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**University Examinations 2016/2017**

FIRST YEAR, FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE PHYSICAL AND BIOLOGICAL SCIENCES, AND BACHELOR OF EDUCATION SCIENCE

**SCH 3100: PRINCIPLES OF INORGANIC CHEMISTRY**

**DATE: December, 2016 TIME: HOURS**

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

**QUESTION ONE - (30 MARKS)**

1. (i) How many groups are there in the periodic table? How are they labeled?(5 Marks)

(ii) List three general properties for each of the following; (4 ½Marks)

1. Alkali metals
2. Noble gases
3. Halogens
4. List two general properties for each of the following sub atomic particles. (3 Marks)
5. Electrons
6. Protons
7. Neutrons
8. Copper metal has two naturally occurring isotopes; Copper – 63 (69.17%; isotopic mass = 62.94 amu) and copper-65 (30.83%; isotopic mass = 64.93 amu).
9. Calculate the atomic mass of copper. (2 Marks)
10. Based on your answer to problem (i), how many atoms of copper are in a pure coin that weighs 2.15 g? ( 1 amu = 1 (2 Marks)
11. What is the de Broglie wavelength (in meters) of a ball with a mass of 120g and a speed of 44.7m/s? Given that h = 6.626 x kg (3½Marks)
12. Give the possible combinations of quantum numbers for a 4p orbital. (3 Marks)
13. Give the expected ground-state electron configurations for the following atoms, and draw the orbitalfilling diagrams for each of them.
14. Ti (z = 22) (2 Marks)
15. Zn (z = 30) (2 Marks)
16. Describe the bonding in ethane, C2H6 , and tell what kinds of orbitals on each atom overlap to form the CC and C – H bonds. (3 Marks)

**QUESTION TWO (20 MARKS)**

1. Draw an electron-dot structure for hydrazine, N2H4 and hydrogen cyanide, HCN

(3 Marks)

1. (i) Provide an explanation for the term reasonance hybrid. (2 Marks)

(ii) Calculate the formal charge on each atom in the following electron-dot structure for SO2. (8 Marks)

1. (i) Explain the difference between a sigma bond and a Pi bond. (1 Mark)

(ii) Draw the correct sp3 hybrid orbitals for the bonding in methane (CH4) and water (H2O) (6 Marks)

**QUESTION THREE (20 MARKS)**

1. Provide a brief explanation for the four quantum numbers. (8 Marks)
2. Define the following terms; (6 Marks)
3. Electron affinity
4. Electronegativity
5. Ionic bond
6. Which atom or ion in each of the following pairs would you expect to be larger? Explain. (6 Marks)
7. or
8. O or S
9. Fe or

**QUESTION FOUR (20 MARKS)**

1. (i) How many protons, neutrons and electrons does an atom of have? (1 Mark)

(ii) Which of the following compounds would you expect to be ionic and which molecular? BaF2, SF4,PH3,CH3OH (4 Marks)

1. Aqueous solutions of sodium hypochlorite (NaOCl), are prepared by reaction of sodium hydroxide with chlorine;

How many grams of NaOH are needed to react with 25.0g of Cl2? (6 Marks)

1. Pure oxygen was first made by heating mercury (II) oxide;  unbalanced.
2. Balance the equation (1 Mark)
3. How many grams of mercury and how many grams of oxygen are formed from 45.5g of HgO? (2 Marks)
4. How many grams of HgO would you need to obtain 33.3g of ?(3 Marks)
5. How many moles of cations are in 1.45 mol of K2SO4? (3 Marks)