WINTER – 2012 EXAMINATION

Subject Code: 12014 **Model Answer**

Section-II (Applied chemistry)

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
4	a)	i) **Specific conductivity**: It is defined as "the conductivity offered by a solution of length one cm. and area of unit cross section. Or It is the conductance of a one centimeter cube of the substance or solution. ii) **Equivalent conductivity**:It is defined as "the conductivity offered by a solution containing 1 gram equivalent of the solute or electrolyte, when placed between two electrodes, which are placed 1 cm apart".	1 1	2
	b)	Materials used for Bakelite are i) Phenol(C_6H_5OH) ii) Formaldehyde(CH_2O)	 1 1	2
	c)	**Refractories:**Refractories are defined as the "non- metallic materials having those chemical and physical properties that make them applicable for structures, or as components of systems used at much higher temperature. Refractories are classified as i) Acidic refractories. ii) Basic refractories. iii) Neutral refractories	1 ½ ½	2
	d)	**Composition of Brass alloy:** Copper :60- 90 % Zinc: 40-10% **Applications of Brass: (** Consider any one related use) It is used in utensils, condenser tubes, sheets, coins etc.	½ ½ 1	2
	e)	**i) Mineral:** It is defined as the naturally occurring substance present in earth's crust which contains metal in the free state or combined state. **ii) Ore:** It is defined as a mineral from which the metal can be extracted economically.	1 1	2
	f)	**Important ores of iron:** i)Hematite ii) Magnetite iii)Limonite iv)Siderite	½ mark each	2
	g)	**Alloy:** It is defined as the homogeneous mixture of two or more elements, out of which one must be metal. **Examples: (** Consider any two related examples) Brass,Bronze,Steel,Duralumin etc.	1 ½ mark each	2

Section-II (Applied chemistry)

<table>
<tr><th>Que. No.</th><th>Sub. Que.</th><th>Model Answer</th><th>Marks</th><th>Total Marks</th></tr>
<tr><td>4.</td><td>h)</td><td>Atmospheric corrosion:
“The corrosion which is brought about by atmospheric conditions is called atmospheric corrosion”.
i.e. This type of corrosion occurs when metal surface come in contact with atmospheric gases like O_2,CO_2, Cl_2, H_2S,SO_2 etc. and gets coated with corresponding compounds like oxides, carbonates, halides, sulphides ,sulphates etc.</td><td>2</td><td>2</td></tr>
<tr><td></td><td>i)</td><td>Differentiation between Paints and Varnishes (consider any 2 points)
<table>
<tr><th>Sr.No.</th><th>Paints</th><th>Varnishes</th></tr>
<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 does not contain pigments.</td></tr>
<tr><td>3</td><td>Paint hides the surface on which it is applied.</td><td>Varnish does 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>
</table></td><td>1 mark each</td><td>2</td></tr>
<tr><td></td><td>j)</td><td>Lubricant:It is defined as any substance introduced between two moving or sliding surfaces to reduce the frictional resistance between them.
Types of lubrication:
i) Fluid film lubrication
ii)Boundary lubrication
iii)Extreme pressure lubrication</td><td>1

1</td><td>2</td></tr>
<tr><td></td><td>k)</td><td>i)Acid Value: It is defined as the number of milligrams of KOH required to neutralize free acid in 1 gram of lubricating oil.
ii)Saponification value: It is defined as milligrams of KOH required to saponify 1 gram of lubricating oil .</td><td>1

1</td><td>2</td></tr>
</table>

Section-II (Applied chemistry)

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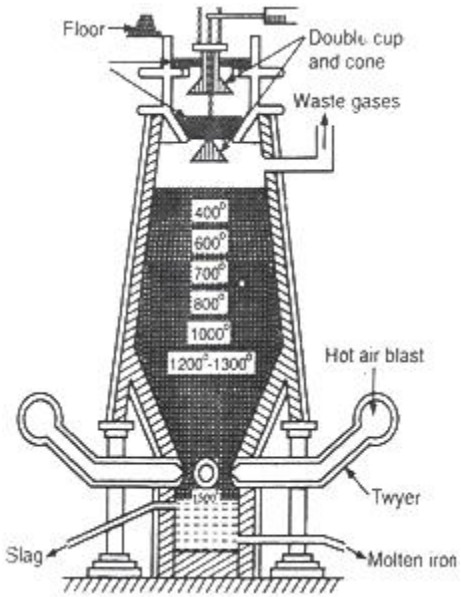
5.	a)	**i) Acidic buffer**: It is obtained by mixing a weak acid with a salt of same weak acid.	1	4
		For example :acetic acid(CH_3COOH) +sodium acetate(CH_3COONa) $CH_3COOH \rightarrow H^+ + CH_3COO^-$ (weakly /feebly ionized) $CH_3COONa \rightarrow CH_3COO^- + Na^+$ (highly ionized)	1	
		As sodium acetate is fully ionized, the acetate ions so produced suppress the ionization of the acetic acid, so mixture contains more unionized acetic acid molecules and more acetate ions than acetic acid alone.		
		ii) Calculate pH Given: $[H^+] = 1\times10^{-5}$ gram –ions/lit. **Solution:** As, $pH = -\log_{10}[H^+]$ $pH = -\log_{10}[1\times10^{-5}]$ pH = 5	1 1	
	b)	**Classification of ceramics according to their use:-(Consider 1 mark for name & 1 mark for example)**		4
		i) Structural Ceramics: these are used for construction of buildings and other structures. Examples: Bricks, Hallow tiles, clinker bricks, ceramic slabs etc.	½+½	
		Ii) Facing materials: Articles used for internal and external facing of building and structures. Examples: facing bricks slabs, oven tiles.	½+½	
		Iii) Refractories: Materials which are used at high temperatures. Examples: refractory bricks used for lining of furnaces.	½+½	
		Iv) Fine Ceramics: Examples- Wash basins, dishes, sink porcelain etc.	½+½	
	c)	**Blast Furnace:**  	2	4

Section-II (Applied chemistry)

Que. No.	Sub. Que.	Model Answer	Marks	Total Mark
5.		**Zone of reduction** (300 -800 °C) in this zone, hematite ore is reduced by carbon monoxide, $Fe_2O_3 \longrightarrow Fe_3O_4 \longrightarrow FeO \longrightarrow Fe$ ferric oxide ferroso -ferric oxide Ferric oxide Iron i) At temperature range [300°C- 500°C] $3\ Fe_2O_3 + CO \longrightarrow 2Fe_3O_4 + CO_2 \uparrow$ ii) At temperature range [650°°C- 700°C] $Fe_3O_4 + CO \longrightarrow 3FeO + CO_2 \uparrow$ [700° c- 800° c] iii) At temperature range [700°C- 800°C] $FeO + CO \longrightarrow Fe + CO_2 \uparrow$ iv) At temperature range [300°C- 800°C & above] $CaCO_3 \longrightarrow CaO + CO_2 \uparrow$	½ ½ ½ ½	
	d)	**Properties of Fire –clay refractories:(consider any 4 points)** i) They are light –yellow to reddish-brown in colour. ii) They are slightly acidic in character. iii)They possess low porosity and lower refractoriness than silica bricks. iv) Their crushing strength is quite high. v) They have better resistance to thermal spalling than silica bricks. vi) They are cheaper. **Uses:(consider any 4 uses)** Fire –clay bricks are used for construction of blast furnace, open – hearth furnaces, ovens, crucible furnaces, flues, kilns, boiler settings, charging doors etc.	2 2	4
	e)	**Duralumin :** **Composition :** Al = 95 % , Cu= 4 % , Mg =0.5 % , Mn =0.5% **Properties:(consider any 2 points)** i) It is light, tough, highly ductile, easily castable, corrosion resistance and good conductor of heat and electricity. ii) It is strong as mild steel. Iii)Its tensile strength is increased by heat treatment up to 2000kg/cm^2 iv) It can be easily worked and possess high machinability. **Applications:(consider any 2 points)** I) It is used for making aero plane, automobile and locomotive parts from 'alclad' sheets. ii) It is used in making cables, surgical instruments and fluorescent tubes. iii) It used for making rivets, bars, body of vehicles etc.	2 1 1	4

Section-II (Applied chemistry)

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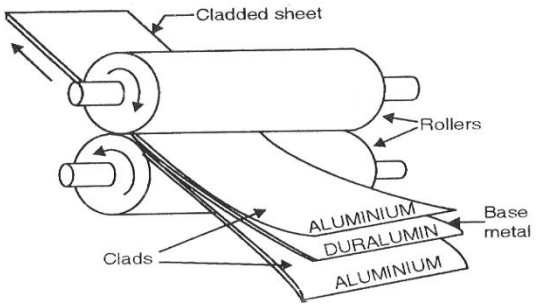
	f)	**Porcelain :** **Composition**: Kaolin=40 %, Feldspar= 30 %, flint= 20 % , Ball clay= 10 % **Properties:(consider any 3 points)** 1) High softening point 2) Perfectly stable up to softening point 3) Coefficient of expansion is low 4) High resistance to corrosive action and resistance to abrasion. 5) Very low electrical conductivity; hence it is good electrical insulator. **Uses : (consider any 3 points)** 1) It is used in making refractory blocks, bricks, and crucibles. 2) It is used in making suspension insulators, pin type insulators, transformer bushings and spark plug insulation. 3) It is used in making jars and components of chemical reaction. 4) It is used for dental applications.	1 ½ Mark each ½ Mark each	4
6.	a)	**Steel:**It is an alloy of carbon and iron. **Classification of steel:** Steels are classified on the basis of percentage of carbon. 1) Mild or low carbon steel: It contains 0.05 to 0.3 % carbon 2) Medium carbon steel: It contains 0.3 to 0.6 % carbon 3) High carbon steel: It contains 0.6 to 1.5 % carbon	1 ½+½ ½+½ ½+½	4
	b)	**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. **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.  Application: This method is used in aircraft industryfor making 'alclad' sheets.	2 2	4

Section-II (Applied chemistry)

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<tr><td>6.</td><td>c)</td><td>Difference between galvanizing & tinning:
<table>
<tr><th>Galvanizing</th><th>Tinning</th></tr>
<tr><td>1) A process of covering iron or steel with a thin coat of zinc to prevent it from rusting.</td><td>A process of covering steel with a thin coat of tin to prevent it from corrosion.</td></tr>
<tr><td>2) Zinc protects the iron sacrificially since it is more electropositive than iron and does not permit iron to pass into the outside solution.</td><td>Tin protects base metal iron from corrosion due to its noble nature i.e. less electropositive than iron and higher corrosion resistant.</td></tr>
<tr><td>3) In galvanizing articles zinc continues to protect the underlying iron by galvanic cell action even if coating of zinc is punctured or broken at some places.</td><td>In tin coated articles, tin is non-toxic and protects the underlying iron till the coating is perfect. Any break in coating cause rapid corrosion of iron.</td></tr>
<tr><td>4) Galvanized containers cannot be used for storing acidic foodstuff. Since zinc reacts with acids in food, forming zinc compounds which are highly toxic i.e. poisonous.</td><td>Tin coated containers and utensils can be used for storing any foodstuff. Since tin is non-toxic and protects the metal from corrosion and avoids any food poisoning.</td></tr>
</table></td><td>1 mark each</td><td>4</td></tr>
<tr><td></td><td>d)</td><td>Factors affecting the rate of electrochemical corrosion:(consider any 4 points)
The factors affecting corrosion are
i) Position of metal in electrochemical series
ii) pH value
iii) Solubility of corrosion product
iv) Differential aeration
v) Physical difference of the metallic surface
vi) Hydrogen over voltage
i) Position of metal in electrochemical series
The position of the metal in the electrochemical series affects corrosion to large extent. A more electropositive metal displaces a less electropositive metal from the solution of its salt.
Metals having positive potential have a great tendency to go in solution as positive metallic ions and hence they get corroded. The metals having negative potentials have less tendency to get corroded.

ii) pH value
The pH value of the solution indicates acidity or alkalinity in numbers from 0 to 14. When the concentration of the hydrogen and hydroxyl ions are equal, the sample of water under test is exactly neutral. If the concentration of H^+ ion is more than 10^{-7}, the solution is acidic. When it is less than 10^{-7}, then it is alkaline. The corrosion of metal is more in highly acidic and alkaline solution.</td><td>1 mark each</td><td>4</td></tr>
</table>

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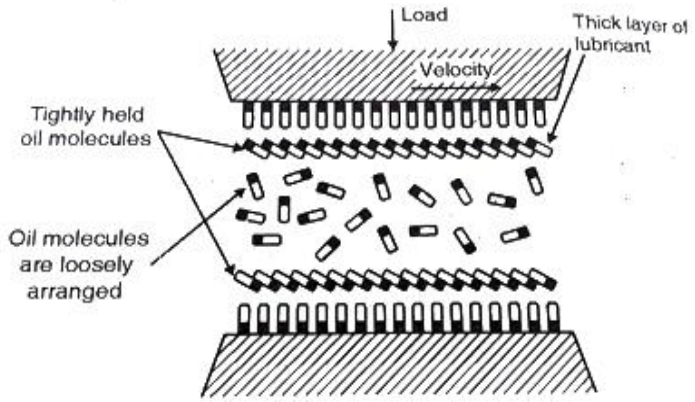
	e)	**iii) Solubility of corrosion product** During the process of corrosion of metal, a film of oxide is formed on the metal surface. The corrosion film may be soluble or insoluble. If it is soluble it gets easily removed thus leaving free surface of metal for exposure. If the film formed is insoluble or slightly soluble, it sticks to the metal surface and so resists further corrosion to some extent. In case the film is porous, corrosion goes on but its rate gets decreases after some time. **iv)Differential aeration** This occurs when one part of the metal is exposed toa different air concentration than the other. It has been found that poor or least oxygenated part is anodic to the remaining part of the metal and it is corroded. In other words corrosion occurs where oxygen access is least. This is known as differential aeration principle. **Lubrication:** The process of reducing frictional resistance between moving or sliding surfaces, by the introduction of lubricants in between them, is called lubrication. **Fluid –film lubrication:** **Process:**It is carried out by introducing the liquid lubricants in between the moving or sliding surfaces. The lubricant film covers the irregularities of the sliding or moving surfaces and the lubricant forms a thin layer in between them. Thin layer of lubricant avoids metal to metal contact and reduces wear and friction.The resistance to movement of moving parts is only due to the internal resistance between the particles of the lubricant moving over each other. **Application:**This type of lubrication is provided in case of delicate instruments and light machines like watches, clocks, guns, etc.where The lubricant chosen should have the minimum viscosity under working conditions and at the same time it should remain in place and separate the surfaces.  	1 1 1 1	4

Section-II (Applied chemistry)

Que. No.	Sub. Que.	Model Answer	Marks	Total Marks
	f)	**i) Viscosity and viscosity index:** **Viscosity:** 'It is defined as the force in dynes required to move 1 cm. sq. of the liquid over another surface with a velocity of 1 cm per second'. Unit of viscosity is poise. It is a measure of internal resistance of the fluid because of which it can flow slowly or quickly. Less viscous liquids are preferred for bearings under light load and high speed whereas highly viscous liquids are used for low speed and high pressure bearings. **Viscosity index:** 'The rate of change of viscosity of a liquid with the change of temperature is known as viscosity index. A good lubricant is that whose viscosity does not change much with temperature. A good lubricant should possess minimum viscosity index. Therefore, during the selection of a particular lubricant for a particular machine, its viscosity and viscosity index should be properly assessed. **ii) Flash point and fire points:** **Flash point:** 'Flash point of oil is the lowest temperature at which the oil begins to give enough vapors which give momentary flash of light when a flame is applied to it'. The vapors do not burn continuously, but only for a moment when flame is brought near it. **Fire point:** 'Fire point is the minimum temperature at which the oil gives enough vapors which catch fire and burn continuously at least for five seconds when flame is applied to it'. A lubricant having low flash and fire point is not safe. Because due to rubbing of machine parts in contact, some heat is produced even if the lubricant has been applied in between them. So the temperature increases and can catch fire which may cause damage to life and property in a factory. Therefore, good lubricant should have high flash and fire points. ----------X XX----------	1 1 1 1	4