

Bago University
Department of Chemistry
Second Semester Examination, September 2019

First Year BSc
(Physics, Geology, Zoology, Botany Specialization)
Answer any six Questions

Chem 1002
General Chemistry II
Time Allowed: (3) hours

1. (a) Fill in the blanks with the correct word(s), unit(s), and etc., as necessary.
 - (i) The most probable velocity is passed by the _____ number of molecules in a gas.
 - (ii) Hydrogen bond is the strongest of all intermolecular _____.
 - (iii) In a colloid, particles are between _____ in size still too small for our eyes to distinguish.
 - (iv) Viscosity is the _____ to flow that is exhibited by all liquids.
 - (v) The larger the K_a value the _____ is the strength of an acid.
 - (vi) Esters are substances obtained by the interaction of an alcohol with _____.
 - (b) Select the correct statement(s), word(s), unit(s) and etc., given in the followings.
 - (i) Surface tension is the (energy, pressure, temperature) required to increase the surface area of a liquid by a unit amount.
 - (ii) The ideal gas equation holds fairly accurately for all gases at (normal, low, high) pressure.
 - (iii) A (solute, solvent, solution) is a homogeneous mixture of two (or) more substances that exist in a single phase.
 - (iv) The energy inside the molecules of gases is called (intermolecular, intramolecular, translational) energy.
 - (v) The basic character of amines is due to the presence of a lone pair of electrons on (oxygen, nitrogen, hydrogen) atom.
 - (vi) Many of the fragrance of flowers and fruits are due to (esters, amines, alcohols).
2. (a) Derive ideal gas law equation by using gas laws and also define the ideal gas law.
 - (b) 60 cm^3 of gas 'A' effuse through a pin hole in 150s. The same volume of SO_2 under identical condition was effused in 120s. Calculate the molar mass of A. ($S = 32, O = 16$)
 - (c) By using kinetic gas equation, deduce Graham's law of diffusion.
3. (a) Drive the equation for the average kinetic energy of a single molecule.
 - (b) Calculate the average kinetic energy of a hydrogen molecule at 0°C . ($N_0 = 6.02 \times 10^{23}, R = 0.8314 \times 10^8 \text{ ergK}^{-1}\text{mol}^{-1}$)
 - (c) What are the limitations of Henry's law?

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4. (a) Define the following terms;
 (i) Molarity (ii) Normality (iii) Re-crystallization (iv) Solubility
- (b) The solubility of pure oxygen in water at 20°C and 1.00 atmosphere pressure is $1.38 \times 10^{-3} \text{ moldm}^{-3}$. Calculate the concentration of oxygen at 20°C and partial pressure of 0.21 atmosphere.
- (c) Nitrobenzene ($\text{C}_6\text{H}_5\text{NO}_2$) is completely miscible with water. A mixture of two liquids boils at 99°C and 753 torr pressure. The vapor pressure of water is 733 torr at this temperature. Find out the weight composition of liquid mixture.
 (C=12, H=1, N=14, O=16)
5. (a) Explain the terms osmosis and osmotic pressure.
 (b) Describe the law of osmotic pressure.
 (c) Calculate the osmotic pressure of a 5% solution of glucose (molecular mass = 180 amu) at 18°C. (C = 12, H = 1, O = 16) ($R = 0.0821 \text{ dm}^3 \text{ atm K}^{-1} \text{ mol}^{-1}$)
6. (a) Write the structural formulae and IUPAC name for each of the following compounds.
 (i) Lactic acid (ii) Methyl propionate (iii) Ethylmethylamine
- (b) Complete the following reactions.
- (i) $\text{CH}_3\text{COOH} + \text{PCl}_3 \xrightarrow{?} ?$
- (ii) $\text{CH}_3\text{COOC}_2\text{H}_5 + \text{NaOH} \xrightarrow{?} ?$
- (iii) $\text{C}_6\text{H}_5\text{COOCH}_3 \xrightarrow{\text{LiAlH}_4, \text{H}_2\text{O}} ?$
- (iv) $\text{CH}_3\text{CONH}_2 + \text{H}_2\text{O} \xrightarrow{\text{H}^+} ?$
7. (a) Illustrate the following reactions with equations.
 (i) Hoffmann degradation of hexamide
 (ii) Dehydration of acetic acid
 (iii) Acid hydrolysis of ester
- (b) How would you separate primary, secondary, tertiary amines from their mixture by Hinsberg's method?
