

2 0 1 7

(3rd Semester)

CHEMISTRY

(CHEM-231)

(Physical Chemistry—I)

Full Marks : 55

Time : 2½ hours

(PART : B—DESCRIPTIVE)

(Marks : 35)

*The figures in the margin indicate full marks
for the questions*

1. (a) What are the main postulates of kinetic theory of gases? Explain Boyle's law on the basis of kinetic theory. 2+1=3
- (b) The van der Waals' constants for a gas are, $a = 0.751 \text{ dm}^6 \text{ atm mol}^{-2}$ and $b = 0.0226 \text{ dm}^3 \text{ mol}^{-1}$. Calculate V_c and P_c . 4

OR

2. (a) Starting from the basic postulates, derive kinetic gas equation. 4
- (b) Derive van der Waals' equation of state for real gases. 3
3. (a) Derive integrated rate expression for the first-order reaction. What is half-life of this reaction? 2+1=3
- (b) A first-order reaction is 20% completed in 10 minutes. Calculate—
- (i) specific rate constant of the reaction;
- (ii) time taken for the reaction to go up to 75% completion. 2+2=4

OR

4. (a) What is meant by the term temperature coefficient of a reaction? What is the effect of temperature on rates of reactions? 2+1=3
- (b) A first-order reaction is 75% completed in 72 minutes. How long will it take for half completion? 2
- (c) What is meant by energy of activation? How is the rate constant of a reaction related to its activation energy? 1+1=2

(3)

5. (a) What are protective colloids? Explain how a lyophilic colloid can stabilize a lyophobic colloid. What is meant by the term Gold Number? $1+1\frac{1}{2}+\frac{1}{2}=3$
- (b) Write notes on the following : $2\times 2=4$
- (i) Brownian movement
- (ii) Electrophoresis

OR

6. (a) What are gels? How would you differentiate gels from emulsions? $2+1=3$
- (b) Derive an expression for Langmuir's adsorption isotherm. 4
7. (a) Define the term heat capacity at constant pressure and constant volume. Show that $C_p - C_v = R$. $2+2=4$
- (b) What do you understand by the terms internal energy and enthalpy of a system? How are they interrelated? $2+1=3$

OR

8. (a) Derive an expression for work done in isothermal reversible expansion of a gas. 3
- (b) For a reaction at 25 °C enthalpy change (ΔH) and entropy change (ΔS) are $-11.7 \times 10^3 \text{ J mol}^{-1}$ and $-105 \text{ J mol}^{-1} \text{ K}^{-1}$ respectively. Find out whether this reaction would be spontaneous or not. $3+1=4$

(4)

9. (a) Describe in detail the Carnot's reversible cycle for maximum convertibility of heat into work. 3
- (b) Explain what is meant by change of entropy (ΔS) of a system. 2
- (c) What is the entropy change for the evaporation of one mol of *n*-hexane at 341.7 K?
(Given, ΔH_{vap} for *n*-hexane = 29 kJ mol^{-1}) 2

OR

10. (a) Derive an expression for the entropy change of an ideal gas accompanying isothermal expansion. 3
- (b) Calculate the maximum work of expansion of 2 mol of an ideal gas when it expands isothermally and reversibly from 10 litres to 20 litres at 300 K. (Given $R = 0.0821 \text{ lit atm K}^{-1} \text{ mol}^{-1}$) 2
- (c) Discuss entropy changes in reversible and irreversible processes. 2

Subject Code : CHEM/III/03

Booklet No. **A**

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Date Stamp

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To be filled in by the Candidate

DEGREE 3rd Semester
(Arts / Science / Commerce /
.....) Exam., **2017**

Subject

Paper

.....

To be filled in by the Candidate

DEGREE 3rd Semester
(Arts / Science / Commerce /
.....) Exam., **2017**

Roll No.

Regn. No.

Subject

Paper

Descriptive Type

Booklet No. B

INSTRUCTIONS TO CANDIDATES

- 1. The Booklet No. of this script should be quoted in the answer script meant for descriptive type questions and vice versa.**
- 2. This paper should be ANSWERED FIRST and submitted within 45 minutes of the commencement of the Examination.**
- 3. While answering the questions of this booklet, any cutting, erasing, overwriting or furnishing more than one answer is prohibited. Any rough work, if required, should be done only on the main Answer Book. Instructions given in each question should be followed for answering that question only.**

Signature of
Scrutiniser(s)

Signature of
Examiner(s)

Signature of
Invigilator(s)

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CHEM/III/03

2 0 1 7

(3rd Semester)

CHEMISTRY

(CHEM-231)

(Physical Chemistry—I)

(PART : A—OBJECTIVE)

(Marks : 20)

The figures in the margin indicate full marks for the questions

SECTION—A

(Marks : 5)

Put a Tick (✓) mark against the correct answer in the brackets provided for it : 1×5=5

1. The average distance travelled by a molecule between successive collisions is called

- (a) collision path ()
- (b) collision diameter ()
- (c) mean free path ()
- (d) collision distance ()

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(2)

2. Rate constant of a reaction changes when

(a) pressure is increased ()

(b) concentration of reactants is changed ()

(c) temperature is changed ()

(d) a catalyst is added ()

3. Light scattering in colloidal system is known as

(a) Brownian motion ()

(b) coagulation ()

(c) Tyndall effect ()

(d) electrophoresis ()

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(3)

4. Heat transfer at constant pressure _____ the enthalpy of a system.

(a) decreases ()

(b) increases ()

(c) first increases then decreases ()

(d) first decreases then increases ()

5. "Heat cannot flow by itself from a colder body to a hotter body", is a statement of

(a) conservation of mass ()

(b) conservation of momentum ()

(c) first law of thermodynamics ()

(d) second law of thermodynamics ()

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(4)

SECTION—B

(Marks : 15)

Answer the following questions :

3×5=15

1. Define the following :
 - (a) Critical temperature
 - (b) Critical volume
 - (c) Critical pressure

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(5)

2. Distinguish between order of a reaction and molecularity. Give examples.

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(6)

3. Distinguish between physisorption and chemisorption.

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(7)

4. Derive an expression for the Joule-Thompson coefficient. Show that its value is zero for an ideal gas.

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(8)

5. Write a note on Clausius inequality.

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