



NATIONAL OPEN UNIVERSITY OF NIGERIA
14/16 AHMADU BELLO WAY, VICTORIA ISLAND, LAGOS
SCHOOL OF SCIENCE AND TECHNOLOGY
MARCH/APRIL 2014 EXAMINATION

COURSE CODE: CHM 307

COURSE TITLE: ATOMIC AND MOLECULAR SPECTRUM AND SYMMETRY

TIME ALLOWED: 2 1/2 HOURS

INSTRUCTION: ANSWER ANY FIVE QUESTIONS

1a) Write short note on electron shell.

1b) State the reason behind the electronic configuration of Lithium being written as $1s^2 2s^1$.

1c) Define Madelung's rule and explain its contribution to electronic configuration of transition

metals.

1d) The Aufbau principle rests on a fundamental postulate that the order of orbital energies is fixed,

both for a given element and between different elements: neither of these is true. Discuss.

2a) Each electron in an atom is described by four quantum numbers, discuss.

2b) Write out the ground state electron configurations in the orbital box notation showing electron

spin for

- i) Chlorine
- ii) Manganese

2c) Highlight the appropriate combinations of orbitals to form molecular orbitals.

2d) Explain the magnetic behavior of oxygen molecule in relation to Molecular Orbital theory.

3a) State the fundamental Thermodynamic formula

3b) What is the effect, if density in the formula in 3a above is changed to molar density in an ideal

gas.

3c) Derive Heat Capacity using quantum mechanics.

3d) List two examples each of the below

- a) Ions having sp^2 hybrid orbitals.
- b) Ions having sp^3 hybrid orbitals.

4a) Write on dsp^3 Hybrid orbital

4b) write the shape of compounds having the below hybrid orbital;

- i) Sp
- ii) sp^2
- iii) sp^3
- iv) dsp^3
- v) d^2sp^3

4c) Draw the energy levels in a Hydrogen Molecule.

4d) Highlight the steps to writing resonance.

5a) Show the molecular orbital diagram for a diatomic Oxygen molecule.

5b) What is the wavelength of a 100eV

6a) Define Rotational Spectroscopy

6b) Classify molecules based on Rotational behaviour

6c) Explain Centrifugal distortion.

7a) Enumerate the order of the effect of interaction responsible for small changes in spectra.

7b) What is Symmetry?

7c) Discuss the symmetry elements.