



MACHAKOS UNIVERSITY COLLEGE

(A Constituent College of Kenyatta University)
University Examinations for 2015/2016 Academic Year

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF PHYSICAL SCIENCES

**FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF
EDUCATION (SCIENCE)**

SCH 300: COMPARATIVE STUDY OF S and P BLOCK ELEMENTS

DATE: 11/8/2016

TIME: 11:00 – 1:00 PM

INSTRUCTIONS:

- The paper consists of **two** sections.
- Section **A** is **compulsory**.
- Answer any **two** questions from section **B**.
- Find Periodic Table on the last Page.

SECTION A: COMPULSORY

QUESTION ONE

- a) Write the electronic configuration of the following elements and indicate which block of elements they belong to
- ^{55}Cs (2 marks)
 - ^{83}Bi (2 marks)
- b) Using a relevant example, explain the following:
- Acidity of group 16 hydrides (3 marks)
 - 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 the following:
- Small difference in covalent radii between Te and Po (2 marks)
 - Nitrogen and oxygen have approximately the same atomic size yet oxygen has a lower 1st ionization energy (IE) than nitrogen (3 marks)
 - The conductivity of alkali metal cations in water increases down the group (2 marks)
- The second ionization energy for group 1 (1A) elements is approximately 10 -14 times higher than their first ionization energy while group 2(2A) elements; the second ionization energy is only about 2 times higher than the first ionization energy. (2 marks)
- d) Write appropriate reaction equations for the following:
- Reaction of aluminium sulfide with water. (2 marks)
 - Rapid decomposition of sodium azide in an air bag after a car accident. (2 marks)
 - Manufacture of sulphuric acid through the **Contact Process**. (3 marks)
- e) Calcium hydride reacts with water to form calcium hydroxide and hydrogen gas.
- Write a balanced chemical equation for this reaction. (2 marks)
 - How many grams of calcium hydride are needed to form 3.25 L of hydrogen gas? (3 marks)

SECTION B: ANSWER ANY TWO (2) QUESTIONS

QUESTION TWO

- a) Define the following terms and give a relevant example in each case

- (i) Amphoteric (2 marks)
- (ii) Catenation (2 marks)
- b) Complete and balance the following reactions
 - (i) $\text{SiCl}_4 + \text{H}_2\text{O} \longrightarrow \text{A} + \text{B}$ (2 marks)
 - (ii) $\text{Cu} + \text{HNO}_3 \longrightarrow \text{A} + \text{B} + \text{C}$ (3 marks)
- c) Briefly discuss the anomalous behavior of beryllium compared to other group two metals (5 marks)
- d)
 - (i) Draw the structure of benzene and Borazine (2 marks)
 - (ii) How does the pi bond in borazine differ from that in benzene. (2 marks)
 - (ii) Explain why the polarity of the B-N bond is less than what is expected on basis of electro negativity difference between boron and nitrogen. (2 marks)

QUESTION THREE

- a) Diamond, graphite and silicon dioxide are all examples of giant covalent structures.
 - (i) What does the word giant mean in this context? (2 marks)
 - (ii) Draw a diagram to show the arrangement of carbon atoms in a diamond crystal. (2 marks)
 - (iii) Draw a diagram or diagrams to show the arrangement of carbon atoms in a graphite crystal. (2 marks)
- b) Answer the following questions by referring to the diagrams you have drawn in question 3 (a).
 - (i) Explain the hybridization of carbon in diamond (3 marks)
 - (ii) Explain why diamond is very hard, whereas graphite is so soft that it can be used in pencils or as a lubricant. (2 marks)
 - (iii) The densities of diamond and graphite are: diamond 3.51 g cm^{-3} ; graphite 2.25 g cm^{-3} . Explain why graphite is less dense than diamond. (2 marks)
 - (iv) Although graphite is very much softer than diamond, both substances have very high melting points. Explain why that is. (2 marks)
 - (v) Explain why graphite conducts electricity whereas diamond doesn't. (2 marks)
- c) Select the member(s) of group 14 that;
 - (i) Forms the most acidic dioxide (1 mark)
 - (ii) Is commonly found in +2 oxidation state. (1 mark)

- (iii) Is used a semiconductor (1 mark)

QUESTION FOUR

- a) Explain how the following processes can be carried out
- Laboratory preparation of oxygen (2 marks)
 - Industrial production of sulphur (3 marks)
- b) Write appropriate reaction equations (including conditions where applicable) for the following reactions
- Interaction of sulfur with fluorine gas diluted with nitrogen. (2 marks)
 - Hydrolysis of tellurium hexafluoride (2 marks)
 - Treatment of sodium sulphite and bisulphite with acids (3 marks)
- c) Kejali was given three samples labeled A, B and C containing group 16 elements. He burnt them in air and made the following observations. Sample A formed gas (D), Sample B formed solid (E) at room temperature while Sample C formed an ionic crystalline solid (F).
- Identify the element(s) present in samples A, B and C (3 marks)
 - What are the possible combustion products labeled D, E and F (3 marks)
 - Kejali then dissolved D and E in water to form G and H respectively. Identify G and H (2 marks)

QUESTION FIVE

- a) Briefly explain the following statements
- Nitrogen (N) has low catenation compared to carbon (C) (2 marks)
 - Red phosphorus (P) is chemically less reactive compare with White P (2 marks)
 - Oxygen exists as diatomic molecule (O_2) whereas sulphur exists as polyatomic molecule (S_8) (2 marks)
 - During dilution of sulphuric acid it must be added to water but water should not be added to acid. (2 marks)
 - Oxidizing ability of halogens is follows this trend; $F_2 > Cl_2 > Br_2 > I_2$ (2 marks)
- b) Compare the chemistry of oxygen and its heavier congeners in terms of hydrides and halides. (10 marks)

1																		18																	
1 H 1.0079														13		14		15		16		17		2 He 4.0026											
3 Li 6.941		4 Be 9.0122														5 B 10.811		6 C 12.011		7 N 14.007		8 O 15.999		9 F 18.998		10 Ne 20.180									
11 Na 22.990		12 Mg 24.305		3												13 Al 26.982		14 Si 28.086		15 P 30.974		16 S 32.065		17 Cl 35.453		18 Ar 39.948									
19 K 39.098		20 Ca 40.078		21 Sc 44.956		22 Ti 47.867		23 V 50.942		24 Cr 51.996		25 Mn 54.938		26 Fe 55.845		27 Co 58.933		28 Ni 58.693		29 Cu 63.546		30 Zn 65.409		31 Ga 69.723		32 Ge 72.64		33 As 74.922		34 Se 78.96		35 Br 79.904		36 Kr 83.798	
37 Rb 85.468		38 Sr 87.62		39 Y 88.906		40 Zr 91.224		41 Nb 92.906		42 Mo 95.94		43 Tc (98)		44 Ru 101.07		45 Rh 102.91		46 Pd 106.42		47 Ag 107.87		48 Cd 112.41		49 In 114.82		50 Sn 118.71		51 Sb 121.76		52 Te 127.60		53 I 126.90		54 Xe 131.29	
55 Cs 132.91		56 Ba 137.33		57-71 *		72 Hf 178.49		73 Ta 180.95		74 W 183.84		75 Re 186.21		76 Os 190.23		77 Ir 192.22		78 Pt 195.08		79 Au 196.97		80 Hg 200.59		81 Tl 204.38		82 Pb 207.2		83 Bi 208.98		84 Po (209)		85 At (210)		86 Rn (222)	
87 Fr (223)		88 Ra (226)		89-103 #		104 Rf (261)		105 Db (262)		106 Sg (266)		107 Bh (264)		108 Hs (270)		109 Mt (268)		110 Ds (281)		111 Rg (272)		112 Uub (285)		113 Uut (284)		114 Uuq (289)		115 Uup (288)		116 Uuh (291)		118 Uuo (294)			

* Lanthanide series	57 La 138.91	58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm (145)	62 Sm 150.36	63 Eu 151.96	64 Gd 157.25	65 Tb 158.93	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.93	70 Yb 173.04	71 Lu 174.97
	# Actinide series														
	89 Ac (227)	90 Th 232.04	91 Pa 231.04	92 U 238.03	93 Np (237)	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (262)