

CORK INSTITUTE OF TECHNOLOGY
INSTITIÚID TEICNEOLAÍOCHTA CHORCAÍ

Autumn Examinations 2008/09

Module Title: General and Inorganic Chemistry CA

Module Code: CHEM 6002

School: Science

Programme Title: Bachelor of Science in Applied Biosciences – Year 1
Bachelor of Science (Hons) in Herbal Science – Year 1
Bachelor of Science in Biomedical Science – Year 1
Bachelor of Science in Applied Physics & Instrumentation – Year 1

Programme Code: **SBIOS_7_Y1**
SHERB_8_Y1
SBMSC_7_Y1
SPHYS_7_Y1

External Examiner(s): Dr G Keaveney
Internal Examiner(s): Dr R Hourihane, Mr D Spicer

Instructions: **Attempt all THREE questions.**

Duration: 2 Hours

Sitting: Autumn 2009

Requirements for this examination:

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

1. Attempt **8** of the following **10** parts

- (i) Predict the trends in the following properties: phase, density, atomic radius and ionisation potential for the halogens, (group VII).
- (ii) High electrical and thermal conductivity are two of the properties of Alkali metals. Explain these properties, diagrams required.
- (iii) Which sample contains more molecules, 15.0 L of steam ($\text{H}_2\text{O g}$) at 123.0°C and 0.93 atm pressure or 10.5 g ice cubes at -5.0°C
- (iv) Distinguish between Boyles Law and Charles Law. A diagram may aid your description.
- (v) Explain how electronegativity values may be used to determine bond polarity. Hence indicate which of the following bonds are polar, and why?
B ----- Cl; Cl ----- Cl.
- (vi) Identify the four quantum numbers by name, symbol and possible values
- (vii) State what is meant by each of the following atomic properties. Identify and explain briefly the trends of each property across a period and down a group in the periodic table?
(i) Atomic Radius, (ii) Ionisation Energy, and (iii) Electron Affinity.
- (viii) Define hybridisation. Taking carbon as an example apply the method and generate any of the hybrid orbitals.
- (ix) Calculate the concentration in mol dm^{-3} of HClO_4 when 25g of the solid salt is dissolved in 250mL of water,
- (x) Calculate the number of moles of a 0.1 mol dm^{-3} solution of CH_3COOH used in the titration when a 25mL aliquot is dispensed

(40 marks)

Section B

Attempt both of the following questions.

2. (a) Describe the process involved in formation of a covalent bond. An energy diagram is required. (10 marks)
- (b) Draw the Lewis structure of the following compounds and where appropriate predict the shape, illustrate giving the bond angle.
- (i) CaCl_2
 - (ii) CO_2
 - (iii) ClO_2^-
 - (iv) PCl_5 (12 marks)
- (c) Name and arrange in order of increasing strength, the different types of intermolecular forces that occur between molecules. (8 marks)
3. (a) Complete and balance the following nuclear equations
- (i) $^{126}_{50}\text{Sn} \rightarrow {}^0_{-1}\text{e} + ?$
 - (ii) $^{210}_{88}\text{Ra} \rightarrow {}^4_2\text{He} + ?$ (10 marks)
- (b) 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, and what is the relationship between them? (10 marks)
- (c) How old is a sample of wood whose ^{14}C content is found to be 43% that of a living tree? The half-life of ^{14}C is 5715 years? (10 marks)