

INSTRUCTIONS TO CANDIDATES

Answer Question one and any other two questions

Appendix I is the periodic table

Duration: 3 hours

QUESTION ONE (30 MARKS)

- a) Explain the following terms as applied to the periodic table
- Groups (2marks)
 - Periods (2marks)
 - Blocks (2marks)
- b) Describe the trends down group 2 in the periodic table (8 marks)
- c) Explain the following observations
- HF is a weaker acid in H_2O than HI (2marks)
 - Boric acid $B(OH)_3$ is different from $Al(OH)_3$ (2marks)
 - Phosphorus pentafluoride PF_5 exists while NF_5 does not exist (3marks)
- d) i) State two chemical characteristics of alkali metals (2 marks)
- ii) List down 3 reasons why Beryllium displays anomalous behaviour unlike other alkaline earth metals (3 marks)
It is much harder than other alkaline earth metals. It has a high melting point. It has a high boiling point.
- iii) Describe the diagonal similarities between beryllium and aluminium (3 marks)
They are both amphoteric. It shows diagonal relationship with aluminium.

QUESTION TWO (20 MARKS)

- a) Describe with the aid of equations the extraction of aluminium (5 marks)
- b) i. List the five elements that constitute the group 13 elements (2 marks)
- ii. Explain the 3 stages in the process of extraction of potassium (3 marks)
- iii. Explain two trends in reaction of group 17 (3 marks)
- c) Draw the structure of the following
- Silica (3 marks)
 - Phosphine (2 marks)

QUESTION THREE (20 MARKS)

- a) Describe the trends in reactivity of halogens (4 marks)
- b) Draw the structures of each of the following oxo acids
- Peroxydisulphuric acid (2 marks)
 - Peroxymonosulphuric acid (2 marks)
- c) i) Describe the bonding in boron hydride (3 marks)

- d) ii) $B(OH)_3$ behaves as an acid in water, explain (3 marks)
- e) Explain the following terms (6 marks)
- Silicones
 - Zeolites
 - Catenation

QUESTION FOUR (20 MARKS)

- a) Explain why boron acids form addition compound with NH_3 (2 marks)
- b) Give reasons of each of the following
- Anhydrous $AlCl_3$ is used to catalyze many organic reactions (1 mark)
 - The tendency for catenation decreases down the group 14 (2 marks)
 - PbO_2 is a stronger oxidizing agent than SnO_2 (1 mark)
 - Molten $AlBr_3$ is a poor conductor of electricity (1 mark)
- c) Group 15 elements combine with hydrogen to form trihydride MH_3 . Comment on the following concerning MH_3
- Ease of formation (2 marks)
 - Stability (2 marks)
 - Regular tetrahedral structure (2 marks)
 - Ability to use the lone pair of electrons to form complex ion $[MH_4]^+$ (3 marks)
- d) Both graphite and diamond are allotropes of carbon, but graphite conducts electricity while diamond does not. Explain (4 marks)

QUESTION FIVE (20 MARKS)

- a) (i) Carbon does not form complexes and yet the rest of the elements in group IV do form complexes. Explain. (3 marks)
- (ii) Explain using an equation the hydrolysis product of dimethyl dichlorosilane $(CH_3)_2SiCl_2$ (3 marks)
- (iii) What are some applications of hydrolyzed products of substituted organosilicon compounds? (3 marks)
- b) Explain the following observations
- Boron and aluminium tend to form covalent compounds (2 marks)
 - The reaction that occurs when silicon is heated with methyl chloride at high temperature in the presence of copper (3 marks)
- c) i. What are interhalogens? (1 mark)
- ii. Interhalogens have different properties from the corresponding halogens, explain. (3 marks)
- d) Draw the structure of Boron Hydride (2 marks)