First Year BSc   **Chem-1101**
(Chemistry Specialization)   **Fundamental Chemistry I**
Answer *any six* **Questions**   **Time Allowed: (3) hours**

1. (a) Fill in the blanks with the correct word(s), unit(s), and etc., as necessary.
   (i)   Silicon possesses both metal and non-metal properties, therefore it is ——.
   (ii)   Two fundamental particles that have equal in magnitude and opposite in charge are —— and electron.
   (iii)   The ratio of number of moles of solute and the total number of moles of solute and solvent is called ——.
   (iv)   The intermolecular forces in liquids are collectively called —— forces.
   (v)   An atom or a group of atom which has a characteristic chemical behavior is called ——.
   (vi)   Carbon-carbon double bond consists of one —— and one ——bond.

   (b) Select the correct statement(s), word(s), unit(s) and etc., given in the followings.
   (i)   The radiation travelling from the cathode to the anode are (cathode, anode, canal) rays.
   (ii)   Among the elements of any row of the periodic table, the ionization energy tends to (equal, decrease, increase) as atomic number increases.
   (iii)   (Dispersion, Effusion, Diffusion) is mixing of gas molecules by random motion under conditions where molecular collisions occur.
   (iv)   (Electrolytes, Non-electrolytes, Weak electrolytes) consist of solutes that dissociate only a little in solution.
   (v)   Alkanes are saturated compounds, so they usually undergo the type of reaction, (addition, substitution, elimination).
   (vi)   Alkynes polymerize to give linear or cyclic compounds of (lower molecular weight, higher molecular weight, molecular weight) polymer.

2. (a) Naturally occurring Boron consists of two isotopes. It is 19.88 % $^{10}_{5}B$, which has a mass of 10.013 amu and 80.12 % $^{11}_{5}B$ which has a mass of 11.009 amu. Calculate the atomic weight of Boron to one decimal place.
   (b) (i) State the two correct postulates of Bohr Theory.
        (ii) Write a set of quantum numbesr for 4f and 3d orbitals.
        (iii)Which equation can be used to determine the energy of the photon of light?

3. (a) Explain the following statement with example.
   "No two electrons in an atom can have the same set of four quantum numbers".
   (b) (i) Write down electronic configuration using orbital diagram for the $_{24}Cr$ and $_{35}Br$.
   (ii) How can you identify metal and metalloid?
   (iii)Write an acceptable set of four quantum numbers for the last electron in $_9F$
      and $_{18}Ar$.

4. (a) Starting from kinetic gas equation, derive (i) Boyle's law, and (ii) Charles' law.
   (b) Calculate the pressure exerted by 1.00 mol of methane (CH_4) in a 250 cm^3
      container at 300 K using van der Waals equation. What pressure will be predicted by
      ideal gas equation?
      (a = 2.253 $dm^6atm\ mol^{-1}$, b = 0.0428 $dm^3\ mol^{-1}$, R = 0.0821 $dm^3atm\ mol^{-1}\ K^{-1}$)

5. (a) What are the differences between "colloid" and "suspensions"?
   (b) 45 g of glucose, $C_6H_{12}O_6$, are dissolved in 500 g of water. Calculate the molality of the
      solution. (C=12, H =1, O = 16)
   (c) Calculate the total pressure in a 10 dm^3 cylinder which contains 0.4 g of helium, 1.6 g
      of oxygen and 1.4 g of nitrogen at 27°C. Also calculate the partial pressure of helium
      gas in the cylinder. Assume ideal behavior for gases.
      (He = 4, O =16, N=14, R = 0.0821 $dm^3atm\ mol^{-1}\ K^{-1}$)

6. (a) Write down the possible isomers of pentane, C_5H_{12} and name them by IUPAC system.
   (b) Write equations for the following reactions.
      (i) Sulphonation of isobutane
      (ii) Dehydration of 3°-butyl alcohol
      (iii)Halogenation of ethyne

7. (a) Provide the names for four types of natural sources of organic compound obtained by
      synthesis processes. Briefly explain about "Plant kingdom" and "Animal kingdom".
   (b) Complete the following reactions;
      (i) $CH_3CH=CH_2 + KMnO_4 + H_2O \rightarrow$
      (ii) $CH_3CH_2OH + CH_3COOH \rightarrow$
      (iii)$HC \equiv CH + O_2 \rightarrow$

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