cl}_2 + \text{H}_2\text{O} \longrightarrow \text{HOCl} + [\text{O}] \\ \text{Hypochlorous acid} \qquad \text{nascent oxygen} \\ \text{HOCl} \longrightarrow \text{HCl} + [\text{O}] \\ \text{hypochlorous acid} \qquad \text{nascent oxygen} \end{array}$ <p>ii) By using bleaching powder: Bleaching powder reacts with water to form chlorine gas which further reacts with water to form hypochlorous acid and nascent oxygen , both are powerful germicides.</p> $\begin{array}{l} \text{CaOCl}_2 + \text{H}_2\text{O} \longrightarrow \text{Ca(OH)}_2 + \text{Cl}_2 \\ \text{Cl}_2 + \text{H}_2\text{O} \longrightarrow \text{HOCl} + [\text{O}] \\ \text{hypochlorous acid} \qquad \text{nascent oxygen} \end{array}$	1 1 1	4



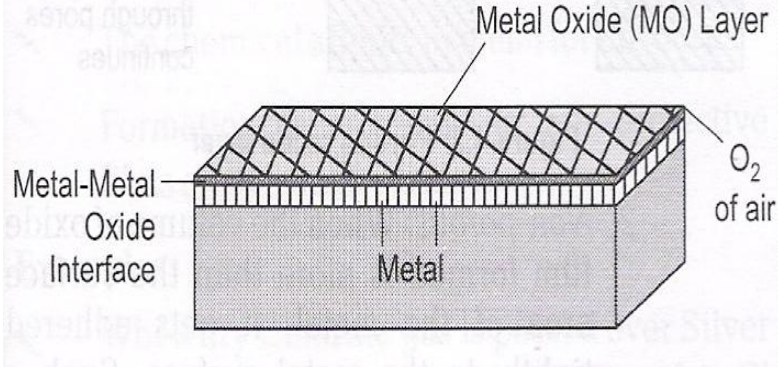
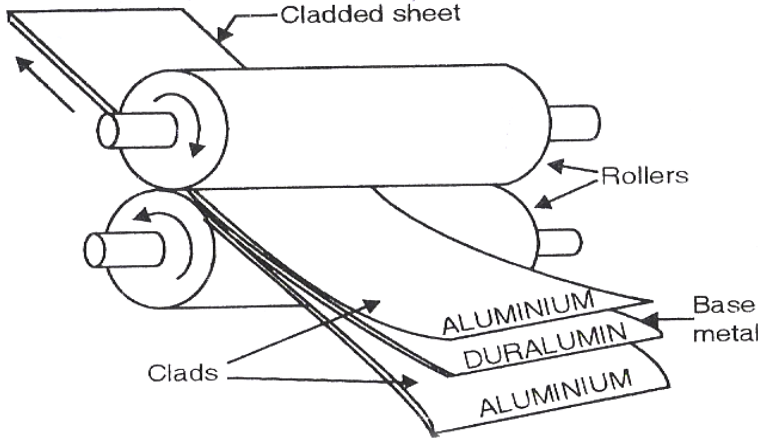
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5.		$\text{HOCl} \longrightarrow \text{HCl} + [\text{O}]$ <p style="text-align: center;">hypochlorous acid nascent oxygen</p> <p>iii)By using chloramines: Chloramine reacts with water to form hypochlorous acid and nascent oxygen , which are powerful germicides.</p> $\text{ClNH}_2 + \text{H}_2\text{O} \longrightarrow \text{HOCl} + \text{NH}_3$ <p style="text-align: center;">hypochlorous acid</p> $\text{HOCl} \longrightarrow \text{HCl} + [\text{O}]$ <p style="text-align: center;">hypochlorous acid nascent oxygen</p>		
	d)	<p>Given: pH = 4.1 [OH⁻] = ?</p> <p>Solution:</p> <p>Part I : pH + pOH = 14 4.1 + pOH = 14 pOH = 14 - 4.1 pOH = 9.9</p> <p>Part II : pOH = - log₁₀[OH⁻] 9.9 = - log₁₀[OH⁻] log₁₀[OH⁻] = - 9.9 [OH⁻] = 10^(-9.9) [OH⁻] = 1.259 x 10⁻¹⁰ moles/ lit.</p>	1 1 1 1	4
	e)	<p>Causes of Hardness of water:</p> <p>1) Rain water combines with CO₂ from air or from decaying plants on soil and forms carbonic acid.</p> $\text{CO}_2 + \text{H}_2\text{O} \longrightarrow \text{H}_2\text{CO}_3$ <p>When such acidic rain water flows over rocks containing calcium or magnesium carbonate forms soluble calcium or magnesium bicarbonate and makes the water hard.</p> $\text{H}_2\text{CO}_3 + \text{CaCO}_3 \longrightarrow \text{Ca}(\text{HCO}_3)_2$ $\text{H}_2\text{CO}_3 + \text{MgCO}_3 \longrightarrow \text{Mg}(\text{HCO}_3)_2$ <p style="text-align: center;">(Soluble)</p> <p>2) On the surface of soil, there are also chloride and sulphate of calcium and magnesium. These salts are water soluble making it hard.</p>	1 1	4



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6.	a)	<p>Chemical composition of Portland cement:</p> <table border="1"><thead><tr><th>Sr. No.</th><th>Compound</th><th>Formula</th><th>Present</th></tr></thead><tbody><tr><td>1</td><td>Lime</td><td>CaO</td><td>60-69</td></tr><tr><td>2</td><td>Silica</td><td>SiO₂</td><td>17-25</td></tr><tr><td>3</td><td>Alumina</td><td>Al₂O₃</td><td>3-8</td></tr><tr><td>4</td><td>Iron oxide</td><td>Fe₂O₃</td><td>0.5-6</td></tr><tr><td>5</td><td>Magnesium oxide</td><td>MgO</td><td>0.1-4</td></tr><tr><td>6</td><td>Sulphur trioxide</td><td>SO₃</td><td>1-2</td></tr><tr><td>7</td><td>Soda and potash</td><td>Na₂O + K₂O</td><td>0.5-1.3</td></tr></tbody></table>	Sr. No.	Compound	Formula	Present	1	Lime	CaO	60-69	2	Silica	SiO ₂	17-25	3	Alumina	Al ₂ O ₃	3-8	4	Iron oxide	Fe ₂ O ₃	0.5-6	5	Magnesium oxide	MgO	0.1-4	6	Sulphur trioxide	SO ₃	1-2	7	Soda and potash	Na ₂ O + K ₂ O	0.5-1.3	4	4
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	b)	<p>Properties of Cement:</p> <p>1. Quality: It is expressed in terms of silica and alumina modules.</p> <p>Silica modules (n)= $y \cdot \text{SiO}_2 / \% \text{Al}_2\text{O}_3 + \% \text{Fe}_2\text{O}_3$.</p> <p>Alumina modules (p)= $\% \text{Al}_2\text{O}_3 / \% \text{Fe}_2\text{O}_3$.</p> <p>2. Setting time: When cement is brought in contact with water it starts setting or hardening involving stepwise hydration, followed by gradual crystallization of various components. The initial setting or early strength is gained within 24 hours through the hydration and crystallization of C₃S which is completed in 7 days.</p> <p>3. Shrinkage: The volume shrinkage depends upon water/cement ratio, drying period and temperature fluctuation of the surroundings, longer the drying period the smaller is the shrinkage.</p> <p>4. Soundness: If the cement is sound, it will not undergo appreciable change in volume or indicate any disintegration or drastic weather conditions.</p> <p>5. Colour: Greenish grey colour of ordinary Portland cement is due to presence of iron in it. If this iron is prevented by some suitable choice of raw material, even white cement can be obtained.</p> <p>6. Corrosion by acid: Cement constructions are attacked by types of acids.</p>	1 mark each	4																																



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6.		<p>7. Dissolved CO₂ corrosion: The strength of cement structure is greatly affected by water containing dissolved CO₂ because it dissolved the free lime present in the cement to form calcium bicarbonate</p> <p>8. Sulphate corrosion: Sulphate like MgSO₄ & Na₂SO₄ disturbs the balance of free lime, silica and aluminates of the cement.</p> <p>(Note: one mark for one property. Consider any related properties)</p> <p>c)</p> <p>Difference between Paints and Varnishes (any four points)</p> <table border="1"><thead><tr><th>Sr. No.</th><th>Paints</th><th>Varnishes</th></tr></thead><tbody><tr><td>1</td><td>Paint is mechanical dispersion mixture of one or more pigments in medium or vehicle</td><td>Varnish is a homogeneous colloidal dispersion solution of resins in oil or thinner or both</td></tr><tr><td>2</td><td>Paint contains pigments</td><td>Varnish do not contain pigments</td></tr><tr><td>3</td><td>Paint hide the surface on which it is applied</td><td>Varnish do not hide the surface on which it is applied</td></tr><tr><td>4</td><td>Paint produces non – transparent film</td><td>Varnish produces transparent film</td></tr><tr><td>5</td><td>In paint ,instead of oil ,the resin cannot be used</td><td>In vanish ,instead of oil ,the resin can be used</td></tr><tr><td>6</td><td>Painted surface reflects heat and light.</td><td>Varnished surfaces do not reflect heat and light.</td></tr></tbody></table>	Sr. No.	Paints	Varnishes	1	Paint is mechanical dispersion mixture of one or more pigments in medium or vehicle	Varnish is a homogeneous colloidal dispersion solution of resins in oil or thinner or both	2	Paint contains pigments	Varnish do not contain pigments	3	Paint hide the surface on which it is applied	Varnish do not hide the surface on which it is applied	4	Paint produces non – transparent film	Varnish produces transparent film	5	In paint ,instead of oil ,the resin cannot be used	In vanish ,instead of oil ,the resin can be used	6	Painted surface reflects heat and light.	Varnished surfaces do not reflect heat and light.	1 mark each	4
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6.		 <p>Metal Cladding: Metal cladding involves bonding firmly and permanently, a dense, homogeneous layer of a metal to the base metal on one or both sides.</p> <p>Process: In this method the base metal to be protected from corrosion is sandwiched or cladded between the two sheets of coating metal. Then it is passed through two heavy rollers at high temperature. The coated metal is cathodic with respect to base metal so that electrolytic protection is provided. Metals used for cladding are like copper, nickel, silver, platinum, and alloys like stainless steel, nickel alloy, lead alloy. The base metals are aluminium, copper, nickel etc.</p>  <p>Disadvantages:</p> <ol style="list-style-type: none"> 1. By metal cladding only plain surfaces can be protected. 2. Cladding not perfect for irregular surfaces. 	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>	<p>4</p>