CHUKA UNIVERSITY

UNIVERSITY SUPPLEMENTARY/SPECIAL EXAMINATIONS.

FIRST YEAR EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF SCIENCE IN CHEMISTRY

CHEM 102: INORGANIC AND PHYSICAL CHEMISTRY

STREAMS: B.SC (GENERAL) **TIME: 2 HOURS**

DAY/DATE: WEDNESDAY 12/09/2018 **2.30 P.M - 4.30 P.M**

QUESTION 1 [30 MARKS]

a). Differentiate between covalent and ionic bonds [3 Marks]

b) . Electrons in atoms of elements are described using four quantum numbers.

i) State the foul quantum numbers [2 Marks]

ii) State the significance of each quantum number [4 Marks]

c). i) Give two characteristics of an orbital [2 Marks]

ii) Write the electronic configuration for elements V(V=23) [2 Marks]

d) The periodic table shows the arrangement of elements according to the atomic numbers.

i) What do elements in the same group have in common? [2 Marks]

ii) What do elements in the same period have in common? [2 Marks]

iii) Give one major differences between the metals and non metals [2 Marks]

iv) Why are metals generally electropositive while non metals are electronegative?

[2 Marks]

e). Write the Lewis structures for the following molecules and polyatomic ions. In each case, the first atom is the central atom. [4 Marks]

i) CCl_4

ii) NCl_3

iii) $COCl_2$

iv)SO_3

f) . A reagent bottle is labeled 0.450 MK_2CO_3

i) How many moles of K_2CO_3 are present in 45.6 ml of this solution? [3 Marks]

ii) How many Ml of this solution are required to furnish 0.800 mole of K_2CO_3? [2 Marks]

QUESTION 2 [20 MARKS]

a) Define the following terms:

i) Mass number (A) [1 Mark]

ii) Atomic number (Z) [1 Mark]

iii) Isotopes [1 Mark]

a) Taking Y a general symbol for an element, indicate how Z and A are indicated on the symbol Y [1 Mark]

c) Give the equation for the ionic product of water (K_w) [2 Marks]

d) Explain the equation for the pH of a solution [2 Marks]

d) Give that the $K_w$for water is 10^{-14}. Calculate at 25 ˚C

i) The $[H^+]$ and pH of a tap water sample in which $[OH^-]= 2.0 \times 10^{-7}$ [4 Marks]

ii) The $[H^+]$ and $[OH^-]$ of human blood at pH 7.40 [4Marks]

iii) The pOH of a solution in which $[H^+] = 5.0[OH^-]$ [4Marks]

QUESTION 3 [20 MARKS]

a) i)Derive the ideal gas law, explaining each term used in the equation [2 Marks]

ii) Explain how the ideal gas law is used to determine the density of any gas [2 Marks]

Explain how the real gases deviated from the ideal gases in obeying the ideal gas law [4 Marks]

b) Explain briefly how the mass spectrometer is used to measure both the relative atomic masses of individual atoms and their isotopic abundances with the help of a graph [4Marks]

c) Give the formula of an ion or molecule in which an atom of ;

i) N forms three bonds using sP^3 hybrid orbitals [1 Mark]

ii) N forms two Pi bonds and one sigma bond [2 Marks]

iii) O forms one sigma and one pi bond [2 Marks]

d) State the Avogadros law [1 Mark]

e) A sample of an ideal gas at 0.93 atm and 25 ˚C occupied a volume of 17.3 L. This gas was transferred to a 3.7 L container without a temperature change. Calculate the pressure of the gas under the new conditions [2 Marks]

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