PEARSON EDEXCEL GCSE CHEMISTRY · 1CH0

CHEMISTRY



EXAM QUESTION PACK

TOPIC 0: FORMULAE, EQUATIONS AND HAZARDS (PACK 3)

SCORE	PERCENTAGE
/175	%

STEMUP

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Q1.

Making sodium chloride

To make pure sodium chloride from sodium hydroxide solution and dilute hydrochloric acid, a titration has to be used.

(a) Ethanol is produced by fermentation of carbohydrates.

The equation for the reaction is

$$HCl(aq) + NaOH(aq) \rightarrow NaCl(.....) + H_2O(.....)$$

(a) Which state symbols follow NaCl and H_2O to complete the equation?

Put a cross (☒) in the box next to your answer.

(1)

		NaCl	H_2O
☒	**A**	s	l
☒	**B**	aq	aq
☒	**C**	s	aq
☒	**D**	aq	l

(b) The reaction above is a neutralisation reaction.

Write the ionic equation for the reaction.

(2)

.....

(c) When sodium hydroxide solution is titrated with dilute hydrochloric acid, an acid-base indicator is used.
The hydrochloric acid is added from a burette to the sodium hydroxide solution in a conical flask. At the end point the indicator changes colour.

(i) Give the name of a suitable indicator to use in this titration.

(1)

.....

(ii) State the colour change for this indicator at the end point.

(1)

from ..... to .....

(d) A sodium hydroxide solution was made up by dissolving 20.0 g of sodium hydroxide in water and making the volume of the solution up to 1.00 dm^3. Calculate the concentration of sodium

hydroxide, NaOH, in this solution in mol dm^{-3}.

(relative atomic masses: H = 1.00, O = 16.0, Na = 23.0)

(2)

.....

.....

.....

concentration = ... mol dm^{-3}

(e) In another experiment, a titration was carried out.
25.0 cm^3 of 1.50 mol dm^{-3} sodium hydroxide solution, NaOH, was titrated with hydrochloric acid. The volume of the hydrochloric acid required to neutralise the sodium hydroxide solution was 30.0 cm^3.

Calculate the concentration of the hydrochloric acid, HCl, in mol dm^{-3}.

$$HCl + NaOH \rightarrow NaCl + H_2O$$

(3)

.....

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.....

concentration = ... mol dm^{-3}

(Total for question = 10 marks)

Q2.

Two compounds of barium are barium sulfide and barium chloride.

The hazard symbol shown in Figure 5 is on bottles containing barium metal.



Figure 5

State the meaning of this hazard symbol.

(1)

.....

(Total for question = 1 mark)

Q3.

Metals

There are many metallic elements in the periodic table.

(a) Which row of the table correctly shows two metals that are in group 1 and two metals that are transition metals?

Put a cross (☒) in the box next to your answer.

(1)

	group 1	transition metals
☒ A	lithium and zinc	calcium and copper
☒ B	potassium and caesium	copper and iron
☒ C	sodium and potassium	copper and magnesium
☒ D	sodium and magnesium	manganese and nickel

(b) (i) Describe the structure of metals in terms of the particles present in their structures.

(2)

.....

.....

.....

(ii) Explain how metals conduct electricity.

(2)

.....

.....

.....

(c) (i) Describe what you would **see** when a small piece of sodium is added to water.

(2)

.....

.....

.....

.....

(ii) Write the balanced equation for the reaction of sodium with water to form sodium hydroxide and hydrogen.

(3)

.....

(Total for question = 10 marks)

Q4.

Metals

There are many metallic elements in the periodic table.

(a) Which row of the table correctly shows two metals that are in group 1 and two metals that are transition metals?

Put a cross (☒) in the box next to your answer.

(1)

	group 1	transition metals
☐ **A**	lithium and zinc	calcium and copper
☐ **B**	potassium and caesium	copper and iron
☐ **C**	sodium and potassium	copper and magnesium
☐ **D**	sodium and magnesium	manganese and nickel

(b) (i) Describe the structure of metals in terms of the particles present in their structures.

(2)

.....

.....

.....

(ii) Explain how metals conduct electricity.

(2)

.....

.....

.....

(c) (i) Describe what you would **see** when a small piece of sodium is added to water.

(2)

.....

.....

.....

.....

(ii) Write the balanced equation for the reaction of sodium with water to form sodium hydroxide and hydrogen.

(3)

.....

(Total for question = 10 marks)

Q5.

Methane burns in oxygen to form carbon dioxide and water.
Write the balanced equation for this reaction.

(3)

.....

Q6.

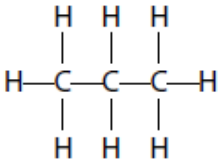
Methane burns in oxygen to form carbon dioxide and water.
Write the balanced equation for this reaction.

(3)

.....

Q7.

The structure of a molecule of propane is shown as



Give the names of the elements combined together in propane.

(2)

.....

(Total for question = 2 marks)

Q8.

(a) Ethanol is produced by the fermentation of glucose solution.

(i) Describe how this fermentation is carried out.

(2)

.....

.....

.....

.....

(ii) Complete the word equation for the fermentation of glucose.

(2)

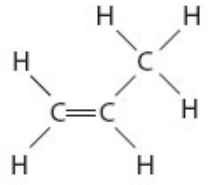
glucose → ..... +
.....

(iii) Complete the sentence by putting a cross ( ) in the box next to your answer.

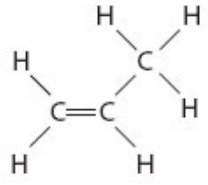
Fermentation produces a dilute solution of ethanol.

A concentrated solution of ethanol is produced from a dilute solution by

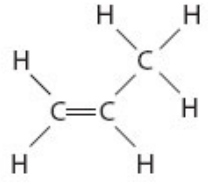
(1)



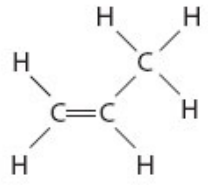
A cracking



B dehydration



C fractional distillation



D polymerisation

(iv) State a possible harmful effect of consuming too many alcoholic drinks.

(1)

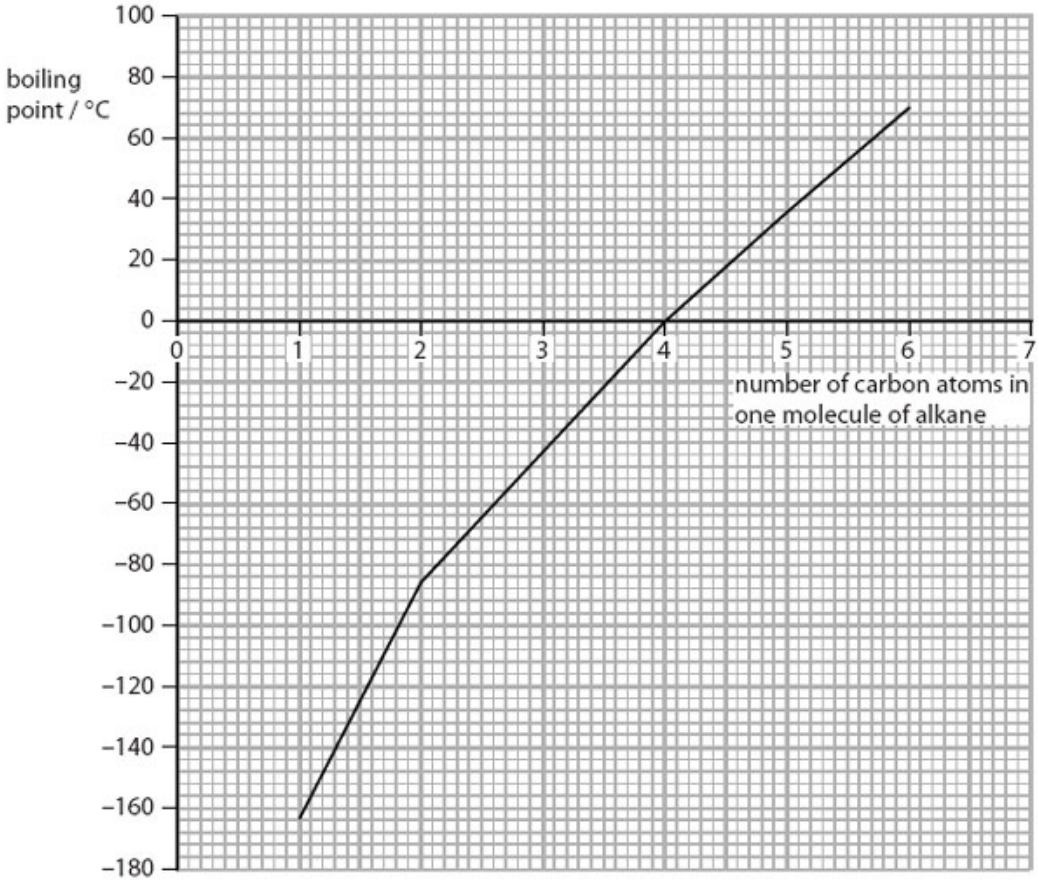
.....

.....

.....

(b) The graph shows the boiling points of some alkanes.

The boiling point of each alkane is plotted against the number of carbon atoms in one molecule of the alkane.



(i) A molecule of pentane contains five carbon atoms.
Use the graph to suggest the boiling point of pentane.

(1)

boiling point of pentane = ... °C

(ii) State how the boiling points of these alkanes change as the number of carbon atoms in one molecule of each alkane increases.

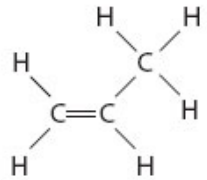
(1)

.....

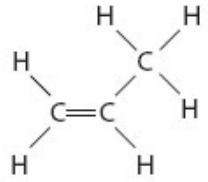
(c) (i) Which of the following is the formula for a molecule of ethane?

Put a cross ( ) in the box next to your answer.

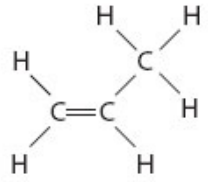
(1)



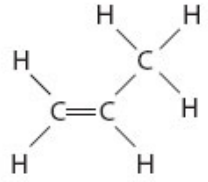
A CH_4



B C_2H_4



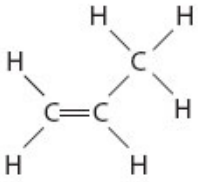
C C_2H_6



D C_6H_8

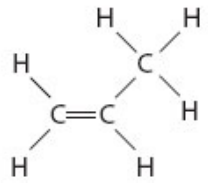
(ii) Complete the sentence by putting a cross ( ) in the box next to your answer.

The structure of a molecule of a substance is shown.

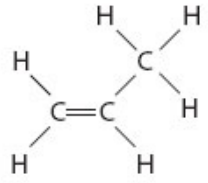


The substance is

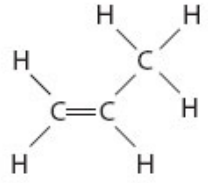
(1)



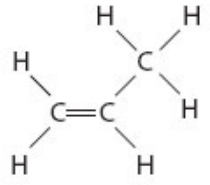
A ethene



B propane



C propene



D butane

(Total for Question = 10 marks)

Q9.

Vinegar contains ethanoic acid.

(a) Which of these is a use of vinegar?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** fuel

☒ **B** perfume

☒ **C** preservative

☒ **D** soap

(b) An indicator can be used to show that ethanoic acid is acidic.

Give the name of an indicator that can be used and state its colour in the acid.

(2)

indicator

.....

colour in acid

.....

(c) Use the gases from the box to complete the sentences.

Each gas may be used once, more than once or not at all.

carbon dioxide	hydrogen	nitrogen	oxygen

(3)

(i) If a bottle of wine is left open, ethanoic acid is formed when

ethanol in the wine is oxidised by ..... .

(ii) Ethanoic acid reacts with magnesium to give a gas. When the gas is mixed

with air and ignited with a lighted splint, it gives a squeaky pop.

This gas is ..... .

(iii) When solid sodium carbonate is added to dilute ethanoic acid,

effervescence occurs. The effervescence is bubbles of ..... .

(d) Ethanoic acid is reacted with ethanol to produce an ester, ethyl ethanoate, and water.

Write the word equation for this reaction.

(2)

.....

.....

Q10.

Vinegar contains ethanoic acid.

(a) Which of these is a use of vinegar?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** fuel

☒ **B** perfume

☒ **C** preservative

☒ **D** soap

(b) An indicator can be used to show that ethanoic acid is acidic.

Give the name of an indicator that can be used and state its colour in the acid.

(2)

indicator

.....

colour in acid

.....

(c) Use the gases from the box to complete the sentences.

Each gas may be used once, more than once or not at all.

carbon dioxide	hydrogen	nitrogen	oxygen

(3)

(i) If a bottle of wine is left open, ethanoic acid is formed when

ethanol in the wine is oxidised by ..... .

(ii) Ethanoic acid reacts with magnesium to give a gas. When the gas is mixed

with air and ignited with a lighted splint, it gives a squeaky pop.

This gas is ..... .

(iii) When solid sodium carbonate is added to dilute ethanoic acid,

effervescence occurs. The effervescence is bubbles of ..... .

(d) Ethanoic acid is reacted with ethanol to produce an ester, ethyl ethanoate, and water.

Write the word equation for this reaction.

(2)

.....

.....

Q11.

(a) (i) Which of the following is the formula for a molecule of butane?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** C_3H_6

☒ **B** C_3H_8

☒ **C** C_4H_8

☒ **D** C_4H_{10}

(ii) Draw the structure of a molecule of propene, showing all covalent bonds.

(2)

(b) Complete the sentence by putting a cross (☒) in the box next to your answer.

Ethanol, C_2H_5OH, can be converted into ethanoic acid, CH_3COOH.

In this reaction, ethanol is

(1)

- ☒ **A** dehydrated
- ☒ **B** neutralised
- ☒ **C** neutralised
- ☒ **D** reduced

(c) (i) Describe what you would **see** when solid sodium carbonate is added to dilute ethanoic acid.

(2)

.....

.....

.....

.....

(ii) When ethanoic acid reacts with ethanol, one of the products is the ester, ethyl ethanoate.

Complete the balanced equation for this reaction.

(2)

$CH_3COOH + C_2H_5OH \rightarrow$ ..... + ...

(Total for Question = 8 marks)

Q12.

(a) (i) Which of the following is the formula for a molecule of butane?

Put a cross (☒) in the box next to your answer.

(1)

- ☒ **A** C_3H_6
- ☒ **B** C_3H_8
- ☒ **C** C_4H_8
- ☒ **D** C_4H_{10}

(ii) Draw the structure of a molecule of propene, showing all covalent bonds.

(2)

(b) Complete the sentence by putting a cross (☒) in the box next to your answer.

Ethanol, C_2H_5OH, can be converted into ethanoic acid, CH_3COOH.

In this reaction, ethanol is

(1)

☒ **A** dehydrated

☒ **B** neutralised

☒ **C** neutralised

☒ **D** reduced

(c) (i) Describe what you would **see** when solid sodium carbonate is added to dilute ethanoic acid.

(2)

.....

.....

.....

.....

(ii) When ethanoic acid reacts with ethanol, one of the products is the ester, ethyl ethanoate.

Complete the balanced equation for this reaction.

(2)

$CH_3COOH + C_2H_5OH \rightarrow$ ..... + ...

(Total for Question = 8 marks)

Q13.

Ethanol can be used as a liquid fuel.

A student investigates how much heat energy is released when a known mass of ethanol is burned.

The apparatus is set up as shown in Figure 3.

A known volume of water is placed in a metal can.
The temperature of the water is measured.
The ethanol is ignited and placed under the beaker so that the flame is touching the beaker.
The water is heated by the flame.
The flame is extinguished.
The final temperature of the water is measured.

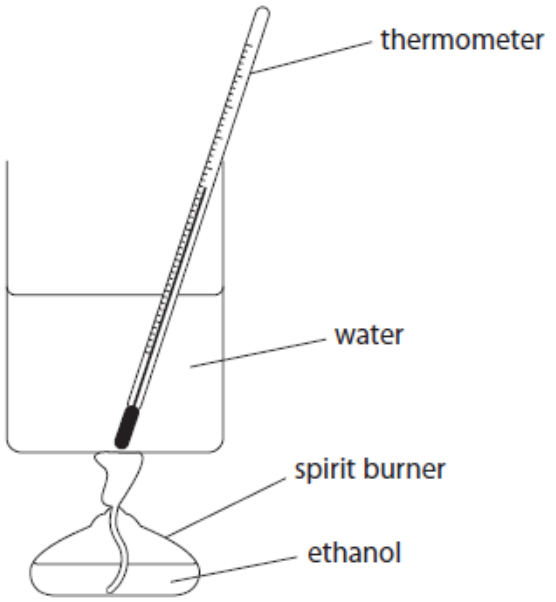


Figure 3

Ethanol can oxidise when exposed to air to produce ethanoic acid and water.
Propanol can also oxidise in a similar reaction when it is exposed to air.

(i) Write the word equation for the reaction when **propanol** oxidises when it is exposed to air.

(2)

.....

.....

(ii) What is the formula of the functional group in carboxylic acids?

(1)

☒ **A** $-OH$

☒ **B** $-CH_3$

☒ **C** $-COOH$

☒ **D** $-CO_2$

(Total for question = 3 marks)

Q14.

Ethanol can be used as a liquid fuel.

A student investigates how much heat energy is released when a known mass of ethanol is burned.

The apparatus is set up as shown in Figure 15.

A known volume of water is placed in a metal can.
The temperature of the water is measured.
The ethanol is ignited and placed under the beaker so that the flame is touching the beaker.
The water is heated by the flame.
The flame is extinguished.
The final temperature of the water is measured.

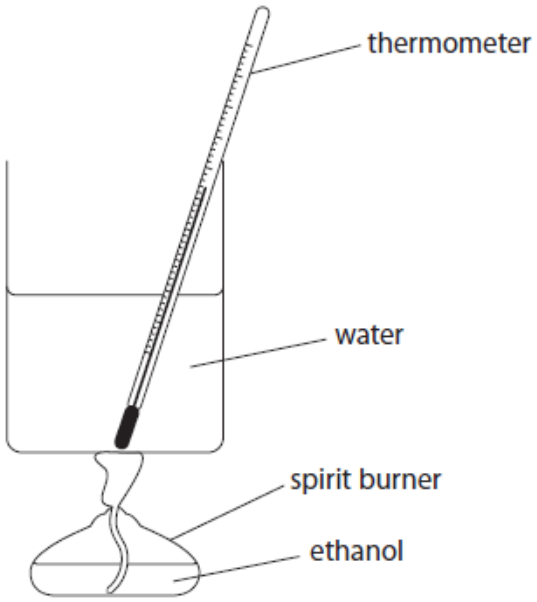


Figure 15

Ethanol can oxidise when exposed to air to produce ethanoic acid and water.
Propanol can also oxidise in a similar reaction when it is exposed to air.

(i) Write the word equation for the reaction when **propanol** oxidises when it is exposed to air.

(2)

.....

.....

(ii) What is the formula of the functional group in carboxylic acids?

(1)

☒ **A** $-OH$

☒ **B** $-CH_3$

☒ **C** $-COOH$

☒ **D** $-CO_2$

(Total for question = 3 marks)

Q15.

Particles and formulae

(a) Atoms contain protons, neutrons and electrons.

Complete the table to show the relative mass and relative charge of each particle and its position in an atom.

(3)

	relative mass	relative charge	position in atom
proton		+1	
neutron	1		in nucleus
electron			

(b) Complete the sentence by putting a cross (☒) in the box next to your answer.

An atom of an element **always** contains

(1)

☒ **A** more protons than neutrons

☒ **B** equal numbers of protons and neutrons

☒ **C** more electrons than protons

☒ **D** equal numbers of protons and electrons

(c) The symbols for some atoms are given in the box

Ca	Cl	K	N	Ne	O

From the box, choose the symbol of

(i) an atom in group 2 of the periodic table

(1)

.....

(ii) an atom that readily forms an ion with a charge of 2−

(1)

.....

(d) The formula of aluminium nitrate is $Al(NO_3)_3$

(i) State the total number of atoms in the formula $Al(NO_3)_3$

(1)

.....

(ii) What is the most likely formula of aluminium nitride?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** $Al(NO_3)_2$

☒ **B** $AlNO_3$

☒ **C** $AlNO_2$

☒ **D** AlN

(Total for question = 8 marks)

Q16.

Particles and formulae

(a) Atoms contain protons, neutrons and electrons.

Complete the table to show the relative mass and relative charge of each particle and its position in an atom.

(3)

	relative mass	relative charge	position in atom
proton		+1	
neutron	1		in nucleus
electron			

(b) Complete the sentence by putting a cross (☒) in the box next to your answer.

An atom of an element **always** contains

(1)

☒ **A** more protons than neutrons

☒ **B** equal numbers of protons and neutrons

☒ **C** more electrons than protons

☒ **D** equal numbers of protons and electrons

(c) The symbols for some atoms are given in the box

Ca	Cl	K	N	Ne	O

From the box, choose the symbol of

(i) an atom in group 2 of the periodic table

(1)

.....

(ii) an atom that readily forms an ion with a charge of 2−

(1)

.....

(d) The formula of aluminium nitrate is $Al(NO_3)_3$

(i) State the total number of atoms in the formula $Al(NO_3)_3$

(1)

.....

(ii) What is the most likely formula of aluminium nitride?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** $Al(NO_3)_2$

☒ **B** $AlNO_3$

☒ **C** $AlNO_2$

☒ **D** AlN

(Total for question = 8 marks)

Q17.

A student investigated the rate of a reaction.
The student investigated the reaction between zinc and dilute sulfuric acid.
The products are zinc sulfate, $ZnSO_4$, and hydrogen.

(i) Write the balanced equation for this reaction.

(2)

.....

*(ii) The student carried out two experiments.
The same mass of zinc and the same sized pieces of zinc were used in each experiment.

The results are shown in the table.

	experiment 1	experiment 2
concentration of sulfuric acid / mol dm^{-3}	0.5	1.5
temperature / °C	20	40
rate of reaction	slow	fast

Evaluate these results, explaining the reasons why the rate of reaction in experiment 2 is faster than the rate of reaction in experiment 1.
In your answer you should refer to the frequency and energy of collisions between particles.

(6)

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Q18.

A student investigated the rate of a reaction.
The student investigated the reaction between zinc and dilute sulfuric acid.
The products are zinc sulfate, $ZnSO_4$, and hydrogen.

(i) Write the balanced equation for this reaction.

(2)

.....

*(ii) The student carried out two experiments.
The same mass of zinc and the same sized pieces of zinc were used in each experiment.

The results are shown in the table.

	experiment 1	experiment 2
concentration of sulfuric acid / mol dm^{-3}	0.5	1.5
temperature / °C	20	40
rate of reaction	slow	fast

Evaluate these results, explaining the reasons why the rate of reaction in experiment 2 is faster than the rate of reaction in experiment 1.
In your answer you should refer to the frequency and energy of collisions between particles.

(6)

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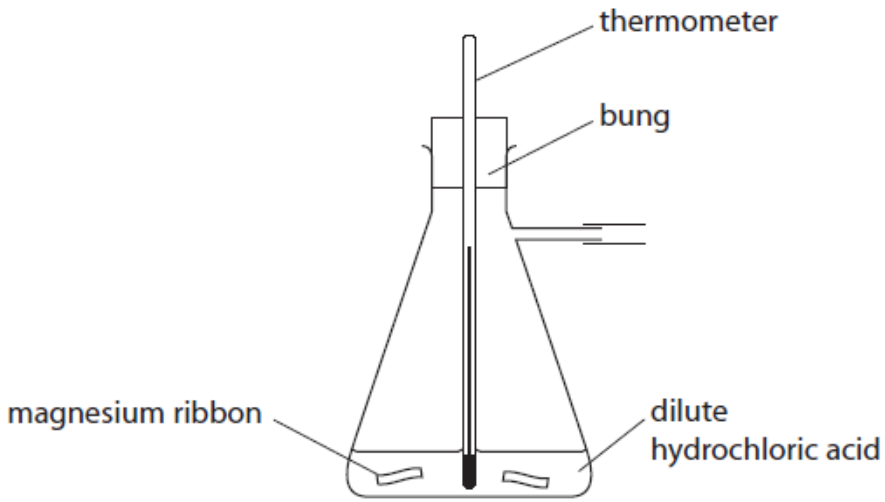
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Q19.

The apparatus shown was used by a student to investigate the reaction between strips of

magnesium ribbon and **excess** dilute hydrochloric acid.



The word equation for the reaction is

$$\text{magnesium(s)} + \text{hydrochloric acid(aq)} \rightarrow \text{magnesium chloride(aq)} + \text{hydrogen(g)}$$

(a) States of substances in reactions can be shown by state symbols.

Explain the difference between magnesium chloride(aq) and magnesium chloride(l).

(2)

.....

.....

(b) Describe what you would **see** when magnesium ribbon reacts with dilute hydrochloric acid.

(1)

.....

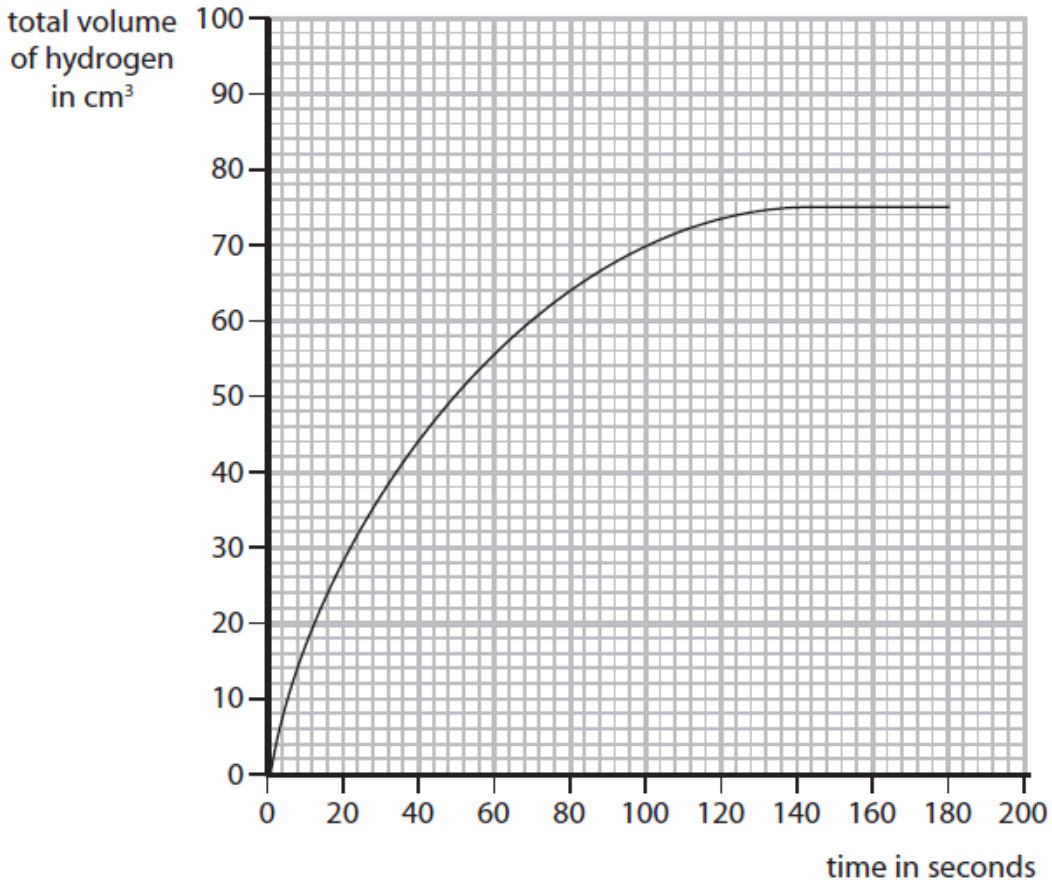
(c) Every 20 seconds, the student recorded the total volume of hydrogen produced in the reaction.

(i) Name a piece of apparatus the student should use to measure the volume of hydrogen produced.

(1)

.....

The results are shown on the graph.



(ii) After how many seconds had all the magnesium reacted?

(1)

..... seconds

(iii) The experiment is repeated using the same volume of a more concentrated hydrochloric acid solution.
All other conditions were kept the same.

On the graph draw a curve to show how the volume of hydrogen changes with time during this experiment.

(2)

(d) A student repeated the original experiment using the same mass of magnesium as a powder instead of as ribbon.
All other conditions were the same as in the first experiment.

Explain the effect on the rate of reaction of using magnesium powder instead of magnesium ribbon.

(2)

.....

.....

.....

.....

(e) When magnesium reacts with dilute hydrochloric acid there is a change in temperature.

In an experiment the results were
temperature at start = 21 °C
temperature at end = 62 °C

Explain what conclusion can be made about the type of reaction, from these results.

(2)

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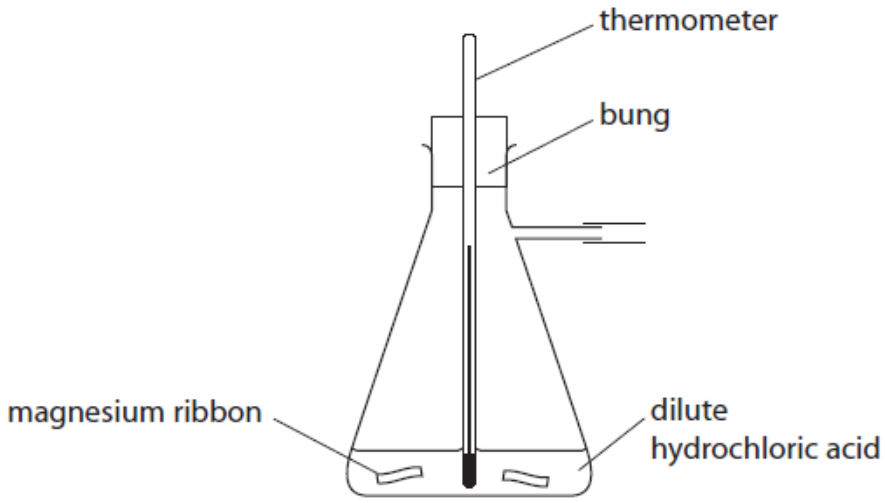
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Q20.

The apparatus shown was used by a student to investigate the reaction between strips of magnesium ribbon and **excess** dilute hydrochloric acid.



The word equation for the reaction is

$$\text{magnesium(s)} + \text{hydrochloric acid(aq)} \rightarrow \text{magnesium chloride(aq)} + \text{hydrogen(g)}$$

(a) States of substances in reactions can be shown by state symbols.

Explain the difference between magnesium chloride(aq) and magnesium chloride(l).

(2)

.....

.....

(b) Describe what you would **see** when magnesium ribbon reacts with dilute hydrochloric acid.

(1)

.....

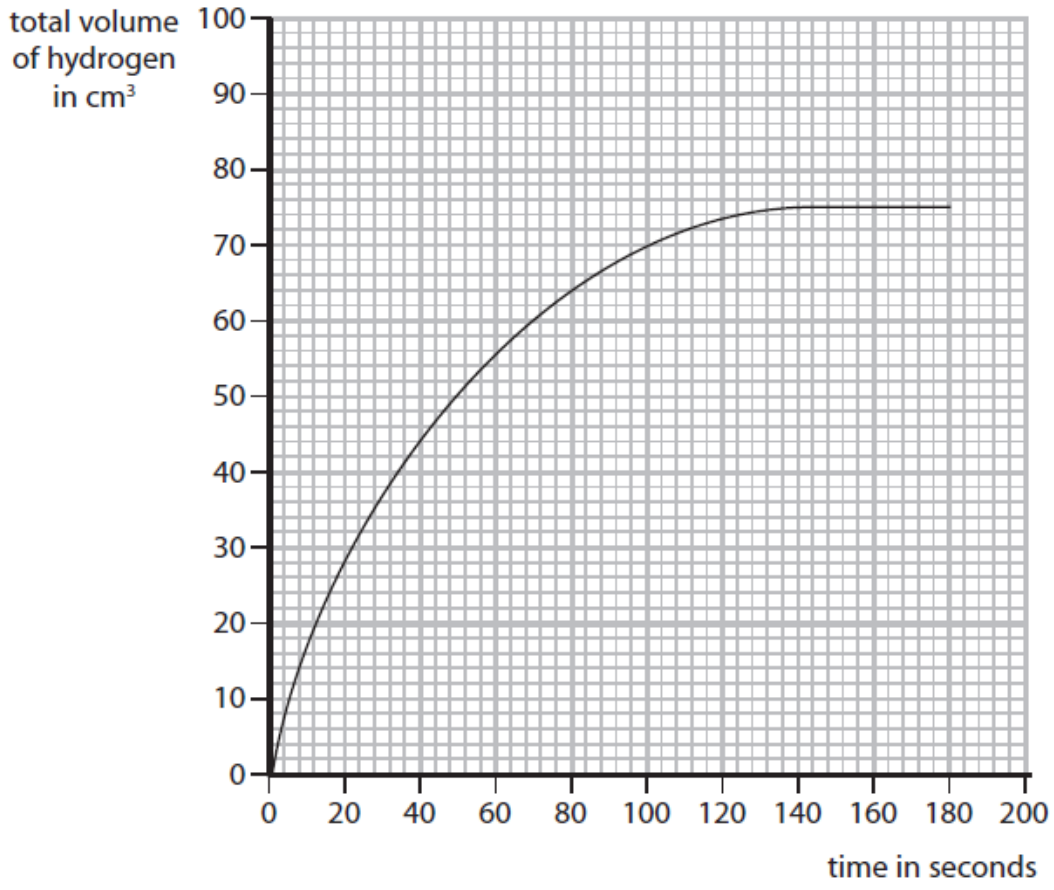
(c) Every 20 seconds, the student recorded the total volume of hydrogen produced in the reaction.

(i) Name a piece of apparatus the student should use to measure the volume of hydrogen produced.

(1)

.....

The results are shown on the graph.



(ii) After how many seconds had all the magnesium reacted?

(1)

..... seconds

(iii) The experiment is repeated using the same volume of a more concentrated hydrochloric acid solution.
All other conditions were kept the same.

On the graph draw a curve to show how the volume of hydrogen changes with time during this experiment.

(2)

(d) A student repeated the original experiment using the same mass of magnesium as a powder instead of as ribbon.
All other conditions were the same as in the first experiment.

Explain the effect on the rate of reaction of using magnesium powder instead of magnesium ribbon.

(2)

.....

.....

.....

.....

(e) When magnesium reacts with dilute hydrochloric acid there is a change in temperature.

In an experiment the results were
temperature at start = 21 °C
temperature at end = 62 °C

Explain what conclusion can be made about the type of reaction, from these results.

(2)

.....

.....

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.....

.....

Q21.

Rates of reactions and energy changes

(a) Marble chips react with hydrochloric acid to produce carbon dioxide.

The equation for the reaction is

$$CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2O + CO_2$$

Which one of these changes would **decrease** the rate of this reaction?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** use hydrochloric acid which is more dilute

☒ **B** use smaller sized marble chips

☒ **C** use marble chips which have a larger surface area

☒ **D** use a larger volume of the hydrochloric acid

(b) Explain why increasing the temperature of a reaction increases the rate of the reaction.

(2)

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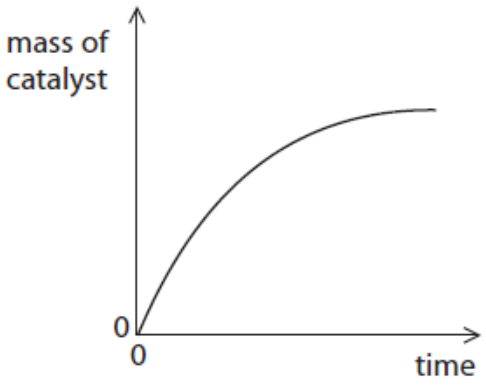
(c) (i) The rate of decomposition of hydrogen peroxide can be increased by adding a catalyst.

Which of these graphs shows the mass of the catalyst during the reaction?

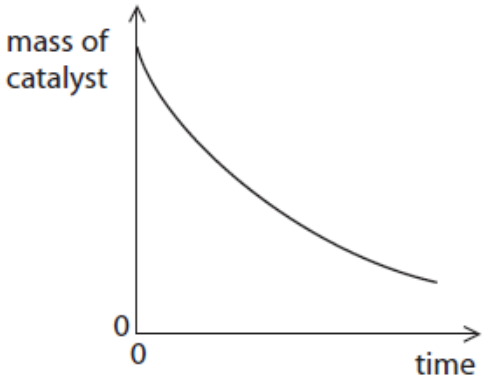
Put a cross (☒) in the box next to your answer.

(1)

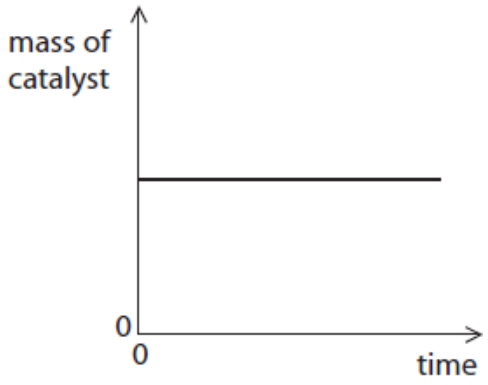
☒ **A**



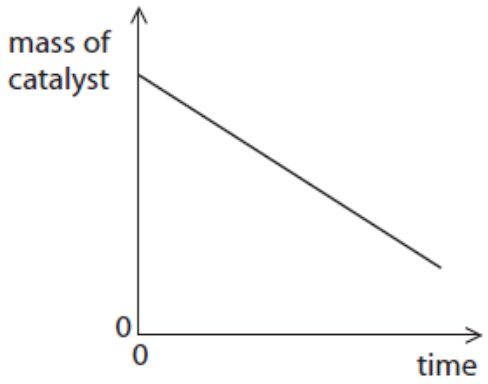
☒ **B**



☒ **C**



☒ **D**



(ii) The decomposition of hydrogen peroxide, H_2O_2, produces oxygen and water.

Give the balanced equation for this reaction.

(2)

.....

(d) Explain, in terms of the energy involved in the breaking of bonds and in the making of bonds, why some reactions are exothermic.

(2)

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(Total for question = 8 marks)

Q22.

Ethanol can be produced by reacting ethene with steam.

Write the balanced equation for this reaction.

(2)

.....

Q23.

Ethanol can be produced by reacting ethene with steam.

Write the balanced equation for this reaction.

(2)

.....

Q24.

Covalent substances can be simple molecular covalent or giant covalent.

(i) Ammonia is a simple molecular, covalent substance.

Which is the most likely set of properties for ammonia?

(1)

	melting point in °C	boiling point in °C	ability to conduct electricity in liquid state
☒ A	1713	2950	does not conduct
☒ B	−78	−33	does not conduct
☒ C	−39	357	conducts
☒ D	801	1413	conducts

(ii) Ammonia, NH_3, is made by reacting nitrogen with hydrogen.

Write the balanced equation for this reaction.

(2)

.....

(Total for question = 3 marks)

Q25.

Qualitative tests are used to identify ions in compounds.

Iron(II) sulfate solution reacts with sodium hydroxide solution to form a pale green precipitate of iron(II) hydroxide, $Fe(OH)_2$.

(i) Write the ionic equation for this reaction.

(3)

.....

(ii) The green iron(II) hydroxide precipitate gradually turns brown when exposed to air.

Explain this observation.

(2)

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(Total for question = 5 marks)

Q26.

The word equation for the reaction of dilute ethanoic acid with sodium hydroxide solution is

ethanoic acid + sodium hydroxide → sodium ethanoate + water

Complete the balanced equation for this reaction.

CH_3COOH + ... → CH_3COONa + ...

Q27.

The word equation for the reaction of dilute ethanoic acid with sodium hydroxide solution is

ethanoic acid + sodium hydroxide → sodium ethanoate + water

Complete the balanced equation for this reaction.

CH_3COOH + ... → CH_3COONa + ...

Q28.

Dilute hydrochloric acid reacts with silver nitrate solution to form silver chloride and nitric acid.

(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

The reaction produces silver chloride as a precipitate.
In an equation this would be shown as

(1)

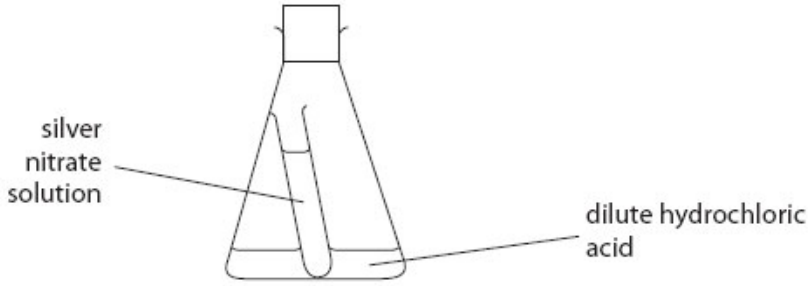
☒ **A** AgCl(aq)

☒ **B** AgCl(g)

☒ **C** AgCl(l)

☒ **D** AgCl(s)

(ii) This apparatus is used to investigate the mass of the reactants and the mass of products in this reaction.



The total mass of this apparatus was measured.
The flask was shaken to allow the silver nitrate solution and dilute hydrochloric acid to react.
After the reaction the total mass of the apparatus was measured again.

State how the total mass of the apparatus after the reaction will compare with the total mass of the apparatus before the reaction.

(1)

.....

(iii) Write the balanced equation for the reaction of silver nitrate solution, $AgNO_3$, with dilute hydrochloric acid to form silver chloride, AgCl, and nitric acid.

(2)

.....

Q29.

Dilute hydrochloric acid reacts with silver nitrate solution to form silver chloride and nitric acid.

(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

The reaction produces silver chloride as a precipitate.
In an equation this would be shown as

(1)

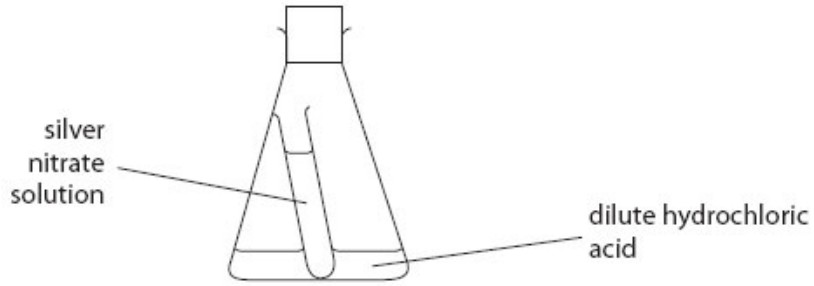
☒ **A** AgCl(aq)

☒ **B** AgCl(g)

☒ **C** AgCl(l)

☒ **D** AgCl(s)

(ii) This apparatus is used to investigate the mass of the reactants and the mass of products in this reaction.



The total mass of this apparatus was measured.
The flask was shaken to allow the silver nitrate solution and dilute hydrochloric acid to react.
After the reaction the total mass of the apparatus was measured again.

State how the total mass of the apparatus after the reaction will compare with the total mass of the apparatus before the reaction.

(1)

.....

(iii) Write the balanced equation for the reaction of silver nitrate solution, $AgNO_3$, with dilute hydrochloric acid to form silver chloride, AgCl, and nitric acid.

(2)

.....

Q30.

(i) Describe what you would **see** when solid sodium carbonate is added to dilute ethanoic acid.

(2)

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(ii) When ethanoic acid reacts with ethanol, one of the products is the ester, ethyl ethanoate.

Complete the balanced equation for this reaction.

(2)

$CH_3COOH + C_2H_5OH \rightarrow$ ..... + ...

Q31.

(i) Describe what you would **see** when solid sodium carbonate is added to dilute ethanoic acid.

(2)

.....

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.....

(ii) When ethanoic acid reacts with ethanol, one of the products is the ester, ethyl ethanoate.

Complete the balanced equation for this reaction.

(2)

$CH_3COOH + C_2H_5OH \rightarrow$ ..... + ...

Q32.

(a) A technician made some dilute sodium hydroxide solution by carefully adding some solid sodium hydroxide to pure water.

This is the hazard symbol on a bottle of solid sodium hydroxide.



(i) State what this symbol shows about sodium hydroxide.

(1)

.....

(ii) Sodium hydroxide solution reacts with dilute hydrochloric acid.
During the reaction heat is released.

What type of reaction is this?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** displacement

☒ **B** endothermic

☒ **C** neutralisation

☒ **D** precipitation

(b) A catalyst is added to some reactions.

Explain the meaning of **catalyst.**

(2)

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.....

(c) Dilute hydrochloric acid reacts with calcium carbonate to produce carbon dioxide gas.

Three different experiments were carried out using large pieces of calcium carbonate, small pieces of calcium carbonate and powdered calcium carbonate.
The size of the calcium carbonate pieces was the only factor that was changed.

In each experiment the volume of carbon dioxide released in five minutes was measured.

The results are

size of calcium carbonate pieces used	volume of carbon dioxide released in five minutes / cm^3
large	3
small	7
powdered	50

Describe what this shows about the effect of the surface area of calcium carbonate on the rate of this reaction.

(2)

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.....

*(d) Hydrochloric acid reacts with magnesium metal to produce hydrogen gas.

magnesium + hydrochloric acid → magnesium chloride + hydrogen

Describe how you could use magnesium ribbon and a solution of hydrochloric acid to show that decreasing the concentration of the hydrochloric acid changes the rate of this reaction.

(6)

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(Total for Question = 12 marks)

Q33.

(a) A student investigated the rate of a reaction.
The student investigated the reaction between zinc and dilute sulfuric acid.
The products are zinc sulfate, $ZnSO_4$, and hydrogen.

(i) Write the balanced equation for this reaction.

(2)

.....

*(ii) The student carried out two experiments.
The same mass of zinc and the same sized pieces of zinc were used in each experiment.

The results are shown in the table.

	experiment 1	experiment 2
concentration of sulfuric acid / mol dm^{-3}	0.5	1.5
temperature / °C	20	40
rate of reaction	slow	fast

Evaluate these results, explaining the reasons why the rate of reaction in experiment 2 is faster than the rate of reaction in experiment 1.
In your answer you should refer to the frequency and energy of collisions between particles.

(6)

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(b) Zinc is reacted with copper sulfate solution.
The equation for the reaction is

$$Zn(s) + CuSO_4(aq) \rightarrow ZnSO_4(aq) + Cu(s)$$

(i) What type of reaction is this?

(1)

Put a cross (☒) in the box next to your answer.

☒ **A** decomposition

☒ **B** displacement

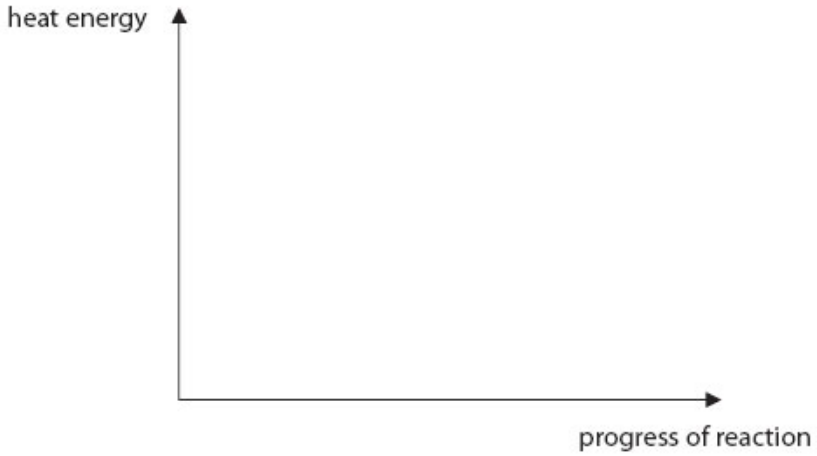
☒ **C** dissolving

☒ **D** neutralisation

(ii) This reaction is exothermic.

On the diagram below draw labelled lines to show the relative energies of the reactants and products in this reaction.

(2)



(Total for Question = 11 marks)

Q34.

(a) A student investigated the rate of a reaction.
The student investigated the reaction between zinc and dilute sulfuric acid.
The products are zinc sulfate, $ZnSO_4$, and hydrogen.

(i) Write the balanced equation for this reaction.

(2)

.....

*(ii) The student carried out two experiments.
The same mass of zinc and the same sized pieces of zinc were used in each experiment.

The results are shown in the table.

	experiment 1	experiment 2
concentration of sulfuric acid / mol dm^{-3}	0.5	1.5
temperature / °C	20	40
rate of reaction	slow	fast

Evaluate these results, explaining the reasons why the rate of reaction in experiment 2 is faster than the rate of reaction in experiment 1.
In your answer you should refer to the frequency and energy of collisions between particles.

(6)

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(b) Zinc is reacted with copper sulfate solution.
The equation for the reaction is

$$Zn(s) + CuSO_4(aq) \rightarrow ZnSO_4(aq) + Cu(s)$$

(i) What type of reaction is this?

(1)

Put a cross (☒) in the box next to your answer.

☒ **A** decomposition

☒ **B** displacement

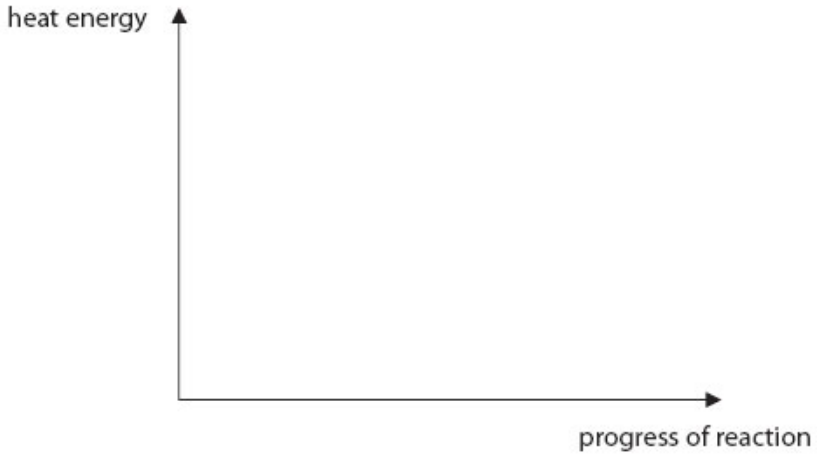
☒ **C** dissolving

☒ **D** neutralisation

(ii) This reaction is exothermic.

On the diagram below draw labelled lines to show the relative energies of the reactants and products in this reaction.

(2)



(Total for Question = 11 marks)

Q35.

Lithium, sodium and potassium are metals in group 1 of the periodic table.

State a safety precaution that should be taken when group 1 metals are added to water.

(1)

.....

.....

(Total for question = 1 mark)

Q36.

Two compounds of barium are barium sulfide and barium chloride.

Barium chloride is toxic.

Explain one safety precaution that should be taken when using barium chloride.

(2)

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.....

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.....

(Total for question = 2 marks)

Q37.

Salts and analysis

(a) Which of the following pairs of substances contains one substance that is soluble in water and one that is insoluble in water?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** aluminium nitrate and lead sulfate

☒ **B** ammonium chloride and copper sulfate

☒ **C** copper hydroxide and lead sulfate

☒ **D** sodium hydroxide and potassium nitrate

(b) Barium chloride is an ionic compound and has a high melting point.

Explain why barium chloride has a high melting point.

(2)

.....

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(c) Barium chloride solution is used to test for the presence of sulfate ions in a solution.

When sulfate ions are present, insoluble barium sulfate is formed.

(i) Describe the appearance of barium sulfate.

(1)

.....

(ii) Complete the balanced equation for the reaction between barium chloride and potassium sulfate.

(2)

$BaCl_2 + K_2SO_4 \rightarrow$ .....

(d) Compound **X** is a metal carbonate.

(i) A flame test was carried out on compound **X**.
A lilac flame was seen.

Complete the sentence by putting a cross (☒) in the box next to your answer.

(1)

The formula of the metal ion in compound **X** is

☒ **A** Ca^{2+}

☒ **B** Cu^{2+}

☒ **C** K^{+}

☒ **D** Na^{+}

(ii) Lead carbonate is an insoluble salt.

Describe how a pure, dry sample of solid lead carbonate can be obtained from sodium carbonate solution and lead nitrate solution.

(3)

.....

.....

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.....

.....

.....

(Total for question = 10 marks)

Q38.

Salts and analysis

(a) Which of the following pairs of substances contains one substance that is soluble in water and one that is insoluble in water?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** aluminium nitrate and lead sulfate

☒ **B** ammonium chloride and copper sulfate

☒ **C** copper hydroxide and lead sulfate

☒ **D** sodium hydroxide and potassium nitrate

(b) Barium chloride is an ionic compound and has a high melting point.

Explain why barium chloride has a high melting point.

(2)

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(c) Barium chloride solution is used to test for the presence of sulfate ions in a solution.

When sulfate ions are present, insoluble barium sulfate is formed.

(i) Describe the appearance of barium sulfate.

(1)

.....

(ii) Complete the balanced equation for the reaction between barium chloride and potassium sulfate.

(2)

$BaCl_2 + K_2SO_4 \rightarrow$ .....

(d) Compound **X** is a metal carbonate.

(i) A flame test was carried out on compound **X**.
A lilac flame was seen.

Complete the sentence by putting a cross (☒) in the box next to your answer.

(1)

The formula of the metal ion in compound **X** is

☒ **A** Ca^{2+}

☒ **B** Cu^{2+}

☒ **C** K^{+}

☒ **D** Na^{+}

(ii) Lead carbonate is an insoluble salt.

Describe how a pure, dry sample of solid lead carbonate can be obtained from sodium carbonate solution and lead nitrate solution.

(3)

.....

.....

.....

.....

.....

.....

(Total for question = 10 marks)

Q39.

Salts

(a) Solutions of soluble salts can react together to form an insoluble salt.

What name is given to this type of reaction?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** combustion

☒ **B** neutralisation

☒ **C** precipitation

☒ **D** separation

(b) Information about the solubility of some salts is given below.

- all nitrates are soluble
- all common carbonates are insoluble except sodium carbonate, potassium carbonate and ammonium carbonate.

Copper carbonate can be made by reacting together solutions of sodium carbonate and copper nitrate.

Complete this equation by filling in the missing state symbols.

(2)

$$\text{sodium carbonate}(aq) + \text{copper nitrate}(aq) \rightarrow \text{copper carbonate}(\ldots\ldots) + \text{sodium nitrate}(\ldots\ldots)$$

(c) The symbol for a copper ion is Cu^{2+}.

The symbol for a carbonate ion is CO_3^{2-}.

Write the formula for copper carbonate.

(1)

.....

(d) In an experiment, solid lead iodide is produced in a mixture with a solution of a soluble salt.

Describe how a pure, dry sample of solid lead iodide can be obtained from this mixture.

(3)

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(e) Two tests were carried out to identify the ions in salt **X**.

(i) Test: flame test on solid salt **X**.

Result: lilac flame.

Identify the ion in salt **X** that gives the lilac flame.

(1)

ion in salt **X** .....

(ii) Test: addition of dilute nitric acid and silver nitrate solution to a solution of salt **X**.

Result: white solid formed.

Identify the ion in salt **X** that produces the white solid.

(1)

ion in salt **X** .....

(Total for question = 9 marks)

Q40.

Salts

(a) Solutions of soluble salts can react together to form an insoluble salt.

What name is given to this type of reaction?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** combustion

☒ **B** neutralisation

☒ **C** precipitation

☒ **D** separation

(b) Information about the solubility of some salts is given below.

- all nitrates are soluble
- all common carbonates are insoluble except sodium carbonate, potassium carbonate and

ammonium carbonate.

Copper carbonate can be made by reacting together solutions of sodium carbonate and copper nitrate.

Complete this equation by filling in the missing state symbols.

(2)

$$\text{sodium carbonate}(aq) + \text{copper nitrate}(aq) \rightarrow \text{copper carbonate}(\ldots\ldots) + \text{sodium nitrate}(\ldots\ldots)$$

(c) The symbol for a copper ion is Cu^{2+}.

The symbol for a carbonate ion is CO_3^{2-}.

Write the formula for copper carbonate.

(1)

.....

(d) In an experiment, solid lead iodide is produced in a mixture with a solution of a soluble salt.

Describe how a pure, dry sample of solid lead iodide can be obtained from this mixture.

(3)

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(e) Two tests were carried out to identify the ions in salt **X**.

(i) Test: flame test on solid salt **X**.

Result: lilac flame.

Identify the ion in salt **X** that gives the lilac flame.

(1)

ion in salt **X** .....

(ii) Test: addition of dilute nitric acid and silver nitrate solution to a solution of salt **X**.

Result: white solid formed.

Identify the ion in salt **X** that produces the white solid.

(1)

ion in salt **X** .....

(Total for question = 9 marks)

Q41.

A student is investigating the maximum mass of sodium chloride that can be dissolved in 100 cm^3 water at room temperature.

The student has been given 1.0 g samples of solid sodium chloride to dissolve in the water.

Which row of the table shows the correct formula of sodium chloride and of water?

(1)

	sodium chloride	water
☒ **A**	$NaCl_2$	H_2O
☒ **B**	$NaCl_2$	HO_2
☒ **C**	NaCl	H^2O
☒ **D**	NaCl	H_2O

(Total for question = 1 mark)

Q42.

A technician made some dilute sodium hydroxide solution by carefully adding some solid sodium hydroxide to pure water.

This is the hazard symbol on a bottle of solid sodium hydroxide.



(i) State what this symbol shows about sodium hydroxide.

(1)

.....

(ii) Sodium hydroxide solution reacts with dilute hydrochloric acid.
During the reaction heat is released.

What type of reaction is this?

Put a cross (☒) in the box next to your answer.

(1)

☒ **A** displacement

☒ **B** endothermic

☒ **C** neutralisation

☒ **D** precipitation

Q43.

A student investigated the reaction between potassium iodide and lead nitrate.

(i) Solutions of potassium iodide and lead nitrate were mixed together.

Lead iodide and potassium nitrate were formed.

Complete the word equation.

(2)

....

\+ → +

....

(ii) The student recorded the total mass of the reactants and the total mass of the products.

The results are shown in Figure 4.

	reactants	products
total mass in g	21.7	21.7

Figure 4

State how the results in Figure 4 show that mass is conserved in this reaction.

(1)

.....

.....

(Total for question = 3 marks)

Q44.

Chlorine, bromine and iodine are elements in group 7 of the periodic table.

Chlorine is toxic.

State **one** safety precaution that should be taken when using chlorine in the laboratory.

(1)

.....

.....

(Total for question = 1 mark)

Q45.

Fertilisers contain compounds that promote plant growth.

(i) State the name of an element in these compounds that promotes plant growth.

(1)

.....

(ii) Potassium nitrate is present in some fertilisers.

Potassium nitrate is formed by the reaction of potassium hydroxide solution with nitric acid.

Complete the balanced equation for this reaction.

(2)

$KOH + HNO_3 \rightarrow$ ..... + ...

(Total for question = 3 marks)

Q46.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Sodium reacts with hydrochloric acid to form sodium chloride and hydrogen.

(i) Write the word equation for this reaction.

(2)

..... → .....

(ii) The hazard symbol shown in Figure 1 is used on containers of sodium.



Figure 1

What is the meaning of this hazard symbol?

(1)

☒ **A** corrosive

☒ **B** flammable

☒ **C** oxidising

☒ **D** toxic

(iii) Hydrogen has one electron in its electron shell.

Figure 2 shows the incomplete dot and cross diagram of a hydrogen molecule.

Complete Figure 2 to show the electrons in the covalent bond between the two atoms of hydrogen.

(1)

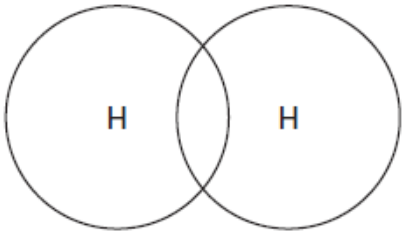


Figure 2

(Total for question = 4 marks)

Q47.

Figure 1 shows the dot and cross diagram for a molecule of ammonia.

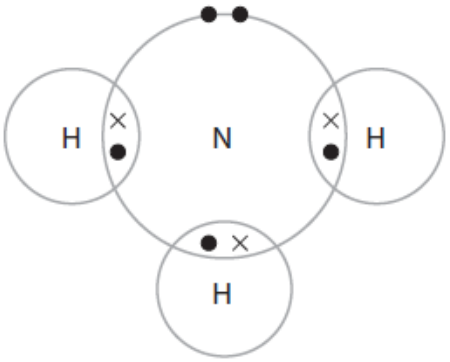


Figure 1

(i) What do the dots and crosses represent in the diagram?

(1)

☒ **A** electrons

☒ **B** neutrons

☒ **C** protons

☒ **D** nuclei

(ii) Give the formula for the molecule of ammonia.

(1)

.....

(Total for question = 2 marks)

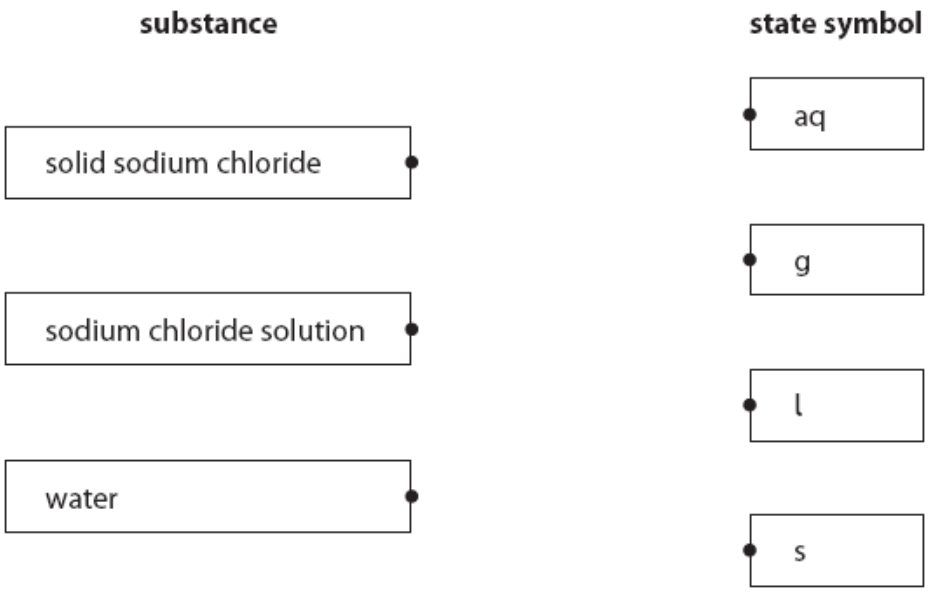
Q48.

A student is investigating the maximum mass of sodium chloride that can be dissolved in 100 cm^3 water at room temperature.

The student has been given 1.0 g samples of solid sodium chloride to dissolve in the water.

Draw **one** straight line from each substance to its state symbol.

(2)

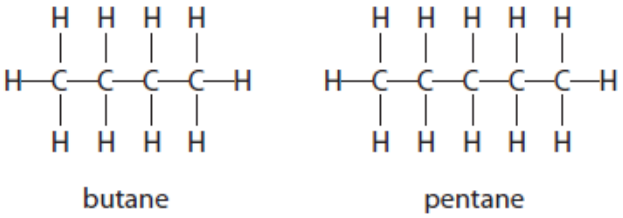


(Total for question = 2 marks)

Q49.

Most of the fuels used today are obtained from crude oil.

Figure 14 shows the formulae of a molecule of butane and of a molecule of pentane. Butane and pentane are neighbouring members of the same homologous series.



butane pentane

Figure 14

(i) Explain, using these formulae, why butane and pentane are neighbouring members of the same homologous series.

(2)

.....

.....

.....

.....

(ii) Butane has the formula C_4H_{10}.

Calculate the mass of carbon in 100 g of butane.

Give your answer to three significant figures.

(relative atomic masses: H = 1.00, C = 12.0;
relative formula mass: C_4H_{10} = 58.0)

You must show your working.

(3)

.....

.....

.....

mass of carbon = ... g

(iii) Butane burns completely in air to form carbon dioxide and water.

Write the word equation for this reaction.

(2)

.....

.....

(Total for question = 7 marks)

Q50.

This question is about the rate of reaction between calcium carbonate and dilute hydrochloric acid.

The word equation for this reaction is

calcium carbonate + hydrochloric acid → calcium chloride + water + carbon dioxide

Which of the following is the formula for calcium carbonate?

(1)

☒ **A** $CaCO_2$

☒ **B** $CaCO_3$

☒ **C** $Ca(CO)_3$

☒ **D** $Ca(CO3)_2$

(Total for question = 1 mark)

Q51.

Acids are a hazard if a high concentration of hydrogen ions is present.

Hydrochloric acid is a strong acid, ethanoic acid is a weak acid.

Figure 9 shows the labels on bottles of dilute hydrochloric acid and concentrated ethanoic acid.

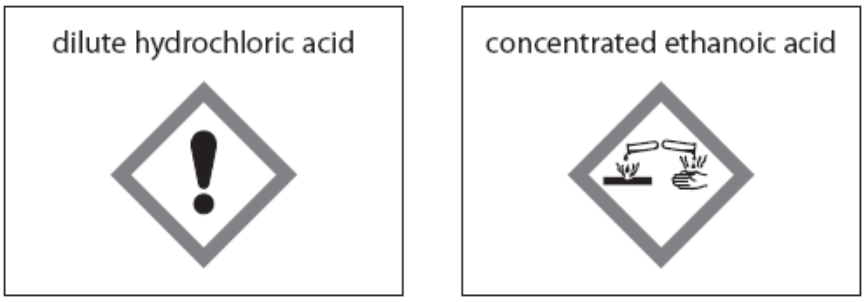


Figure 9

Explain why the hazard of the dilute hydrochloric acid is lower than the hazard of concentrated ethanoic acid, even though hydrochloric acid is a strong acid and ethanoic acid is a weak acid.

(4)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total for question = 4 marks)

Q52.

Hydrogen reacts with chlorine to form hydrogen chloride.

Write the word equation for this reaction.

(1)

.....

(Total for question = 1 mark)

Q53.

In a hydrogen-oxygen fuel cell, hydrogen and oxygen react at the electrodes.

The overall reaction occurring in this fuel cell is a reaction of hydrogen with oxygen.

Write the balanced equation for this reaction.

(2)

.....

.....

(Total for question = 2 marks)

Q54.

Some nickel ores contain nickel sulfide.

(i) In the first stage of extracting nickel from nickel sulfide, the nickel sulfide, NiS, is heated in air to form nickel oxide, NiO, and sulfur dioxide.

Write the balanced equation for this reaction.

(2)

.....

.....

(ii) In the final stage of the extraction process, a nickel compound is electrolysed to produce pure nickel.

An advantage of producing a metal by electrolysis is that

(1)

☒ **A** electrolysis uses a large amount of electricity

☒ **B** the metal produced by electrolysis is very pure

☒ **C** electrolysis is a very cheap method of extraction

☒ **D** electrolysis is the only method of extracting unreactive metals

(Total for question = 3 marks)

Q55.

Figure 9 shows a sample of hydrogen peroxide solution decomposing to form water and oxygen gas.

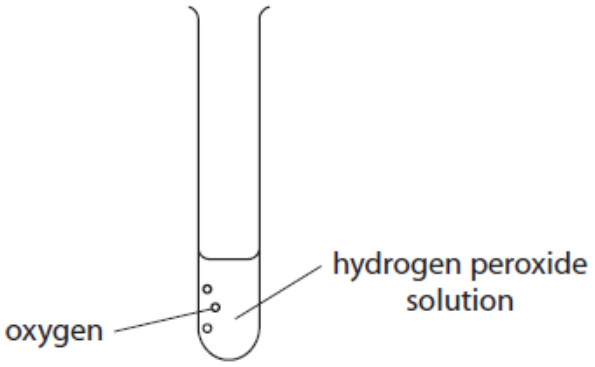


Figure 9

(i) Write the word equation for hydrogen peroxide solution decomposing.

(1)

..... →
.....

(ii) In this reaction hydrogen peroxide is a solution, water is a liquid and oxygen is a gas.

Draw one straight line from each substance to its correct state symbol.

(2)

substance	state symbol
hydrogen peroxide solution	(aq)
liquid water	(g)
oxygen gas	(l)

(Total for question = 3 marks)

Q56.

Metals are extracted from substances naturally occurring in the Earth's crust.

Zinc can be extracted by heating zinc oxide with carbon.

The products are zinc and carbon dioxide.

(i) Write the word equation for this reaction.

(2)

.....

.....

(ii) In this reaction zinc oxide loses oxygen.

State the type of reaction taking place when an oxide loses oxygen.

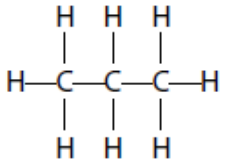
(1)

.....

(Total for question = 3 marks)

Q57.

The structure of a molecule of propane is shown as



Propane can burn completely in oxygen to form carbon dioxide and water.

(i) Write the word equation for this reaction.

(2)

.....

(ii) Propane is a fuel.

Give the reason why fuels are burned.

(1)

.....

.....

(Total for question = 3 marks)

Q58.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

When chromium reacts with oxygen, chromium oxide is formed.

(i) Write the word equation for this reaction.

(1)

..... + ... →
.....

(ii) What type of reaction occurs when chromium reacts with oxygen?

(1)

☒ **A** condensation

☒ **B** evaporation

☒ **C** neutralisation

☒ **D** oxidation

(iii) Calculate the relative formula mass of chromium oxide, Cr_2O_3.

(relative atomic masses: O = 16, Cr = 52)

(2)

.....

.....

relative formula mass = ...

(Total for question = 4 marks)

Q59.

Chlorine reacts with hydrogen to form hydrogen chloride.

Write the balanced equation for this reaction.

(3)

.....

.....

(Total for question = 3 marks)

Q60.

Chlorine reacts with hydrogen to form hydrogen chloride.

Write the balanced equation for this reaction.

(3)

.....

.....

(Total for question = 3 marks)

Q61.

Ethene, C_2H_4, is an unsaturated hydrocarbon.

A sample of ethene is burned completely in oxygen.

Write the balanced equation for this reaction.

(3)

.....

(Total for question = 3 marks)

Q62.

Fluorine, chlorine, bromine, iodine and astatine are elements in group 7.

Fluorine reacts vigorously with iron to produce iron(III) fluoride, FeF_3.

Write the balanced equation for this reaction.

(2)

.....

(Total for question = 2 marks)

Q63.

The first four elements in group 1 are lithium, sodium, potassium and rubidium.

An example of an endothermic reaction is the reaction between rubidium hydroxide and ammonium carbonate, $(NH_4)_2CO_3$.

This reaction forms rubidium carbonate, Rb_2CO_3, ammonia and one other product.

Write the balanced equation for this reaction.

(3)

.....

.....

(Total for question = 3 marks)

Q64.

In the test for chloride ions, silver nitrate solution is added to a solution containing chloride ions. A white precipitate forms.

Write the ionic equation for this reaction.

(2)

.....

(Total for question = 2 marks)