

DIPLOMA EXAMINATION IN ENGINEERING / TECHNOLOGY/ MANAGEMENT/ COMMERCIAL PRACTICE

ENGINEERING CHEMISTRY-I

MAXIMUM MARKS: 100

SCHEME OF EVALUATION

REVISION - 2015						
SUBJECT CODE: 1004						
ENGINEERING CHEMISTRY-I						
Qst No			Scoring Indicator	Split up Score	Sub Total	Total
Unit	No	Sub				
PART A						
I	1		Materials containing particles in the Nano range of 1-100nm size Any two examples	1 $\frac{1}{2} + \frac{1}{2}$	1 1	2
	2		At the end point number of equivalents of acid is equal to number of equivalents of base. $V_1N_1 = V_2N_2$	1 1	1 1	2
	3		Soft water give lather with soap but hard water does not. Soft water contains no multivalent ions but hard water contains bicarbonates, chlorides and sulphates of Ca and Mg	1 1	1 1	2
	4		• Brass: Cu and Zn • Solder: Pb, Sn	$\frac{1}{2} + \frac{1}{2}$ $\frac{1}{2} + \frac{1}{2}$	1 1	2
	5		Product of concentrations of H^+ ions and OH^- ions in water. At $25^\circ C$, $K_w = [H^+][OH^-] = 10^{-7} \times 10^{-7} = 10^{-14}$	1 1	1 1	2
PART B						
II	1	a	Graphite sheet(s) of sp^2 hybridized carbon atoms rolled into a cylindrical tube of approximately 0.3nm diameter. SWCNT and MWCNT	2 $\frac{1}{2} + \frac{1}{2}$	2 1	3
		b	i) $^{31}_{15}P$: P = 15, N= 31-15 = 16, E= 15 ii) $^{35}_{17}Cl$: P = 17, N= 35-17 = 18, E= 17 iii) $^{28}_{14}Si$: P = 14, N= 28-14 = 14, E= 14	1 1 1	1 1 1	3
	2	a	Caused by presence of (HCO_3^-) of Ca and Mg. Any one process	1 Explanation :1 Reaction :1	1 2	3
		b	Soaps are sodium salt of fatty acid. Ca^{2+} and	Reaction:1	1	3

			Mg^{2+} ions replace Na^+ and form insoluble scum. $(R - COO)_2Ca$.	Explanation:2	2	
3	a		Neutralization: Acid + Base \rightarrow Salt + Water Arrhenius Concept: acids $\rightarrow H^+ + OH^- \rightarrow H_2O$ Lewis concept: formation of coordinate bond.	1 1 1	1 1 1	3
	b		$W = \frac{NEV}{1000}$ $= \frac{0.15 \times 69 \times 250}{1000}$ $= 2.5875$	Equation: 1 Substitution: 1 Answer : 1	1 1 1	3
4	a		Any three properties.	1+1+1	1+1+1	3
	b		Cast iron : Carbon Content = 2.5 to 4.3% Wrought iron : Carbon Content=0.12 to 0.25% Steel : Carbon Content= 0. 2 to 1.5%	1 1 1	1 1 1	3
5	a		Homogenous catalysis: catalyst and reactants in same phase. Any one example Heterogeneous catalysis: catalyst and reactants in different phase. Any one example	1 + ½ 1 + ½	1 ½ 1 ½	3
	b		Any three difference	1+1+1	1+1+1	3
6	a		Art of producing articles from metal powders. Any two uses.	1 1 + 1	1 2	3
	b.		Any three disadvantages	1+1+1	1+1+1	3
7	a		i) Methyl orange (pH range 3.1 – 4.5) weak base X strong acid. At the endpoint, pH change from 3.5 to 7.5 ii) Phenolphthalein (pH range 8.3 - 10) weak acid X strong base. At the endpoint, pH change from 6.5 – 10.	Indicator : ½ Explanation :1 Indicator : ½ Explanation :1	1 ½ 1 ½	3
	b		pH = $-\log[H^+]$ i) $[H^+] = 0.001$; pH = $-\log[0.01] = 2$ ii) $[H^+] = 0.004$; pH = $-\log[0.004] = 2.3979$	½ + ½ + ½ ½ + ½ + ½	1 ½ 1 ½	3
PART C						
Unit I	III	a	HiPCO: Carbon monoxide acts as a feedstock. SWNT grow on catalytic clusters of Fe under high-pressure and high-temperature via CO disproportionation. $CO + CO \rightarrow CO_2 + C(SWNT)$. SWNT material of up to 97 mole-% purity has been produced Arc Discharge method: MWNTs can be obtained in the cathode deposit of the DC arc discharge evaporation of pure graphite rods in an enclosure that is filled with inert gas at low pressure.	2 ½ 2 ½	2 ½ 2 ½	5
		b	Any five applications	1X5	1X5	5

		c	Promoter: enhance the activity of catalyst Any one example Poison : decrease the activity of catalyst Any one example	1 ½ 1 1 ½ 1	2 ½ 2 ½	5
	IV	a	Any five properties	5 X 1	5 X 1	5
		b	Any five applications	5 X 1	5 X 1	5
		c	Atom is the smallest particles that retain all properties of an element. Fundamental particles: Protons, Electrons, neutrons Protons : Mass = 1.672×10^{-24} g Charge = $+ 1.6022 \times 10^{-19}$ C Neutrons : : Mass = 1.6749×10^{-24} g Charge = 0 Electrons : : Mass = 9.109×10^{-27} g Charge = $+ 1.6022 \times 10^{-19}$ C	1 1 ½ ½ ½ ½ ½	1 1 1 1 1	5
Unit II	V	a	Lowry - Bronsted theory: Any example illustrating Acid as proton donor and base as proton acceptor. Explanation of the reaction Conjugate pair: a pair of acid and base that differ by a proton. Amphoteric substance: any substance that can act both as acid and base.	1 2 1 1	3 1 1	5
		b	A solution which resist s any change in its pH when small amount of acid or base is added to it. Acidic buffer: mixture of weak acid and its salt with a strong base. One example Basic buffer: mixture of weak base and its salt with a strong acid. One example	2 1 ½ 1 ½	2 1 ½ 1 ½	5
		c	1. $N(\text{Na}_2\text{CO}_3) = \frac{W \times 1000}{E \times V} = 0.1005$ 2. $V_1N_1 = V_2N_2$ 3. $N_2 = \frac{V_1N_1}{V_2} = 0.0971$ 4. $W(\text{HCl}) = \frac{NEV}{1000} = 0.5258\text{g}$	1. Equation : ½ Substitution : ½ Result : ½ 2. Principle : ½ 3. Equation : ½ Substitution : ½ Result : ½ 4. Equation : ½ Substitution : ½ Result : ½	1. 1 ½ 2. ½ 3. 1 ½ 4. 1 ½	5
	VI	a	Any five applications	1 x 5	1X5	5
		b	$V_1N_1 = V_2N_2$	1. Equation : 1	2 ½	5

			$200 \times 0.02 = N_2 \times 2000$ 1. $N_2 = 0.002$ 2. $pH = -\log(0.002) = 1.699$	Substitution : 1 Result : $\frac{1}{2}$ 2. Equation : 1 Substitution : 1 Result : $\frac{1}{2}$	2 $\frac{1}{2}$	
		c	1. Buffer capacity: The quantity of a strong acid or strong base that must be added to one liter of a solution to change it by one pH unit. $\beta = \frac{dn}{dpH}$; dn =no of moles of acid or base added; dpH= change in pH 2. p OH = $-\log 0.004$ $= 2.3979$ $pH = 14 - pOH = 11.6021$	1. Definition: 2 Expression: 1 2. pOH= 1 pH= 1	3 2	5
Unit III	VII	a	Water that can be used to drink or can be used for cooking. Any four characteristics.	1 4 X 1	1 4	5
		b	Chlorides and Sulphates of Ca and Mg Ion Exchange method Cation exchange: explanation with reaction Anion exchange : explanation with reaction Neutralization to produce potable water	1 1 + $\frac{1}{2}$ 1 + $\frac{1}{2}$ 1	1 4	5
		C	Bleaching Powder: $CaOCl_2 + H_2O \rightarrow Ca(OH)_2 + Cl_2$ $Cl_2 + H_2O \rightarrow HOCl + HCl$ $HOCl \rightarrow HCl + (O)$ Ozone: $O_3 \rightarrow O_2 + (O)$ Nascent oxygen kills germs and bacteria Advantages of Ozonization over chlorine.	Explanation: 1 Reactions : 1 Explanation: 1 Reactions : 1 1	2 2 1	5
	VIII	a	Removal of salt from sea water Desalination using RO: RO definition SPM used: synthetic membranes made of nylon or cellulose. Pressure greater than osmotic pressure applied. Water flows from sea water to fresh water side.	1 1 1 1 1	1 4	5
		b	Clarification : Screening, Sedimentation, Coagulation, Filtration Explanation Sterilization : Explanation (Chlorination, Ozonization, UV, Ultrasonic Sound)	$\frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2}$ $\frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	2 2 1	5
		c	Hard crust or scales formed on the inner walls of the steam boilers due to using hard water.	2	2	5

			The bicarbonates or sulphates of Ca and Mg precipitate out on boiling.	1	1	
			Fuel wastage	1	2	
			Boiler explosion	1		
Unit IV	IX	a	Homogenous mixture of two or more elements out of which at least one is metal.	1	1	5
			Any four purposes.	1 X 4	4	
		b	Si: increases strength and hardness, removes trapped gases and blow holes.	1	1	5
			C: increases hardness, decreases ductility.	1	1	
			Mn: weldability decreases, surface quality increases.	1	1	
			P: cold short	1	1	
			S: red short	1	1	
		c	Explanation 1. Annealing	1	1	5
			2. Quenching	1	1	
			3. Tempering	1	1	
			4. Nitriding	1	1	
			Hardness and elasticity of steel can be controlled by heat treatment.	1	1	
	X	a	Steps with Explanation			5
			Production of metal powders	$\frac{1}{2} + \frac{1}{2}$	1	
			Mixing or blending	$\frac{1}{2} + \frac{1}{2}$	1	
			Compacting	$\frac{1}{2} + \frac{1}{2}$	1	
			Pre-sintering	$\frac{1}{2} + \frac{1}{2}$	1	
			Sintering	$\frac{1}{2} + \frac{1}{2}$	1	
		b	Any five advantages	1X 5	1X 5	5
		c	Diagram:	1	1	5
			Explanation: Components are fused together in brick lined melting pot. The component metal with a higher melting point is melted first and then the other component with a lower melting point is added to the melt. Molten mass stirred with graphite rod to get uniform composition. Surface of molten mass covered by powdered carbon to prevent oxidation.	4	4	