



OFFICE OF THE DEPUTY PRINCIPAL
ACADEMICS, STUDENT AFFAIRS AND RESEARCH

UNIVERSITY EXAMINATIONS

2019/2020 ACADEMIC YEAR

FIRST YEAR FIRST SEMESTER REGULAR MAIN
EXAMINATION



FOR THE DEGREE OF BACHELOR OF
EDUCATION SCIENCE

COURSE CODE: CHE 110

COURSE TITLE: FUNDAMENTALS OF CHEMISTRY

DATE: 6TH DECEMBER, 2019

TIME: 9AM – 12NOON

INSTRUCTION TO CANDIDATES

- SEE INSIDE

THIS PAPER CONSISTS OF 4 PRINTED PAGES

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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.
- iii. Do not write on the question paper.

Physical Constants

Planck's constant $h=6.626 \times 10^{-34}$ Js, mass of electron $m=9.1091 \times 10^{-31}$ kg, charge of an electron, $e=1.602 \times 10^{-19}$ C, permittivity of free space, $\epsilon_0=8.854 \times 10^{-12}$ kg⁻¹ m⁻³ A² Rb=37, Fe=26, Co=27, Na=11, P=15, Cl=17, Mg=12, Na=11, Be=4, Cl=17, Ca=20

$$\int \sin^2 \frac{\pi x}{L} dx = \left(\frac{x}{2} - \frac{L}{4\pi} \sin \frac{2\pi x}{L} \right)$$

Question One

- (a) Discuss briefly the limitations of the following atomic models;
 - (i.) Plum pudding model (2 Marks)
 - (ii.) Rutherford's planetary model (2 Marks)
- (b) Write down the electron configuration of the following atoms/ions (4 Marks)
 - (i) Ca²⁺ (ii) Cr (iii) S²⁻ (iv) N
- (c) Explain the principles upon which the mechanical model of the atom is based? (2 Marks)
- (d) Explain why the second ionization energy of Li is greater than that of Be (2 Marks)

Question Two

- (a) Explain why water is liquid at room temperature while hydrogen sulphide is a gas at room temperature. (3 Marks)
- (b) With relevant examples, explain how polarity of bonds varies with electronegativities. (2 Marks)
- (c) Outline three properties of ionic compounds. (3 Marks)
- (d) Define the valence shell electron pair repulsion theory. (1 Mark)
- (e) Predict the shapes of NOCl and N₂F₂. (3 Marks)

Question Three

- (a) What is a dipole dipole force? (1 Mark)
- (b) Give two examples of atoms with polar bonds and illustrate them clearly indicating the polarity of each atom. (3 Marks)
- (c) Differentiate between electronegativity and electron affinity. (2 Marks)
- (d) Explain a mole of a substance (1 Mark)
- (e) Draw the Lewis structures of NaCl, HCN and NH₃. (3 Marks)
- (f) Explain why the bond angle in H₂O is 106.5° while that in H₂S is 92°. (2 Marks)

Question Four

- (a) What volume will 2.1 moles of an ideal gas occupy at 25°C and 0.957 atm of pressure? (3 Marks)
- (b) Explain the term common ion effect. (2 Marks)
- (c) For the reaction, $CO + 3H_2 \rightarrow CH_4 + H_2O$, calculate K_c from the following equilibrium concentrations: [CO] = 0.0613 M; [H₂] = 0.1839 M; [CH₄] = 0.0387 M; [H₂O] = 0.0387 M. (3 Marks)
- (d) Differentiate between zero order and first order reactions. (2 Marks)
- (e) Discuss homogeneous and heterogeneous catalysis. (1 Mark)
- (f) Write the electronic configuration of Ca (1 Mark)

Question Five

- (a) A sample of air occupies 150 ml at 20°C. What volume will it occupy when the sample is immersed in a bath at 100°C supposing that it is free to expand against a constant pressure. (3 Marks)
- (b) Briefly discuss four factors affecting reactions at equilibria (4 Marks)
- (c) The decay constant for beta decay of $^{99}_{43}Tc$ was obtained as $1.0 \times 10^{-13} s^{-1}$. What is the half-life of this isotope in years? (3 Marks)
- (d) What is radioactive decay. Give an example. (2 Marks)

Question Six

- a) What is lattice energy? (1 Mark)
- b) Differentiate between heat of combustion and heat of neutralization and for each case, give an example. (2 Marks)

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- c) Differentiate between heat and work. (2 Marks)
- d) What volume will 2.1 moles of an ideal gas occupy at 25°C and 0.975 Torr of pressure? (3 Marks)
- e) What does the term common ion effect mean? (2 Marks)
