21 18/11/23 10 Nov-23 10

SCHEME OF VALUATION

(Scoring Indicators)

Revision:15 **Course Code: 1004**

Course Title: Engineering Chemistry I

Qn No.	Scoring Indicator	Split up Score	Sub Total	Total
I	**PART A**			
1.	Atom consists of equal number of positively charged protons and negatively charged electrons.			2
2.	Promoter increases the activity of a catalyst. Poison decreases the activity of a catalyst.	1 1		2
3.	An acid and a base which differ by only one proton are called conjugate acid base pair. Eg: HCl and Cl^- or any other example	1½ ½		2
4.	Boiler scales are thick deposits of $CaCO_3$. (i) Loss of heat (ii) Explosion	1 ½ + ½	1 1	2
5.	Bronze – Cu 80 – 90% and Tin 20-10% Solder - Lead 50% and Tin 50%	1 1		2
	PART B			
II **1. a.**	i. Tumours can be detected and located with accuracy. ii. New borns will have their DNA mapped quickly. iii. Nano technology can create bio compatible joint replacements. iv. Delivery of right amount of medicine to the exact spot of the body. v. Nano shells can float through the body attaching only to cancer shells. When excited by a laser beam, they give off heat and thereby destroy cancer. **Any four applications**	4 x 1		4
b.	Atomic number- number of protons or electrons present in a neutral atom. Mass number- total number of protons and neutrons in an atom	1 1		2
2. a.	Weight of base which exactly neutralize one equivalent of acid. $\text{Equivalent weight of base} = \frac{\text{Molecular weight of base}}{\text{Acidity}}$ Equivalent weight of H_3PO_4 $= \frac{1 \times 3 + 31 + 16 \times 4}{3} = 32.66$	1 1 1		

	Equivalent weight of $Ca(OH)_2 = \frac{40+2(16+1)}{2} = 37$	1		4
b.	Number of moles of acid or base added to one litre of buffer solution as to change the pH by unity.	2		2
3. a.	i. Phenolphthalein ii. Methyl orange iii. Methyl orange or Phenolphthalein iv. Methyl orange	1 x 4		4
b.	It is the product of molar concentration of hydrogen ion and hydroxide ion. Or $K_W = [H^+][OH^-]$	2		2
4. a.	Water can be disinfected by adding about 1kg of bleaching powder to 1000kilo litres of water and allow to remain undisturbed for several hours. $CaOCl2 \rightarrow Ca(OH)_2 + Cl_2$ $Cl2 + H_2O \rightarrow HOCl + HCl$ $HOCl \rightarrow HCl + [O]$	1 3 x 1		4
b.	Salts present in hard water reacts with the soap to form insoluble salts, called scum. This will damage the clothes and hence hard water is not suitable for washing.	2		2
5. a.	i. Clear and odourless ii. Pleasant to taste iii. Free from microorganisms. **Any four characteristics** iv. TDS should be less than 500ppm v. Free from dissolved gases vi. pH should be around 8 vii. Free from suspended impurities viii. Reasonably soft	4 x 1		4
b.	Hardness of water is due to the presence of bicarbonates, chlorides and sulphates of calcium and magnesium	2		2
6. a.	i. Filaments of electric bulb ii. Electric clocks and sewing machine **Any four** iii. Diamond impregnated cutting tools iv. Parts of gas turbine. v. Bearings of automobiles, clutches etc. vi. Surgical implants like Ti-Ta composites.	4 x 1		4

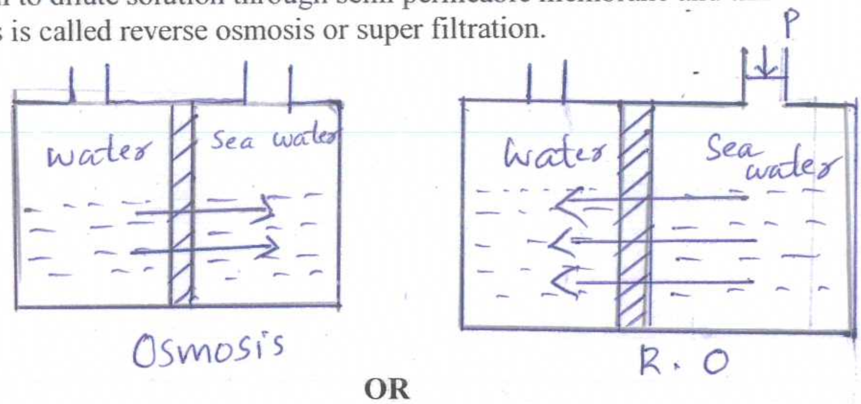
	vii. Magnetic materials like Alnico			
b.	Homogeneous mixture of two or more elements, one of which is essentially a metal.	1	1	2
	Eg: bronze, brass	½ x 2	1	
7.				
a.	Diagram	1	1	4
	In this method, the components of alloys are fused together in a brick lined crucible. The component with higher melting point is first melted and then the component with lower melting point is added. The melt is stirred with graphite rod .Powdered carbon is spreadmon the surface to prevent oxidation.	3		
b.	Name of any two impurities	½ x 2	1	2
	Effect (any two) Silicon: Upto 0.2%Silicon increases strength, without decreasing ductility Sulphur: Sulphur as FeS surrounds the metallic grains and melts during the hot working of steel, that is brittle at red heat. Manganese: If present above 1%, it makes steel harder and brittle Oxygen: Oxygen present as Ferrous oxide, which may cause fracture of steel under load. Phosphorus: Makes steel cold short, that is brittle at room temperature. Nitrogen: Nitrogen as nitride makes steel hard and undesirable for working.	½ x 2	1	
	PART C **UNIT I**			
III.	**Name only**	½ each		
a.	**Name and Explanation** a) HiPCO: Carbon monoxide gas and clusters of iron atoms are heated in a chamber under pressure. CO molecules settle on iron clusters and breaks into carbon and oxygen. Iron acts as the catalyst and carbon atoms combine to form CNT b) CVD: Hydrocarbon like methane is heated in a chamber containing iron as catalyst. Due to high temperature, C-H bond breaks and carbon atoms are formed. c) Plasma torch method: Methane is passed through plasma torch. The C-H bond breaks and carbon atoms are formed.	2 each		6
b.	~~Five properties~~ i. Very strong ii. High thermal conductivity iii. High electrical conductivity. iv. Light weight, density about one fourth of steel v. Tensile strength is 100 times greater than that of steel of same diameter. vi. Young's modulus is about 5 times grater than that of steel	5 x 1		5

	vii. Sticky due to van der Waal's force of attraction.			
	Any five properties			
c.	Positive catalyst: It increases the rate of a chemical reaction.	1		
	Eg: Spongy iron in Haber process	1		4
	Negative catalyst- It decreases the rate of a chemical reaction	1		
	Eg: Phosphoric acid acts as a negative catalyst in the decomposition of hydrogen peroxide	1		
	OR			
IV. a.	a. Homogeneous catalysis- catalytic reaction in which both the reactants and catalyst are in same phase.	2	3	
	Eg: $SO_{2(g)} + O_2(g) \text{-------------}\rightarrow SO_{3(g)}$	1		
	b. Heterogneous catalysis- catalytic reaction in which the reactant and catalyst are in different phase.	2	3	6
	Eg: $N_2 + 3H_2 \text{-----------------}\rightarrow 2NH_3$	1		
b.	Carbon nano tube is formed by rolling one atom thickness graphite(graphene)	2	2	
	Single walled carbon nano tube It contains only single cylinder or single layer.	½ 1	1½	5
	Multi walled carbon nano tube It contains multiple layers	½ 1	1 ½	
c.	(see table below)	4 x 1		4

Atom	Molecule
Atom is the smallest particle of an element	Molecule is the smallest particle of an element or compound
Atom is chemically indivisible	Molecule can be split into constituent atoms
Atom may or may exist in free state	Molecule can exist in free state
Atom directly take part in chemical reaction	Molecule split into atoms and these atoms take part in chemical reaction

	UNIT II			
V.				
a.	**Arrhenius theory**			
	Acids liberates hydrogen ion when dissolved in water or acids are proton donors	1		
	$HCl \longrightarrow H^+ + Cl^-$	½	3	
	Base liberates hydroxide ion when dissolved in water or bases are hydroxide donors	1		
	$NaOH \longrightarrow Na^+ + OH^-$	½		6
	Lewis theory			
	Lewis acids accept lone pair of electron to form co-ordinate bond.	1	3	
	Eg: H^+, BF_3	½		
	Lewis bases donate lone pair of electron to form co-ordinate bond.	1		
	Eg: H_2O, NH_3	½		
b.	Buffer solution: Solution which can resist the change in pH by the addition of small amount of acid or base.	2	2	5
	Acidic and Basic	½ + ½		
	Acidic buffer is a mixture of weak acid and its salt with a strong base.	½	3	
	Eg: Acetic acid and sodium acetate	½		
	Basic buffer is a mixture of weak base and its salt with a strong acid.	½		
	Eg: Ammonium hydroxide and ammonium chloride	½		
c.	pH is negative logarithm to the base 10 of hydrogen ion concentration. Or $pH = -\log_{10}[H^+]$	1	1	
	$[OH^-] = 0.01$	½		4
	$pOH = -\log_{10}[OH^-]$			
	$= \log_{10}[0.01]$	1		
	$= 2$ (substitution and result)	~~½~~	3	
	$pH + pOH = 14$	½ 1		
	$pH = 14 - 2 = 12$			
	OR			
VI.				
a.	Molarity: Number of moles of solute present in one litre of solution. Or Molarity = $\dfrac{\text{Weight/ litre of solute}}{\text{Molecular weight}}$	2		

	Normality: Number of equivalents of solute present in one litre of solution. Or Normality $= \dfrac{\text{Weight/ litre of solute}}{\text{Equivalent weight}}$	2		6
	Standard solution: Solution whose concentration is known.	2		
b.	1. To find out the acidic, basic or neutral nature of a medium. 2. In the production of potable water. 3. Electroplating 4. In agriculture. 5. In food digestion. 6. Textile industry 7. Sugar industry 8. In food preservation 9. Vomiting. 10. pH of human blood and its importance			
	Any five applications	1 x 5		5
c.	$N_1V_1 = N_2V_2$	½		
	$V_1 = 24ml$ Wt / litre $= 12.6 \times 2 = 25.2g/l$ $N_1 = 25.2 / 63 = 0.4N$ $V_2 = 20ml$	 ½ ½ 		
	$N_2 = \dfrac{0.4 \times 24}{20}$	½		
	$= 0.48N$	½		4
	$w = \dfrac{NEV}{1000}$	½		
	$= \dfrac{0.48 \times 56 \times 400}{1000}$	½		
	$= 10.752g$	½		
	UNIT III			
VII a.	Diagram	1		
	Two types of resins are used- acidic or cation exchange resin	½		

	And basic or anion exchange resin	½			
	Resins in the form of pellets are filled in two separate tanks. Hard water first is passed through the acidic resin and the organic acid group will exchange all the cations from water.	1			
	$E\text{-}H + M^+ \dashrightarrow EM + H^+$	½			6
	The water became acidic and this water is then passed through the second tank containing basic resin. Substituted ammonium hydroxide group present in the resin will exchange all the negative ions from water	1			
	$E\text{-}OH + X^- \dashrightarrow EX + OH^-$	½			
	H+ ions from the first tank and OH- ions from second tank combines to form water and the water coming out from the second tank contains no ions.	½			
	$H^+ + OH^- \dashrightarrow H_2O$	½			
b.	1. Colourless, odourless and tasteless liquid. 2. Freezes at 0°C and boils at 100°C. 3. Density is $1 g/cm^3$ 4. Water molecule is polar. 5. Ionic and polar compounds dissolve in water. 6. Poor conductor of electricity. 7. Water molecule has an angular V shaped structure with a bond angle of 104.5° 8. It gives a bluish tinge in thick layers. **Any five properties**	1 x 5			5
c.	When a pressure greater than osmotic pressure is applied on the concentrated solution, the solvent is forced to move from concentrated solution to dilute solution through semi permeable membrane and this process is called reverse osmosis or super filtration.	2			
		2			4
	OR				
VIII a.	Block diagram	1			
	1. Screening: The water is passed through bar screen or mesh screen to remove coarse soils or gravel. 2. Sedimentation: Water is allowed to stand undisturbed in big tanks for 6 to 12 hours. During this process most of the suspended particles settle down under force of gravity.	1 x 5			

<table>
<tr><td></td><td>3. Coagulation: Finely divided suspended particles can be settled down by adding certain chemicals like alum.
4. Filtration: Insoluble colloidal and bacterial impurities are removed by using filters. Two types of filters are there
a. Gravity sand filter
b. Pressure filter
5. Sterilisation: The process of destroying disease producing bacteria and microorganisms from the water and make it safe for drinking is called sterilization or disinfection.</td><td></td><td></td><td>6</td></tr>
<tr><td></td><td>Methods- Name only</td><td>½ x 5</td><td>2 ½</td><td></td></tr>
<tr><td></td><td>Explanation</td><td>½ x 5</td><td>2 ½</td><td></td></tr>
<tr><td>b.</td><td>1. By boiling</td><td>½</td><td></td><td></td></tr>
<tr><td></td><td>2. Clarke's method</td><td>½</td><td>1</td><td></td></tr>
<tr><td></td><td>Boiling Method: On boiling, soluble bicarbonates of Calcium or magnesium are decomposed into insoluble carbonates.</td><td>1 ½</td><td>2</td><td></td></tr>
<tr><td></td><td>$Ca(HCO_3)_2 \dashrightarrow CaCO_3 + CO_2 + H_2O$</td><td>½</td><td></td><td></td></tr>
<tr><td></td><td>Clarke's Method: Required quantity of Ca(OH)2 (slaked lime) is added to hard water. Bicarbonates of calcium or magnesium are precipitated as insoluble carbonates.</td><td>1 ½</td><td>2</td><td>5</td></tr>
<tr><td></td><td>$Ca(HCO_3)_2 + Ca(OH)_2 \dashrightarrow 2CaCO_3 + 2H_2O$</td><td>½</td><td></td><td></td></tr>
<tr><td>c.</td><td><table><tr><th>Soft water</th><th>Hard water</th></tr><tr><td>1. Produces lather immediately with soap solution.
2. Does not contain calcium or magnesium salts.
3. It can be used for domestic purpose, industries and in boilers.
4. It dissolves lead from lead pipes and thus cause lead poisoning</td><td>1. Does not produce lather immediately with soap solution.
2. Contains calcium or magnesium salts.
3. It cannot be used for domestic purpose, industries and in boilers.
4. It does not dissolve lead from lead pipes and thus prevent lead poisoning.</td></tr></table></td><td>1 x 4</td><td></td><td>4</td></tr>
<tr><td></td><td>UNIT IV</td><td></td><td></td><td></td></tr>
<tr><td>IX
a.</td><td>Name only
Name and explanation
1. Annealing: Process of heating steel to a certain high temperature in a furnace and cooling it slowly in a planned manner.
2. Quenching or hardening: Heating steel beyond redness (1123K) and suddenly cooling by dipping in water or oil.</td><td>½ x 3
2 each</td><td></td><td>6</td></tr>
</table>

	3. Tempering: Steel is heated to a temperature of about 550K.It is then kept at that temperature for some time and cooled slowly. 4. Nitriding: Steel isheated to about 820K in an atmosphere of ammonia gas. After heating for long time, it is cooled slowly. Nitriding provides a hard coating of nitrides of metals on steel.			
b.	Advantages: 1. Rate of production is high 2. Dimensional accuracy and good surface finish 3. Cleaner and quieter operation 4. Life of component parts is longer. 5. Porous parts can be produced. 6. Highly skilled labour is not required. 7. Process makes use of 100% raw materials. 8. Complex shapes can be produced . 9. Parts with any composition can be produced. 10. Impossible parts like super hard cutting tools can be produced. **Any three advantages**	1 x 3		
	Limitations: 1. Toxicity 2. Pyrophoricity 3. Explosivity **Any two limitations**	1 x 2		5
c.	1. To increase the resistance to corrosion. 2. To increase the hardness of metal. 3. To lower the melting point of the metal and make it easily fusible 4. To modify the chemical activity of the metal. 5. To modify colour 6. To provide better castability **Any four points**	1 x 4		4
	OR			
X a.	Powder metallurgy is the technology of producing metallic articles by compacting metal powder in a die with little or no melting followed by sintering.	1		6
	Name only — Atomization & Reduction, chemical mixing, compacting, pre-sintering and Sintering.	1 x 5		
b.	1. Malleability 2. Ductility 3. Thermal conductivity 4. Electrical conductivity 5. Weldability 6. Machinability 7. Toughness 8. Hardness 9. High melting point			

	10. Specific gravity **Any five properties**	1 x 5		5
c.	(table below)	1 x 4		4

Property	Cast iron	Wrought iron	steel
1.Composition	**2-5% Carbon**	**Less than 0.2% carbon**	**0.2 – 2% carbon**
2.Structure	Crystalline	Fibrous	Granular
3. Melting point	1200oC	1500oC	1300-1400oC
4.Hardness	Hard	Soft	Medium hardness
5.Tempering	Cannot be tempered	Cannot be tempered	Can be tempered
6.Magnetisation	Cannot be permanently magnetised	Easily magnetized, but not permanent	Can be permanently magnetized.