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MAIN EXAMINATION

JANUARY – APRIL 2014 TRIMESTER

FACULTY OF SCIENCE

DEPARTMENT OF NATURAL SCIENCE

REGULAR PROGRAMME

CHEM 104: CHEMICAL BONDING AND STRUCTURE

Date: APRIL 2014	**Duration: 2 Hours**
INSTRUCTIONS: Answer Question ONE and ANY OTHER TWO Questions	

Q1. a) Explain why the Bohr model is also known as the "planetary model". **(3 marks)**

b) Using a suitable diagram, explain why it is impossible to reduce the bond length to zero nm in a molecule. **(3 marks)**

c) What do you understand by "photoelectric effect"? **(3 marks)**

d) What is a hydrogen bond? **(3 marks)**

e) In valence bond theory (VBT), central atoms do not use atomic (s, p, d, f) orbitals to form sigma bonds. Explain. **(3 marks)**

f) By use of appropriate axes clearly show the spatial orientation of s and p orbitals. **(3 marks)**

g) Explain any FOUR characteristics of resonance. **(4 marks)**

h) In – phase and out-of-phase orbital combinations lead to bonding and anti-bonding molecular orbitals. Explain. **(4 marks)**

i) What do you understand by atomization as applied to bonding processes? **(3 marks)**

Q2. a) What do you understand by the hydrogen spectrum? **(4 marks)**

b) Explain application of Hooke's law to the fragmentation of covalent bonds. **(6 marks)**

c) Illustrate the correctness of the formula $2n^2$ in determining the maximum number of electrons a given energy level can carry. **(4 marks)**

d) Explain the **TWO** principles and **ONE** rule that govern electronic configuration. **(6 marks)**

Q3. a) With convincing explanation, determine the hybridization expected in the following geometries:
i) Trigonal planar
ii) Trigonal bipramidal
iii) Tetrahedral
iv) Octahedral **(4 marks)**

b) Determine the number of bonds in CO_2 and the corresponding Lewis structure. **(4 marks)**

c) Why are ionic substances brittle? **(4 marks)**

d) Heating a metal decreases its electrical conduction. Explain. **(4 marks)**

e) Larger molecules (of 'a' homologous family) usually have a higher boiling points. Explain. (4 marks)

Q4. a) All bonding is electrostatic in nature. Explain. **(4 marks)**

b) Explain what you understand by molecular polarity. **(4 marks)**

c) Energy and electromagnetic spectrum are related. Explain the relationship between the two concepts. **(4 marks)**

d) Differentiate between ductility and malleability. **(4 marks)**

e) Explain the factors that determine the strength of an ionic bond. **(4 marks)**

Q5. a) Explain Fajan's rules as applied to the prediction of covalent and/or ionic bonds. **(4 marks)**

b) Using a correct example, demonstrate that it is possible to figure out if an atom is negative, positive or neutral in a molecular arrangement. **(4 marks)**

c) Draw a molecular orbital diagram to clearly show the Atomic orbitals and molecular orbitals in CO. **(8 marks)**

d) State the structural differences between heteroatomic and homoatomic molecular orbital diagrams. **(4 marks)**

END