**-SQA- SCOTTISH QUALIFICATIONS AUTHORITY**

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## NATIONAL CERTIFICATE MODULE DESCRIPTOR

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**-Module Number-** **3180032** **-Session- 1992-93**
**-Superclass-** **RD**

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**-Title-** **INORGANIC CHEMISTRY - STRUCTURE AND REACTIONS**

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**-DESCRIPTION-**

Purpose

This module is designed to enable the candidate to gain a broad-based understanding of the nature and properties of the major element types and their compounds. The module will also develop problem-solving skills in the context of Inorganic Chemistry.

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Preferred Entry Level

3181101 Using Avogadro's constant and the Periodic Table or
Higher Grade Chemistry at Grade C.

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Outcomes

The candidate should:

1. explain bonding in chemical substances;

2. describe the main types of chemical reactions and their applications in chemical analysis;

3. explain the properties of compounds of selected main group elements.

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Assessment Procedures

Acceptable performance in this module will be satisfactory achievement of all the Performance Criteria specified for each Outcome.

The following abbreviations are used below:

PC Performance Criteria
IA Instrument of Assessment

**Note:** The Outcomes and PCs are mandatory and cannot be altered. The IA may be altered by arrangement with SQA. (Where a range of performance is indicated, this should be regarded as an extension of the PCs and is therefore mandatory.)

**OUTCOME 1** **EXPLAIN BONDING IN CHEMICAL SUBSTANCES**

PCs

(a) The description of bonding for given substances is correct.
(b) Predictions of the structure of chemical substances is correct with respect to bonding.
(c) Prediction of bond type of a chemical substance is correct with respect to the position of its constituent atoms in the periodic table.

IA Free Response Questions

10 free response questions to assess the candidate's ability to explain bonding in chemical substances.

For Performance Criterion (a) the candidate should answer 4 free response questions related to bonding, and should cover the following:

(i) metallic
(ii) ionic
(iii) covalent
(iv) intermediate

For Performance Criteria (b) and (c) the candidate should answer 4 free response questions and 2 free response questions respectively.

Satisfactory achievement of the Outcome will be demonstrated by the candidate answering for Performance Criteria (a) and (b) 3 correct responses from 4 and the full and correct completion of Performance Criterion (c).

**OUTCOME 2** **DESCRIBE THE MAIN TYPES OF CHEMICAL REACTIONS AND THEIR APPLICATIONS IN CHEMICAL ANALYSIS**

PC's

(a) The prediction of reaction type is correct.
(b) The construction and use of chemical equations is correct for given reactions.
(c) The interpretation of analytical procedures is correct in terms of the chemical reactions and calculations involved.

IA Structured Questions

9 structured questions to assess the candidate's ability to describe the main types of chemical reactions and their applications in chemical analysis.

For Performance Criterion (a) the candidate should answer 3 structured questions related to reactions, and should cover the following:

(i) oxidation/reduction
(ii) acid/base
(iii) precipitation reactions

For Performance Criterion (b) the candidate should answer 3 structured questions on chemical equations and should cover the following:

(i) oxidation/reduction
(ii) acid/base
(iii) precipitation reactions

For Performance Criterion (c) the candidate should answer 3 structured questions relating to analytical procedures.

Satisfactory achievement of the Outcome will be demonstrated by the candidate achieving for each Performance Criterion, 2 correct responses from 3.

**OUTCOME 3** **EXPLAIN THE PROPERTIES OF COMPOUNDS OF SELECTED MAIN GROUP ELEMENTS**

PCs

(a) The explanation of the properties of the compounds of s block elements is accurate with respect to physical and chemical properties.
(b) The explanation of the properties of the compounds of p block groups of elements is correct with respect to physical and chemical properties.

(c) The explanation of group trends for different classes of compounds in the periodic table is correct.

IA Free Response Questions

9 free response questions to assess the candidate's ability to explain the properties of compounds of selected main group elements.

For Performance Criterion (a) the candidate should complete 5 free response questions relating to S block elements and should include the following:

(i) solubility
(ii) oxidation/reduction
(iii) acid/base properties
(iv) bonding
(v) structure and stability

For Performance Criterion (b) the candidate should complete 2 free response questions, each covering two p block groups. For Performance Criterion (c) the candidate should complete 2 free response questions relating to trend in the periodic table.

Two types of free response questions may be appropriate for the above assessment such as restricted response questions or structured questions.

Satisfactory achievement of the Outcome will be demonstrated by the candidate completing for Performance Criterion (a) 3 correct responses from 5 and the full and correct completion of Performance Criteria (b) and (c).

**The following sections of the descriptor are offered as guidance.**
**They are not mandatory.**

CONTENT/CONTEXT

Safety regulations and safe working practices and procedures should be observed at all time.

Corresponding to Outcomes 1-3:

1. Chemical Bonding.

   Ionic Bonding - Electronic structure of atom - s, p, d, f orbitals. Enthalpies of ionisation, electron attachment, atomisation, lattice, bond, thermochemical cycles for the formation and dissolution of an ionic compound, enthalpy of solution and hydration enthalpy; solubility. Covalent bonding - hybridisation - sp, $sp^2$ $sp^3$ effect of lone pairs of electrons. Hydrogen bonding and effects on physical properties. Structural features associated with giant molecules.

   Deviations from Bond Types - ionic - Fajans's rules. Covalent - electronegativity and electronegativity differences, polarisation. Metallic bonding - description and reference to physical properties.

2. Electron transfer reactions - redox reactions, ion-electron equations; standard reduction potential.

   Acids/bases, conjugate pairs, strength of acids/bases; neutralisation and precipitation reactions. Use of the above reactions in volumetric and gravimetric analysis. Solubility, precipitation and solubility product.

3. Characteristics of s,p, blocks; explanation of group and period trends. Examples of group trends in redox, acidity, basicity, solubility.

SUGGESTED LEARNING AND TEACHING APPROACHES

During the work of the modules candidates should have several opportunities to develop their problem-solving and practical skills. Each candidate should be assessed at appropriate points throughout the module. Where a candidate is unsuccessful in achieving an Outcome, provision should be made for remediation and reassessment.

Laboratory practical work is likely to play a part in this module. The Outcomes of Chemical and Instrumental Analysis (1) could be integrated with this module. Candidates' practical work to illustrate reaction types and chemical properties of the elements could apply to Outcomes 2 and 3.

Safety considerations should be observed at all times.

A candidate-centred resource-based approach is likely to be the most flexible for this module.

The Outcomes can be integrated so that concepts can be developed throughout the module.

Selection of data, tabulating and drawing conclusions are examples of the problem-solving approach which is appropriate for establishing concepts involved in relating atomic structure to periodicity and properties of substances to bonding.

Numerical calculations are necessary for the completion of Outcome 2. Reinforcement and remediation of all Outcomes could be accomplished through commercially available computer software packages. Use of computer databases to select appropriate data on elements and compounds and use of computer software to model types of bonding and properties is to be encouraged.

Tutor/trainer exposition and demonstration will be required for consolidation of the Outcomes.

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