USCH501/02/2022 (Rev)

[Duration: 3 hrs][Marks: 100]

N. B.: 1. All the questions are compulsory
2. Figures to the right indicate full marks.
3. Use of log table/programmable calculator is allowed.
4. Answer to the same question must be written together.

Q.1 Attempt **Any Four** of the following.

(A) What is mean by dipole moment? Explain the structure of CO_2 and SO_2 on the basis of dipole moment. (5)

(B) Derive the expression for moment of inertia. (5)

(C) Define infrared spectroscopy?Calculate the number of vibrational modes associated with following molecules: (i) H_2O, (ii)Benzene (5)

(D) The frequency separation of successive lines in the rotational spectrum of $^{12}C^{16}O$ was found to be 3.842×10^2 m^{-1} while that of $*C^{16}O$ was 3.673×10^2 m^{-1}Calculate the atomic mass of *C (5)

(E) Derive the expression for energy associated with rotational line. (5)

(F) The rotational constant for HCl molecule is 1059 m^{-1} Find the distance in the molecule. Also calculate the oscillation frequency of this molecule if force constant is 516 Nm^{-1}. (5)

Q.2 Attempt **Any Four** of the following.

(A) Show the relation between elevation in boiling point and molecular weight. (5)

(B) Describe Backmann's method of determination of molecular weight of compound. (5)

(C) Describe the dynamic method for measuring the lowering of vapour pressure. (5)

(D) Explain the Berkeley and Hartley's method of determination of osmotic pressure. (5)

(E) State and explain Rault's law for non-electrolyte solution. (5)

(F) A solution containing 0.194 g urea in 100 g of water was found to freeze at -0.06° C. Calculate the molecular weight of urea. Freezing point of water is 0 ° C. Kf = 1.86 K kg mol^{-1}. (5)

Q.3 Attempt **Any Four** of the following.

(A) With neat label diagram explain principle and constructions of Geiger Muller counters. **(5)**

(B) Explain the fissile and fertile material. **(5)**

(C) Describe basic components of nuclear reactor. **(5)**

(D) Define decay constant. A radio element has half life of 140 days. How much time in seconds will be required so that activity falls to 0.05^{th} of its original value? **(5)**

(E) The C14 activity of a sample of wood reported by from Egyptial pyramids is 3.3 dpm/g, if in living plants the equilibrium value of C^{14}activity is 15.3 dpm/g, calculate the age of sample of wood. Half life of C14 is 5720 years. **(5)**

(F) Explain artificial radioactivity with suitable example. **(5)**

Q.4 Attempt **Any Four** of the following.

(A) Explain classification of gel. **(5)**

(B) Explain colloidal electrolyte. **(5)**

(C) Write a note on origin of charge on colloidal particles. **(5)**

(D) With neat label diagram explain the electrophoretic technique. **(5)**

(E) What is colloidal state? Explain its classification. **(5)**

(F) Explain the use of surfactants in pesticide and food industry. **(5)**

Q.5 Answers the following question. **(5)**

(A) Match the following (**Any Five**).

Group A	**Group B**
a. Radiowave	1. Electronic spin
b. Microwave	2. Nuclear transition
c. Infrared	3. Rotational
d. Ultraviolet	4. Nuclear spin
e. X-ray	5. Electronic
f. Gamma ray	6. Bond breaking
	7. Vibrational

(B) State true or false for the following (**Any Five**). **(5)**

a. Boiling point is a colligative property

b. For ideal solution van't Hoff factor i<1.

c. Beckmann thermometer is not used for determination of lowering vapor pressure.

d. Molal depression constant is denoted by k_f.

e. Rast method to determine molecular weight is based on depression in freezing point

f. Osmotic pressure is not a colligative property.

g. Reverse osmosis technique used for water purification.

(C) Answer **Any Five** of the following in one sentence. **(5)**

a. What is recoil nucleus in radioactivity?

b. Write formula forhalf-life of radioelement.

c. What is threshold energy?

d. What is fission energy?

e. Write unit ofradioactivity.

f. Define beta decay.

g. What is mean life of radioactive substance?

(D) Fill in the blanks from the given words (**Any Five**). **(5)**

(Gas in solid, anionic, Xerogel, Zeta potential, viscosity, cationic, detergent)

a. ..... is calculated by equation $=4\pi l\sigma/D$

b. Cake is an example of ..... Colloidal state.

c. $C_{16}H_{33}N(CH3)_3^+Br^-$ is the example of ..... surfactant.

d. Electrophoresis is also dependent on .....

e. The gel which contain more amount of solid is called as .....

f. ..... Is a cleaning agent.

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