

KABARAK



UNIVERSITY

UNIVERSITY EXAMINATIONS

2009/2010 ACADEMIC YEAR

FOR THE DEGREE OF BACHELOR OF EDUCATION SCIENCE

COURSE CODE: CHEM 111

COURSE TITLE: INORGANIC CHEMISTRY

STREAM: SESSION 1

DAY: FRIDAY

TIME: 2.00 – 4.00 P.M.

DATE: 13/08/2010

INSTRUCTIONS:

Attempt all questions

Constants;

$h=6.626 \times 10^{-34} \text{Js}$, $C=2.999 \times 10^8 \text{m/s}$, $R=1.097 \times 10^{-8} \text{m}^{-1}$

PLEASE TURNOVER

QUESTION ONE (17.5marks)

- a) Distinguish between a chemical and physical change and give an example in each case. (2marks)
- b) Explain Dalton's theory on the laws of chemical reactions. (6marks)
- c) State and explain the significance of the four quantum numbers, and hence give all the possible quantum numbers that define an electron in the second energy level. (6marks)
- d) Use the following mass-spectrometric data to calculate the atomic mass of silver.

Isotope	Mass(amu)	% abundance
^{107}Ag	106.906	51.84
^{109}Ag	108.905	48.16

(3.5marks)

QUESTION TWO (17.5marks)

- a) Adipic acid which is used in the manufacture of nylon was found to contain 49.3% C, 6.9%H, and 43.8% O by mass. What is its molecular formula given that it has a molecular weight of 146 amu? [C = 12, H = 1, O = 16] (4marks)
- b) A sample of orange juice has a hydrogen ion concentration of 2.9×10^{-4} M. What is the pH of the orange juice? (3marks)
- c) A flask contains a solution with unknown amount of HCl. When this solution is titrated with 0.101M NaOH requires 3.35ml NaOH to complete the reaction. What is the mass of the HCl acid? [Cl = 35.5, H = 1, Na = 23] (3marks)
- d) Methanol can easily burn in air. If 112g of methanol is used up in a combustion process, how many moles of H_2O are produced? (3marks)
- e) Monosodium glutamate (MSG) has the following mass composition: 35.51% C, 4.77 % H, 37.85% O, 8.29% N, and 13.60% Na. What is its molecular formula if its molar mass is 169 gmol^{-1} ? (N = 14) (4.5marks)

QUESTION THREE (17.5marks)

- a) Define the following terms.
- Electronegativity (2marks)
 - Electron Affinity (2marks)
- b) The second ionization energy of Al is higher than the first. Explain this observation. (2marks)
- c) Write the electronic configuration of the following elements; B, Mg, Ne and P. Atomic no: (B = 5, Mg = 12, Ne = 10, P = 15) (4marks)

- d) If the energy difference between the electronic states of hydrogen atom is $214.68 \text{ kJ mol}^{-1}$, what will be the frequency of light emitted when the electron jumps from the higher to the lower energy state? (2marks)
- e) Hydrogen atoms absorb energy so that the electrons are excited to the energy level $n=7$. These electrons then undergo the following transitions; $n=7$ to 1, $n=7$ to 6 and $n=7$ to 5.
- Which of these transitions has the highest energy? (1mark)
 - Arrange these transitions in order of increasing wavelengths. (1.5marks)
 - Calculate the energy involved in the $n=7$ to $n=5$ transition. (3marks)

QUESTION FOUR (17.5marks)

- Differentiate between intramolecular and intermolecular bonds. (2marks)
- Explain the existence of the following bonds, giving an example in each case.
 - Hydrogen bond (2marks)
 - Dipole-dipole bonds (2marks)
- Illustrate the shapes of the following atomic orbitals: *S*, *P_x*, *P_y* and *P_z*. (3.5marks)
- Draw resonance structures obtained when sulfur bonds to three oxygen atoms. (4marks)
- Explain the following observations;
 - $\text{C}_{20}\text{H}_{40}$ is a solid at 25°C , while C_4H_8 is a gas at 25°C . (2marks)
 - Hydrogen forms a negative ion when it combines with sodium to form NaH. (2marks)