



Western Australian Certificate of Education Examination, 2011

Question/Answer Booklet

CHEMISTRY

Stage 2

Please place your student identification label in this box

Student Number: In figures

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In words

Time allowed for this paper

Reading time before commencing work: ten minutes
Working time for paper: three hours

Materials required/recommended for this paper

To be provided by the supervisor

This Question/Answer Booklet
Multiple-choice Answer Sheet
Chemistry Data Sheet

To be provided by the candidate

Standard items: pens, pencils, eraser, correction fluid/tape, ruler, highlighters

Special items: non-programmable calculators satisfying the conditions set by the Curriculum Council for this course

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. If you have any unauthorised material with you, hand it to the supervisor **before** reading any further.

Structure of this paper

Section	Number of questions available	Number of questions to be answered	Suggested working time (minutes)	Marks available	Percentage of exam
Section One: Multiple-choice	25	25	45	25	25
Section Two: Short answer	11	11	70	80	40
Section Three: Extended answer	5	5	65	70	35
Total					100

Instructions to candidates

1. The rules for the conduct of Western Australian external examinations are detailed in the *Year 12 Information Handbook 2011*. Sitting this examination implies that you agree to abide by these rules.

2. 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, do not erase or use correction fluid, and shade your new answer. 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.

3. When calculating numerical answers, show your working or reasoning clearly, unless instructed otherwise.
4. 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.
5. 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.
 - Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.
 - Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question(s) that you are continuing to answer at the top of the page.

Section One: Multiple-choice

25% (25 Marks)

This section has **25** questions. 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, do not erase or use correction fluid, and shade your new answer. Marks will not be deducted for incorrect answers. No marks will be given if more than one answer is completed for any question.

Suggested working time: 45 minutes.

1. Carbon atoms exist in nature with mass numbers 12, 13 and 14. Which one of the following is an **incorrect** statement?
 - (a) The different carbon atoms in nature are called isotopes.
 - (b) All of the carbon atoms in nature have the same number of neutrons in the nucleus.
 - (c) All the isotopes of carbon in nature have identical chemical properties.
 - (d) All of the carbon atoms in nature have the same number of protons in the nucleus.

2. In which one of the following groups do all species contain the same number of electrons?
 - (a) F, Ne, Na
 - (b) Cl^- , Ar, K^+
 - (c) Li, Be, B
 - (d) O^{2-} , S^{2-} , P^{3-}

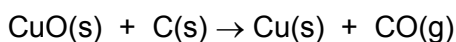
3. Which one of the following characteristics is **unique** to the Group 1 elements in the Periodic Table?
 - (a) metallic character
 - (b) reaction with HCl to form ions in solution and hydrogen gas
 - (c) increasing atomic mass with increasing atomic number
 - (d) noble gas electron configuration of the singly-charged positive ion

4. A pure substance is found to be a good conductor of electricity in both its solid and liquid phases. The bonding in the substance is which one of the following?
 - (a) ionic
 - (b) covalent molecular
 - (c) metallic
 - (d) covalent network

5. Metals have many characteristic properties, including malleability, conductivity, ductility and high lustre. Which one of the following accounts for these properties?
 - (a) the covalent network bonding in metals
 - (b) the mobility of the valence electrons in metals
 - (c) equally-shared electrons between metal atoms
 - (d) covalent molecular bonding between metal atoms

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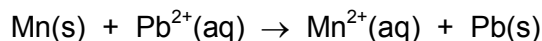
6. When a teaspoon of sugar is added to a beaker containing a saturated sugar solution, which one of the following would be observed?
- (a) All the added sugar would dissolve.
 - (b) The solution would become a little sweeter.
 - (c) Only some of the added sugar would dissolve.
 - (d) More sugar crystals than before would appear in the beaker.
7. Which one of the following sets of 0.1 mol L^{-1} solutions can be mixed to make a green solution without a precipitate?
- (a) sodium iodide, nickel chloride, silver nitrate
 - (b) chromium(III) sulfate, ammonium carbonate, iron(II) chloride
 - (c) potassium sulfate, sodium carbonate, sodium phosphate
 - (d) magnesium sulfate, potassium nitrate, nickel ethanoate
8. Which one of the following lists classifies all of the substances correctly?
- | | pure substances | homogeneous mixtures | heterogeneous mixtures |
|-----|------------------------|-----------------------------|-------------------------------|
| (a) | copper sulfate | steel | the ocean |
| (b) | air | cordial | sugar solution |
| (c) | tap water | dissolved cooking salt | carbon dioxide |
| (d) | distilled water | diamond | iron ore |
9. Consider the following 1.0 mol L^{-1} solutions. Which one of the following lists the solutions in decreasing order (that is, strongest to weakest) of electrolyte strength?
- (a) sodium phosphate > sulfuric acid > phosphoric acid > sucrose (sugar)
 - (b) sucrose (sugar) > sulfuric acid > phosphoric acid > sodium phosphate
 - (c) sulfuric acid > sodium phosphate > phosphoric acid > sucrose (sugar)
 - (d) sodium phosphate > phosphoric acid > sulfuric acid > sucrose (sugar)
10. Copper(II) oxide undergoes a redox reaction with carbon to produce copper metal and carbon monoxide gas, as shown in the equation below.



Which one of the following is the reductant in this reaction?

- (a) copper(II) oxide
- (b) carbon
- (c) copper
- (d) carbon monoxide

11. Consider the following reaction between manganese and lead ions.



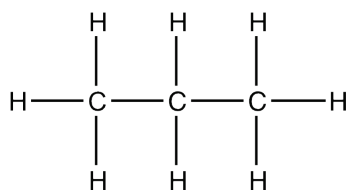
Which one of the following statements is correct?

- (a) The manganese metal has removed electrons from the lead ions.
 - (b) The lead ions have reduced the manganese metal.
 - (c) Electrons have been transferred from the manganese metal to the lead ions.
 - (d) The oxidation number of the lead ions has increased.
12. Which one of the four elements (S, C, Cl, Cr) shown in **bold** below has the **lowest** oxidation number?
- (a) $\text{KH}\textbf{S}\text{O}_4$
 - (b) $\text{Na}_2\textbf{C}_2\text{O}_4$
 - (c) $\text{HO}\textbf{C}\text{Cl}$
 - (d) $\text{K}_2\textbf{C}\text{r}_2\text{O}_7$
13. Which one of the following species is the conjugate acid of the CO_3^{2-} ion?
- (a) HCO_3^-
 - (b) H_2CO_3
 - (c) H_3O^+
 - (d) CO_2
14. Which one of the 0.02 mol L^{-1} solutions below will have the **highest** pH?
- (a) HCl
 - (b) H_2SO_4
 - (c) HNO_3
 - (d) CH_3COOH
15. Which one of the following combinations of species shows all the products of the reaction of hydrochloric acid and zinc metal which have reacted completely with one another?
- (a) $\text{ZnCl}_2(\text{s}) + \text{H}_2\text{O}(\text{aq})$
 - (b) $\text{ZnCl}_2(\text{s}) + \text{H}_2(\text{g})$
 - (c) $\text{Zn}^{2+}(\text{aq}) + 2 \text{Cl}^-(\text{aq}) + \text{H}_2(\text{g})$
 - (d) $\text{Zn}^{2+}(\text{aq}) + \text{H}_2(\text{g})$

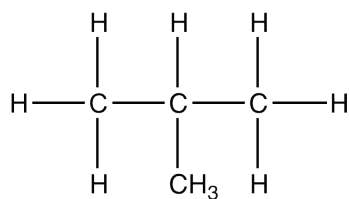
16. If a strip of aluminium metal is placed in a 1.0 mol L^{-1} copper(II) sulfate solution, the aluminium dissolves and the blue colour of the copper(II) sulfate solution fades. This is an example of which one of the following types of reaction?
- (a) displacement
 - (b) acid-base
 - (c) decomposition
 - (d) acid-metal
17. Use your understanding of the energy changes of bond breaking and bond making to decide which one of the following processes is exothermic.
- (a) $\text{Br}_2(\text{g}) \rightarrow 2 \text{Br}(\text{g})$
 - (b) $\text{Br}_2(\text{s}) \rightarrow \text{Br}_2(\text{g})$
 - (c) $\text{Na}(\text{g}) \rightarrow \text{Na}^+(\text{g}) + \text{e}^-$
 - (d) $\text{K}^+(\text{g}) + \text{Br}^-(\text{g}) \rightarrow \text{KBr}(\text{s})$
18. As water evaporates from an open container at 40°C , which one of the following is **true**?
- (a) The water becomes warmer as the kinetic energy of the liquid water molecules increases.
 - (b) The water molecules decompose into hydrogen and oxygen molecules.
 - (c) The water molecules return to the surface as fast as they leave.
 - (d) The water vapour molecules have greater kinetic energy than the liquid water molecules.
19. Hot-air ballooning involves heating the air in a large overhead balloon. Which one of the following statements best explains why the balloon rises as the air is heated?
- (a) Heating air increases the volume it occupies.
 - (b) Atmospheric pressure decreases with temperature.
 - (c) The air in the balloon becomes less dense as it is heated.
 - (d) The pressure in the balloon decreases as it is heated.
20. The concentration of vitamin C in a particular brand of orange juice is 35 mg per 100 mL. Which one of the following is the correct mass of vitamin C contained in a 2.5 L bottle of orange juice?
- (a) 87.5 mg
 - (b) 875 mg
 - (c) 8.75 g
 - (d) 875 g
21. How many atoms are there in one molecule of hexane?
- (a) six
 - (b) ten
 - (c) twelve
 - (d) twenty

22. Which one of the following compounds is an isomer of butane?

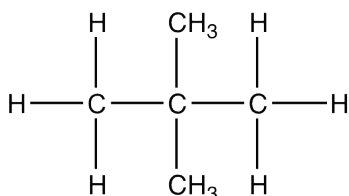
(a)



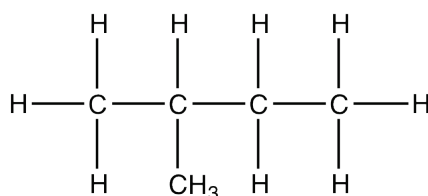
(c)



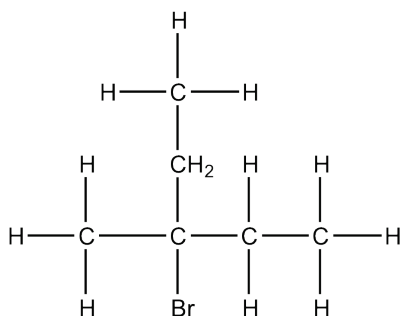
(b)



(d)



23. Which one of the following is the correct name for the compound with the structural formula shown below?



- (a) 2-bromo-2-ethylbutane
- (b) 3-bromo-3-ethylbutane
- (c) 3-bromohexane
- (d) 3-bromo-3-methylpentane

24. Which one of the following compounds can show cis-trans isomerism?

- (a) $\text{CH}_3\text{CH}_2\text{CH}_2\text{Cl}$
- (b) $\text{Cl}_2\text{C}=\text{CClCH}_3$
- (c) $\text{CH}_2\text{ClCHClCH}_3$
- (d) $\text{ClCH}=\text{CClCH}_3$

25. A commonly-used test in organic chemistry is to shake a sample of a compound with bromine water and observe the colour change, if any, of the bromine water. Which one of the following compounds would cause the colour of bromine water to fade in such a test?

- (a) benzene
- (b) ethene
- (c) ethane
- (d) cyclopentane

End of Section One

See next page

Section Two: Short answer

40% (80 Marks)

This section has **11** questions. Answer **all** questions. Write your answers in the spaces provided.

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.

- Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.
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Suggested working time: 70 minutes.

Question 26

(6 marks)

- (a) Complete the table below.

(4 marks)

Symbol	Atomic number	Mass number	Number of neutrons	Electron configuration	Number of valence electrons
	11	23			

- (b) Write the equation, including appropriate state symbols, for the reaction of sodium metal and chlorine gas at room temperature. (2 marks)

Question 27

(6 marks)

- (a) Complete the table below by writing the formula of each of the compounds listed. (3 marks)

Name of compound	Formula of compound
Hydrogen peroxide	
Acetic acid	
Sulfurous acid	

- (b) Complete the table below by writing the name of each of the species listed. (3 marks)

Formula of species	Name of species
$\text{Pb}(\text{OH})_2$	
N_2O_5	
Br^-	

Question 28

(8 marks)

- (a) For the species listed in the table below, draw electron dot diagrams. (4 marks)

All valence shell electron pairs should be represented either as : or as —

(for example, water $\text{H}:\ddot{\text{O}}:\text{H}$ or $\text{H}-\ddot{\text{O}}-\text{H}$ or $\text{H}-\overline{\text{O}}-\text{H}$)

Species	Electron dot diagram
K_2O	
NCl_3	

- (b) Diamond and methane contain covalently bonded carbon atoms, yet their melting points are very different (3547°C and -182°C respectively). State the reasons for the difference in melting points in terms of chemical bonding. (4 marks)

Question 29

(7 marks)

- (a) Complete the table below by writing the name of a substance that contains carbon for each of the categories listed. (3 marks)

Strong electrolyte	Weak electrolyte	Non-electrolyte

- (b) Write equations, including appropriate state symbols, to show clearly what happens when each of the following solid substances dissolves in water. (4 marks)

- (i) Glucose ($\text{C}_6\text{H}_{12}\text{O}_6$)

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- (ii) Sodium bromide (NaBr)

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Question 30

(7 marks)

The poisonous compound oxalic acid ($\text{H}_2\text{C}_2\text{O}_4$) is found in significant quantities in the leaves of the rhubarb plant, while its stalks contain only trace amounts, making them safe to eat. Oxalic acid is a polyprotic acid.

- (a) Explain what is meant by the term 'polyprotic'. (1 mark)

- (b) Complete the table below by giving appropriate formulae. (2 marks)

Substance	Example
A polyprotic acid (other than oxalic acid)	
A monoprotic acid	

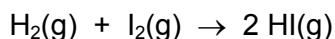
- (c) Write the equations for the successive ionisation of oxalic acid. (2 marks)

- (d) Explain why a 0.1 mol L^{-1} solution of oxalic acid would have a higher pH than a 0.1 mol L^{-1} solution of sulfuric acid. (2 marks)

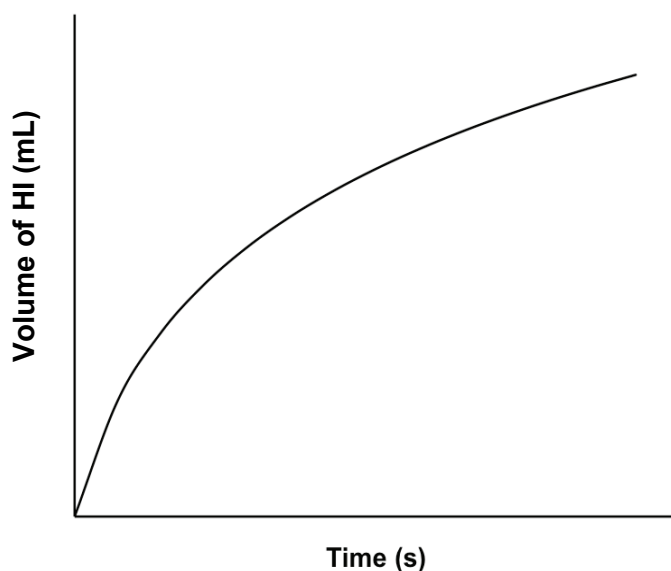
Question 31

(7 marks)

Hydrogen gas and gaseous iodine can react to form hydrogen iodide according to the following equation.



Below is a graph showing the volume of HI(g) formed with time. Assume the reaction was carried out at 40°C in a 250 mL vessel.

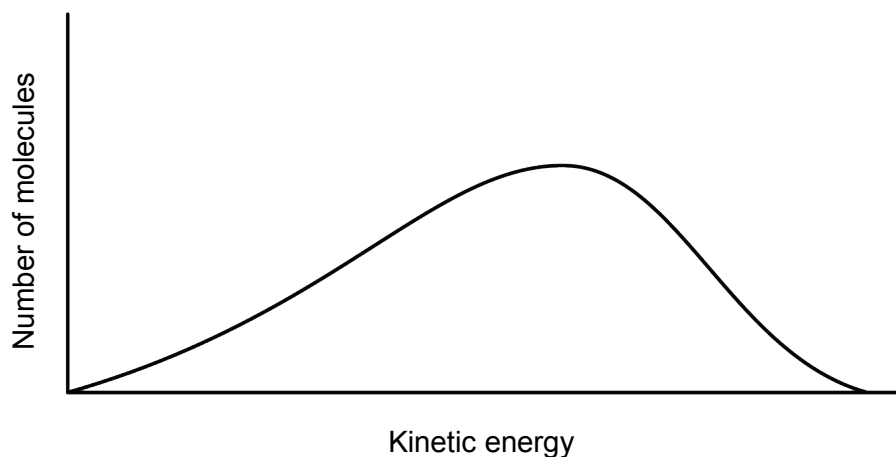


- (a) Use your understanding of the collision theory to explain the decreasing slope of the curve as the reaction progresses. (3 marks)

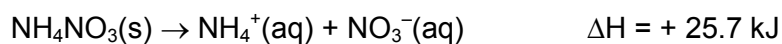
- (b) Plot a new curve on the graph to show how the volume of HI(g) formed as the reaction progresses would change if the volume of I₂(g) in the vessel was increased and the temperature is kept at 40°C. Label this **Plot B**. (1 mark)

- (c) Plot a new curve on the graph to show how the volume of HI(g) formed as the reaction progresses would change if the temperature of the original system was decreased to 30°C. Label this **Plot C**. (1 mark)

- (d) Below is a kinetic energy distribution graph for the reacting system at 40°C. On the graph below, draw a new curve to show how the kinetic energy distribution would change if the temperature was decreased from 40°C to 30°C. (2 marks)

**Question 32****(7 marks)**

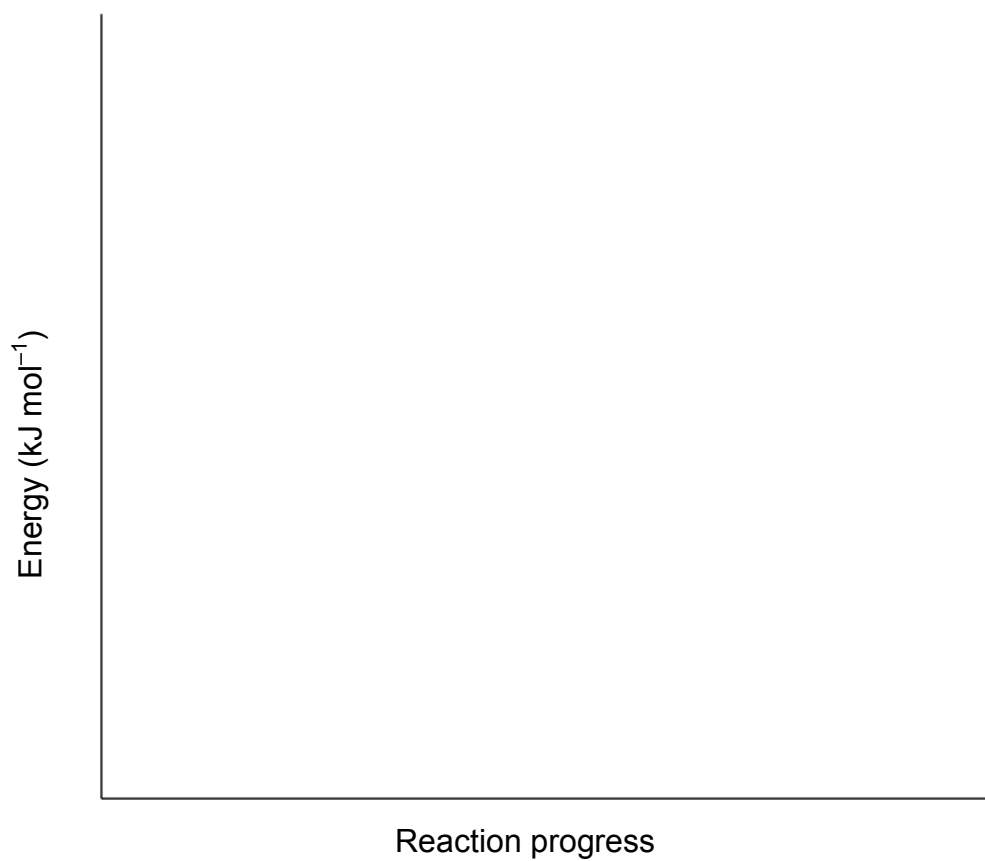
The reaction for the dissolution of ammonium nitrate in water is shown below.



- (a) Will the reaction vessel feel warm or cool to the touch? (1 mark)

- (b) Explain your answer to (a). (2 marks)

- (c) The activation energy for the reaction is approximately 50 kJ mol^{-1} . Draw an energy profile diagram for the reaction on the axes below, and label the following. (4 marks)
- (i) The activation energy, E_a
 - (ii) The heat of reaction



Question 33

(13 marks)

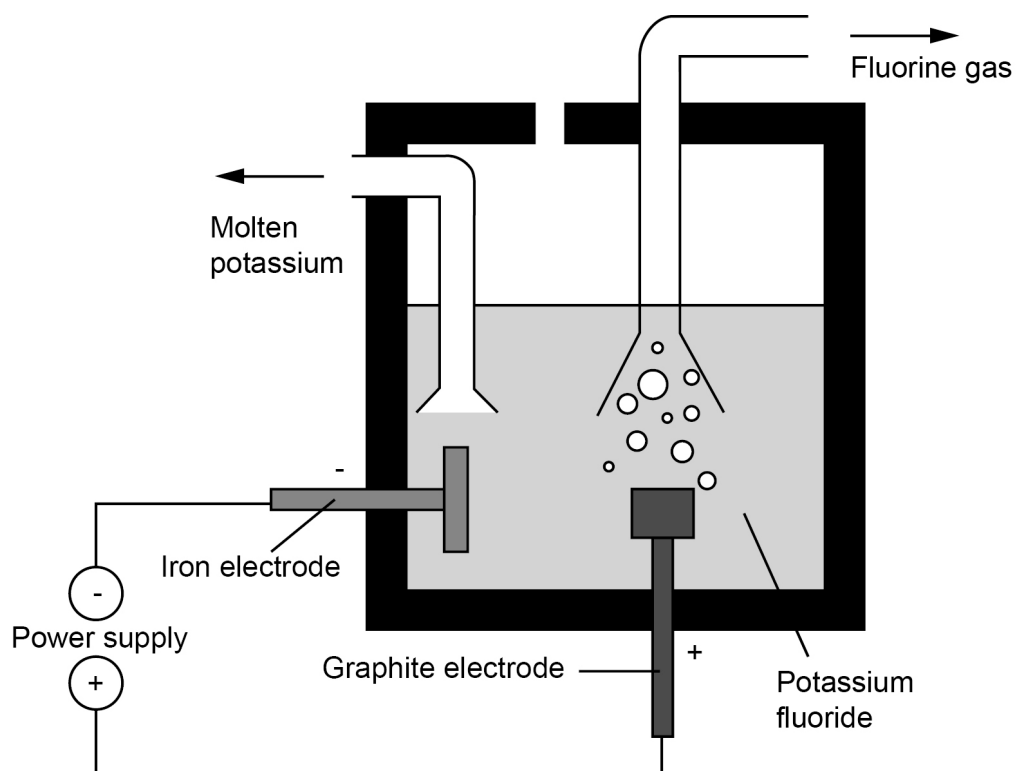
In industry, sodium is extracted from molten sodium chloride by electrolysis. Likewise, potassium can be extracted from its molten salts.

- (a) When potassium fluoride is melted, it dissociates to release ions. Write the equation, including appropriate state symbols, to show this process. (2 marks)

- (b) Write the oxidation and reduction half equations for the electrolysis of molten potassium fluoride. (2 marks)

Oxidation	
Reduction	

In the extraction of potassium from molten potassium fluoride, an apparatus similar to that shown in the diagram below is used. Refer to the diagram to answer the parts of the question that follow.



See next page

- (c) Complete the table below by writing the electrode (anode or cathode) for which each of the substances shown is used. (1 mark)

Graphite	Iron

- (d) On the diagram, show clearly the direction of flow of fluoride ions. (1 mark)

- (e) Name the substance that forms at the anode. (1 mark)

- (f) Explain why solid potassium fluoride cannot undergo electrolysis. (2 marks)

- (g) (i) List three potential hazards associated with the electrolysis of molten potassium fluoride. (3 marks)

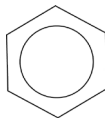
1	
2	
3	

- (ii) State one safety precaution that workers using electrolysis to extract potassium from molten potassium fluoride should take. (1 mark)

Question 34

(8 marks)

Benzene (C_6H_6) is a liquid organic compound that is used to produce thousands of other compounds, such as plastics and pharmaceuticals. Its structure is given below.



- (a) Write the equation for the reaction of benzene with chlorine (Cl_2), in the presence of a catalyst, aluminium chloride ($AlCl_3$). (2 marks)

- (b) Name the type of reaction that takes place in (a). (1 mark)

- (c) Name the organic product of the reaction in (a). (1 mark)

- (d) (i) State the effect of the $AlCl_3$ catalyst on this reaction. (1 mark)

- (ii) Use your understanding of the collision theory to explain how the catalyst produces the effect stated in your answer to part (i). A labelled diagram could be included in your answer. (3 marks)

Question 35

(7 marks)

With a few exceptions, compounds containing carbon are classified as organic. Millions of organic compounds are known to exist, and each year organic chemists synthesise more new organic compounds than all the known compounds of all of the other elements combined.

One of the reasons why carbon atoms can form so many compounds is their small size, which allows them to fit comfortably as part of large molecules. The other key factor is the unique bonding capacity of the carbon atom.

- (a) Write the electron configuration of a carbon atom and indicate the number of covalent bonds it can form with other atoms, including other carbon atoms.

(2 marks)

- (b) Write the structural formula **or** give the name, as appropriate, of an organic compound that exhibits features given in the table below.

(4 marks)

A branched-chain containing five carbon atoms	Structural formula:
A ring structure containing five carbons	Structural formula:
A molecule containing carbon-carbon double bonds	Name:
A molecule containing a halogen	Name:

- (c) Write the name of one other element in the Periodic Table you would expect to show some properties that are similar to those of carbon.

(1 mark)

Question 36

(4 marks)

A 2.80 L sample of a gaseous organic compound at S.T.P. is found to have a mass of 7.00 g.

- (a) Calculate the molar mass of the compound. (2 marks)

- (b) Determine the molecular formula of the compound if its general formula is known to be C_nH_{2n} . (2 marks)

Section Three: Extended answer

35% (70 Marks)

This section contains **five (5)** questions. You must answer **all** questions. Write your answers in the spaces provided.

When calculating numerical answers, show your working and reasoning clearly, unless instructed otherwise. Include appropriate units in your answer where applicable, express numerical answers to three (3) significant figures and include appropriate units.

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Suggested working time: 65 minutes.

Question 37

(11 marks)

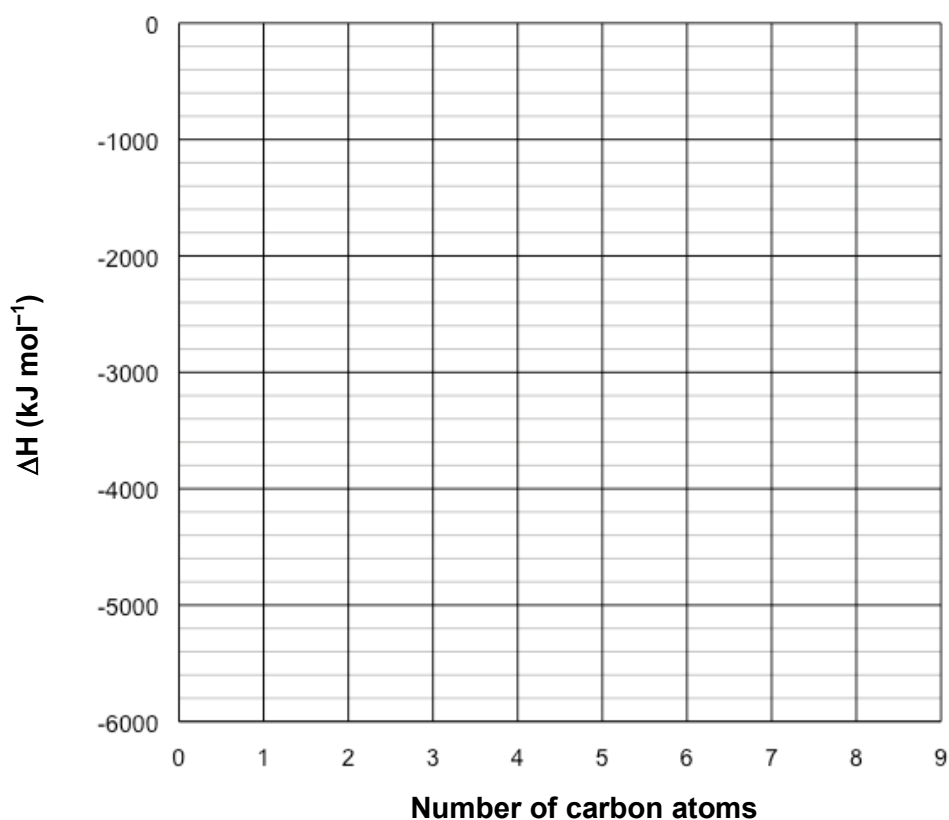
Fuels such as methane combust by reaction with oxygen to produce carbon dioxide and water. This process is accompanied by the release of heat energy to the surroundings.

- (a) Write the equation for the combustion of pentane. Include the energy term in your equation. (2 marks)

The heats of reaction for the combustion of some alkanes are shown in the table below.

Fuel	ΔH (kJ mol ⁻¹)
methane	-890
butane	-2881
pentane	-3536
octane	-5510

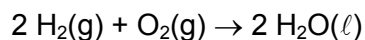
- (b) Plot ΔH (kJ mol⁻¹) of the combustion reaction versus the number of carbon atoms in each compound on the grid below. (2 marks)



- (c) State the relationship between the number of carbon atoms in the fuel compound and ΔH . (1 mark)

- (d) Predict, and write below, an approximate value for the heat of reaction for the combustion of hexane. (1 mark)

Hydrogen gas may also be used as a fuel, and reacts with oxygen when ignited to form water according to the reaction below.



1200 kg of hydrogen gas is ignited in air to form H_2O .

- (e) What volume of oxygen gas will react with this mass of hydrogen at S.T.P.? Your answer must be expressed with the appropriate number of significant figures and must include units. (4 marks)

- (f) Given that air is approximately 20% oxygen by volume, what volume of air would be required to react with 1200 kg of hydrogen gas? (1 mark)

Question 38

(11 marks)

Household drain cleaners and oven cleaners usually contain sodium hydroxide (caustic soda), because of its ability to dissolve fats and grease.

- (a) Calculate the percentage by mass of the element that constitutes the greatest percentage by mass in sodium hydroxide. (3 marks)

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49.00 mL of 0.100 mol L⁻¹ hydrochloric acid solution was required to react completely with an 8.00 g sample of impure sodium hydroxide.

- (b) Write the ionic equation for the reaction of hydrochloric acid with sodium hydroxide. (1 mark)

- (c) Calculate the number of moles of sodium hydroxide in the impure sample. (2 marks)

- (d) Calculate the percentage purity of the sodium hydroxide sample. (2 marks)

- (e) To prepare an oven cleaning agent, 1.08 g of a further sample of the impure sodium hydroxide was dissolved in 250 mL of distilled water. Calculate the concentration of sodium hydroxide in the oven cleaner. Express your answer in g L^{-1} . (2 marks)

- (f) Express your answer to (e) in mol L^{-1} . (1 mark)

- (c) (i) Usually, the salt used in this process is sodium chloride because it is relatively cheap and plentiful. Predict whether using calcium chloride (CaCl_2) in place of sodium chloride (NaCl) would be more, less or similarly effective. (1 mark)

Circle your answer:

More

Less

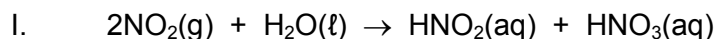
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- (ii) Give the chemical reasoning for your prediction. (2 marks)

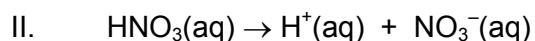
- (d) Assume that the desired concentration of sodium chloride is 3420 moles per tonne. What mass of pure sodium chloride is needed to treat each tonne of ice and snow? Express your final answer to three significant figures and show the appropriate units. (3 marks)

- (e) Calculate the sodium chloride concentration in the resulting solution (in moles per litre) if 10.0 kg of sodium chloride melted ice to form 30.0 L of sodium chloride solution.
(3 marks)

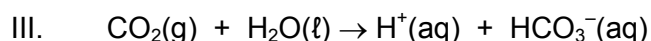
Nitrogen dioxide is a by-product of energy use, and can contribute to the production of 'acid rain' and the gradual acidification of the environment through its reaction with water, as shown below.



The HNO_3 formed in the reaction above ionises as follows.



Carbon dioxide and sulfur dioxide also take part in reactions that lead to the formation of acid rain. Carbon dioxide reacts with water according to the reaction below.



- (b) Samples of $\text{NO}_2(\text{g})$ and $\text{CO}_2(\text{g})$, each weighing 1.00 g, are bubbled through separate beakers containing 100 mL of water. (4 marks)

- (i) Determine the number of moles of each gas in 1.00 g.

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

- (ii) Assuming reactions I, II and III are the only reactions to occur that will influence pH, determine which one of the 1.00 g gas samples (NO_2 or CO_2) will cause the greater decrease in the pH of the water. (2 marks)

Sulfur dioxide contributes to the acidification of the environment through the production of sulfurous acid.

- (c) Write the equation, including appropriate state symbols, for the reaction of sulfur dioxide with water. (2 marks)

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- (d) State two impacts of acids on the environment. (2 marks)

1	
2	

- (e) In the same way that rainwater can 'capture' and react with gaseous pollutants such as carbon dioxide and sulfur dioxide, it may also capture gaseous ammonia. State, and show with the help of an equation/s, the effect that reaction with ammonia will have on the pH of rainwater. (2 marks)

Question 41

(15 marks)

While searching the pantry, a student notices the labels have fallen off two bottles, each containing a white powder. One label reads 'Epsom Salt' (magnesium sulfate) while the other reads 'Iodised Salt' (sodium chloride, also containing sodium iodide).

The student has the latest Chemistry Data Sheet and a chemistry set at home. The chemistry set contains distilled water and the solutions listed below.

Solutions in chemistry set
sodium bromide lead(II) nitrate silver nitrate barium ethanoate copper(II) sulfate sodium carbonate ammonium chloride

The student sets about performing a series of tests to determine the identity of each of the powders.

- (a) How should the student prepare the two powders before testing them by reacting them with any of the solutions in the chemical set? (1 mark)

- (b) Using the Chemistry Data Sheet, list in the table below the solutions from the chemistry set that could form a precipitate with solutions of each unknown substance. (4 marks)

	'Unknown' substance	
	Epsom salt (MgSO ₄)	Iodised salt (NaCl / NaI)
Solutions that could form a precipitate		

- (c) Using your answer to (b), describe briefly a simple test that could be used to distinguish between the two unknown substances. Include a description of the observations of the test. (3 marks)

- (d) State the name and colour, according to the Data Sheet, of **one** coloured (not white) precipitate that could be produced from reactions of the solutions in the chemistry set with the unknown substances. (2 marks)

Name of precipitate	Colour of precipitate

- (e) (i) Describe the expected observation when potassium phosphate (K_3PO_4) solution is added to Epsom Salt ($MgSO_4$). (1 mark)

- (ii) Write the equation for any reaction that may occur between potassium phosphate (K_3PO_4) solution and the NaI in the Iodised Salt. (1 mark)

- (f) Would a solution of ammonium carbonate, $(\text{NH}_4)_2\text{CO}_3$ (if it was available in the chemistry set) be an appropriate solution to distinguish between the two white powders in the pantry? Explain your answer, and use chemical equations to aid your explanation. (3 marks)

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Published by the Curriculum Council of Western Australia
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