

KABARAK



UNIVERSITY

EXAMINATIONS

2008/2009 ACADEMIC YEAR

**FOR THE DEGREE OF BACHELOR OF EDUCATION
SCIENCE**

COURSE CODE: CHEM 111

COURSE TITLE: INORGANIC CHEMISTRY

STREAM: Y1S1

DAY: WEDNESDAY

TIME: 8.30 - 10.30 A.M.

DATE: 10/12/2008

INSTRUCTIONS:

ANSWER ALL QUESTIONS

DATA

$$h = 6.6262 \times 10^{-34} \text{ JS}^{-1}, \quad R = 1.097 \times 10^7 \text{ m}^{-1}, \quad R_H = 1.82 \times 10^{-18} \text{ J}$$

$$C = 3 \times 10^8 \text{ ms}^{-1}$$

$$\text{Mass of an electron } m = 9.02 \times 10^{-31} \text{ kg}$$

$$\text{Charge of an electron } e = 1.6022 \times 10^{-19} \text{ C}$$

$$\text{Permittivity of vacuum } \epsilon = 8.8541 \times 10^{-12} \text{ ms}^{-1}$$

PLEASE TURN OVER

Q1. a]. Define the following terms

- i) Orbital
- ii) Electronic configuration
- iii) Electronegativity
- iv) Electron affinity [4 mks]

b]. What are the assumptions on which the Bohr theory of structure of the hydrogen atom is based. [3mks]

c] i). Name the series of lines that occur in the atomic spectrum of hydrogen. Indicate the region in the electromagnetic spectrum where these series occur. [5mks]

ii) Give a general equation for the wavelength applicable to all the series. [1mk]

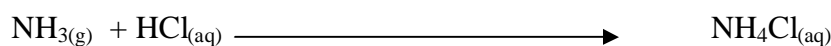
d] An electron undergoes a transition from $n=4$ level to $n= 2$ in hydrogen atom.

i) In which region of the electromagnetic spectrum is the transition likely to occur where these series appear.

ii) Calculate the wavelength emitted in nm of the emitted photon. [3 mks]

iii) Calculate the frequency of the photon. [3mks]

Q2. a] A 50 ml sample of ammonia solution is analysed by titration with HCl. The reaction is



It took 39.47 ml of 0.0984 M HCl to react completely with ammonia. What is the concentration of the original ammonia solution?

b] Write the electronic configuration for the elements in ground state with the following atomic numbers

i) 23

ii) 54

iii) 79

c] Give the shapes of each of the following orbitals

- i) d_{xy} ii) P_z iii) d_{yz}

d] For each of the following atoms give how many protons, neutrons are present?

- i) ${}_4^9\text{Be}$ ii) ${}_{53}^{127}\text{I}$

e] What is the maximum number of electrons that can be found in each of the following subshells

- i) 4f ii) 3d

Q3. a] For an electron to remain in its orbit the centrifugal force and the coulombic attractive force must be equal. Given that centrifugal force = $\frac{mv^2}{r}$ and coulombic attractive force = $\frac{ze^2}{4\pi\epsilon r^2}$

i) Using the angular momentum of the electron derive an equation of the radius of Bohr atom [5mks]

ii) Calculate the radii of the 1st orbits for hydrogen [6mks]

b] A chloride of sulphur was found to have a RFM of 135. A 5.4 g sample was found to contain 2.84g chlorine. What is the molecular formula of the chloride? [4mks]

Q4 a]. The blue colour of the sky results from scattering of sunlight by air molecules. The blue light has a frequency of about $7.5 \times 10^{14}\text{Hz}$

- i) Calculate the wavelength associated with this radiation
ii) Calculate the E in joules of the photon associated with this frequency

[2mks]

b] How does atomic radius of elements in the periodic table vary across the period and down the group [2mks]

c] State

i) Hund's rule

ii) Aufbau principle [3mks]

d] Explain why the ground state electronic configuration for chromium and copper are different from what is expected [3mks]

e] Which of the following species has the most unpaired electrons S^+ , S , S^-

[3mks]