UNIVERSITY EXAMINATIONS

2020 /2021 ACADEMIC YEAR

FIRST YEAR FIRST SEMESTER REGULAR EXAMINATION

FOR THE DEGREE OF BACHELOR OF EDUCATION SCIENCE

COURSE CODE: CHE 110

COURSE TITLE: **FUNDAMENTALS OF CHEMISTRY**

DATE: 23ᴿᴰ FEBRUARY 2021   **TIME: 1400 – 1700 HRS**

INSTRUCTION TO CANDIDATES

- **SEE INSIDE**

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CHE 110: FUNDAMENTALS OF CHEMISTRY

STREAM: BED (Science)   DURATION: 3 Hours

INSTRUCTIONS TO CANDIDATES

i.   Answer *ALL* questions.

ii. *Diagrams may be used whenever they serve to illustrate the answer*

Question One

a) Clearly define the term atomic structure.   (3 Marks)

b) Differentiate between atomic number and mass number.   (2 Marks)

c) State three postulates of Dalton's atomic theory.   (3 Marks)

d) Using a well labeled diagram, discuss three observations made using cathode ray

   experiment.   (6 Marks)

e) What is the maximum number of electrons that can be present in the principal

   Level for n=3?   (4 Marks)

Question Two

a) i. Using nitrogen as an example, state Hund's rule.   (3 Marks)

   ii. Write the electronic configuration of Ca^{2+} and Cu   (3 Marks)

b) i. Why is the second ionization energy of Li greater than that of Be?   (2 Marks)

   ii. Discuss why atoms of neutral elements are electrically neutral.   (2 Marks)

c) i. Why do elements combine to form compounds?   (1 Mark)

   ii. Using Na and Cl, discuss ionic bonding.   (4 Marks)

d) Explain why water is a liquid at room temperature while hydrogen sulphide is a gas.(3 Marks)

Question Three

a) Distinguish between London (dispersion) forces and dipole-dipole forces.   (2 Marks)

b) Draw the Lewis structure of boron tetrafluoride, BF_3.   (3 Marks)

c) Predict the shapes of the following molecules

   i. $BeCl_2$ (2 Marks)

   ii. BF_2Cl (3 Marks)

d) In an experiment to determine the citric acid content in a lemon juice, 25 ml of

   the juice was diluted to 250 ml using diluted water. A 20 ml of diluted solution

   neutralized 22.4 ml of 0.01 M NaOH. Determine the concentration of citric acid

in the lemon juice given that the molecular weight of citric acid is 192 g   (4 Marks)

e) Dichromate ion ($Cr_2O_7^{2-}$) oxidizes Fe^{2+} to Fe^{3+} in acidic condition and gets reduced to chromium ion (Cr^{3+}). Write a balanced redox equation for this reaction.   (4 Marks)

Question Four

a) State Hess's law.   (1 Mark)

b) i. Draw a Born-Haber cycle for sodium chloride, naming each step.   (3 Marks)

   ii. Calculate the lattice enthalpy for sodium chloride given that;

   ΔH_f^θ (NaCl) = -411 kJmol^{-1}

   ΔH_{at}^θ (Na(g))= +107 kJmol^{-1}

   ΔH_{at}^θ ($\frac{1}{2}Cl_2$(g))= +121 kJmol^{-1}

   ΔH_{i1}^θ (Na(g))= +496 kJmol^{-1}

   ΔH_{ea1}^θ (Cl(g))= -348 kJmol^{-1} (4 Marks)

c) A sample of air occupies 150 ml at 20^0C. What volume will it occupy when the sample is immersed in a bath at 100^0C supposing that it's free to expand against a constant pressure?   (3 Marks)

d) Differentiate between diffusion and effusion.   (2 Marks)

e) The solubility product of PbI_2 is 7.1 x 10^{-9} mol^3/l^3. Calculate its solubility.   (4 Marks)

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