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CCEA A2

CHEMISTRY EXAM PRACTICE

COLOURPOINT EDUCATIONAL

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Health and Safety: This book describes practical tasks or experiments that are either useful or required for the course. These must only be carried out in a school setting under the supervision of a qualified teacher. It is the responsibility of the school to ensure that students are provided with a safe environment in which to carry out the work. Where it is appropriate, they should consider reference to CLEAPPS.

CONTENTS

Introduction

This workbook for CCEA A2 Chemistry is divided into the two content units A2 1 and A2 2. The topics in each A2 unit are comprised of a series of questions including multiple choice questions and structured questions and where appropriate practical questions and calculations. Topics are subdivided to assist your revision. All answers are provided online with worked solutions to calculations.

A2 examinations

The A2 examinations for CCEA Chemistry comprise A2 1 (Further Physical and Organic Chemistry), A2 2 (Analytical, Transition Metals, Electrochemistry and Organic Nitrogen Chemistry) and A2 3 (Further Practical Chemistry).

A2 1 and A2 2 are both worth 110 raw marks and consist of 10 multiple choice questions worth 1 mark each and 100 marks of structured questions.

A2 3 consists of two components. A2 3 Booklet A is a practical examination carried out in your school laboratory and is worth 30 raw marks. A2 3 Booklet B is a practical theory examination and is a timetabled examination worth 60 raw marks. A2 3 can cover any practical aspects of all the content in A2 1 and A2 2 and questions are found throughout the topics in the workbook.

Multiple choice questions will always include distractors, so read all answers carefully. Don't spend too much time on the multiple choice questions as they are only worth 1 mark each so better to come back to the ones you need to think about at the end if you have time. There are no multiple choice questions in A2 3.

A2 1 and A2 2 contain "quality of written communication" questions which will assess your ability to write coherently in proper sentences with correct spelling, punctuation and grammar. There are two of these questions on A2 1 and A2 2 and they are clearly labelled. Note that all A2 examination papers will contain questions on synoptic content from AS Chemistry.

Using past papers

Be aware that raw marks in the individual units are converted to uniform marks (UMS) and the grade boundaries change from module to module but these are published on the CCEA microsite so always check what grade you would have achieved in the unit you tried if you are using past papers. Legacy units (from previous specifications) are also useful for revision but be careful as some topics have moved to a different unit or may have removed. Check with the latest specification or ask your teacher if you are unsure.

Command words

Command words are important so make sure you read the questions carefully. "State and explain" means you should state a trend or pattern and then explain why this occurs. "Suggest" is often used if the question is asking you to apply your knowledge from the specification in an unfamiliar context. "Calculate" will be used where you have to carry out a calculation and show the steps in your calculation. Calculation are marked based on errors made with each error losing a mark. Errors are also carried forward so make sure you show all steps clearly as some marks may still be obtained even if you make a mistake. "Name" means you would provide a name and not a formula. Be careful with organic nomenclature as errors in using commas and dashes are penalised.

CCEA support documents

CCEA provide guidance on "Clarification of terms", "Acceptable colour changes and observations" as well as AS and A2 "Practical support documents". These should be adhered to carefully. Errors in definitions are penalised by each error.

Colours which are separated by a solidus (/) mean alternatives. Only one of the alternatives should be given. For example the colour of a solution of bromine is yellow/orange/brown so only one of

these colours should be used in an observation question. Colours which are separated by a dash must always include the dash such the flame test colour for copper(II) ions which is blue-green or green-blue. Both colours should be provided and should be separated by a dash (never a solidus). Make sure you apply this to colour changes too. The practical document gives suggested methods for all practical activities detailed in the specification.

Level of precision in calculations

Many calculations will include an instruction to give your answer to a specified number of significant figures or decimal places. This is only for the final answer given and it is often good practice to work through the calculation to a number of decimal places or significant figures one higher than the level requested for the final answer and round appropriately at the end. In some calculations you will be asked to give your answer to an appropriate level of significant figures. You should check the numbers of significant figures for each piece of data provided in the question and give your answer to same level of precision as the least precise piece of data. For example, a question with all the data provided to 3 significant figures would require an answer to 3 significant figures. However, a calculation with most figures to 3 significant figures but having one to 2 significant figures would require an answer to 2 significant figures. RAMs/ RFMs/RMMs and balancing numbers in equations do not affect the number of significant figures in your answer so these can be ignored.

Drawing diagrams of apparatus

Diagrams, when asked for, should be cross-sectional and show a free flow of the liquids and gases in the apparatus with no blockages caused by line across the flow. Draw a two-dimensional representation of the apparatus and ensure you label all appropriate apparatus. Include heat where required and include labels for "water in" and "water out" in reflux and distillation.

Finally

Questions will address all the assessment objectives within the specification. Read the stem carefully as often there is information which will assist you in answering the questions which follow. Work through the paper and be aware of time. Check you have not missed any pages as it does happen more often than you think.

The mark scheme (the answers) for this workbook is available online. Visit www.colourpointeducational.com and search for *Chemistry Exam Practice for CCEA A2 Level*. The page for this book will contain instructions for downloading the mark scheme. If you have any difficulties please contact Colourpoint.

Good luck!

Unit A2 1:
Further Physical and Inorganic Chemistry

4.1 Lattice Enthalpy

1 Which one of the following represents the enthalpy of formation of magnesium oxide?

A $Mg(s) + O(g) \rightarrow MgO(s)$

B $Mg^{2+}(g) + O^{2-}(g) \rightarrow MgO(s)$

C $Mg(s) + \frac{1}{2}O_2(g) \rightarrow MgO(s)$

D $Mg(g) + \frac{1}{2}O_2(g) \rightarrow MgO(s)$ [1]

2 The lattice enthalpy of calcium chloride is +2237 kJ mol^{-1}. The enthalpy of hydration of calcium ions is –1650 kJ mol^{-1} and of chloride ions is –364 kJ mol^{-1}. What is the enthalpy of solution of calcium chloride?

A –223 kJ mol^{-1}

B –141 kJ mol^{-1}

C +223 kJ mol^{-1}

D +951 kJ mol^{-1} [1]

3 Give the definitions of the following:

(a) First ionisation energy _____

_____

_____ [2]

(b) Standard enthalpy of formation _____

_____

_____ [2]

(c) Standard enthalpy of atomisation _____

_____

_____ [2]

(d) Lattice enthalpy _____

_____

_____ [2]

4 The information below relates to the formation of caesium chloride, CsCl. Caesium is a solid at room temperature and pressure.

	$\Delta H^{\ominus}$ / kJ mol^{-1}
First ionisation energy of caesium	+380
Enthalpy of atomisation of caesium	+78
Enthalpy of formation of caesium chloride	–433
Enthalpy of atomisation of chlorine	+122
First electron affinity of chlorine atoms	–364

(a) Write equations, including state symbols, for the reactions which would have enthalpy changes equal to the following:

(i) The first ionisation energy of caesium

_____ [1]

(ii) The enthalpy of formation of caesium chloride

_____ [1]

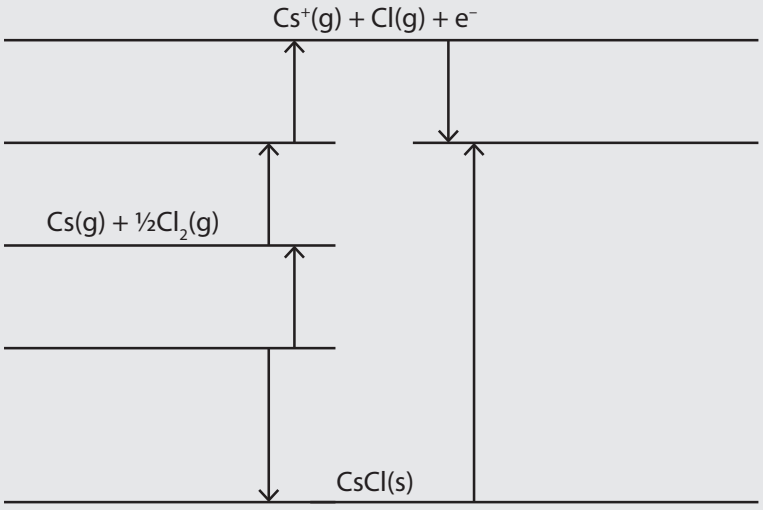
(iii) The first electron affinity of chlorine

_____ [1]

(iv) The lattice energy of caesium chloride

_____ [1]

(b) **(i)** Complete the missing levels of the Born-Haber cycle for caesium chloride below. Include state symbols.



[3]

(ii) Using the constructed Born-Haber cycle, or any other method, calculate the lattice enthalpy of caesium chloride.

_____

_____

_____

_____ [2]

(c) The lattice enthalpies for sodium chloride, potassium chloride and rubidium chloride are +776, +710 and +685 kJ mol^{-1} respectively. Suggest why there is a difference in these results compared with the value you calculated for caesium chloride in (b)(ii).

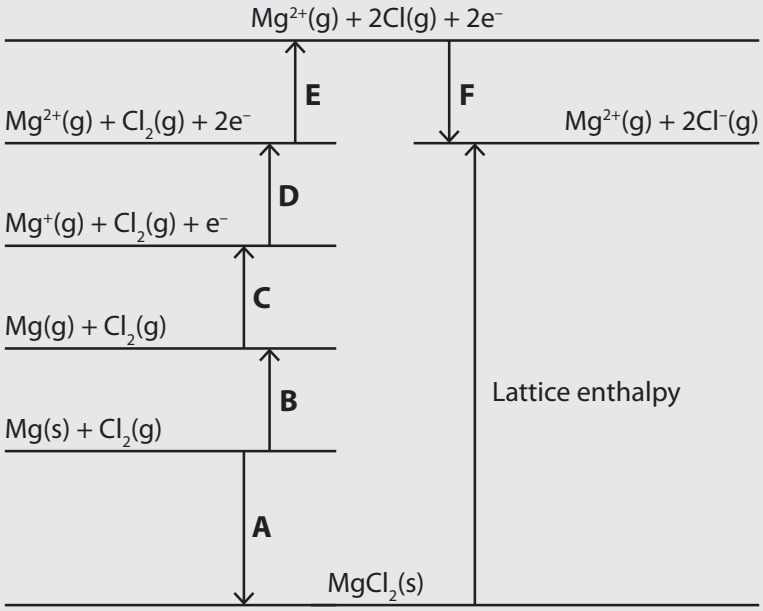
_____

_____

_____

_____ [2]

5 The Born-Haber cycle shown below is for magnesium chloride.



(a) Write the letters beside the terms below which are represented on the diagram above.

Standard enthalpy of formation of magnesium chloride (–642 kJ mol^{-1}) _____

Second ionisation energy of magnesium (+1450 kJ mol^{-1}) _____

Standard enthalpy of atomisation of magnesium (+150 kJ mol^{-1}) _____

Standard bond dissociation enthalpy of chlorine (+242 kJ mol^{-1}) _____

First ionisation energy of magnesium (+736 kJ mol^{-1}) _____

First electron affinity of chlorine (–364 kJ mol^{-1}) _____ [2]

(b) Calculate the lattice enthalpy of magnesium chloride using the data given above.

_____

_____

_____

_____

_____ [3]

(c) The enthalpy of solution of magnesium chloride is –165 kJ mol^{-1}. The hydration enthalpy of the magnesium ion is –1891 kJ mol^{-1}. Using this information and the value calculated in (b), calculate the hydration enthalpy of the chloride ion.

_____

_____

_____

_____ [3]

(d) Explain, using a diagram, why energy is released when magnesium and chloride ions become hydrated.

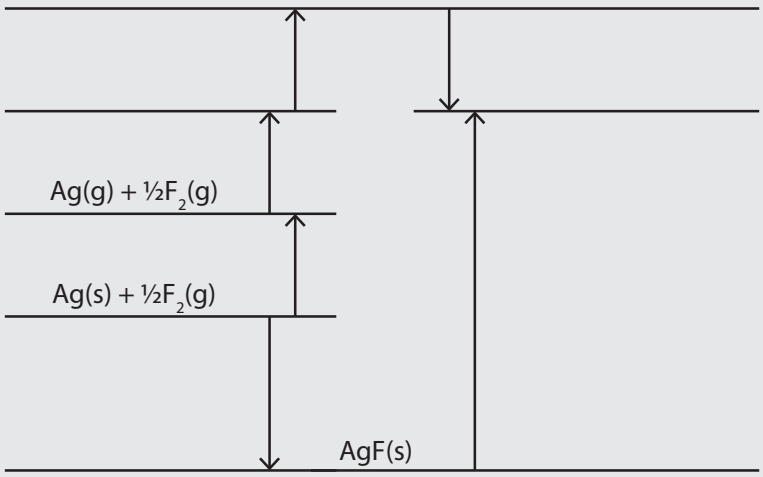
_____

_____

_____

_____ [4]

6 The diagram below shows a Born Haber cycle for silver(I) fluoride.



(a) Complete the cycle by filling in the missing spaces with the particles involved. [3]

(b) The information in the table shows the enthalpy changes associated with this Born Haber cycle.

Enthalpy change	$\Delta H^{\ominus}$ / kJ mol^{-1}
Enthalpy of formation of silver(I) fluoride	–203
Enthalpy of atomisation of silver	+286
First ionisation energy of silver	+730
Enthalpy of atomisation of fluorine	+79
Lattice enthalpy of silver(I) fluoride	+943

Calculate the first electron affinity for fluorine using the information in the table.

_____

_____

_____

_____ [2]