

CORK INSTITUTE OF TECHNOLOGY
INSTITIÚID TEICNEOLAÍOCHTA CHORCAÍ

Autumn Examinations 2007/08

Module Title: General and Inorganic Chemistry

Module Code: CHEM 6002

School: Science

Programme Title: Bachelor of Science in Biomedical Science – Year 1
Bachelor of Science in Applied Biosciences – Year 1
Bachelor of Science (Honours) in Herbal Science – Year 1

Programme Code: SBMSC_7_Y1
SBIOS_7_Y1
SHERB_8_Y1

External Examiner(s): Prof. G. Walsh
Internal Examiner(s): Dr. R. Hourihane
Mr. D. Spicer

Instructions: Attempt 3 questions.
Question 1 Section A is compulsory (40 marks)
Attempt two questions from Section B.

Duration: 2 hours

Sitting: Autumn 2008

Note to Candidates: Please check the Programme Title and the Module Title to ensure that you have received the correct examination paper.
If in doubt please contact an Invigilator.

Section A

Q1. Attempt eight of the following all carry equal marks.

- (a) Define (i) Mass Number (ii) Atomic Number. Give examples from the periodic table.
- (b) Chlorine has two naturally occurring isotopes; Cl^{35}_{17} which has an abundance of 75.77% and an isotopic mass of 34.969 amu and Cl^{37}_{17} with an abundance of 24.23% and an isotopic mass of 36.966 amu. What is the atomic mass of Cl?
- (c) Explain the underlined terms in part (b) above.
- (d) What is the trend in the following properties going across a period in the periodic table?
- (i) atomic radius
 - (ii) ionisation potential
- (e) Name and arrange in order of increasing strength, the different types of intermolecular forces that occur between molecules.
- (f) High electrical and thermal conductivity are two of the properties of Alkali metals. Explain these properties, diagrams required.
- (g) List three differences between ionic and covalent bonds? Supplement your answer with examples.
- (h) What does it mean when we say that the half-life of iron-59 is 44.5 days? What is the difference between a half life and a decay constant, what is the relationship between them?
- (i) Define Charles law, in words and by equation.
- (j) Complete and balance the following nuclear equations
- (i) $^{126}_{50}\text{Sn} \rightarrow ^0_{-1}\text{e} + ?$
 - (ii) $^{210}_{88}\text{Ra} \rightarrow ^4_2\text{He} + ?$
- (40 marks)

Section B

Attempt two of the following questions

- Q2. (a) (i) What are quantum numbers? What does each one specify?
(ii) Give all possible quantum numbers associated with the L shell ($n=2$ level)
- (b) The ground state electron configuration of any multi electron atom is written by following a series of 3 rules.
(i) Define these rules.
(ii) Applying these rules, give the expected ground state electron configuration for the following elements; N^7 ; Cr^{24} . In each case illustrate the orbital occupancy of the valance shell (30 marks)
- Q3. (a) (i) Describe the steps and energies involved in the formation of an ionic bond.
(ii) Distinguish between a chemical bond and an intermolecular force. Which is stronger? What affect(s) does the presence of intermolecular forces have on the physical properties of compounds? Pick one physical force to illustrate.
- (b) Draw the Lewis Structure of each of the following, giving as many resonance structures as possible where appropriate.
 CBr_4 ; NO^+ ; SO_3
Hence or otherwise predict the shape of each molecule. (30 marks)
- Q4. (a) Define Dalton's Law of Partial Pressure and Graham's Law of diffusion (effusion).
- (b) A special gas mixture used in bacterial growth chambers contains 1.00% by weight CO_2 and 99.0% O_2 . What are the partial pressures (in atmospheres) of each gas at a total pressure of 0.977 atm?
- (c) An unknown gas X, was found to diffuse through a porous partition 2.92 times more slowly than H_2 . What is the molecular weight of gas X? (30 marks)

- Q5. (a) List three metallic and three nonmetallic properties of elements. Identify an element in each case.
- (b) What is the trend in the metallic characteristics across a period and down a group of the periodic table?
- (c) In general, what type of bonds do metals form with
- (i) other metals
 - (ii) nonmetals

Give an example of a compound formed in each case.

(30 marks)