OFFICE OF TASMANIAN ASSESSMENT, STANDARDS & CERTIFICATION

Tasmanian Certificate of Education
External Assessment 2018

PLACE YOUR CANDIDATE LABEL HERE

CHEMISTRY

(CHM415115)

PART 1

Time: 45 minutes

Pages:	12
Questions:	7
Attachments:	Information Sheet

Candidate Instructions

1. You **MUST** make sure that your responses to the questions in this examination paper will show your achievement in the criterion being assessed.
2. Answer **ALL** questions. Answers must be written in the spaces provided on the examination paper.
3. You should make sure you answer all parts within each question so that the criterion can be assessed.
4. This examination is 3 hours in length. It is recommended that you spend approximately 45 minutes in total answering the questions in this booklet.
5. The External Examination Information Sheet for Chemistry can be used throughout the examination. No other written material is allowed into the examination.
6. A TASC approved calculator can be used throughout the examination.
7. All written responses must be in English.

On the basis of your performance in this examination, the examiners will provide results on the following criterion taken from the course statement:

Criterion 5 Identify and apply fundamental principles and theories of electrochemistry.

Section Total: /40

Additional Instructions for Candidates

In calculations no credit can be given for incorrect answers unless they are accompanied by details of the working. Some credit will be given for unsimplified answers. Appropriate units must be included.

Note:

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- a candidate should calculate their own answer to the appropriate number of significant figures and **use this subsequently.**
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A spare diagram has been provided in the back of the answer booklet for you to use if required. If you use this spare diagram, you **MUST** indicate you have done so in your answer to that question.

Question 1

For Marker Use Only

Aqueous manganese(II) ions, $Mn^{2+}_{(aq)}$, react with aqueous bismuthate ions, $BiO_3^-{}_{(aq)}$, to produce a solution containing permanganate ions, $MnO_4^-{}_{(aq)}$ and bismuth(III) ions, $Bi^{3+}_{(aq)}$.

Use half-equations to balance the chemical equation that represents the reaction.

(4 marks)

Oxidation half-equation:

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Reduction half-equation:

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Overall equation:

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Question 2

For Marker Use Only

(a) Consider the following reaction: $2\mathrm{Cu}^{+}{}_{(aq)} \rightarrow \mathrm{Cu}^{2+}{}_{(aq)} + \mathrm{Cu}_{(s)}$

Is this an example of a redox reaction? Explain. (2 marks)

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(b) Consider the compound with the formula, K_3CuF_6. Would the ion, $(CuF_6)^{3-}$, be an oxidiser, a reducer or neither? Explain. (2 marks)

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Question 3

Use the table of Standard Reduction Potentials in the Information Sheet to support your answers in the following questions.

(a) Explain why chlorine gas is often produced in the laboratory by reacting manganese dioxide powder, $MnO_{2(s)}$, with **concentrated** hydrochloric acid rather than using 1 mol L^{-1} hydrochloric acid. (2 marks)

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(b) A lithium battery is a galvanic cell. Explain why these cells typically use non-aqueous electrolytes, rather than aqueous electrolytes. (2 marks)

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Question 4

For Marker Use Only

A steel pole supporting part of a building has become partly rusted. To maintain the pole, the following steps were carried out.

Step 1: The rust was removed from the steel pole.

Step 2: A paint containing zinc was then applied to the cleaned surface of the steel pole.

(a) Explain the role of the zinc in the paint. (3 marks)

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The instructions for using the paint include:

Any small holes are susceptible to rusting and must be filled with the paint.

(b) Explain why these holes are more susceptible to rusting than other areas. Include an appropriate labelled diagram as part of your answer. (3 marks)

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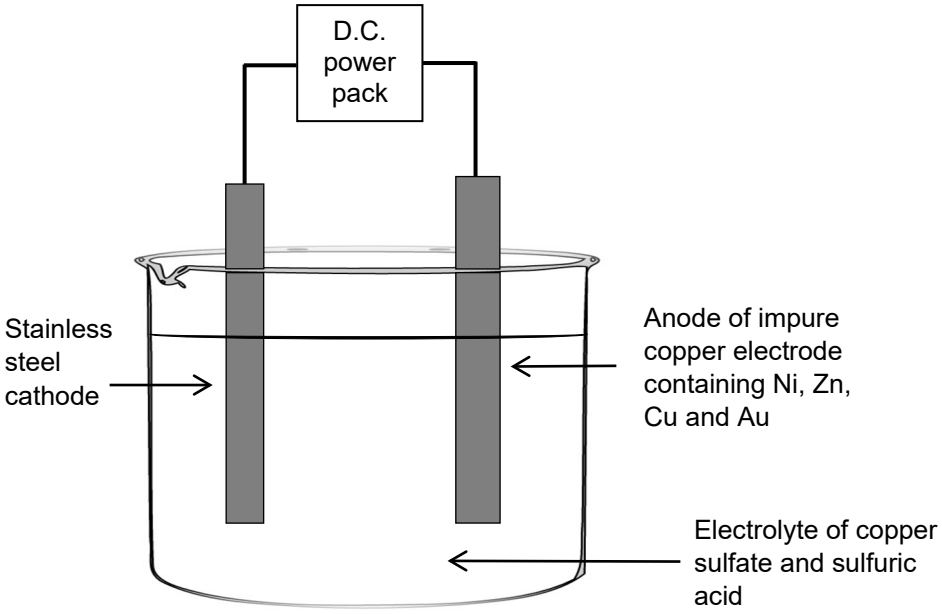
Question 5

For Marker Use Only

Electrorefining is an electrolysis process that results in the production of metals with purity usually greater than 99.99%.

During the electrorefining of copper, the anode is made of the impure copper and the cathode is made of stainless steel. The electrolyte is a solution of copper(II) sulfate and sulfuric acid.

The electrolytic cell below replicates this process.



(a) On the diagram above indicate: (1 mark)

- the polarity of the D.C. power-pack
- electron flow

(b) Use half-equation(s) to represent the reaction(s) occurring at the anode. (2 marks)

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Question 5 continues.

Question 5 (continued)

For Marker Use Only

(c) Explain why nickel and zinc are not found on the stainless steel cathode. (2 marks)

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(d) Explain why only a very small potential is needed for the electrorefining of copper. (2 marks)

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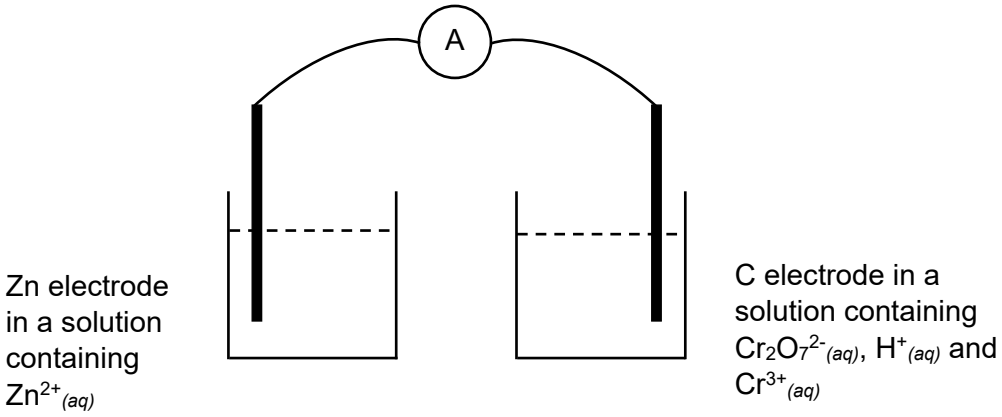
Question 6

For Marker Use Only

An electrochemical cell is set up using zinc metal in a solution of zinc nitrate, $Zn(NO_3)_{2(aq)}$, in one half-cell and acidified potassium dichromate, $K_2Cr_2O_{7(aq)}$, mixed with chromium(III) nitrate, $Cr(NO_3)_{3(aq)}$, in the other. A carbon electrode is used in the latter half-cell.

A diagram of this **incomplete** electrochemical cell is shown below.



When set up as shown above, the ammeter does not register a reading.

(a) Complete the diagram of the electrochemical cell above so that a reading will be detected on the ammeter. Explain the role of the change(s) you have made. (2 marks)

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(b) Write balanced half-equations to represent the chemical reaction occurring in each half-cell. (2 marks)

Anode:

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Cathode:

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(c) Write the **shorthand notation** for this electrochemical cell. (1 mark)

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Question 6 continues.

(d) After a period of time, the ammeter reading decreases. Explain. (1 mark)

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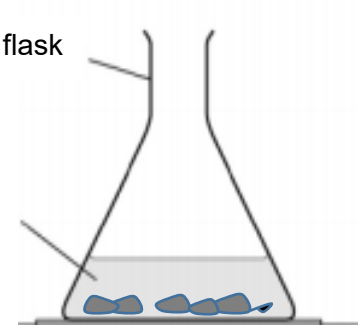
When excess zinc metal is placed in a conical flask containing acidified potassium dichromate solution, $K_2Cr_2O_{7(aq)}$, the same reactions occur in the flask as your answers given in part (b).



(e) Comment on the changes that would be observed in the flask over a period of time.

(3 marks)

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(f) Use the following half equations, together with their E^o values, to predict if there will be any further reaction(s) in this flask which still contains some zinc metal, as well as the products. Justify your answer.

$$Cr^{3+}_{(aq)} + e^- \rightleftharpoons Cr^{2+}_{(aq)} \qquad -0.44\ V$$

$$Cr^{2+}_{(aq)} + 2e^- \rightleftharpoons Cr_{(s)} \qquad -0.91\ V$$

(2 marks)

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Question 7

For Marker Use Only

0.998 g of element X is formed when a solution containing cations X^{2+} is electrolysed.

(a) A current of 0.600 A flows for 45.0 minutes. Show that there are about 1×10^{22} electrons passing into the electrolysis cell. (2 marks)

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(b) Determine the mass in grams, of one atom of X. (2 marks)

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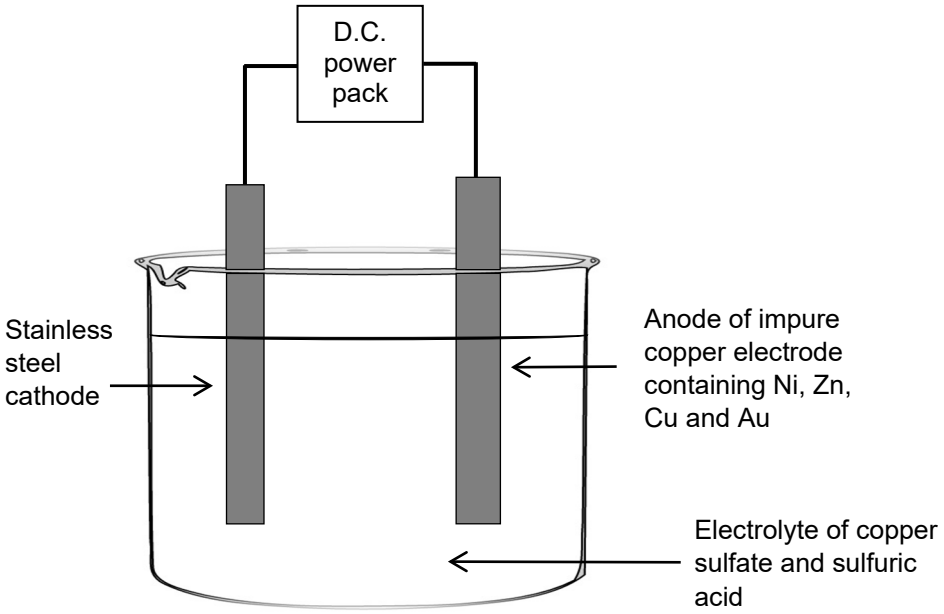
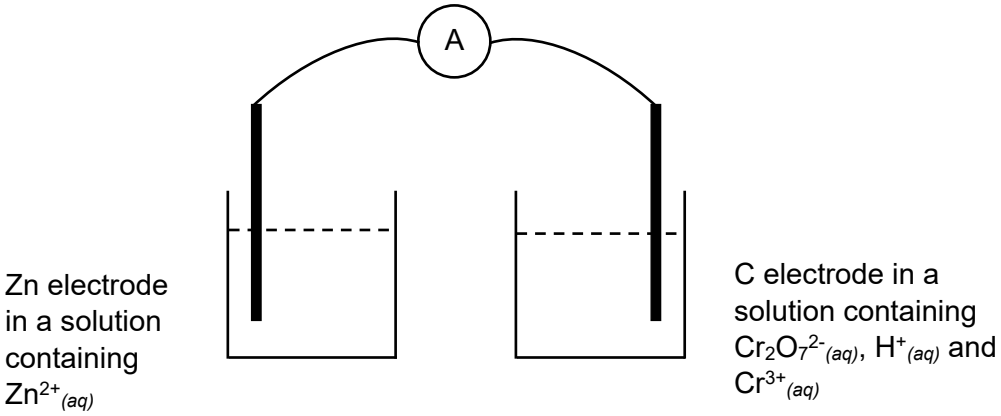
SPARE DIAGRAM

Question 5



Question 6



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External Assessment 2018

PLACE YOUR CANDIDATE LABEL HERE

CHEMISTRY

(CHM415115)

PART 2

Time: 45 minutes

Pages:	12
Questions:	5
Attachments:	Information Sheet

Candidate Instructions

1. You **MUST** make sure that your responses to the questions in this examination paper will show your achievement in the criterion being assessed.
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6. A TASC approved calculator can be used throughout the examination.
7. All written responses must be in English.

On the basis of your performance in this examination, the examiners will provide results on the following criterion taken from the course statement:

Criterion 6 Identify and apply principles and theories of thermochemistry, kinetics and equilibrium.

Section Total: /40

Additional Instructions for Candidates

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Question 8

For Marker Use Only

White phosphorus, P_4, ignites spontaneously in air at 32°C producing phosphorus pentoxide, P_4O_{10}. The white phosphorus continues to burn vigorously.

The reaction occurring is

$$P_{4(s)} + 5O_{2(g)} \rightarrow P_4O_{10(s)}$$

(a) Draw a labelled potential energy diagram for this chemical reaction. (2 marks)

(b) Explain the main features of your diagram from part (a). (2 marks)

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(c) A safety sheet states that white phosphorus, P_4, ignites more readily when **warmed** and **finely divided**.

Explain why these conditions favour the ignition of phosphorus. (3 marks)

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Question 9

For Marker Use Only

'Water gas' and 'producer gas' are both man-made fuels. They are produced in the same furnace by alternating blasts of steam and air through a heated coal, $C_{(s)}$.

Water gas, which is a mixture of hydrogen and carbon monoxide, is formed when steam is passed over the heated coal:

$$H_2O_{(g)} + C_{(s)} \rightarrow \underbrace{H_{2(g)} + CO_{(g)}}_{\text{water gas}} \qquad \Delta H = +131 \text{ kJ}$$

Producer gas, which is a mixture of carbon monoxide and nitrogen, is formed when air is passed over the heated coal:

$$O_{2(g)} + 2C_{(s)} + 3.73N_{2(g)} \rightarrow \underbrace{2CO_{(g)} + 3.73N_{2(g)}}_{\text{producer gas}} \qquad \Delta H = -221 \text{ kJ}$$

(a) Producer gas and water gas are made one after the other in a furnace. Explain the advantage of producing both gases in the same furnace. (2 marks)

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Question 9 continues.

(b) Use the bond energies given in the table below to predict the heat of reaction when carbon monoxide burns to form carbon dioxide. (3 marks)

$$CO_{(g)} + \frac{1}{2}O_{2(g)} \rightarrow CO_{2(g)}$$

Bond	Bond energy (kJ mol^{-1})
$C \equiv O$ (in carbon monoxide)	1072
$C = O$ (in carbon dioxide)	805
$O = O$	496

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When one mole of hydrogen is burnt in oxygen 220 kJ of heat energy is released.

(c) Predict which of the gases, 'water gas' or 'producer gas', has the greater energy output per mole of gas burnt, measured at the same temperature and pressure. Explain your choice. (2 marks)

Prediction: .....

Explanation:.....

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Question 10

For Marker Use Only

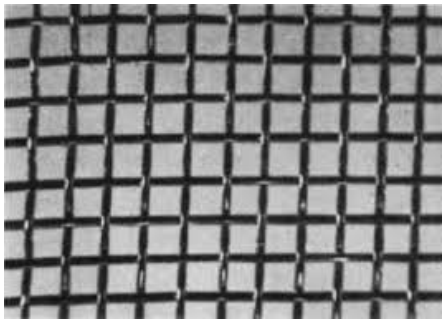
The manufacture of nitric acid is a multi-step process in which ammonia is converted to nitrogen monoxide; this is then converted to nitrogen dioxide gas. The nitrogen dioxide gas is then absorbed in water to form the acid.

Initially ammonia reacts with oxygen to produce nitrogen monoxide, NO, and steam.

The reversible reaction occurring is represented by the following chemical equation:

$$4\mathrm{NH}_{3(g)} + 5\mathrm{O}_{2(g)} \rightleftharpoons 4\mathrm{NO}_{(g)} + 6\mathrm{H}_2\mathrm{O}_{(g)} \qquad \Delta H = -905\ \mathrm{kJ}$$

A heated gauze catalyst made of a platinum-rhodium alloy, as shown opposite, is used in this part of the process.



(a) Explain why the catalyst is heated initially. (2 marks)

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(b) Explain why this catalyst increases the rate of reaction. (2 marks)

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Question 10 continues.

This reaction has about a 95% conversion rate of ammonia to nitrogen monoxide.

(c) Discuss this high conversion rate by considering the two driving forces of equilibrium. (2 marks)

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The ratio of 1 part ammonia to 8 parts oxygen is used in the reaction vessel.

(d) What is the advantage of using this ratio of gases, rather than the ratio suggested by the balanced equation given at the start of the question? (2 marks)

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Nitrogen monoxide is cooled before reacting with oxygen gas to produce nitrogen dioxide:

$$2\mathrm{NO}_{(g)} + \mathrm{O}_{2(g)} \rightleftharpoons 2\mathrm{NO}_{2(g)} \qquad \Delta H = -113\ \mathrm{kJ\ mol^{-1}}$$

(e) Explain the advantage of cooling this reaction mixture. (2 marks)

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Question 11

For Marker Use Only

The reaction between carbon monoxide gas and hydrogen gas produces methanol gas. In a closed vessel this reaction is represented by the following equilibrium equation:

$$\mathrm{CO}_{(g)} + 2\mathrm{H}_{2(g)} \rightleftharpoons \mathrm{CH_3OH}_{(g)} \quad K_c = 14.5 \text{ at } 500 \text{ K}$$

(a) What does the value of K_c convey about the relative concentration of each of the chemicals in the equilibrium mixture at 500 K. (1 mark)

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(b) What change(s), if any, are occurring in this reaction mixture at equilibrium? (2 marks)

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(c) At 700 K the value of K_c decreases. Classify the **forward reaction** as either exothermic or endothermic. Explain. (2 marks)

Classification: .....

Explanation.....

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(d) What effect, if any, would the addition of an inert gas to this reaction mixture make to the K_c value at 700 K? (1 mark)

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Question 11 continues.

Question 11 (continued)

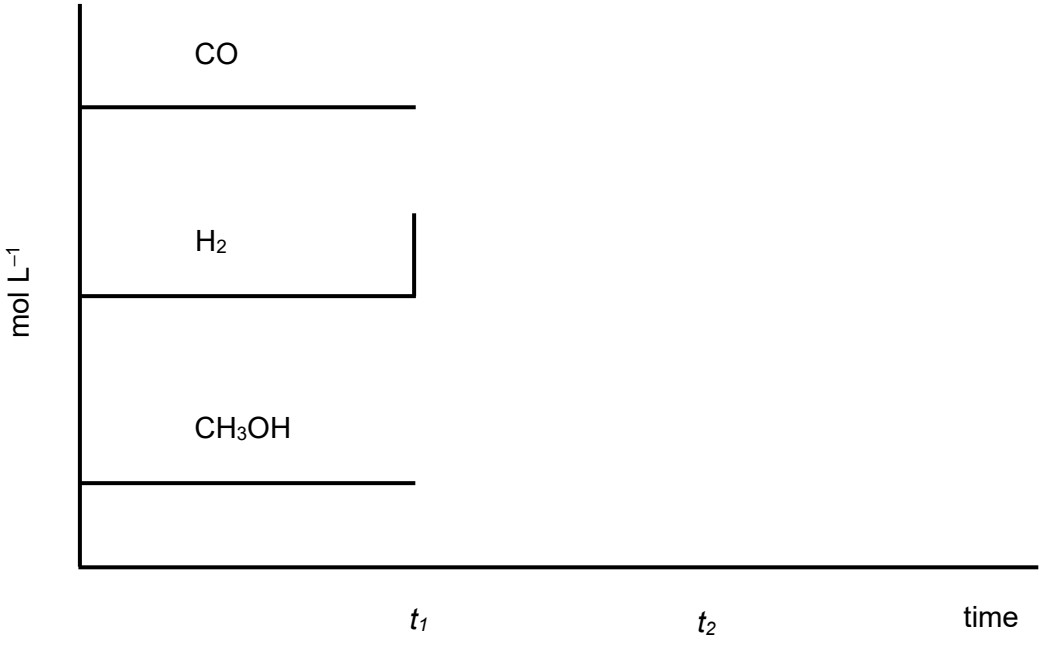
For Marker Use Only

(e) Use following graphs to show how the concentration of the 3 components of the reaction mixture, the equation which is shown below, changes with time when changes are made to the equilibrium mixture.

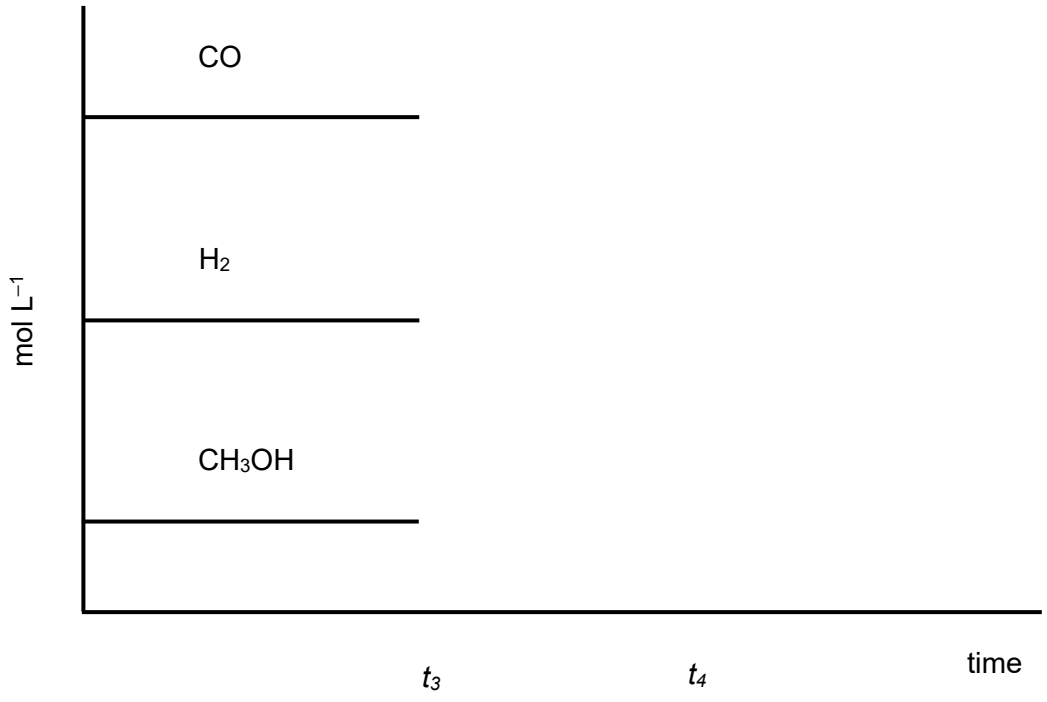
$$CO_{(g)} + 2H_{2(g)} \rightleftharpoons CH_3OH_{(g)}$$

(4 marks)

(i) Hydrogen gas is added to the system at time t_1; the system is again at equilibrium at time t_2.



(ii) The volume of the vessel is reduced at time t_3; the system is again at equilibrium at time t_4.



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Question 12

For Marker Use Only

When bubbled into water, hydrogen fluoride gas, $HF_{(g)}$, reacts with water to form a weak acidic solution.

(a) Write a chemical equation to show the reaction of hydrogen fluoride gas dissolving in water. (1 mark)

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(b) Hydrogen fluoride gas dissolves in pure nitric acid, HNO_3.

$$HNO_3 + HF \rightarrow H_2NO_3{}^+ + F^-$$

State, with a reason, which of the two reactants is acting as a Brønsted-Lowry acid.

(2 marks)

Brønsted-Lowry acid: .....

Reason: .....

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(c) Calculate the pH of a hydrofluoric acid solution of concentration 0.20 mol L^{-1}, given the $K_a = 6.8 \times 10^{-4}$. (3 marks)

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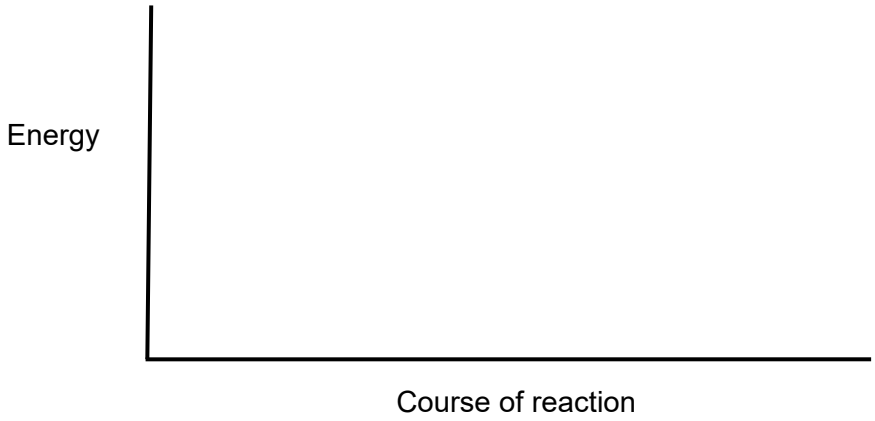
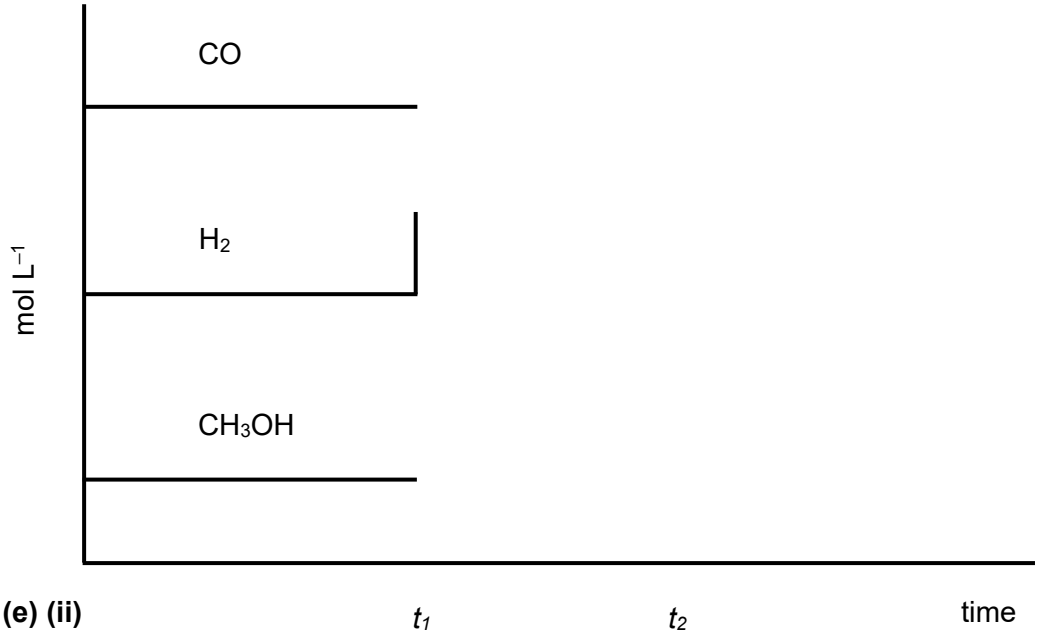
SPARE DIAGRAMS

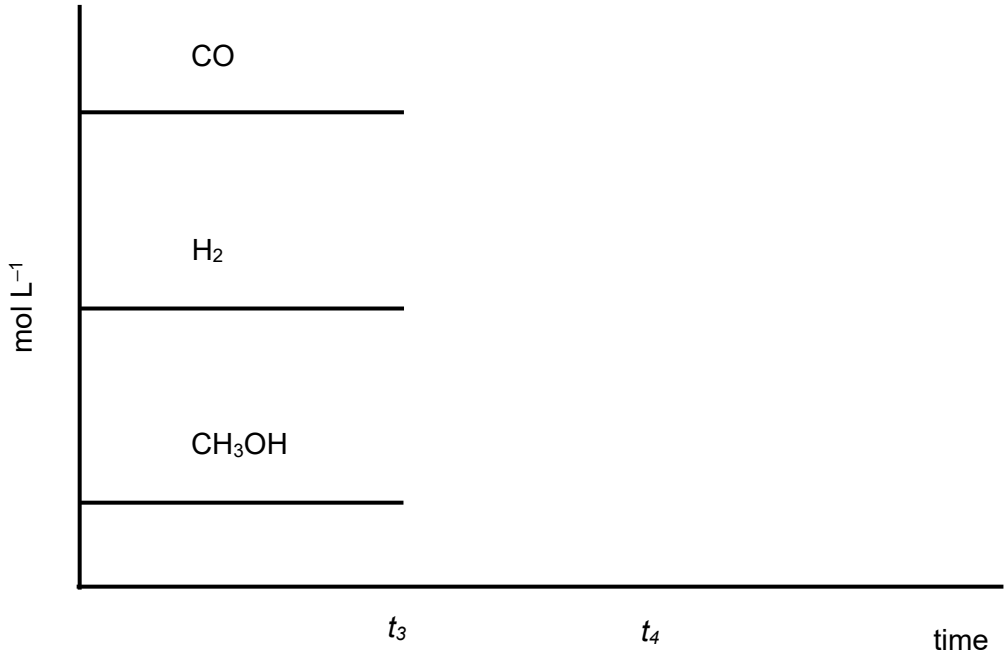
Question 8



Question 12 (e) (i)



Question 12 (e) (ii)



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CHEMISTRY

(CHM415115)

PART 3

Time: 45 minutes

Pages:	12
Questions:	6
Attachments:	Information Sheet

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Criterion 7 Demonstrate knowledge and understanding of properties and reactions of organic and inorganic matter.

Section Total: /40

Additional Instructions for Candidates

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Question 13

For Marker Use Only

There are two straight chain isomers of butene, C_4H_8.

Explain how these can be identified by reacting each with hydrogen chloride gas.

Use at least one structural chemical equation to support your answer. (3 marks)

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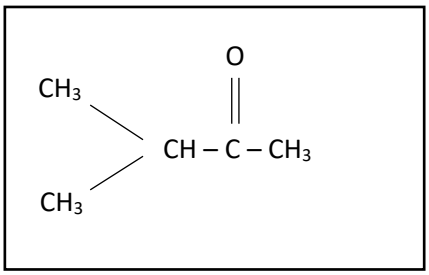
Question 14

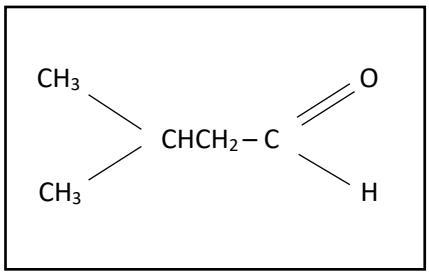
For Marker Use Only

The following isomers, labelled **P** and **Q**, were investigated using a chemical reaction and spectroscopy.

P



Q



(a) Name isomer **P**. (1 mark)

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(b) Identify a reagent, or combination of reagents, you could use to distinguish between the two isomers in a school laboratory.

State what you would observe when both isomers are tested separately with this reagent or combination of reagents. (2 marks)

Reagent(s) added:.....

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Observation(s): .....

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(c) State the structural feature that is present in both **P** and **Q** that can be identified from infrared spectra by absorption at about 1720 cm^{-1}. (1 mark)

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Question 14 continues.

(d) The major molecular ion peaks of the mass spectra of the two isomers are recorded in the table below:

Spectrum 1	
m/z	Relative intensity
43	100

Spectrum 2	
m/z	Relative intensity
29	46
41	90
43	93
44	100
58	81

(i) Identify the fragment(s) with m/z = 43. (2 marks)

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(ii) Identify which spectrum is that of isomer **P**. Explain your choice. (2 marks)

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(e) Isomer **P** is slightly soluble in water. Outline the main factor(s) to explain this solubility. (2 marks)

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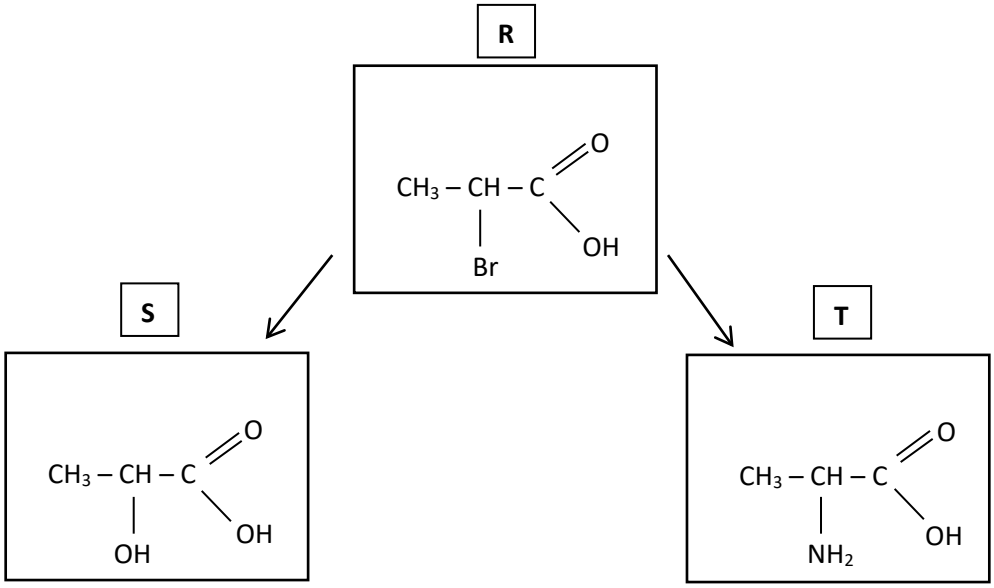
Question 15

For Marker Use Only

Alkyl halides are useful organic chemicals due to their relative reactivity. Two reactions of one such compound, labelled **R**, are summarised below:



(a) Name compound **R.** (1 mark)

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(b) Consider compound **T:** (2 marks)

(i) Name a chemical that will react with compound **R** to produce compound **T.**

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(ii) Name the functional group(s) of compounds to which **T** belongs.

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Question 15 continues.

Question 15 (continued)

For Marker Use Only

(c) Compound **S** is a weak acid. (2 marks)

(i) Classify compound **S** as either a monoprotic acid or a diprotic acid.

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(ii) Write a semi-structural chemical equation to confirm your answer.

(d) Compound **R** will react with ethanol in the presence of concentrated sulfuric acid. Write a semi-structural chemical equation to represent the reaction occurring.
(2 marks)

(e) Part of the process to convert compound **R** to compound **S** is to react compound **R** with sodium hydroxide, NaOH, under suitable conditions, producing one organic compound. Write a semi-structural chemical equation to represent the reaction occurring.
(2 marks)

/9

Question 16

For Marker Use Only

This question focuses on the period 3 elements and their 1+ ions.

(a) Explain why sulfur is more electronegative than silicon. (2 marks)

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Aluminium and silicon are called *p block* elements.

(b) Why are they classified in this way? (1 mark)

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(c) Write the electron configuration of the singly charged aluminium ion, Al^+. (1 mark)

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The Al^+ ion can be further ionised by removing a second electron.

(d) Write the equation to represent this process. (1 mark)

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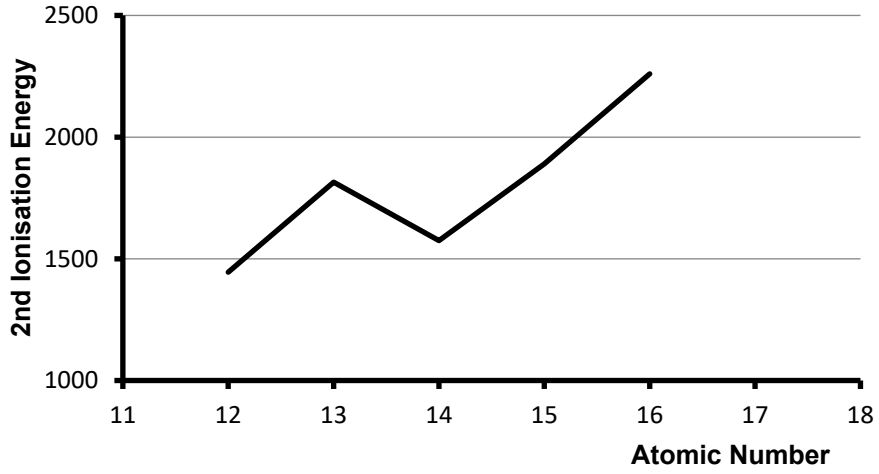
Question 16 continues.

Question 16 (continued)

For Marker Use Only

The graph below shows how the second ionisation energy varies with atomic number.



(e) Explain why the second ionisation energy of silicon (atomic number 14) is less than that of aluminium (atomic number 13). (3 marks)

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Question 17

For Marker Use Only

Neon is one of the noble gases commonly used in gas discharge tubes, known as 'neon lights'.

Within the tube neon atoms are excited by collisions caused by an applied electric field. These atoms then emit light of characteristic frequencies.

(a) Explain why only certain frequencies of light are emitted. (2 marks)

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(b) Which of the noble gases would require the most energy to ionise it? Explain. (2 marks)

Identity of noble gas: .....

Explanation: .....

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Question 18

For Marker Use Only

(a) State the two assumptions from the kinetic theory of gases to explain why real gases vary from ideal gases. (2 marks)

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Consider the gas nitrogen, $N_{2(g)}$.

(b) As the temperature increases nitrogen becomes more like an ideal gas. Explain. (2 marks)

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(c) At higher pressures, nitrogen gas becomes less ideal. Explain. (2 marks)

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Tasmanian Certificate of Education
External Assessment 2018

PLACE YOUR CANDIDATE LABEL HERE

CHEMISTRY

(CHM415115)

PART 4

Time: 45 minutes

Pages:	12
Questions:	7
Attachments:	Information Sheet

Candidate Instructions

(a) You **MUST** make sure that your responses to the questions in this examination paper will show your achievement in the criterion being assessed.

(b) Answer **ALL** questions. Answers must be written in the spaces provided on the examination paper.

(c) You should make sure you answer all parts within each question so that the criterion can be assessed.

(d) This examination is 3 hours in length. It is recommended that you spend approximately 45 minutes in total answering the questions in this booklet.

(e) The External Examination Information Sheet for Chemistry can be used throughout the examination. No other written material is allowed into the examination.

(f) A TASC approved calculator can be used throughout the examination.

(g) All written responses must be in English.

On the basis of your performance in this examination, the examiners will provide results on the following criterion taken from the course statement:

Criterion 8 Apply logical processes to solve quantitative chemical problems.

Section Total: /40

Additional Instructions for Candidates

In calculations no credit can be given for incorrect answers unless they are accompanied by details of the working. Some credit will be given for unsimplified answers. Appropriate units must be included.

Note:

When candidates are asked to ‘show that’:

- a candidate should calculate their own answer to the appropriate number of significant figures and **use this subsequently**.
- a candidate who is unable to determine the required value should use the value given by the examiner in subsequent part(s) to the question.

Question 19

For Marker Use Only

A student reacted 2.40 g of magnesium carbonate, $MgCO_3$, with 25.0 mL of 2.00 mol L^{-1} hydrochloric acid solution. The chemical reaction that occurred is represented by the following equation:

$$MgCO_{3(s)} + 2HCl_{(aq)} \rightarrow MgCl_{2(aq)} + CO_{2(g)} + H_2O_{(l)}$$

(Useful information: $M_r(MgCO_3) = 84.32$)

a) Show that the magnesium carbonate is in excess in this reaction. (2 marks)

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After the reaction was complete, the solution was filtered and the filtrate left so that the water evaporated. When dried, 3.75 g of hydrated magnesium chloride crystals, $MgCl_2 \cdot 6H_2O$, were obtained.

b) Calculate the percentage yield of hydrated magnesium chloride. (3 marks)

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Question 20

For Marker Use Only

The heats of reaction for two chemical reactions are given below:

Reaction 1: $N_{2(g)} + 3H_{2(g)} \rightarrow 2NH_{3(g)} \quad \Delta H = -92.4\ \text{kJ}$

Reaction 2: $2H_{2(g)} + O_{2(g)} \rightarrow 2H_2O_{(g)} \quad \Delta H = -484\ \text{kJ}$

Ammonia combusts in oxygen to form nitrogen and steam according to the chemical equation given below:

$$4NH_{3(g)} + 3O_{2(g)} \rightarrow 2N_{2(g)} + 6H_2O_{(g)}$$

(a) Calculate the heat of reaction, ΔH, for the reaction occurring between ammonia and oxygen. (2 marks)

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(b) Is the volume of gases produced by combustion of ammonia **greater than, the same as,** or **less than** the volume of reactant gases?

(All measurements are made at the same pressure and temperature). (2 marks)

Prediction: .....

Reason: .....

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(c) Consider the following reaction:

$$2H_{2(g)} + O_{2(g)} \rightarrow 2H_2O_{(l)}$$

Is the heat of reaction, ΔH, **greater than, the same as,** or **less than** that for Reaction 2 (ΔH = -484 kJ)? Give a reason for your answer. (2 marks)

Prediction: .....

Reason: .....

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Question 21

For Marker Use Only

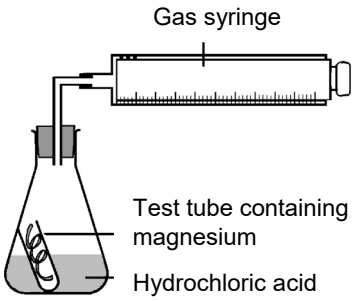
Hydrogen gas is produced when magnesium reacts with excess hydrochloric acid solution:

$$Mg_{(s)} + 2H^{+}_{(aq)} \rightarrow Mg^{2+}_{(aq)} + H_{2(g)}$$

(All measurements were taken at **standard laboratory conditions)**.

Two groups of students collected hydrogen gas using different techniques.

(a) One group of students collected 67.3 mL of hydrogen gas using a gas syringe.



Calculate the mass of magnesium used. (2 marks)

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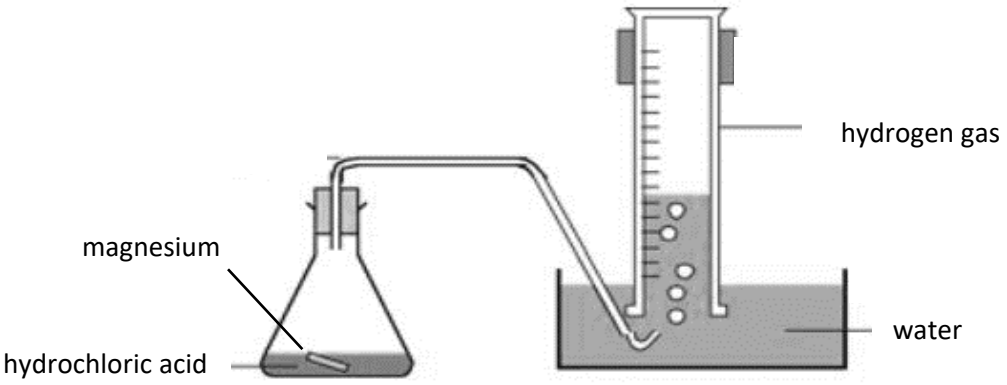
Another group of students used the **same** mass of magnesium and collected the hydrogen gas over water.



(b) Determine the expected volume of gas in the gas tube.
(Useful information: The vapour pressure of water at 25°C is 3.17 kPa.) (3 marks)

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Question 22

For Marker Use Only

Consider the gaseous equilibrium between three compounds, **E**, **F** and **G.**

The expression for the equilibrium constant, K_c, is

$$K_c = \frac{[\mathbf{E}]^3[\mathbf{F}]}{[\mathbf{G}]^2}$$

(a) Write a balanced chemical equation to represent the equilibrium mixture. (1 mark)

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In an experiment, conducted at a constant temperature, the following gaseous chemicals are in a sealed flask.

Compound	**E**	**F**	**G**
Concentration (mol L^{-1})	2.00	5.00	2.00

At this temperature K_c = 7.62.

(b) (i) Show that this system is not at equilibrium. (2 marks)

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(ii) Predict the direction in which the reaction will proceed to attain equilibrium. (1 mark)

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Question 22 continues.

For Marker Use Only

In another experiment at a different temperature, 1.50 mol of gas **G** is placed in a sealed flask with a volume of 500.0 mL. The flask is sealed and the system allowed to come to equilibrium. There is 0.400 mol of **F** present in the equilibrium mixture.

(c) Calculate K_c at this temperature. (4 marks)

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Question 23

For Marker Use Only

A sample of limewater, $\mathrm{Ca(OH)_{2(aq)}}$, was titrated against hydrochloric acid solution at 25°C.

$$\mathrm{Ca(OH)_{2(aq)} + 2HCl_{(aq)} \rightarrow CaCl_{2(aq)} + H_2O_{(l)}}$$

(a) A 25.00 mL sample of limewater was titrated against hydrochloric acid. 21.60 mL of 0.0480 mol L^{-1} of hydrochloric acid was required to neutralise the limewater.

Calculate the concentration of the limewater.

Give your answer to the correct number of significant figures. (2 marks)

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A **saturated** solution of calcium hydroxide contains 0.166 g/100 mL under the same conditions. (Useful information: $M_r(Ca(OH)_2 = 74.096$.)

(b) Is the limewater tested in part (a) a **saturated** solution? Justify your answer. (2 marks)

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Question 23 continues.

Question 23 (continued)

For Marker Use Only

(c) Calculate the pH of a **saturated** calcium hydroxide solution. (4 marks)

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Question 24

For Marker Use Only

In a school experiment, excess magnesium oxide powder, $MgO_{(s)}$, was added to 50.0 mL of 3.00 mol L^{-1} hydrochloric acid solution. The temperature of the insulated reaction vessel rose from 21.0°C to 53.0°C.

(a) Calculate the experimental heat of reaction for one mole of magnesium oxide reacting with the acid. (4 marks)

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(b) Write a thermochemical equation representing the reaction occurring. (1 mark)

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Question 25

At standard temperature and pressure the density of xenon is 5.894 g L^{-1}.

Use the ideal gas equation to determine the value of the relative atomic mass of xenon. (3 marks)

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