

# ATAR CHEMISTRY UNITS 1 & 2

## SEMESTER ONE EXAM REVISION

SEMESTER ONE EXAM IS WEIGHTED 15% OF THE YEAR MARK

Time allowed for this paper

Reading time before commencing work: ten minutes

Working time for paper: two and a half hours

Materials required/recommended for this paper

To be provided by the supervisor

This Question/Answer Booklet

Multiple-choice Answer Sheet

Chemistry Data Booklet

To be provided by the candidate

Standard items: pens (blue/black preferred), pencils (including coloured), sharpener, correction fluid/tape, eraser, ruler, highlighters

Special items: up to three non-programmable calculators approved for use in the WACE examinations

**Important note to candidates:** No other items may be taken into the examination room. It is your responsibility to ensure that you do not have any unauthorised notes or other items of a non-personal nature in the examination room.

Section	Suggested working time	Number of questions available	Number of questions to be attempted	Percentage of paper	Marks
<b>ONE</b> Multiple Choice	37 minutes	25	25	25	25
<b>TWO</b> Short Answer	53 minutes	13	13	35	60
<b>THREE</b> Extended Answer	60 minutes	7	7	40	70
			<b>Total</b>	100	155

1. Answer the questions according to the following instructions.

Section One: Answer all questions on the separate Multiple-choice Answer Sheet provided. For each question, shade the box to indicate your answer. Use only a blue or black pen to shade the boxes. If you make a mistake, place a cross through that square, then shade your new answer. Do not erase or use correction fluid/tape. Marks will not be deducted for incorrect answers. No marks will be given if more than one answer is completed for any question.

Sections Two and Three: Write your answers in this Question/Answer Booklet.

2. When calculating numerical answers, show your working or reasoning clearly. Express numerical answers to the appropriate number of significant figures and include appropriate units where applicable.
3. You must be careful to confine your responses to the specific questions asked and to follow any instructions that are specific to a particular question.
4. Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.

## Unit Content Covered

### **Properties and structure of atoms (elements and compounds) – 30% of the exam**

- elements are represented by symbols
- atoms can be modelled as a nucleus, surrounded by electrons in distinct energy levels, held together by electrostatic forces of attraction between the nucleus and electrons; the location of electrons within atoms can be represented using electron configurations
- the ability of atoms to form chemical bonds can be explained by the arrangement of electrons in the atom and in particular by the stability of the valence electron shell
- the structure of the periodic table is based on the atomic number and the properties of the elements
- the elements of the periodic table show trends across periods and down main groups, including in atomic radii, valencies, 1<sup>st</sup> ionisation energy and electronegativity as exemplified by groups 1, 2, 13–18 and period 3
- flame tests and atomic absorption spectroscopy (AAS) are analytical techniques that can be used to identify elements; these methods rely on electron transfer between atomic energy levels and are shown by line spectra
- isotopes are atoms of an element with the same number of protons but different numbers of neutrons and are represented in the form  ${}^A\text{X}$  (IUPAC) or X-A
- isotopes of an element have the same electron configuration and possess similar chemical properties but have different physical properties
- the relative atomic mass (atomic weight),  $A_r$  is the ratio of the average mass of the atom to 1/12 the mass of an atom of  ${}^{12}\text{C}$ ; relative atomic masses of the elements are calculated from their isotopic composition
- mass spectrometry involves the ionisation of substances and the separation and detection of the resulting ions; the spectra which are generated can be analysed to determine the isotopic composition of elements and interpreted to determine relative atomic mass
- molecular formulae represent the number and type of atoms present in the molecules (refer to Appendix 2 in syllabus)
- percentage composition of a compound can be calculated from the relative atomic masses of the elements in the compound and the formula of the compound.

### **Properties and structure of materials (bonding) – 20% of the exam**

- materials are pure substances with distinct measurable properties, including melting and boiling points, reactivity, hardness and density; or mixtures with properties dependent on the identity and relative amounts of the substances that make up the mixture
- pure substances may be elements or compounds which consist of atoms of two or more elements chemically combined; the formulae of compounds indicate the relative numbers of atoms of each element in the compound
- nanomaterials are substances that contain particles in the size range 1–100 nm and have specific properties relating to the size of these particles which may differ from those of the bulk material
- differences in the physical properties of substances in a mixture, including particle size, solubility, density, and boiling point, can be used to separate them
- the type of bonding within ionic, metallic and covalent substances explains their physical properties, including melting and boiling points, conductivity of both electricity and heat and hardness
- chemical bonds are caused by electrostatic attractions that arise because of the sharing or transfer of electrons between participating atoms; the valency is a measure of the bonding capacity of an atom

- ions are atoms or groups of atoms that are electrically charged due to a loss or gain of electrons; ions are represented by formulae which include the number of constituent atoms and the charge of the ion (for example,  $\text{O}^{2-}$ ,  $\text{SO}_4^{2-}$ )
- ionic bonding can be modelled as a regular arrangement of positively and negatively charged ions in a crystalline lattice with electrostatic forces of attraction between oppositely charged ions
- the ionic bonding model can be used to explain the properties of ionic compounds, including high melting point, brittleness and non-conductivity in the solid state; the ability of ionic compounds to conduct electricity when molten or in aqueous solution can be explained by the breaking of the bonds in the lattice to give mobile ions
- the formulae of ionic compounds can be determined from the charges on the relevant ions (refer to Appendix 2 of syllabus)
- metallic bonding can be modelled as a regular arrangement of atoms with electrostatic forces of attraction between the nuclei of these atoms and their delocalised electrons that are able to move within the three dimensional lattice
- the metallic bonding model can be used to explain the properties of metals, including malleability, thermal conductivity, generally high melting point and electrical conductivity; covalent bonding can be modelled as the sharing of pairs of electrons resulting in electrostatic forces of attraction between the shared electrons and the nuclei of adjacent atoms
- the properties of covalent network substances, including high melting point, hardness and electrical conductivity, are explained by modelling covalent networks as three-dimensional structures that comprise covalently bonded atoms
- elemental carbon exists as a range of allotropes, including graphite, diamond and fullerenes, with significantly different structures and physical properties
- the properties of covalent molecular substances, including low melting point, can be explained by their structure and the weak intermolecular forces between molecules; their non-conductivity in the solid and liquid/molten states can be explained by the absence of mobile charged particles in their molecular structure

### **Properties and structure of materials (organic chemistry) – 30% of the exam**

- hydrocarbons, including alkanes, alkenes and benzene, have different chemical properties that are determined by the nature of the bonding within the molecules
- molecular structural formulae (condensed or showing bonds) can be used to show the arrangement of atoms and bonding in covalent molecular substances
- IUPAC nomenclature is used to name straight and simple branched alkanes and alkenes from  $\text{C}_1$ -  $\text{C}_8$
- alkanes, alkenes and benzene undergo characteristic reactions such as combustion, addition reactions for alkenes and substitution reactions for alkanes and benzene

### **Chemical reactions: reactants, products and energy change - 20% of the exam**

- chemical reactions can be represented by chemical equations; balanced chemical equations indicate the relative numbers of particles (atoms, molecules or ions) that are involved in the reaction.
- chemical reactions and phase changes involve enthalpy changes, commonly observable as changes in temperature of the surroundings and/or the emission of light.
- endothermic and exothermic reactions can be explained in terms of the Law of Conservation of Energy and the breaking of existing bonds and forming of new bonds; heat energy released or absorbed by the system to or from the surroundings, can be represented in thermochemical equations
- empirical formula can be determined using percentage composition, mass composition and combustion data.
- the limiting reagent in a chemical reaction can be determined using masses and moles of reactants.

## Revision Exercises

- It is essential to **first** read through the booklets, revising, summarising and studying the notes, to ensure you have learnt and understood the work covered in the course.
- **Essential Chemistry ATAR Chemistry Units 1 + 2**
  - All sets listed in the booklets are very worthwhile reworking through as another source of revision.
- **Exploring Chemistry Year 11 – Experiments, Investigations and Problems**
  - Set 7: Elements and Compounds
  - Set 8: Atoms and Isotopes
  - Set 9: Atomic Structure and the Periodic Table
  - Set 10: Ionisation Energy
  - Set 11: Periodic Trends
  - Set 12: Properties and Structures of Atoms
  - Set 13: Compounds and Formulae
  - Set 14: Bonding and Properties
  - Set 21: Relative Atomic Mass and Mass Spectroscopy
  - Set 25: Percentage Composition
  - Set 40: Naming and Drawing Hydrocarbons
  - Set 41: Reactions of Hydrocarbons
- **Chemistry Year 11 ATAR Course WACE Study Guide**
  - 1.1 Structure of the Atom
  - 1.2 Atomic Number, Mass Number
  - 1.3 Isotopes
  - 1.4 The Mass Spectrometer
  - 1.5 Atomic Structure and Light Spectra
  - 1.6 Electron Arrangements in Atoms
  - 1.7 Flame Tests
  - 1.8 Atomic Emission Spectra
  - 1.9 Atomic Absorption Spectrometry
  - 1.10 Electron Configurations and the Periodic Table
  - 1.11 From Atoms to Ions
  - 1.13 Ionisation Energy
  - 1.14 Removal of Successive Electrons from Atoms
  - 1.15 Trends and the Periodic Table
  - Review Questions Chapter 1 p24-28
  - Trial Test 1 Atomic Structure p224-228 (Do this under strict test conditions)
  - 2.1 Elements, Compounds and Mixtures
  - 2.2 Separation of Mixtures
  - 2.3 Nanomaterials
  - 2.4 Nanotechnology
  - Review Questions Chapter 2 p42-44
  - 3.1 Bonding – Making Atoms Stick Together
  - 3.2 Ionic Bonding

- o 3.3 Ionic Solids
- o 3.4 Ions
- o 3.5 Valencies
- o 3.6 Metallic Bonding
- o 3.7 Properties of Metals Explained
- o 3.8 Covalent Bonding
- o 3.12 Covalent Molecular Substances
- o 3.13 Covalent Network Lattices
- o 3.14 Allotropes of Carbon
- o 3.15 The Structure of Solids – Summary
- o 3.16 Writing Correct Formula
- o Review Questions Chapter 3 p63-66
- o Trial Test 2 Materials and Bonding p229-234 (Do this under strict test conditions)
- o 4.1 Covalent Bonding and Carbon
- o 4.3 Hydrocarbons
- o 4.4 Haloalkanes
- o 4.5 Structural Formula
- o 4.6 Cyclic Hydrocarbons
- o 4.7 Reactions of Hydrocarbons
- o 4.8 Benzene -  $C_6H_6$
- o 4.9 Isomerism
- o 5.2 Writing Equations
- o 5.3 Exothermic and Endothermic Reactions
- o Review Questions Chapter 4 p79-82
- o Trial Test 3 Carbon Chemistry p235-239 (Do this under strict test conditions)