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**University Examinations 2015/2016**

FIRST YEAR, FIRST SEMESTER EXAMINATION FOR BACHELOR OF SCIENCE PUBLIC HEALTH AND BACHELOR OF SCIENCE IN COMMUNITY HEALTH

**SCS 3110: GENERAL CHEMISTRY**

**DATE: NOVEMBER, 2015 TIME:** $2 $**HOURS**

**INSTRUCTIONS:** *Answer question* ***one*** *and any other* ***two*** *questions.*

**QUESTION ONE – (30 MARKS)**

1. Distinguish between; (7 Marks)
2. Heterogeneous and homogeneous mixtures
3. A substance and a mixture
4. Isotope and Isomer
5. Polar and nonpolar covalent bond
6. Electron affinity and electronegativity
7. Lewis acid and Lewis base
8. Nuclear fission and nuclear fusion
9. (i) Define hydrogen bond and explain its significance in biological system (3 Marks)

(ii) Which hydrogen bond would you expect to be stronger, S – H-----O pr O –H ------S. Why? (2 Marks)

1. (i) Name the two main types of nuclear reactions. (2 Marks)

(ii) Write the equation for a nuclear reaction when magnesium-25 undergoes positron emission. (1 Mark)

1. State Pauli’s exclusion principle and write the electron configuration for each of the following atoms and ions. (5 Marks)
2. 
3. 
4. 
5. 
6. (i) What is a buffer solution? (1 Mark)

(ii) Calculate the pH of a buffer solution containing 0.20 mole per litre CH3COONa and 0.15 mole per litre CH3 COOH, Ka for acetic acid is 1.8 x $10^{-5}$ (4 Marks)

1. Give the Arrhenius definations for an acid and a base in aqueous solution. (2 Marks)
2. Draw line structure for 2, 2-dimethyl-butene. (1 Mark)
3. Compare the boiling point of CH3 CH2 CH2CH2OH With that of CH3CH2CH2CH2CH3

(2 Marks)

**QUESTION TWO (20 MARKS)**

a) Classify the following reactions as precipitation, neutralization, or redox. If a precipitation reaction, write a net ionic equation; If a neutralization reaction, identify the acid and the base; if redox reaction identify the oxidizing agent and the reducing agent. (12 Marks)

1. 5CO (g) + I2O5(g) $\rightarrow I\_{2}$(g) +5 CO2(g)
2. UF4(g) + 2Mg(s)$ \rightarrow $U(s) + 2 MgF2(s)
3. AgNO3 (aq) + $Br^{-}$(aq)$\rightarrow $AgBr(s) + NO(aq)
4. Na2CO3(s) + H2C2O4(aq)$\rightarrow $Na2C2O4(aq) + CO2(g) + H2O(l)

b) List and explain properties of water that are anomalous as a result of hydrogen bonding.

(8 Marks)

**QUESTION THREE (20 MARKS)**

a) Radioisotopes are widely used in medicine to diagnose, study and treat illness. provide four specific examples of such applications. (8 Marks)

b) Radioactivity is measured by using its ionizing effect. (1 Mark)

(i) What do you understand by ionizing radiation? (1 Mark)

(ii) Explain three ways by which nuclear radiation can be monitored. (6 Marks)

c) Determine the number of protons, neutrons and nucleons in each of the following;

(3 Marks)

(i) 

(ii) 

d) Isotope x has a half-life of 120 seconds. If the initial mass of such an isotope is 80 grams, how many grams will be present after 240 seconds? (2 Marks)

**QUESTION FOUR (20 MARKS)**

a) Natural sources of fresh water will generally contain a small amount of heavy metal cations which have toxic effects on living system. To remove these contaminants, water is treated with pulverized sea shells causing the heavy metals to precipate as solids that can be removed by a simple filtration. Toxic metal like mercury and lead will precipitate from these heater –sea shell mixture as their carbonate salts.

1. What is a precipitate? (1 Mark)
2. In order to bond with the heavy metal ions , some of the carbonate ions from the calcium carbonate (CaCO3)in the sea shells must dissolve into the water. Write an equilibrium expression for dissolution of CaCO3. (2 Marks)
3. What do you understand by the term solubility product. (2 Marks)
4. How would you expect the solubility product of caCO3 to compare with that of HgCO3. Give reasons to your answer. (2 Marks)
5. Write a chemical equation for the reaction between hydrochloric acid and seashell. (2 Marks)
6. If 20 ml of 0.1M HCl is completely neutralized by a certain amount of crushed seashell, How many moles of calcium ions would be precipitated from the resultant solution on addition of excess solution of 1M Na2CO3? (6 Marks)

b) How many electrons can have the following quantum numbers in an atom; (3 Marks)

1. n = 2, l = 1
2. n = 4 , l = 2 , M1 = -2
3. n = 2

c) What type of orbitals are represented by quantum numbers; (2 Marks)

1. n = 2, l = 1
2. n = 4, l = 2