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Reg. No. : .....

Code No. : 10002 E      Sub. Code : SMCH 12

B.Sc. (CBCS) DEGREE EXAMINATION, APRIL 2023

First Semester

Chemistry — Core

PHYSICAL CHEMISTRY — I

(For those who joined in July 2017–2019)

Time : Three hours

Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

- The relation for root mean square velocity is
  - $\sqrt{\frac{3RT}{M}}$
  - $\sqrt{\frac{2RT}{M}}$
  - $\sqrt{\frac{8RT}{\pi M}}$
  - $\sqrt{\frac{RT}{M}}$
- The number of vibrational modes of CO<sub>2</sub> and H<sub>2</sub>O molecules are
  - 4, 3
  - 2, 2
  - 3, 2
  - 2, 4

3. The quantum yield ( $\Phi$ ) of a photochemical reaction is expressed as

- $$\frac{\text{Number of molecules decomposed or formed}}{\text{Number of photons of radiation energy absorbed}}$$
  - $$\frac{\text{Number of molecules activated}}{\text{Number of photons of activation energy absorbed}}$$
  - $$\frac{\text{Number of molecules of reactants}}{\text{Number of photons of radiation energy absorbed}}$$
  - None of the above
- Sulphates of calcium, barium and strontium exhibit
    - Chemiluminescence
    - Fluorescence
    - Phosphorescence
    - Bioluminescence
  - ${}_{19}\text{K}^{40}$  and  ${}_{20}\text{Ca}^{40}$  are
    - Isomers
    - Isotopes
    - Isobars
    - Isotones

6. Complete the following nuclear reaction with suitable particle in the place of x.  
 ${}_{27}\text{Co}^{59} + x \rightarrow {}_{27}\text{Co}^{60} + {}_1\text{H}^1$
- (a)  ${}_1\text{H}^1$                       (b)  ${}_1\text{D}^2$   
(c)  ${}_1\text{H}^3$                       (d)  ${}_0\text{n}^1$
7. The crystal defect observed in AgBr is
- (a) Schottky defect  
(b) Frenkel defect  
(c) Metal excess defect  
(d) Metal deficiency defect
8. Which of the following is not a covalent crystal?
- (a) Graphite                      (b) Diamond  
(c) Rock salt                      (d) Fullerene
9. Two solutions of equal osmotic pressures are called \_\_\_\_\_
- (a) Hypotonic solutions  
(b) Hypertonic solutions  
(c) Isotonic solutions  
(d) None of these

10. Freezing point of 0.1 M aqueous solutions will be maximum for
- (a) Glucose                      (b) KCl  
(c) NaCl                          (d)  $\text{K}_2\text{SO}_4$

PART B — (5 × 5 = 25 marks)

Answer ALL questions choosing either (a) or (b).  
Each answer should not exceed 250 words.

11. (a) Explain the principle of equipartition of energy.
- Or
- (b) Calculate the root mean square velocity of oxygen at 27°C. (R =  $8.314 \times 10^7$  ergs; Molecular weight of oxygen = 32).
12. (a) Write a note on quantum yield.
- Or
- (b) Briefly explain the phenomenon of photosensitization with an example.
13. (a) Write a note on half life period and average life period.
- Or
- (b) Write short notes on the composition of nucleus and nuclear forces.

14. (a) Draw the crystal structure of NaCl.

Or

(b) Discuss Schottky and Frenkel defects in crystals.

15. (a) Describe a method of determining the molecular weight of solute using depression in freezing point.

Or

(b) Cottrell's method used to determine the elevation of boiling point.

PART C — (5 × 8 = 40 marks)

Answer ALL questions choosing either (a) or (b).

Each answer should not exceed 600 words.

16. (a) (i) Write the relation for Maxwell's distribution of molecular velocities and explain the terms in it.

(ii) Write notes on viscosity of gases.

Or

(b) (i) Define collision number, collision diameter and mean free path

(ii) Explain how the mean free path and collision diameter of a gas can be calculated from coefficient of viscosity of the gas.

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17. (a) Explain with examples

(i) Phosphorescence

(ii) Fluorescence.

Or

(b) What are lasers? Give the principle, types and applications of lasers.

18. (a) Explain nuclear fission and fusion with suitable examples.

Or

(b) Explain liquid drop model and shell model of the nuclear structure.

19. (a) Write notes on

(i) Miller indices

(ii) Bravais lattices

(iii) Structure of ZnS crystal.

Or

(b) Discuss Schottky and Frenkel defects in crystals.

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20. (b) Derive an expression for the relationship between molal depression in freezing point and molality of a solution.

Or

(b) Write notes on

- (i) Laws of osmotic pressure
- (ii) Vant Hoff Factor
- (iii) Abnormal molecular mass.