



KENYATTA UNIVERSITY

EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE (MEDICAL LABORATORY SCIENCE)

HML 109: INORGANIC CHEMISTRY FOR MLS

2ND SEMESTER 2022/2023

TIME: 2 HOURS

INSTRUCTIONS:

The Periodic Table of Elements is provided.

This paper consists of three sections A, B, and C

Section A: Answer ALL questions (4 marks each)

1. Explain how Heisenberg's uncertainty principle influence our understanding of the structure of an atom? [4 marks]
2. Gallium (Ga) consist of two naturally occurring isotopes with masses of 68.926 and 70.925 amu. The average atomic mass of Ga is 69.72 amu. Calculate the abundance of each isotope. [4 marks]
3. Draw Lewis diagram for each of the following ion: [4 marks]
 - a) H_3O^+
 - b) NO_2^+
4. Explain the variation of atomic radii of the elements in the Na to Ar period of the Periodic Table of Elements. [4 marks]
5. An electron in a ground state hydrogen atom has an approximate speed of $1.0 \times 10^5 \text{ m/s}$. Calculate the deBroglie wavelength for this electron. [4 marks]

6 (a) Use molecular orbital theory to describe the bonding in diatomic oxygen (O_2). [10 marks]

(b) Construct a molecular orbital energy level diagram for He_2 . Use your diagram to explain why helium does not exist as diatomic molecules. [10 marks]

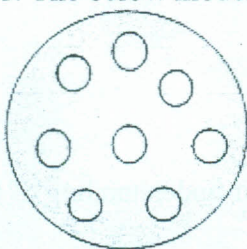
7 (a) Explain the significance of the aufbau principle in atomic structure and state the Pauli Exclusion Principle. [4 marks]

(b) Sketch the full set of 3p orbitals and label them with their Cartesian labels [6 marks]

(c) Sketch the full set of 4d orbitals and label them with their Cartesian labels [10 marks]

SECTION C: ANSWER ALL QUESTIONS BY INDICATING THE CORRECT CHOICE (½ MARK EACH)

1. The below model of organization of electrons in atom is given by



- a) R. A. Millikan
- b) J. J. Thomson
- c) Rutherford
- d) Bohr

2. The ground state electron configuration for arsenic is:

- (a) $[Ar] 4s^2 4p^{13}$
- (b) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{12} 4s^2 4p^1$
- (c) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^8 4p^5$
- (d) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^3$

3. What is the maximum number of electrons that can occupy the second principle energy level?

- a) 18
- b) 8
- c) 10
- d) 3

4. Bonding molecular orbitals are produced by

- (a) constructive interaction of atomic orbitals.
- (b) destructive interaction of atomic orbitals.
- (c) the overlap of the atomic orbitals of two negative ions
- (d) all of these

- 13, 13
b) 13, 27
c) 14, 13
d) 27, 14

6. How many moles of KBrO_3 are required to prepare 0.0700 moles of Br_2 according to the reaction:



- (a) 0.0732
(b) 0.0704
(c) 0.220
(d) 0.0233

7. Identify the quantum numbers associated with a 3p orbital

- (a) $n = 3, l = 1, m = -1$
(b) $n = 1, l = 0, m = 0$
(c) $n = 4, l = 0, m = 0$
(d) $n = 4, l = 0, m = 1$

8. Which atomic orbital has 4 lobes?

- (a) 2p
(b) 4f
(c) 3s
(d) 3d

9. Which of the following pairs of elements and valence electrons is incorrect?

- (a) Al - 3
(b) Br - 7
(c) S - 4
(d) Sr - 2

10. The pH of a solution is 3.5. $[\text{H}^+] = ?$

- (a) 3.16×10^{-7}
(b) 3.16×10^{-4}
(c) 1.16×10^{-4}
(d) 3.16×10^{-3}

11. What type of bond is formed when magnesium and chloride react?

- (a) hydrogen bond
(b) coordinate bond
(c) covalent bond
(d) ionic bond

12. Determine the number of atoms in a 3.0 g sample of Magnesium (Mg).

- (a) 7.8×10^{23}
(b) 7.8×10^{22}
(c) 7.8×10^{24}
(d) 7.8×10^{21}

- (b) $\{3, 1, -2, -\frac{1}{2}\}$
- (c) $\{3, 2, 1, 0\}$
- (d) $\{3, 2, 1, -\frac{1}{2}\}$

14. How many particles of Xe are equivalent to one mole?

- (a) 6.022×10^{23}
- (b) 6.022×10^{22}
- (c) 6.022×10^{24}
- (d) 6.022×10^{21}

15. Which one of the following violates the octet rule?

- (a) PCl_3
- (b) CBr_4
- (c) NF_3
- (d) AsF_5

16. Draw one of the resonance structures of SO_3 . The formal charge of S is

- (a) +2
- (b) +1
- (c) 0
- (d) -1

17. In the Lewis structure for the CO_2 molecule, the number of lone pairs of electrons around the central atom is

- (a) 0
- (b) 1
- (c) 2
- (d) 3

18. What is the maximum number of electrons that can be accommodated in a sublevel for which $l = 3$ is:

- (a) 2
- (b) 10
- (c) 6
- (d) 14

19. The oxidation state of S in SOCl_2 is?

- (a) 2
- (b) 4
- (c) 8
- (d) -2

20. What is the number of moles in 52g of He?

- (a) 1
- (b) 26
- (c) 13
- (d) 52

PERIODIC TABLE OF ELEMENTS

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1 H Hydrogen																	2 He Helium
3 Li Lithium	4 Be Beryllium											5 B Boron	6 C Carbon	7 N Nitrogen	8 O Oxygen	9 F Fluorine	10 Ne Neon
11 Na Sodium	12 Mg Magnesium											13 Al Aluminum	14 Si Silicon	15 P Phosphorus	16 S Sulfur	17 Cl Chlorine	18 Ar Argon
19 K Potassium	20 Ca Calcium	21 Sc Scandium	22 Ti Titanium	23 V Vanadium	24 Cr Chromium	25 Mn Manganese	26 Fe Iron	27 Co Cobalt	28 Ni Nickel	29 Cu Copper	30 Zn Zinc	31 Ga Gallium	32 Ge Germanium	33 As Arsenic	34 Se Selenium	35 Br Bromine	36 Kr Krypton
37 Rb Rubidium	38 Sr Strontium	39 Y Yttrium	40 Zr Zirconium	41 Nb Niobium	42 Mo Molybdenum	43 Tc Technetium	44 Ru Ruthenium	45 Rh Rhodium	46 Pd Palladium	47 Ag Silver	48 Cd Cadmium	49 In Indium	50 Sn Tin	51 Sb Antimony	52 Te Tellurium	53 I Iodine	54 Xe Xenon
55 Cs Cesium	56 Ba Barium	57 La* Lanthanum	72 Hf Hafnium	73 Ta Tantalum	74 W Tungsten	75 Re Rhenium	76 Os Osmium	77 Ir Iridium	78 Pt Platinum	79 Au Gold	80 Hg Mercury	81 Tl Thallium	82 Pb Lead	83 Bi Bismuth	84 Po Polonium	85 At Astatine	86 Rn Radon
87 Fr Francium	88 Ra Radium	89 Ac** Actinium	104 Rf Rutherfordium	105 Db Dubnium	106 Sg Seaborgium	107 Bh Bohrium	108 Hs Hassium	109 Mt Meitnerium	110 Ds Darmstadtium	111 Rg Roentgenium	112 Cn Copernicium	113 Nh Nihonium	114 Fl Flerovium	115 Mc Moscovium	116 Lv Livermorium	117 Ts Tennessine	118 Og Oganesson

* 58 Ce Cerium	59 Pr Praseodymium	60 Nd Neodymium	61 Pm Promethium	62 Sm Samarium	63 Eu Europium	64 Gd Gadolinium	65 Tb Terbium	66 Dy Dysprosium	67 Ho Holmium	68 Er Erbium	69 Tm Thulium	70 Yb Ytterbium	71 Lu Lutetium
** 90 Th Thorium	91 Pa Protactinium	92 U Uranium	93 Np Neptunium	94 Pu Plutonium	95 Am Americium	96 Cm Curium	97 Bk Berkelium	98 Cf Californium	99 Es Einsteinium	100 Fm Fermium	101 Md Mendelevium	102 No Nobelium	103 Lr Lawrencium