SCHEME OF VALUATION
(Scoring Indicators)

Revision: 2015 **Course Code: 1004**

Course Title: ENGINEERING CHEMISTRY – I

Qst. No	Scoring Indicator	Split Up Score	Sub Total	Total
	PART – A			
I 1	Definition of Nano chemistry Two examples.	1 ½ +½	2	
2	Definition of buffer solution. Example.	1 1	2	
3	Temporary hardness-Dissolved bicarbonate of calcium and magnesium Permanent hardness-Dissolved chlorides or sulphates of calcium and magnesium	1 1	2	**10**
4	Statement of powder metallurgy.	2	2	
5	Brass – Cu = 60% , Zn = 40% Bronze – Cu = 90%, Sn = 10%	½ +½ ½ +½	2	
II	**PART – B**			
1 (a)	Any 3 differences between atom and molecule.	1+1+1	3	
(b)	Homogeneous catalysis statement and one example. Heterogeneous catalysis statement and one example.	1 + ½ 1 + ½	3	**6**
2 (a)	Any 3 applications of carbon nanotubes.	1+1+1	3	
(b)	(i) No of protons = 6 No of neutrons = 13 – 6 = 7 No of electrons = 6 (ii) No of protons = 11 No of neutrons = 23 – 11= 12 No of electrons = 11	½ ½ ½ ½ ½ ½	3	**6**
3 (a)	Definition of equivalent weight of an acid and equivalent weight of a base.	1+1	2	
(b)	Any 4 applications of p^H.	4 x 1	4	**6**

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4 (a)	• Strong acid x strong base → Phenolphthalein or methyl orange.	1		
	• Strong acid x weak base →Methyl orange	1		
	• Weak acid x strong base → Phenolphthalein	1	4	
	• Weak acid x weak base → No sharp end point	1		
(b)				**6**
	$P^{OH} = -\log [OH]^-$	½		
	$p^{OH} = -\log [0.02] = 2 - \log 2 = 3 - 0.3030 = \underline{1.699}$	½		
	$p^H + p^{OH} = 14$	½	2	
	$p^H = 14 - P^{OH} = 14 - 1.699 = \underline{12.301}$	½		
5 (a)	Definition of ion exchanger, cation exchanger and anion exchanger.	½+½+½		
	Cation exchangers remove all positive ions in water (Ca^{2+}, Mg^{2+}) by exchange with H^+.	½	3	
	Anion exchangers remove all negative ions in water (cl^-, SO_4^{2-}) by exchange with OH^-.	½		**6**
	H^+ and OH^- combine to form H_2O.	½		
(b)	Definition of reverse osmosis.	1	3	
	Any two advantages of reverse osmosis.	1+1		
6 (a)	Any three characteristics of potable water.	3 x 1	6	
(b)	Three limitations of hard water in industrial use.	3 x 1		**6**
7 (a)	Three limitations of powder metallurgy.	3 x 1	6	
(b)	Any 3 physical properties of metal with statement.	3 x 1		**6**
	PART – C			
III(a)	Any two methods out of HiPCO, CVD, Plasma process, Laser ablation method, Arc discharge method.	3+3	6	
(b)	Catalytic promoter and catalytic poison definition.	1 ½ +1½		**15**
	One example for each.	1+1	5	
(c)	Any four applications of nano particles.	4 x 1	4	

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IV(a)	Any six properties of carbon nanotubes.	6 x 1	6	
(b)	Electrons, Protons and neutrons.	½+½+½		
	Electrons are negatively charged particle.	½		
	Mass of electron $= 9.109 \times 10^{-31}$Kg	½		
	Charge of electron $= 1.602 \times 10^{-19}$C	½		
	Mass of proton $= 1.672 \times 10^{-27}$Kg.	½	5	
	Charge of proton is opposite to that of electron.	½		
	Neutrons are chargeless particle.	½		
	Mass of neutron $= 1.675 \times 10^{-27}$Kg.	½		15
(c)	carbon nanotubes are cylindrical tubes formed by rolling one or more graphene sheets.	1		
	Single walled carbon nanotube – single cylinder.	1	4	
	Double walled carbon nanotubes – consist of multiple concentric nanotube cylinders.	1		
	Based on orientation there are 3 varieties of CNTs – Arm chair, zig zag and chiral.	1		
V(a)	Statement of Arrhenius theory and 2 examples.	1+1		
	Statement of Lowry – Bronsted theory and 2 examples.	1+1	6	
	Statement of Lewis theory and 2 examples.	1+1		
(b)	(i) $p^H = -\log[H^+]$	1		
	$[H^+] = 0.002 \times 2 = 0.004 = 4 \times 10^{-3}$	1		
	$p^H = -\log [4 \times 10^{-3}] = 3 - \log 4 = 3 - 0.602 = \underline{2.398}$	½		
	(ii) $p^H = -\log[H^+]$	1	5	
	$P^H = -\log[0.002] = -\log[2 \times 10^{-3}] = 3 - \log 2$	1		15
	$= 3 - 0.3010 = \underline{2.699}$	½		
(c)	Definition of ionic product of water.	1		
	Water undergoes self ionisation as follows			
	$H_2O \rightleftharpoons H^+ + OH^-$	1		
	$K = \frac{[H^+][OH^-]}{[H_2O]}$	1	4	

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	$K[H_2O] = [H^+][OH^-]$	1		
	$K_W = [H^+][OH^-]$	1		
VI(a)	Definition of acidic and basic buffer.	1+1		
	Acidic buffer $P^H < 7$	1		
	Basic buffer $P^H > 7$	1	6	
	Examples for acidic and basic buffer.	1+1		
(b)	Base + Acid ⟶ Salt + Water (neutralisation reaction)	1		
	According to Arrhenius concept acid gives H^+ ions and base gives OH^- ions when dissolved in water. H^+ and OH^- combine to form H_2O.	1		
	One example.	1	5	
	According to Lewis concept base donates an electron pair to acid forming co ordinate bond. Lewis base have at least one lone pair electron in its valence shell. Lewis acid must have vacant orbital.	1		
	One example.	1		15
(c)	(i) $N = \frac{W \times 1000}{E \times V}$	½		
	Equivalent weight of NaOH = $\frac{\text{Molecular weight}}{\text{Acidity}}$ = 40/1 = 40	1		
	$N = \frac{96 \times 1000}{40 \times 600} = \underline{\underline{4N}}$	½		
	(ii)) $N = \frac{W \times 1000}{E \times V}$	½	4	
	Equivalent weight of crystalline oxalic acid($H_2C_2O_4.2H_2O$) = $\frac{\text{Molecular weight}}{\text{Basicity}}$ = $\frac{2x1 + 2x12 + 4x16 + 2x18}{2} = \frac{126}{2} = \underline{\underline{63}}$	1		
	$N = \frac{3.15 \times 1000}{63 \times 100} = \underline{\underline{0.5N}}$	½		
VII(a)	Block diagram	1		
	Different steps – screening, sedimentation, coagulation, filtration, sterilization with explanation.	5 x 1	6	

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(b)	Statement of temporary hardness. i) **Boiling** – explanation with one equation. ii) **Clark's process** – explanation with one equation.	1 1+1 1+1	5	**15**
(c)	Any four differences between hard water and soft water.	4 x 1	4	
VIII(a)	The removal of dissolved salts and minerals from the sea water and making it drinkable is called desalination of sea water. Reverse osmosis diagram and explanation.	1 2+3	6	
(b)	Statement of sterilization. Any 4 sterilization methods out of chlorination, sterilization by bleaching powder, ozone, UV radiation, ultrasonic oscillation with explanation .	1 4 x 1	5	
(c)	▪ **Formation of boiler scales:** On boiling, hard water deposits scale on the inner walls of the boilers. The scale is hard and heat insulating and leads to wastage of fuel. ▪ **Danger of explosion:** Boiler scales crack **and** the water suddenly comes in contact with overheated iron walls of the boiler, large amount heat produced and the boiler explodes due to corrosion. ▪ **Corrosion:** $MgCl_2$ present in hard water hydrolysed and generates free HCl. It corrodes the boiler and shortens its life.	2 1 1	4	**15**
IX(a)	Four methods of heat treatment of steel with explanation.	1½+1½+ 1½ +1 ½	6	**15**
(b)	Any 5 advantages of powder metallurgy.	5 x 1	5	
(c)	Effects of any 2 impurities in steel (S, Si, P, N, O)	2 +2	4	

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X(a)	Statement of powder metallurgy .	1		
	Steps with explanation			
	i) Production of metal powder	1		
	ii) Chemical mixing and blending of metal powder	1	6	
	iii) Compacting	1		
	iv) Pre sintering	1		**15**
	v) Sintering	1		
(b)	Definition of alloy.	1		
	Diagram of fusion method	2	5	
	Explanation	2		
(c)	Any four purposes of making alloys.	4 x 1	4	