TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Applied and Health Sciences

Department of Pure & Applied Sciences

UNIVERSITY SUPPLEMENTARY/SPECIAL EXAMINATION FOR:
DIPLOMA IN ANALYTICAL CHEMISTRY AND DIPLOMA IN SCIENCE LABORATORY TECHNOLOGY
ACH2205: CHEMISTRY OF S-AND P-BLOCK ELEMENTS
TIME: 2 HOURS
DATE: Pick Date **Dec 2024**

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of **FIVE** questions. Attempt **question ONE (Compulsory) and any other TWO questions**.

Do not write on the question paper.

The modern periodic Table is attached as Appendix I

Question ONE

(a) Write the noble core electronic configuration for each of the following elements and indicate which block of elements they belong to:

(i) $_{55}Cs$ (**2 marks**)

(ii) $_{83}Bi$ (**2 marks**)

(b) Using a relevant example in each case, explain the following:

(i) Acidity of group VI hydrides (**3 marks**)

(ii) What happens to the size of an atom when one or more electrons are removed from the neutral atom? (**2 marks**)

(c) Give a reason for each of the following:

(i) Nitrogen and oxygen have approximately the same atomic size yet oxygen has a lower 1st ionization energy (IE) than nitrogen (**3 marks**)

(ii)The conductivity of alkali metal cations in water increases down the group (**3 marks**)

(iii) The second ionization energy for group I elements is approximately 10-14 times higher than their first ionization energy while group II elements; the second ionization energy is only about 2 times higher than the first ionization energy. (**3 marks**)

(d) Write appropriate chemical equations for each of the following:

(i) Reaction of aluminium sulfide with water. (**2 marks**)

(ii) Rapid decomposition of sodium azide in an air bag after a car accident. (**2 marks**)

(e) Briefly explain each of the following statements:

(i) Nitrogen (N) has lower catenation compared to carbon (C) (**2 marks**)

(ii) Red phosphorus (P) is chemically less reactive compared to white P (**2 marks**)

(iii) Oxygen exists as diatomic molecule (O_2) whereas sulphur exists as polyatomic molecule (S_8) (**2 marks**)

(iv) Oxidizing ability of halogens follows the trend: $F_2>Cl_2>Br_2>I_2$ (**2 marks**)

Question TWO

Carbon is the first element in group IV of the periodic table with two allotropes graphite and diamond

(a) Draw the structure of diamond and graphite (**5 marks**)

(b) Using the structure drawn in (2a) above, explain why:

(i) Diamond is harder than graphite (**3 marks**)

(ii) Diamond is a poor electrical conductor while graphite is a good conductor of electricity (**3 marks**)

(c) State any **TWO** uses of diamond and graphite (**4 marks**)

Question THREE

(a)The first ionization energy of phosphorous is higher than that of sulphur while that of magnesium is lower than that of aluminium. Briefly account for these observations (**5 marks**)

(b) Explain why all the halogens are coloured **(4 marks)**

(c) Discuss the diagonal relationship of boron with silicon **(6 marks)**

Question FOUR

(a) Explain why the first elements in each group exhibit considerable differences from the rest of the elements of the same group (**6 marks**)

(b) Outline any **FOUR** properties of beryllium that make it differ from the rest of the alkaline earth metals **(4 marks)**

(c) (i) Explain the meaning of the term 'catenation' (**1 mark**)

(ii) Briefly discuss the main differences between the hydrides of carbon and silicon (**4 marks**)

Question FIVE

(a) Explain each of the following observations:

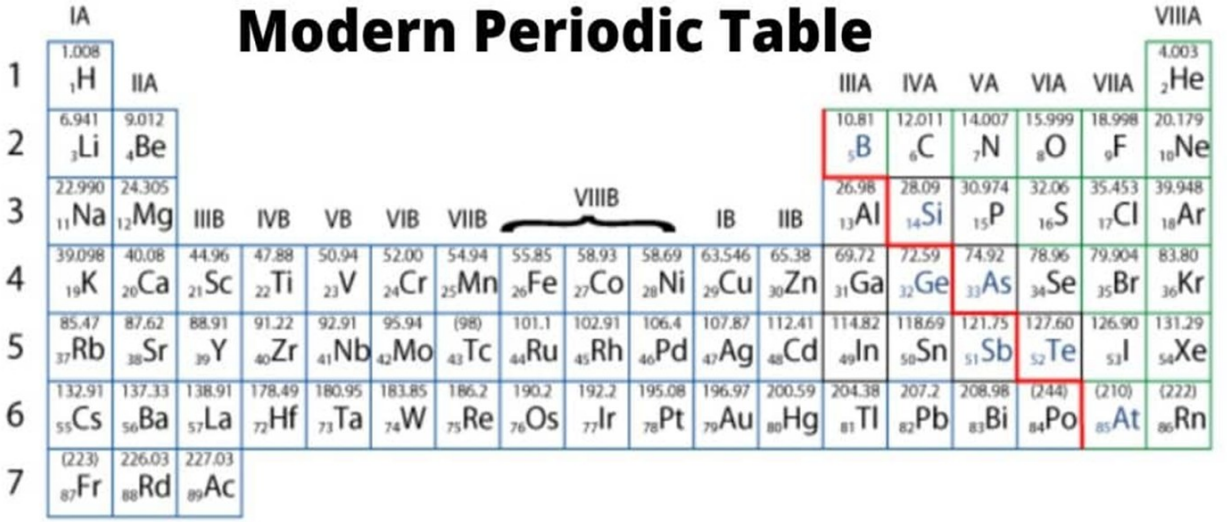
(i) In group IV, carbon (1st row element) has a stronger tendency to catenation than its homologues, while in group VI, sulphur (2nd row element) has a stronger tendency to catenation relative to the other group members. **(5 marks)**

(ii) The O-O and O-F bonds are much weaker than S-S and S-F bonds, while O-H and O-C bonds are much stronger than S-H and S-C bonds. (**5 marks**)

(b) Explain why the solubility products of the carbonates of Group II elements decrease, while those of the fluorides increase down the series. **(5 marks)**

Appendix I

Modern Periodic Table



Lanthanide Series	140.12 Ce	140.9077 Pr	144.24 Nd	(145) Pm	150.36 Sm	151.96 Eu	157.25 Gd	158.93 Tb	162.50 Dy	164.93 Ho	167.26 Er	168.93 Tm	173.04 Yb	174.97 Lu
Actinide Series	232.04 Th	231.0359 Pa	238.03 U	237.05 Np	(244) Pu	(243) Am	(247) Cm	(247) Bk	(251) Cf	(254) Es	(257) Fm	(258) Md	(259) No	(260) Lr