CHUKA   **UNIVERSITY**

UNIVERSITY EXAMINATION
RESIT/SUPPLEMENTARY / SPECIAL EXAMINATIONS
EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF

CHEM 211: PHYSICAL INORGANIC CHEMISTRY

STREAMS: **TIME: 2 HOURS**

DAY/DATE: WEDNESDAY 11/08/2021   **11.30 A.M - 1.30 P.M.**

INSTRUCTIONS

- **Answer question one and any other two questions**

QUESTION ONE (30 marks)

1. a) Give two basic principles of classical mechanics   (4 marks)

2. Discuss the following briefly:

  a)   Wave-particle duality

  b)   Photo electric effect

  c)   Heisenberg Uncertainty Principle   (9 marks)

3. How many photons does a monochromatic infrared range finder of power 1mW and a wavelength 1000 nm emit in 0.1 s   (3 marks)

4. Give 4 qualities of acceptable solutions to the Schrödinger wave equation (4 marks)

5. Show that e^{ax3} is not n eigen function $\square_{\square}^{d/dx}$ (4 marks)

6. Find the term symbols arising from the following

  i)   [Ne] $3s^1$ ii) [Ne] $3p^1$ iii) Na   (6 marks)

QUESTION TWO (20 marks)

1. List three Fajan rules   (3 marks)

2. Using the Band Theory discuss conductors and insulators   (5 marks)

3. Draw the molecular orbital energy order of the following molecules. Calculate their bond orders and predict whether they exist or not

   i) B_2 molecule

   ii) O_2 molecule

   iii) O_2^{2+} molecule

   iv)   NO molecule   (12 marks)

QUESTION THREE (20 MARKS)

4. Define the following i) Aufbau principle ii) Hunds rule.   (4 marks)

5. List three rules for linear combination of atomic orbitals.   (3 marks)

6. i) Define hybridization   (1 mark)

   ii) Determine the hybridization of the following molecules and predict their shape

   (12 marks)

   a) BF_3 b) PCl_5 c)BeF_2 d) CO_2

QUESTION FOUR (20 MARKS)

7. i) Briefly explain the octet rule using the formation of a Cl_2 molecule   (3 marks)

   ii)   Using an example give two cases in which the octet rule is broken (4 marks)

   iii)   b. i) Define hybridization of atomic orbitals   (2 marks)

   iv)   ii) Using suitable illustrations indicate the type of hybridization of PCl_5 and predict the shape   (3 marks)

   v)   c. i) Differentiate between sigma and pi bonds   (2 marks)

   vi)   ii) Consider CO_2 molecule, using suitable orbitals illustration indicate which bonds will be δ, which will be π bonds and predict the shape   (3 marks)

   vii)   Define the following terms i) Electron affinity ii) Polarizing power iii) Polarizability   (3 marks)

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