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Total number of printed pages – 3

B.Tech
BS 1103 (New)

Second Semester Examination – 2011

CHEMISTRY – I

Full Marks – 70

Time : 3 Hours

Answer Question No. 1 which is compulsory and any **five** from the rest.
The figures in the right-hand margin indicate marks.

1. Answer the following questions :

2 × 10

- (a) Why the fusion curve of ice in phase diagram is slightly inclined toward pressure axis.
- (b) Write the time – independent Schrödinger equation for particle of mass M with potential V .
- (c) Identify the crystal system in following cases :
- (i) if $a = 4 \text{ nm}$, $b = 7 \text{ nm}$, $c = 9 \text{ nm}$ and $\alpha = \beta = \gamma = 90^\circ$
- (ii) $a = 6 \text{ nm}$, $b = 6 \text{ nm}$, $c = 6 \text{ nm}$ and $\alpha = \beta = \gamma = 90^\circ$
- (d) In an ionic crystal of general formula AX . The co-ordination number is six and value of radius ratio is in the range.
- (i) 0.155–0.215 (ii) 0.215–0.414
- (iii) 0.732–1 (iv) 0.414–0.732
- (e) Why it is essential to remove the arsenic in contact process for manufacture of H_2SO_4 ?
- (f) Write down electrode reaction of calomel electrode and oxygen gas electrode.
- (g) Calculate the entropy change in melting 5 gm of ice at 0°C . Given that molar heat of fusion of ice 1440 cal.
- (h) What do you mean by heat of hydration? Give an example.
- (i) What do you mean by fuel cell? Write down the fuel cell reaction of H_2 - O_2 fuel cell.
- (j) What do you mean by intensive properties? Justify emf of the electro-chemical cell is an intensive property.

P.T.O.

2. (a) Explain with suitable example with diagram the following terms used in the phase rule study of heterogeneous equilibrium. 6
- (i) Triple point
- (ii) Eutectic point
- (iii) Univariant system.
- (b) If $\partial U = T\partial S - P\partial V$ then show that $[\partial T/\partial V]_S = -[\partial P/\partial S]_V$. 4
3. (a) What do you mean by gas electrode ? How you determined P^H of solution with help of hydrogen electrode ? Write down the construction of S.H.E. 6
- (b) Heat of reaction for combustion of glucose at constant pressure is -651 kcal at 17°C . Calculate the heat of reaction for same at constant volume. 4
4. (a) Calculate EMF cell
- $\text{Pt}, \text{H}_2(1\text{atm})/\text{HCl}(0.2\text{M})//\text{Cl}_2(1.0\text{atm})/\text{Pt}$ $E^\circ \text{Cl}_2/\text{Cl} = 1.36\text{ V}$. 4
- (b) Justify the order stability in O_2^+ , O_2^{2-} , O_2^- , O_2 by molecular orbital theory. Compare their bond orders, bond lengths and magnetic properties using their molecular orbital electronic configuration. 6
5. (a) What is the effect of temperature on reaction rate ? Give Arrhenius equation. Plot the graph showing variation of K with temperature. What can you calculate from slope. 5
- (b) What do you mean by body centered unit cell ? At room temperature, sodium metal crystallize in body centered cubic cell with $a = 4.24 \text{ \AA}$. Calculate the theoretical density of sodium. Molar mass of sodium is 23.0 gmol^{-1} . 5
6. (a) Define term (i) molecularity, (ii) order (iii) half life period of reaction with example. Describe any one method for determination of order of reaction. 6
- (b) Calculate the voltage required to accelerate an electron to have velocity $1.42 \times 10^9 \text{ ms}^{-1}$. What will be de Broglie wave length ? 4

7. (a) State and explain Hess's law. The molar heat of combustion of $C_2H_2(g)$, C (graphite) and $H_2(g)$ are 310.62, 94.05 and 68.32 Kcal respectively. Calculate heat of combustion of $C_2H_2(g)$. 6
- (b) Calculate the standard potential of Ni^{+2}/Ni electrode. If the cell potential of the cell $Ni/Ni^{+2}(0.01M)//Cu^{+2}(0.1M)/Cu$ is 0.59 V, $E^0_{(Cu^{+2}/Cu)} = 0.34$ V. 4
8. (a) Derive Gibb's Helmholtz equation in term of free energy change and enthalpy change. With help of above equation explain how emf of the cell is calculated. 6
- (b) What do you mean by eigen value and eigene function ? Write down the some application of Schrodinger's equation. 4