

Reg. No. : .....

**Sub. Code : EMCH 31**

### Third Semester

Chemistry — Core

## GENERAL CHEMISTRY — III

(For those who joined in July 2023 onwards)

Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. How many degrees of freedom does a diatomic gas have?
  - (a) 2
  - (b) 3
  - (c) 5
  - (d) 6
2. The point where gas and liquid phases become indistinguishable is known as the
  - (a) Triple point
  - (b) Boiling point
  - (c) Critical point
  - (d) Melting point

3. Miller indices represent
- (a) Interplanar distances
  - (b) Symmetry elements of the crystal
  - (c) The orientation of crystal planes
  - (d) The volume of the unit cell
4. The coordination number in CsCl crystal is
- (a) 4
  - (b) 6
  - (c) 8
  - (d) 12
5. The mass defect is defined as
- (a) The difference in mass between a nucleus and its constituent nucleons
  - (b) The difference between atomic and molecular mass
  - (c) The energy required to break a nucleus apart
  - (d) The energy produced during radioactive decay
6. Radiation hazards are caused mainly due to the emission of
- (a) Light rays
  - (b) Ultraviolet rays
  - (c) Ionizing radiation
  - (d) Infrared rays

7. What is the result of the reaction between an alcohol and a carboxylic acid in the presence of sulfuric acid?
- (a) Esterification                      (b) Hydrolysis  
(c) Oxidation                              (d) Reduction
8. Which of the following compounds will undergo nucleophilic substitution by an  $S_N2$  mechanism?
- (a) tert-Butyl chloride                      (b) Isopropyl chloride  
(c) Ethyl chloride                              (d) Benzyl chloride
9. In Kolbe's reaction, phenol reacts with carbon dioxide to produce
- (a) p-Hydroxybenzoic acid  
(b) Salicylic acid  
(c) Acetic acid  
(d) Phenyl acetic acid
10. Which of the following reagents is used for the reduction of benzaldehyde to benzyl alcohol?
- (a) Sodium borohydride  
(b) Lithium aluminum hydride  
(c) Grignard reagent  
(d) Hydrogen peroxide

PART B — (5 × 5 = 25 marks)

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

Each answer should not exceed 250 words.

11. (a) What are the main postulates of the kinetic molecular theory of gases?

Or

- (b) What is Boyle temperature, and how does it relate to gas behavior?

12. (a) Explain the symmetry elements of crystals.

Or

- (b) Explain anisotropy and isotropy with examples.

13. (a) What is the Geiger – Nuttall rule? How does it relate to radioactive decay?

Or

- (b) Explain the process of radiocarbon dating and its applications.

14. (a) What are the chemical reactions of benzyl chloride?

Or

- (b) Explain the oxidation of diols.

15. (a) Explain the Fries rearrangement reaction.

Or

(b) How is benzyl alcohol prepared by hydrolysis and reduction?

PART C — ( $5 \times 8 = 40$  marks)

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

Each answer should not exceed 600 words.

16. (a) What are Andrews' and Amagat's plots and what do they reveal about gas behavior?

Or

(b) (i) Calculate the root mean square velocity of oxygen molecules at 300 K.

(ii) Explain the Virial equation of state and its relevance to real gases.

17. (a) Compare the structure and properties of diamond and graphite.

Or

(b) What are liquid crystals? Classify and discuss their applications.

18. (a) Describe the concept of radioactive decay series.

Or

(b) Discuss nuclear fission and fusion with example.

19. (a) Describe the  $S_N2$  reaction mechanism with an example.

Or

(b) Explain the chemical properties of alcohols.

20. (a) Explain the mechanism of electrophilic substitution in phenols.

Or

(b) Describe the preparation, properties and uses of resorcinol.

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