RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

B.A./B.Sc. FIRST SEMESTER EXAMINATION, DECEMBER 2018

FIRST YEAR [BATCH 2018-21]

Date : 19/12/2018 **CHEMISTRY (General)**

Time : 11 am – 1 pm **Paper : I** Full Marks : 50

(Use a separate Answer book for each group)

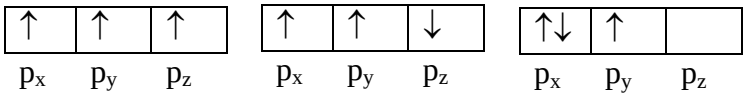
Group – A

UNIT-I

Answer **any one** of the following: [1 × 13]

1. a) State the assumption of Bohr model of hydrogen atom. [2]
   b) Calculate the wavelength of spectral lines when an electron drops from the third to the second Bohr orbit in a H atom.(Rydberg constant = 109700 cm^{-1}) [3]
   c) Give the mathematical expression of the 'Radioactive Decay law' and hence give the physical significance of decay constants. [3]
   d) Radio nuclide with n:p ratio above the stability ratio range decay by β emission and not by neutron emission — Explain. [3]
   e) Frist ionization potential of C atom is greater than that of B atom, whereas the reverse is true for the second ionization potential— Explain. [2]

2. a) Draw the nuclear binding energy curve and point out the information obtained from it regarding the stability of atomic nuclei. [1+3]
   b) What is the difference between electronegativity and electron affinity of an element? [2]
   c) State Hund's rule of maximum multiplicity. [2]
   d) State the significance of principal, azimuthal and magnetic quantum number. [3]
   e) Which of the following arrangement would be more stable and why? [2]



UNIT-II

Answer **any one** of the following: [1 × 12]

3. a) Define order and molecularity of a reaction. Derive an expression for the rate constant of a zero order reaction. What is the unit of the rate constant? Derive the half life period of the reaction. [2+2+1+1]
   b) The equivalent conductance of CH_3COONa, HCl and NaCl at 25°C and at infinite dilution are 78, 384 and 109 ohm^{-1} cm^2 g $equiv^{-1}$ respectively. Calculate the equivalent conductance of acetic acid at infinite dilution at same temperature. [3]
   c) For a chemical reaction the rate constants at temperatures 298 K and 338K are 3.46×10^{-5} min^{-1} and 4.87×10^{-3} min^{-1} respectively. Calculate the energy of activation. [3]

4. a) Deduce Michales Menten equation for an enzyme catalysed reaction. [5]

b) The resistance of a conductivity cell filled with 0.02 (N) KCl is 17.6 ohm. The specific conductance of the solution is 0.0024 $ohm^{-1}cm^{-1}$. Determine the cell constant of the conductivity cell. [2]

c) State Kohlrasuch's law of independent migration of ion. [1]

d) A first order reaction completes 50% in 1 hour. Calculate the time for 90 % completion of the same reaction. [2]

e) State and explain Ostwald dilution law. [2]

Group – B

UNIT-III

Answer **any one** of the following: [1 × 12]

5. a) State the basic postulates the kinetic theory of gas is based upon. [2]

b) At what temperature would ethane molecules have the same r.m.s. velocity as methane molecules at 27^oC. [2]

c) Write down the units of the van der Waals constant a and b. [2]

d) State the principle of equipartition of energy. [1]

e) Applying equipartition law of energy, predict the C_v of CO_2 and CH_4. [3]

f) Write down the expression for Maxwell's distribution law of molecular speeds. Explain the terms. [2]

6. a) Define surface tension. What are the CGS and SI units of surface tension. State whether surface tension of a liquid is an extensive or intensive property. [1+2+2]

b) Establish the relation $\frac{RTc}{P_cV_c}=\frac{8}{3}$ for van der Waals gas. Symbols have their usual meaning. [3]

c) Define critical temperature. Sketch the P-V diagram for a real gas below and above the critical temperature. [2]

d) How does the viscosity coefficient of a gas depend on temperature? [2]

UNIT-IV

Answer **any one** of the following: [1 × 13]

7. a) Classify the following quantities as extensive or intensive properties
mass, density, heat capacity, enthalpy. [2]

b) i) Write down the mathematical definition of the first law of thermodynamics.
ii) From the above expression show that the energy of the universe is a constant. [2+2]

c) Find Q,ΔU, W, ΔH for adiabatic expression of an ideal gas into vacuum. [3]

d) For the reaction
$C(graphite)+H_2O(g)\rightarrow CO(g)+H_2(g)$
$\Delta H^o_{298}=131.28$ kJ/mole. The values of $\bar{C}_p$ / (J / K mol) are : graphite, 8.53; H_2O, 33.58; CO(g) 29.12 and $H_2(g)$, 28.82. Calculate the value of ΔH^o at 125^oC. [4]

8. a) Derive Kirchhoff's equation when C_p values are independent of temperatue. [3]

b) Establish a relation between C_p and C_V where the symbols have their usual meanings. [3]

c) Calculate the maximum work in ergs when 2.0 moles of an ideal gas expand isothermally at 27^oC from 1 lt to 5 lt. [3]

d) Show that Joule Thomson expansion is an isenthalpic process. [2]

e) Obtain the concept of temperature from zeroth law of thermodynamics. [2]

———— × ————