(Set-R)

B.Tech-2 (All Br.)

Chemistry

Full Marks : 70

Time : 3 hours

Answer all questions.

The figures in the right-hand margin indicate marks.

Symbols carry usual meaning.

1. Anawer *all* questions : 2×10

(*a*) Write two important applications of Schrödinger wave equation.

(*b*) Electromagnetic radiation having wavelength 250 nm is just sufficient for ionization of sodium atom. Calculate the ionization energy of sodium in kJ/mole ($h = 6.626 * 10^{-34}$ JS)

(*c*) What is the condition of change entropy in spontaneous procss ?

(*d*) Write the Gibb's Duhen equation.

(*e*) What is triple point ?

(*f*) What are the criteria for thermodynamic equilibrium ?

(*g*) Why, it is not possible to measure the absolute value of single electrode potential ?

(*h*) Calculate the pH of solution if cell potential of cell $Ag(s)/Ag^{+}(aq)//H^{+}(aq)/H_2(g)$ is 0.15V

(*i*) What is the difference between nanoparticle and quantum dots ?

(*j*) What is chain reaction ?

2. Show that the energy of a particle in one dimensional box is $E = \frac{n^2h^2}{8ma^2}$. Calculate the energies of an electron in electron volt which is confined in a box of length 1 Å. Also draw the energy level diagram. ($h = 6.626*10^{-34}$ JS, $m = 9.1*10^{-31}$ kg) 5+5

Or

Discuss the applications and limitations of microwave spectroscopy. Explain the rotational activity of following molecules (O_2, F_2, CO, HCl).5+5

3. Derive the expression for chemical potential of an ideal gas $\mu = \mu_0 + RT \ln P$, using the relation $dG = VdP - SdT$. Write the significance of chemical potential. 6+4

Or

From the definition of work function and Gibb's free energy show that $\left(\frac{\partial S}{\partial V}\right)_T = \left(\frac{\partial P}{\partial T}\right)_V$ and $\left(\frac{\partial V}{\partial T}\right)_P = \left(\frac{\partial S}{\partial P}\right)_T$. 5+5

4. Explain different terms involved in phase rule with suitable examples. 10

Or

Discuss the phase diagram of Ag-Pb system. 10

5. Explain the measurement of pH of a solution using glass electrode. Write the advantages of this electrode. 7+3

Or

What is consecutive reaction ? Derive the kinetic equation of this type of reaction. 3+7

6. What is fullerene ? Discuss the classification and applications of fullerene. 10

Or

Discuss the measurement of EMF by potentiometric method. Calculate the emf of the cell : $Ni(s)/Ni^{2+}(0.36\ M)//Cu^{2+}(0.72\ M)/Cu(s)$ using following data : $E^0_{Ni/Ni2+} = 0.25$ V and $E^0_{Cu2+/Cu} = 0.34$ V. 6+4
