

SEAT No. _____

SARDAR PATEL UNIVERSITY
B. Sc. (SEMESTER-II) EXAMINATION

No. of Printed Pages: 2

[A-4]



2022

Thursday, 29/09/2022

9:30 a.m. to 11:30 a.m.

PHYSICAL CHEMISTRY (US02CCHE02)

Total Marks: 70

Q:1 Choose one alternative that best completes the statements or answers the question.(10)

(i) For one mole of gas, the ideal gas equation is:

- (a) $PV=RT$ (b) $PV=1/2RT$ (c) $PV=3/2RT$ (d) $PV=5/2RT$

(ii) The compressibility factor Z is given by _____.

- (a) $Z = PV/RT^2$ (b) $Z = PV/2RT$ (c) $Z = PV/RT$ (d) $Z = 2PV/RT$

(iii) The real gases show nearly ideal behavior at

- (a) high P and low T (b) low P and high T (c) low P and low T (d) high P and high T

(iv) The units of surface tension and viscosity of a liquid are, respectively:

- (a) $\text{kg m}^{-1} \text{s}^{-1}, \text{Nm}^{-1}$ (b) $\text{kg m}^2 \text{s}^{-1}, \text{Nm}^{-1}$ (c) $\text{Nm}^{-1}, \text{kg m}^2 \text{s}^{-1}$ (d) $\text{Nm}^{-1}, \text{kg m}^{-1} \text{s}^{-1}$

(v) When a drop of mercury is put on a glass surface it becomes sphere due to:

- (a) cohesion is greater than adhesion (b) adhesion greater than cohesion
(c) surface tension of mercury (d) inter molecular force of attraction

(vi) Which of the following relation is true?

- (a) $C_p > C_v$ (b) $C_v > C_p$ (c) $C_p = C_v$ (d) $C_p = C_v = R$

(vii) Enthalpy of a compound is equal to its:

- (a) heat of combustion (b) heat of reaction (c) heat of formation (d) heat of solution

(viii) The first law of thermodynamics is about

- (a) activation energy (b) conservation of energy (c) thermal energy (d) none of these

(ix) Rate of chemical reaction indicates the change in the concentration of a reactant or a product per _____.

- (a) unit time (b) unit pressure (c) unit temperature (d) none of these

(x) Which of the following is a unit of rate constant k of a third order reaction ?

- (a) $\text{lit}^2 \text{mol}^{-2} \text{sec}^{-1}$ (b) $\text{lit}^2 \text{mol} \text{sec}^{-1}$ (c) $\text{lit mol}^{-2} \text{sec}^{-1}$ (d) sec^{-1}

Q:2 Fill in the blanks / true or false

(08)

(i) Excluded volume is _____ times the actual volume of molecules. (four /two)

(ii) The normal boiling point of any liquid is related to the critical temperature by the expression. ($1/3 T_c$ or $2/3 T_c$).

(iii) Vapor pressure is related with Reynold number. True or False.

(iv) _____ has lowest value of surface tension. (ethyl ether/ chloroform)

(v) Change in energy for a chemical reaction occurring at constant pressure is called _____.
(change in internal energy / change in enthalpy)

(vi) Mechanical work is especially important in systems that contains _____. (gases / liquids)

[P.T.O.]

(vii) The sum of power to which the concentration of a substance appears in the rate expression is overall order of a reaction. True or False.

(viii) The minimum amount of kinetic energy of a molecule must have to react is known as _____ (activation energy / potential energy).

Q:3 Give answers of any ten questions.

(20)

- (i) Define Boyle's temperature. How is it related to Van der Waal's constants?
- (ii) Define the following: excluded volume and critical temperature.
- (iii) Explain exceptional behavior of hydrogen and helium.
- (iv) Define refractive index and surface tension.
- (v) Prove that $1 \text{ poise} = 10^{-1} \text{ kg m}^{-1} \text{ sec}^{-1}$.
- (vi) Why water rises while mercury falls when we put capillary in it?
- (vii) Define the terms: state function and system.
- (viii) Work is not a state function. Explain.
- (ix) Establish the relation between C_p and C_v for gases.
- (x) What is meant by differential rate law and by integrated rate law?
- (xi) Write mechanism and rate law of the reaction: $2\text{NO}_2 + \text{F}_2 \longrightarrow 2\text{NO}_2\text{F}$
- (xii) Give classification of elementary processes.

Q:4 Give answers of any four questions.

(32)

- (i) Give main postulates of kinetic molecular theory of gases.
- (ii) Calculate the critical temperature of a van der Waal's gas for which P_c is 100 atm and b is $50 \text{ cm}^3 \text{ mol}^{-1}$ ($R = 0.08206 \text{ dm}^3 \text{ atm K}^{-1} \text{ mol}^{-1}$).
- (iii) Write a note on vapor pressure of a liquid.
- (iv) Write a note on double capillary rise method.
- (v) Derive Kirchoff's equation.
- (vi) Discuss the classification of system on the basis of number of phases present in a system and interaction between system and surrounding
- (vii) Derive integrated rate law for second order reaction and give its characteristics.
- (viii) Raising the temperature of a reaction by 20°C in the vicinity of 37°C the rate constant is increased by four times. Calculate the activation energy of this reaction.
($R = 1.99 \text{ cal deg}^{-1} \text{ mole}^{-1}$)

————— x —————

(2)