

UGANDA MARTYRS UNIVERSITY - NKOZI

END OF SEMISTER ONE 2023/2024 EXAMINATIONS

HECB 1103: Foundation Physical and Inorganic chemistry

Time: 2 hours 30 minutes.

Name Reg. no.

MON. 11 DEC. 2023

2:00 PM - 5:00 PM

Answer all questions in section A and B, and only two from section C.

SECTION A (Choose the correct alternative).

1. In the modern periodic table, the period indicates the value of:
A. atomic number
B. atomic mass
C. principal quantum number
D. azimuthal quantum number
2. The atomic number of sodium is 11 and its mass number is 23. It has
A. 11 neutrons and 12 protons.
B. 12 protons and 11 electrons.
C. 11 electrons and 12 neutrons.
D. 12 electrons and 11 neutrons.
3. The following sets of quantum numbers define electrons in an atom of Beryllium except
A. $n=1, l=0, m_l=0, m_s=+\frac{1}{2}$
B. $n=2, l=1, m_l=0, m_s=+\frac{1}{2}$
C. $n=2, l=0, m_l=0, m_s=+\frac{1}{2}$
D. $n=2, l=0, m_l=0, m_s=-\frac{1}{2}$
4. Which of the following is an ionic hydride?
A. PH_3
B. H_2S
C. HI
D. KH
5. With regard to the species $^{16}\text{O}^{2-}$, $^{19}\text{F}^-$ and ^{20}Ne , which of the following statements is correct?
A. All three species contain 10 electrons.
B. The sum of the neutrons in all three species is 27.
C. The sum of the protons in all three species is 28.
D. Both $^{19}\text{F}^-$ and ^{20}Ne contain 20 neutrons.
6. In the Lewis structure for the OF_2 molecule, the number of lone pairs of electrons around the central oxygen atom is
A. 0
B. 1
C. 2
D. 3

7. Choose the molecule that is **incorrectly** matched with the **electronic** geometry about the central atom.

- A. CF_4 - tetrahedral
- B. BeCl_2 - linear
- C. H_2O - tetrahedral
- D. NH_3 - pyramidal

8. Which of the following elements does not form hydride by direct heating with dihydrogen?

- A. Be
- B. Mg
- C. Sr
- D. Ba

9. In which of the following substances will hydrogen bond be strongest?

- A. HCl
- B. H_2O
- C. HI
- D. H_2S

10. Amongst the following elements whose electronic configurations are given below, the one having the highest ionisation enthalpy is

- A. $[\text{Ne}]3s^23p^1$
- B. $[\text{Ne}]3s^23p^3$
- C. $[\text{Ne}]3s^23p^2$
- D. $[\text{Ar}]3d^{10}4s^24p^3$

SECTION B (*Write in the spaces provided on the question paper*)

11(a). What is atomic orbital?

1mark

(b). Describe the shape of orbitals associated with the following quantum numbers.

(i) $n=2, l=1$

(ii) $n=1, l=0$

5marks

12(a). What is the meaning of the term isoelectronic species?

1mark

(b). Using the box notation, write the electronic configurations of the following species.



3marks

(c). From the following list, identify the largest and the smallest species in terms of radius.



2marks

13(a). Explain why a water molecule adopts a v-shaped geometry?

2marks

(b). using the VSEPR theory, predict and sketch the shape of



2marks



2marks

14. The table shows some properties of one of the groups in the periodic table.

Element	Melting point	Boiling point	Electron structure
P	-220	-188	2, 7
Q	-101	-35	2, 8, 7
R	-7	-7 58	2, 8, 18, 7
S	114	183	2, 8, 18, 18, 7

(a). Name the group of the periodic table that is shown and explain why these elements are part of the group you have named.

2marks

(b). Describe and explain the trend in reactivity of the elements in this group.

4marks

15(a). State Hund's rule of maximum multiplicity and illustrate it using an oxygen atom.

3marks

(b). write the possible sets of quantum numbers that can be used to define the electrons in the 2p subshell of a Nitrogen atom. 2 marks

(c). what is the significance of magnetic quantum number? 1 mark

SECTION C

(Choose only two questions from this section and write your answers in the separate answer booklet provided).

16(a). Define the term ionisation energy. 2marks

Table shows the first ionization energies of period 3 elements.

Element	Na	Mg	Al	Si	P	S	Cl	Ar
I.E/ kJ mol ⁻¹	495	745	587	791	1060	1000	1260	1530

(b). Plot a graph to show variation of first ionization energy with atomic number for period 3 elements. 4marks

(c). State and explain the general trend of 1st I.E across period 3. 3marks

(d). Explain the anomalies observed between

i) Mg and Al 3marks

ii) P and S 3marks

17(a). Explain with examples the meaning of the terms:

i. Hydrogen bonding 3marks

ii. Coordinate bonding 3marks

(b). Describe using lewis symbols how a carbondioxide molecule is formed from atoms of its constituent elements. 3marks

(c). Explain how the particles in a piece of aluminium metal are held together and why the shape of the metal can be changed without it breaking. 4marks

(d). Give two differences between covalent and ionic compounds. 2marks

18(a)(i). Beryllium is a group 2 element but is not an alkaline earth metal. Explain. 3marks

(ii). Write equation(s) showing the reaction of Calcium with air. 3marks

(b)(i). What is a transition element? 2marks

(ii). Write the electronic configurations of Cr (z=24) and Zn (z=30). 2marks

(iii). Explain why Zn is not considered a transition element? 2marks

(c). Give any 3 characteristic properties of transition elements. 3marks

END