

### OFFICE OF THE DEPUTY VICE CHANCELLOR ACADEMICS, STUDENT AFFAIRS AND RESEARCH

# UNIVERSITY EXAMINATIONS 2022/2023 ACADEMIC YEAR

SECOND YEAR FIRST SEMESTER REGULAR
EXAMINATION

## FOR THE DEGREE OF BACHELOR OF EDUCATION SCIENCE

**COURSE CODE:** 

**CHE 210** 

**COURSE TITLE:** 

ATOMIC STRUCTURE AND

BONDING

DATE:

19/12/2022

TIME: 2-5 P.M.

#### INSTRUCTION TO CANDIDATES

SEE INSIDE

THIS PAPER CONSISTS OF 4 PRINTED PAGES

PLEASE TURN OVE

#### **REGULAR - MAIN EXAM**

#### CHE 210: ATOMIC STRUCTURE AND BONDING

STREAM: BED (Science)

**DURATION: 3 Hours** 

#### INSTRUCTIONS TO CANDIDATES

Answer ALL questions.

#### **Question One (12 Marks)**

a. State the four quantum numbers necessary to completely describe an electron in an atom

(4 Mark

b. Write down two possible sets of quantum numbers that describe an electron in

a 2 s atomic orbital



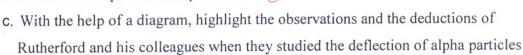
c. Give the Lewis dot structure of each of the following compounds:

- (i) Ammonia
- monia
- (ii) Carbon monoxide 🗘
- (iii) Hydrogen peroxide 🗢
- (iv) Water



#### Question Two (13 Marks)

- a. Derive the de Broglie's equation and use it to explain the 'dual nature of matter' concept
- b. Sketch the shapes of s and p orbitals.



targeted at a gold foil



(5 Mai

#### Question Three (13 Marks)

a. Define the term resonance

(2 Ma

b. Show resonance in the following molecules

i. Nitrate ion

(2.5)

ii. Nitrite ion

(2.5 Ma)

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Chief C	c. Using examples, explain the meaning of the following terms,	
0433	i Dipole-dipole forces	(2 1
Thref - 33.	— 26 Ki. Hydrogen bonding 6	(2 N
4th rear. 15. 7	iii. London dispersion forces	(2)
elechie	150	
10.	Question Four (14 Marks)	
T. 12001a	a. Give the electron configuration for atoms with the following atomic numbers and	
	with reason(s) state their group and period numbers	
	i. $Z=24$	
	ii. $Z=29$	
	b. With the help of a diagram explain how bonding occurs in metals	
	c. With the help of Lewis structures, demonstrate how coordinate bond occurs	
	in the following molecules:	
	i. Ammonium ion 🥝	(2 M
	ii. Hydroxonium ion 🍩	(2 N
	iii. Carbon monoxide molecule 🕏	(2
	Question Five (9 Marks)	
	a. Define the term expanded octet	(1 N
	b. With the aid of Lewis structures, demonstrate bonding in the following molecules	
	i. Sulphur hexafluoride	(2 N
	ii. Phosphorus pentachloride	(2 1
	iii. Triiodide ion	(2 M
	c. State the main postulate of the Valence Shell Electron Pair Repulsion	
	c. State the main postulate of the valence shell electron rail Repulsion	

(VSEPR) theory

J.M/x ofm

(2 mar

#### Question Six (11 Marks)

a. On the basis of the VSEPR theory, explain the shapes of the following molecules	
and clearly state the bond angles between the bonding atoms:	
(i) Beryllium dichloride	(2 M
(ii) Beryllium trifluoride	(2 M
(iii) Water	(2 Mai
(iv) Ammonia	(2 Ma
b. Explain the relationship between the number of lone pairs of electrons in a	
molecule and bond angles of the molecule in question	(3