PEARSON EDEXCEL GCSE COMBINED SCIENCE (HIGHER) · 1SC0

CHEMISTRY



EXAM QUESTION PACK

TOPIC 7: RATES OF REACTION AND ENERGY CHANGES: HEAT ENERGY CHANGES IN CHEMICAL REACTIONS (PAPER 2)

SCORE	PERCENTAGE
/145	%

STEMUP

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Q1.

Students are investigating exothermic and endothermic reactions.
They are finding the temperature change in 50 cm^3 water when a solid dissolves in it.
The apparatus is shown in Figure 1.

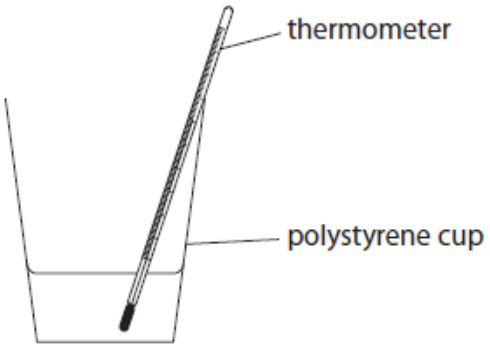


Figure 1

The steps needed to carry out this experiment are **P**, **Q**, **R**, **S** and **T**.
They are shown below.

They are not in the correct order.

P pour the 50 cm^3 water into the polystyrene cup
Q add the solid to the water and stir
R measure 50 cm^3 water using a beaker
S vmeasure the initial temperature of the water
T measure the final temperature of the solution when all the solid has dissolved

Write the steps in the correct order, from left to right.

(2)

☐ ☐ ☐ ☐ ☐

(Total for question = 2 marks)

(**Q01 1SC0/2CF, June 2018**)

Q2.

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 ☒.

Ammonia can be produced from the reaction of hydrogen with nitrogen.

The reaction between hydrogen and nitrogen is exothermic.

Figure 8 shows the reaction profile of this exothermic reaction.

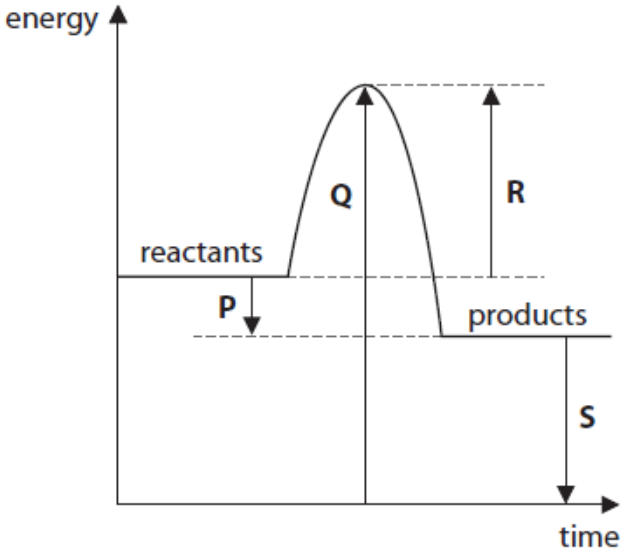


Figure 8

(i) Which arrow represents the activation energy for the reaction?

(1)

☒ **A** arrow **P**

☒ **B** arrow **Q**

☒ **C** arrow **R**

☒ **D** arrow **S**

(ii) Describe what the reaction profile shows about the energy involved in bond breaking and bond making in this reaction.

(2)

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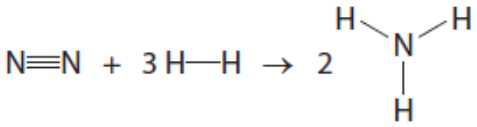
.....

(iii) Figure 9 shows the energies of some bonds.

bond	bond energy in kJ mol^{-1}
N≡N	944
H—H	436
H—N	388

Figure 9

The equation for the reaction between nitrogen and hydrogen to form ammonia is



Calculate the energy change, in kJ mol^{-1}, for this reaction.

(4)

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energy change = ... kJ mol^{-1}

(Total for question = 7 marks)

(**QU05b 1SC0/2CH, June 2023**)

Q3.

In an experiment, a salt is dissolved in water.

The temperature change is measured.

Figure 3 shows the apparatus that is used.

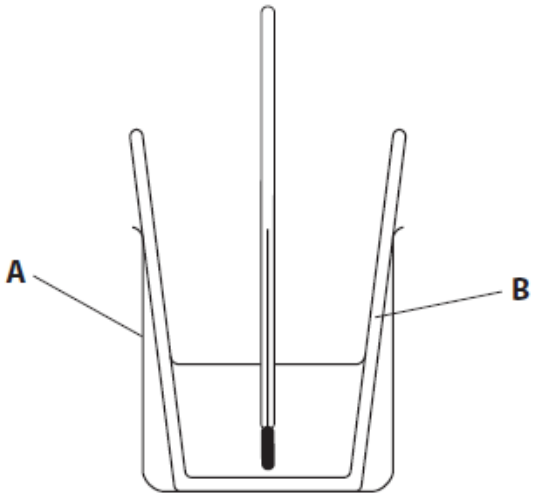


Figure 3

(i) State what is used to measure the temperature change in Figure 3.

(1)

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(ii) State **one** reason for using the piece of equipment **A** in Figure 3.

(1)

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(iii) A student suggests putting a lid on piece of equipment **B**.

State why this would help to give a more accurate value for the temperature change.

(1)

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.....

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(iv) Four different salts, **P**, **Q**, **R** and **S**, are dissolved in water.

Figure 4 shows the starting temperature of the water and the final temperature of the solution after the salt dissolves.

	salt P	salt Q	salt R	salt S
starting temperature in °C	20.0	20.0	20.0	20.0
final temperature in °C	22.4	19.5	23.0	18.5
temperature change in °C	+2.4	–0.5	.....	.....
salt that absorbed most heat energy when it dissolved				

Figure 4

Complete the table

- to show the temperature changes when salt **R** and salt **S** dissolve
- by placing a tick (✓) in the box, on the bottom row, for the salt that **absorbs** the most heat energy when it dissolves.

(4)

(v) One of the salts dissolved is barium chloride, $BaCl_2$.

Barium chloride contains the chloride ion, Cl^-.

Give the **formula** of the barium ion in barium chloride.

(1)

.....

(Total for question = 8 marks)

(**QU02b 1SC0/2CF, June 2024**)

Q4.

This question is about bromine.

Bromine reacts with hydrogen to form hydrogen bromide.

(i) Write the word equation for this reaction.

(2)

..... + ... → .....

(ii) Hydrogen bromide dissolves in water to form a solution.

This solution of hydrogen bromide reacts with alkalis.

State the type of reaction that occurs when a solution of hydrogen bromide reacts with an alkali.

(1)

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.....

(Total for question = 3 marks)

(**QU04b 1SC0/2CF, June 2024**)

Q5.

A student investigates the temperature change when 10 g of solid magnesium chloride is dissolved
in 100 cm^3 of water.

Figure 2 shows the apparatus the student uses.

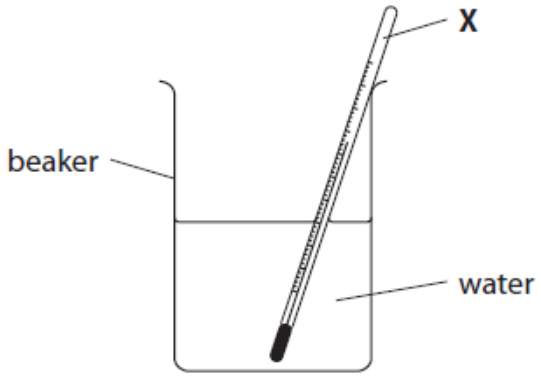


Figure 2

The student carries out the following steps

step 1 measure the initial temperature of the water in the beaker

step 2 add the magnesium chloride

step 3 stir the mixture

step 4 record the new temperature.

(i) State why the mixture is stirred in step 3.

(1)

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(ii) State **two** ways the apparatus could be changed to reduce the heat energy lost during the investigation.

(2)

1 .....

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2 .....

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(iii) The student carries out the experiment three times.

Figure 3 shows the results.

initial temperature of water in °C	temperature of mixture after stirring in °C	temperature change in °C
20.0	33.5	+13.5
20.0	32.8	+12.8
20.0	33.9	+13.9

Figure 3

Calculate the mean temperature change for this investigation.

(2)

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.....

mean temperature change = ... °C

(iv) Explain, using the information in Figure 3, the type of reaction that occurs when magnesium chloride dissolves in water.

(2)

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(Total for question = 7 marks)

(**QU02b 1SC0/2CF, June 2025**)

Q6.

The energies of some bonds are shown in Figure 13.

bond	energy of bond / kJ mol^{-1}
H—H	436
Cl—Cl	243
H—Cl	432

Figure 13

Hydrogen reacts with chlorine to form hydrogen chloride.

$$H_2(g) + Cl_2(g) \rightarrow 2HCl(g)$$

Calculate the energy change, in kJ mol^{-1}, for the reaction of 1 mol of hydrogen gas, H_2, with 1 mol of chlorine gas, Cl_2, to form 2 mol of hydrogen chloride gas, HCl.

(4)

energy change = ... kJ mol^{-1}

(Total for question = 4 marks)

(**Q06d 1SC0/2CH, SAM 2016**)

Q7.

Methane reacts with chlorine to form chloromethane and hydrogen chloride.

$$CH_4 + Cl_2 \rightarrow CH_3Cl + HCl$$

Energies of bonds are shown in Figure 5.

bond	energy of bond / kJ mol^{-1}
C—H	413
Cl—Cl	243
C—Cl	346
H—Cl	432

Figure 5

Use the information in Figure 5 for the following calculation.

Calculate the overall change in heat energy when 1 mol methane, CH_4, reacts with 1 mol chlorine, Cl_2, to form 1 mol of chloromethane, CH_3Cl, and 1 mol hydrogen chloride, HCl, in this reaction, stating, with a reason, whether the reaction is endothermic or exothermic.

(4)

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energy change ..... kJ mol^{-1}

(Total for question = 4 marks)

(**Q06b 1SC0/2CH/S2, SAM**)

Q8.

Ethene reacts with hydrogen chloride.

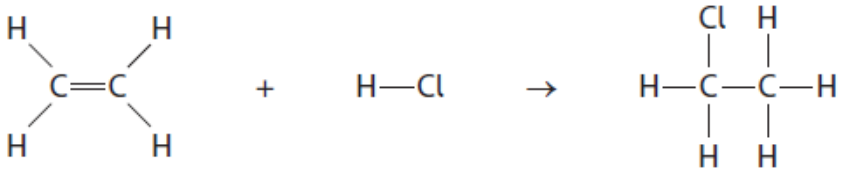


Figure 7 shows the bond energies for the different bonds in the three molecules in the reaction.

bond	bond energy in kJ mol^{-1}
C—H	412
C═C	612
C—C	348
H—Cl	431
C—Cl	338

Figure 7

Calculate the energy change for this reaction.

(4)

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energy change = ... kJ mol^{-1}

(Total for question = 4 marks)

(**QU05d 1SC0/2CH, June 2024**)

Q9.

This question is about molecules containing two atoms.

Hydrogen iodide reacts with oxygen to form water and iodine

The equation for this reaction is

$$4HI + O_2 \rightarrow 2H_2O + 2I_2$$

Calculate the energy change for this reaction using the bond energies in Figure 7.

bond	bond energy in kJ mol^{-1}
H—I	299
O═O	495
H—O	464
I—I	151

Figure 7

Include a sign and unit in your answer.

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energy change = ...

(Total for question = 4 marks)

(**QU06e 1SC0/2CH, June 2025**)

Q10.

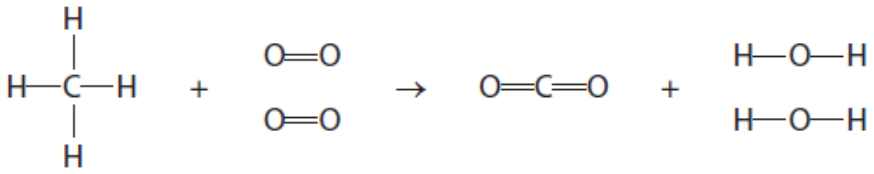
The energies of some bonds are shown in Figure 6.

bond	bond energy in kJ mol^{-1}
C—H	435
O=O	496
C=O	805
H—O	463

Figure 6

Methane burns in oxygen to form carbon dioxide and water.

The equation shows the structures of the molecules.



Calculate the energy change, in kJ mol^{-1}, for this reaction.

(4)

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energy change = ... kJ mol^{-1}

(Total for question = 4 marks)

(**Q06b 1SC0/2CH, Nov 2020**)

Q11.

A student investigated the temperature change that took place when different salts were dissolved in water.

The student used the following method.

step 1 pour 50 cm^3 of water into a polystyrene cup and record the temperature of the water

step 2 find the mass of an empty boiling tube

step 3 add 2 spatula measures of a salt to the boiling tube and find its new mass

step 4 add the salt to the water

step 5 stir the mixture and record the temperature after 2 minutes.

Figure 3 shows the apparatus used.

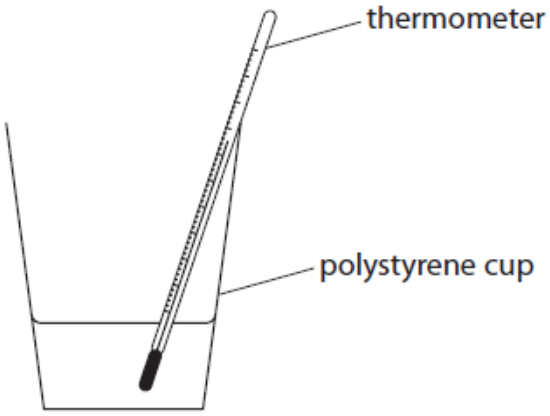


Figure 3

For steps 2 and 3, the student obtained the mass measurements shown in Figure 4 for the first salt.

mass of empty boiling tube in g	22.52
mass of boiling tube + 2 spatula measures of a salt in g	24.16

Figure 4

Use the mass measurements in Figure 4 to calculate the mass of salt, in grams, added to the water.

(1)

.....

mass of salt = ... g

(Total for question = 1 mark)

Q12.

A student investigated the temperature change that took place when different salts were dissolved in water.

The student used the following method.

step 1 pour 50 cm^3 of water into a polystyrene cup and record the temperature of the water

step 2 find the mass of an empty boiling tube

step 3 add 2 spatula measures of a salt to the boiling tube and find its new mass

step 4 add the salt to the water

step 5 stir the mixture and record the temperature after 2 minutes.

Figure 3 shows the apparatus used.

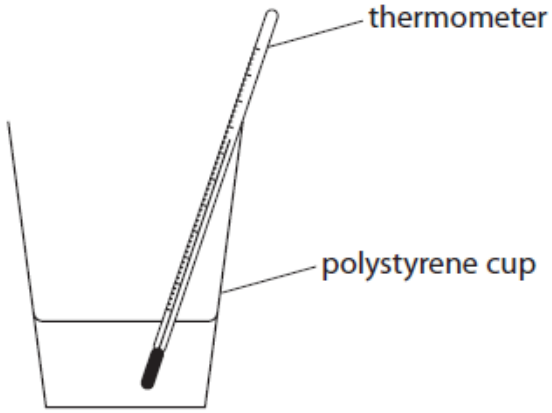


Figure 3

The student repeated the method for three different salts, **A**, **B** and **C**.

The same mass of each salt was used.

Figure 5 shows the temperature readings obtained for the three different salts.

salt	starting temperature of the water in °C	temperature of the mixture after 2 minutes in °C	temperature change in °C
A	20.5	25.6	+5.1
B	20.5	19.8	–0.7
C	20.5	29.2	

Figure 5

(i) Calculate the temperature change for salt **C**.

Include a sign to show if the temperature change is an increase or a decrease.

(2)

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temperature change = ... °C

(ii) Explain which salt produces the biggest exothermic change.

(2)

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(Total for question = 4 marks)

(**QU02b 1SC0/2CF, June 2023**)

Q13.

Crude oil is a complex mixture of substances.

When crude oil is separated into fractions, the amount of each fraction obtained rarely matches the demand for that fraction.

Figure 9 shows the relative amounts of six of the fractions present in a crude oil and the relative demand for each of these fractions.

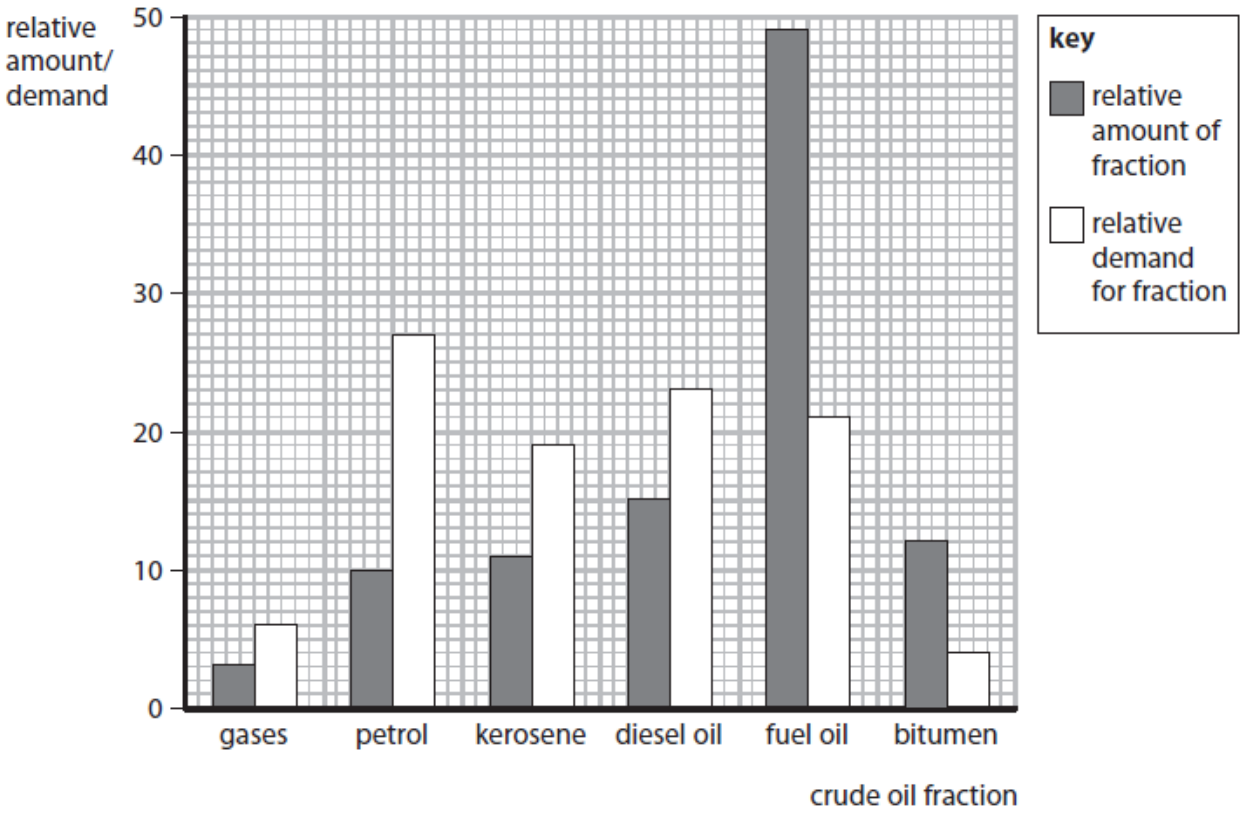


Figure 9

Cracking is used to match the relative amount of a fraction of crude oil to the demand for that fraction.

(i) Use the information in Figure 9 to give the name of the fraction that is most likely to need to be cracked.

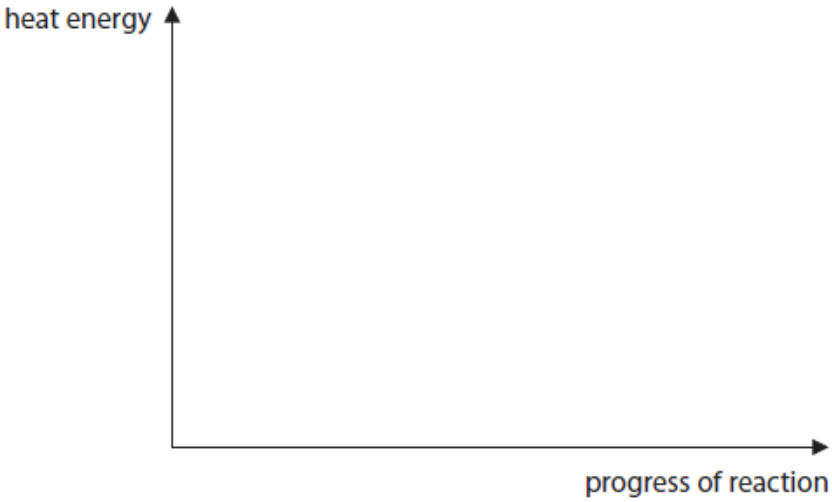
(1)

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(ii) In a cracking reaction, reactants are heated to form products.
This reaction is endothermic.

On the axes provided, draw the reaction profile of this reaction.
Label the energy of the reactants, the energy of the products and the activation energy of the reaction.

(3)



(iii) Dodecane, $C_{12}H_{26}$, can be cracked to form useful products.

Complete the equation for the cracking of dodecane by filling in the formula of the single molecule needed to balance the equation.

(1)

$$C_{12}H_{26} \rightarrow \text{.....} + 3C_2H_4$$

(Total for question = 5 marks)

(**Q15 1SC0/2CH, June 2018**)

Q14.

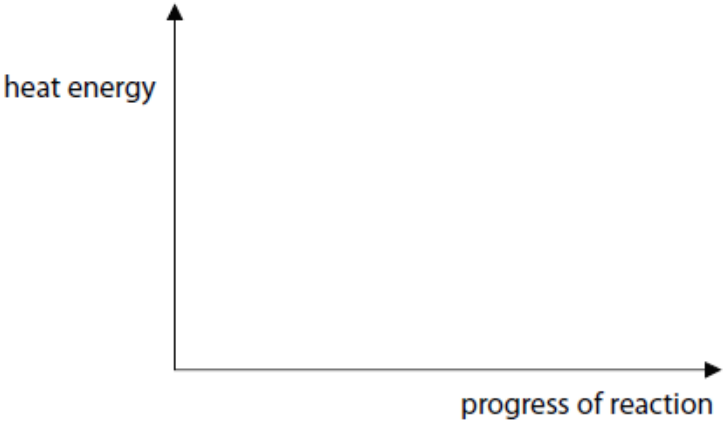
Hydrogen reacts with chlorine to form hydrogen chloride.

$$H_2(g) + Cl_2(g) \rightarrow 2HCl(g)$$

The reaction is exothermic.

Draw and label the reaction profile diagram for this reaction, identifying the activation energy.

(3)



(Total for question = 3 marks)

(**Q06c 1SC0/2CH, SAM 2016**)

Q15.

Energy changes and rates of reaction

(a) When zinc reacts with copper sulfate solution, zinc sulfate solution and copper are formed.

(i) An experiment was carried out to measure the temperature change when zinc powder reacts with copper sulfate solution.

initial temperature of copper sulfate solution = 20 °C
final temperature of mixture after the reaction = 46 °C

Explain what the temperature readings show about the type of heat change that occurs during this reaction.

(2)

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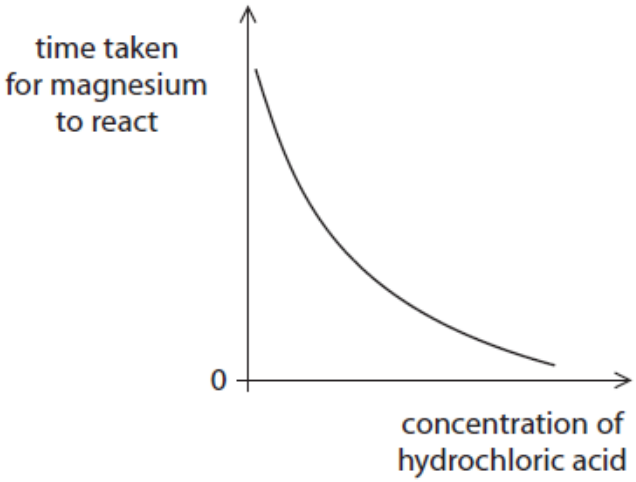
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(ii) Complete the equation for the reaction between zinc and copper sulfate by putting formulae in the spaces provided.

(2)

$Zn + CuSO_4 \rightarrow$ ..... + ...

(b) A length of magnesium ribbon was added to excess hydrochloric acid. The time for all of the magnesium to react was recorded. The experiment was repeated with the same lengths of magnesium ribbon but different concentrations of the acid.
The graph shows the time taken for the magnesium to react with different concentrations of this acid.



Use the graph to explain how the rate of this reaction changes as the concentration of hydrochloric acid increases.

(2)

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*(c) Marble chips react with dilute hydrochloric acid to produce carbon dioxide gas. The rate of this reaction can be changed by changing the size of the marble chips.

Describe experiments to investigate what effect using smaller marble chips has on the rate of this reaction.

(6)

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(Total for question = 12 marks)

(**Q06 1SC0/2CF, June 2014**)

Q16.

Students are investigating exothermic and endothermic reactions.
They are finding the temperature change in 50 cm^3 water when a solid dissolves in it.
The apparatus is shown in Figure 1.

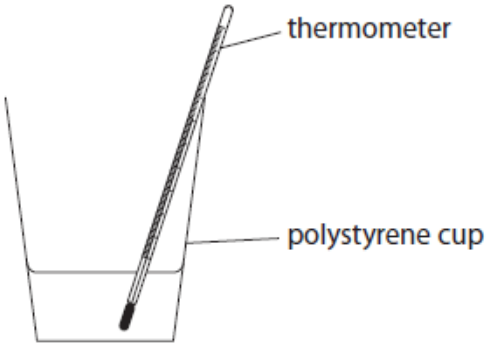


Figure 1

The dissolving of this solid in water is an exothermic change.
The experiment is repeated a number of times.
Compared with the initial temperature of the water, the final temperature of the solution is

(1)

☒ **A** always higher

☒ **B** always lower

☒ **C** sometimes higher and sometimes lower

☒ **D** always unchanged

(Total for question = 1 mark)

(**Q02 1SC0/2CF, June 2018**)

Q17.

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

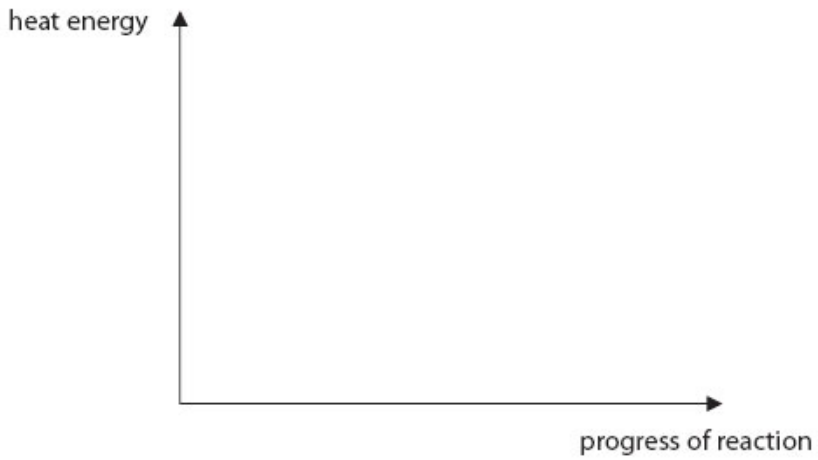
☒ **C** dissolving

☒ **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)



(**Q20 1SC0/2CH, June 2013**)

Q18.

Dissolving ammonium chloride in water is an endothermic process.
Figure 10 shows part of the reaction profile for this process.

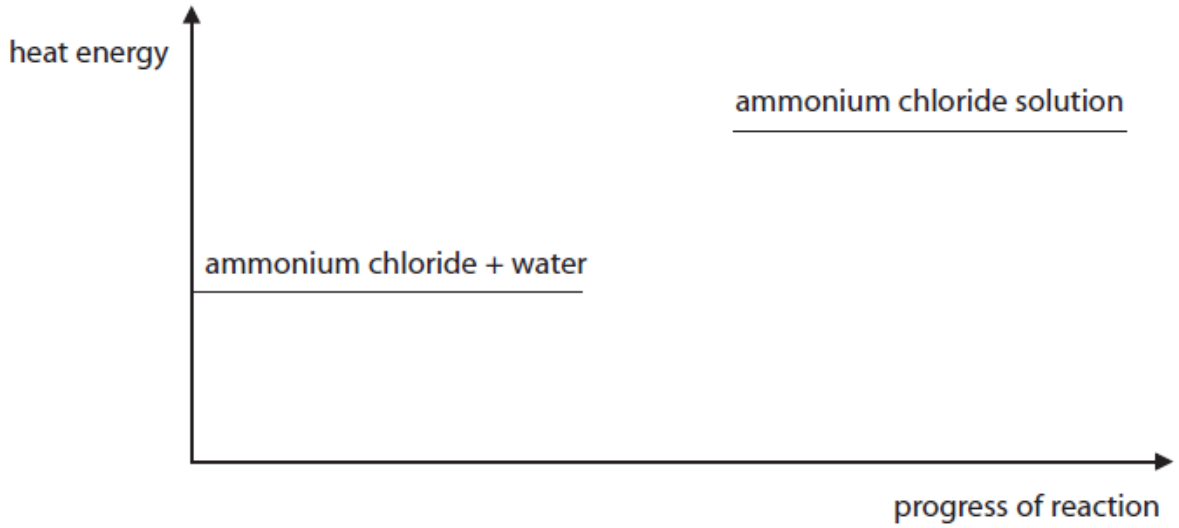


Figure 10

(i) Explain how Figure 10 shows that dissolving ammonium chloride in water is an endothermic process.

(2)

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(ii) Complete the reaction profile in Figure 10 and label the activation energy.

(2)

(Total for question = 4 marks)

(**Q05b 1SC0/2CF, Nov 2021**)

Q19.

Dissolving ammonium chloride in water is an endothermic process.
Figure 1 shows part of the reaction profile for this process.

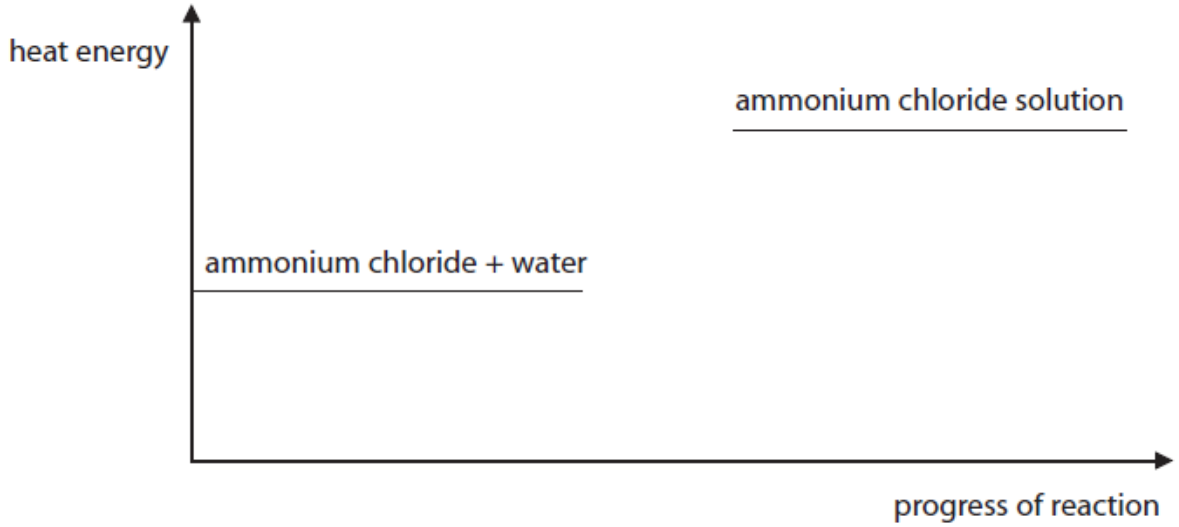


Figure 1

(i) Explain how Figure 1 shows that dissolving ammonium chloride in water is an endothermic process.

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(2)

(ii) Complete the reaction profile in Figure 1 and label the activation energy.

(2)

(Total for question = 4 marks)

(**Q01b 1SC0/2CH, Nov 2021**)

Q20.

Some reactions are endothermic.

Explain, in terms of bond breaking and bond forming, why some reactions are endothermic.

(3)

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(Total for question = 3 marks)

(**QU05c 1SC0/2CH, June 2024**)

Q21.

A student poured 50 cm^3 water into a beaker and measured the water's temperature.

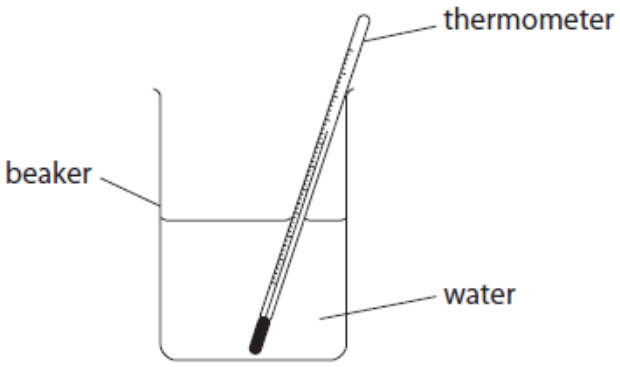


Figure 5

The student added 1.00 g calcium chloride to the water, stirred the mixture and then recorded the temperature.

The student's results were

temperature of water at start = 21 °C temperature of mixture after stirring = 32 °C

Explain, using these results, the type of heat energy change that occurs when calcium chloride dissolves in water.

(2)

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(Total for question = 2 marks)

(**Q03b 1SC0/2CF, June 2019**)

Q22.

A student investigated the temperature change that took place when different salts were dissolved in water.

The student used the following method.

step 1 pour 50 cm^3 of water into a polystyrene cup and record the temperature of the water

step 2 find the mass of an empty boiling tube

step 3 add 2 spatula measures of a salt to the boiling tube and find its new mass

step 4 add the salt to the water

step 5 stir the mixture and record the temperature after 2 minutes.

Figure 3 shows the apparatus used.

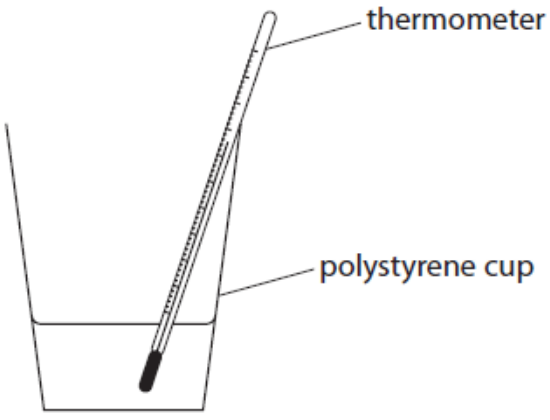


Figure 3

Explain why a polystyrene cup is a better container to use for this investigation than a glass beaker.

(2)

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(Total for question = 2 marks)

(**QU02c 1SC0/2CF, June 2023**)

Q23.

The reaction between calcium carbonate and dilute hydrochloric acid is exothermic.
Explain, in terms of bond breaking and bond making, why some reactions are exothermic.

(3)

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(Total for question = 3 marks)

(**Q05b 1SC0/2CH, June 2019**)

Q24.

A student poured 50 cm^3 water into a beaker and measured the water's temperature.

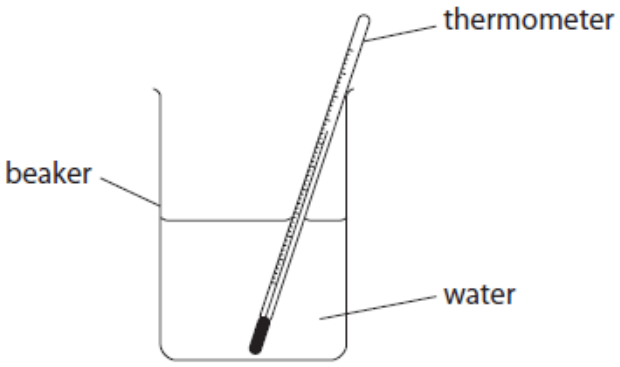


Figure 5

The student added 1.00 g calcium chloride to the water, stirred the mixture and then recorded the temperature.

Give the name of the apparatus that could be used to measure 1.00 g of calcium chloride.

(1)

.....

(Total for question = 1 mark)

(**Q03a 1SC0/2CF, June 2019**)

Q25.

In an experiment, a solid is mixed with a liquid.
The temperature change of the mixture is measured.

Figure 3 shows the apparatus that is used.

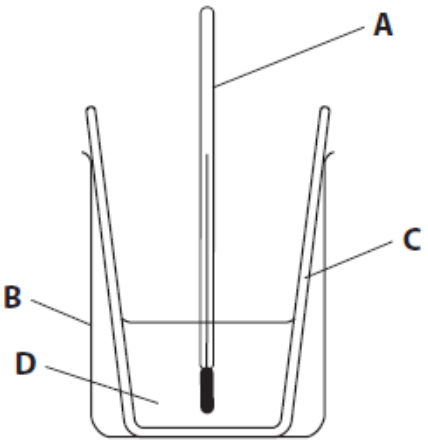


Figure 3

(i) Give the letter of the piece of apparatus, **A**, **B**, **C** or **D**, in Figure 3 that is used to measure the temperature.

(1)

.....

(ii) Give the name of the piece of apparatus **B** shown in Figure 3.

(1)

.....

(iii) The piece of apparatus labelled **C** is made from polystyrene.

State why polystyrene is a better material than glass for this piece of apparatus.

(1)

.....

(iv) The results of the experiment are given in Figure 4.

temperature of liquid at start in °C	18.6
temperature of products at end in °C	16.1

Figure 4

Calculate the change in temperature.

Give a sign and a unit in your answer.

(3)

.....

.....

temperature change = ...

(v) The solid used in this experiment contained only NH_4^+ ions and NO_3^- ions.

Give the formula and the name of the solid.

(2)

formula .....

name .....

(Total for question = 8 marks)

(**QU02b 1SC0/2CF, June 2019**)

Q26.

In an experiment, a solid is mixed with a liquid.
The temperature change of the mixture is measured.

Figure 3 shows the apparatus that is used.

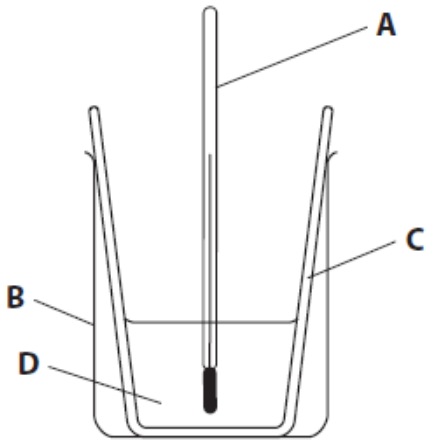


Figure 3

(i) Give the letter of the piece of apparatus, **A**, **B**, **C** or **D**, in Figure 3 that is used to measure the temperature.

(1)

.....

(ii) Give the name of the piece of apparatus **B** shown in Figure 3.

(1)

.....

(iii) The piece of apparatus labelled **C** is made from polystyrene.

State why polystyrene is a better material than glass for this piece of apparatus.

(1)

.....

(iv) The results of the experiment are given in Figure 4.

temperature of liquid at start in °C	18.6
temperature of products at end in °C	16.1

Figure 4

Calculate the change in temperature.

Give a sign and a unit in your answer.

(3)

.....

.....

temperature change = ...

(v) The solid used in this experiment contained only NH_4^+ ions and NO_3^- ions.

Give the formula and the name of the solid.

(2)

formula .....

name .....

(Total for question = 8 marks)

(**QU02b 1SC0/2CF, June 2022**)

Q27.

When solid ammonium chloride is added to water a colourless solution is formed.

During the process the temperature of the liquid decreases.

Describe how you would measure the change in temperature.

(2)

.....

.....

.....

.....

(Total for question = 2 marks)

(**Q02b 1SC0/2CF/S2, SAM**)

Q28.

When solid ammonium chloride is shaken with water, a colourless solution forms and the temperature changes from 20°C to 16°C.

Give the name of the type of heat change occurring.

(1)

.....

(Total for question = 1 mark)

(**Q03a 1SC0/2CF, SAM 2016**)

Q29.

In another experiment, a student investigated the temperature decrease when different amounts of ammonium nitrate crystals were dissolved in 100 cm^3 of water.

The apparatus used is shown in Figure 3.

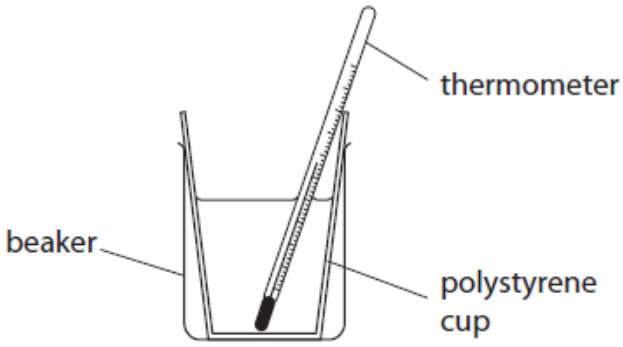


Figure 3

The student used the following method.

step 1 pour 100 cm^3 of water into the polystyrene cup

step 2 add one spatula of ammonium nitrate crystals to the water

step 3 stir the mixture

step 4 use the thermometer to record the lowest temperature reached by the mixtur e

step 5 repeat steps 1 to 4 using different amounts of ammonium nitrate

(i) Name a piece of apparatus that should be used to measure the 100 cm^3 of water in **step 1**.

(1)

.....

(ii) The student cannot work out the temperature decrease using the method described.

State what the student must do before **step 2** to be able to work out the temperature decrease.

(1)

.....

.....

(iii) State why a polystyrene cup is used in this experiment.

(1)

.....

.....

(iv) Figure 4 shows the reaction profile for this reaction.

Use the words from the box to complete the labels on Figure 4.

activation energy	products	reactants

(2)

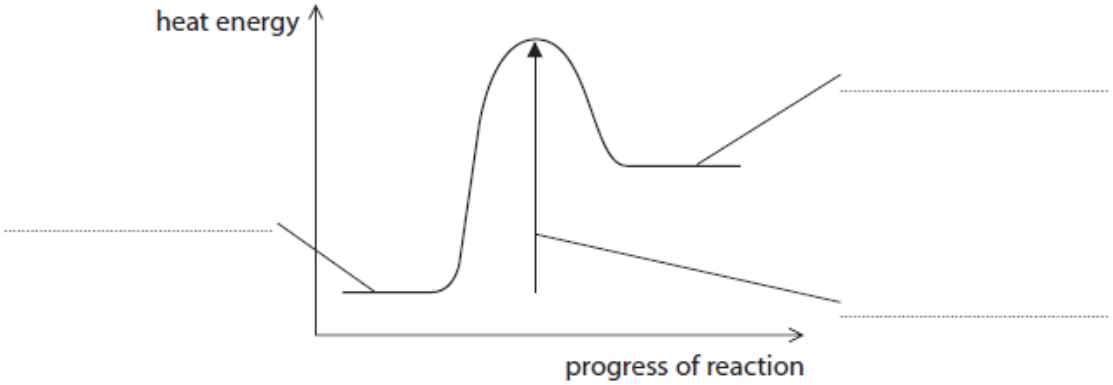


Figure 4

(Total for question = 5 marks)

(Q02b 1SC0/2CF, Nov 2020)

Q30.

What type of chemical change causes a decrease in temperature?

(1)

- ☒ **A** combustion
- ☒ **B** endothermic
- ☒ **C** exothermic
- ☒ **D** neutralisation

(Total for question = 1 mark)

(Q02c 1SC0/2CF/S2, SAM)

Q31.

In some chemical reactions, bonds are broken in the reactant molecules and new bonds are formed to make the product molecules.

(i) Which row is correct about the energy changes for these processes?

(1)

		energy change	
		breaking a bond	**making a bond**
☒	**A**	energy is released	energy is released
☒	**B**	energy is released	energy is absorbed
☒	**C**	energy is absorbed	energy is released
☒	**D**	energy is absorbed	energy is absorbed

(ii) Hydrogen reacts with fluorine.

$$H_2 + F_2 \rightarrow 2HF$$

Figure 7 shows the bond energies for the bonds in the three molecules in the equation.

bond	bond energy in kJ mol^{-1}
H—H	436
F—F	158
H—F	562

Figure 7

Calculate the energy change for this reaction.

(4)

.....

.....

.....

.....

.....

.....

.....

.....

energy change = ... kJ mol^{-1}

(Total for question = 5 marks)

(**QU06a 1SC0/2CH, June 2022**)

Q32.

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 ☒.

A student poured 50 cm^3 water into a beaker and measured the water's temperature.

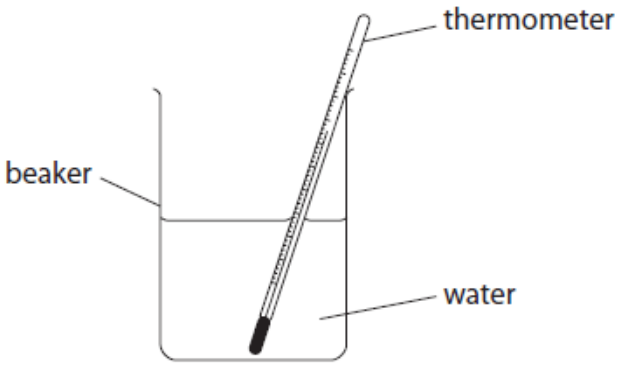


Figure 5

The student added 1.00 g calcium chloride to the water, stirred the mixture and then recorded the temperature.

Calcium chloride is hazardous to health.

(i) Which hazard symbol would be expected to be seen on a container of calcium chloride?

(1)

☒ **A** 

☒ **B** 

☒ **C** 

☒ **D** 

(ii) Give a safety precaution that the student should take during the experiment.

(1)

.....

.....

(Total for question = 2 marks)

(**Q03c 1SC0/2CF, June 2019**)

Q33.

When solid ammonium chloride is added to water a colourless solution is formed.

What process has occurred?

(1)

☒ **A** displacement

☒ **B** dissolving

☒ **C** neutralisation

☒ **D** precipitation

(Total for question = 1 mark)

(**Q02a 1SC0/2CF/S2, SAM**)

Q34.

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 ☒.

In one reaction the temperature of the reaction mixture decreases.

Which word describes this type of reaction?

(1)

☒ **A** displacement

☒ **B** endothermic

☒ **C** exothermic

☒ **D** neutralisation

(Total for question = 1 mark)

(**QU02a 1SC0/2CF, June 2024**)

Q35.

A student carries out an experiment to measure accurately the temperature changes when different metals are added to iron(II) sulfate solution.

The method for the experiment is:

- measure 25 cm^3 of iron(II) sulfate solution and pour into a container
- record the initial temperature of the solution
- add excess magnesium ribbon
- record the highest temperature of the mixture
- repeat the experiment using excess copper turnings, then using excess zinc foil.

(i) State a suitable container for the iron(II) sulfate solution in this experiment.

(1)

.....

(ii) State what the student should do to the mixtures during the experiment.

(1)

.....

(iii) Figure 5 shows the results obtained by the student.

metal added to iron(II) sulfate solution	temperature rise / °C
magnesium	6.0
copper	0.0
zinc	2.8

Figure 5

Explain the order of reactivity of the metals magnesium, copper and zinc using the results.

(2)

.....

.....

.....

.....

(iv) Explain how the student could improve the method to make a fairer comparison of the temperature change produced by the different metals.

(2)

.....

.....

.....

.....

(v) The iron(II) sulfate solution contained 6.2 g of iron(II) sulfate in 50 cm^3 of solution.

Calculate the concentration of the iron(II) sulfate solution in g dm^{-3}.

(2)

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

(Total for question = 8 marks)

(**Q03b 1SC0/2CF, SAM 2016**)

Q36.

This question is about the noble gas xenon.

Under extreme conditions, xenon reacts with fluorine to form xenon hexafluoride.

The reaction is exothermic.
The energy change for the reaction is −400 kJ mol^{-1}.

On Figure 4

- add a label to the y-axis
- draw the reaction profile for this reaction
- label the energy change and the activation energy for the reaction.

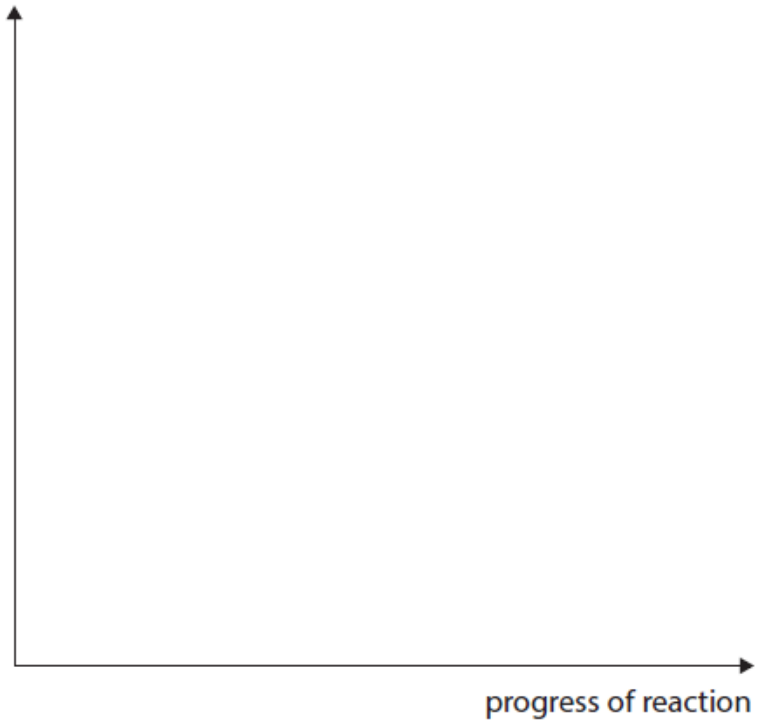


Figure 4

(Total for question = 3 marks)

(**QU04c 1SC0/2CH, June 2025**)

Q37.

Students are investigating exothermic and endothermic reactions.
They are finding the temperature change in 50 cm^3 water when a solid dissolves in it.
The apparatus is shown in Figure 1.

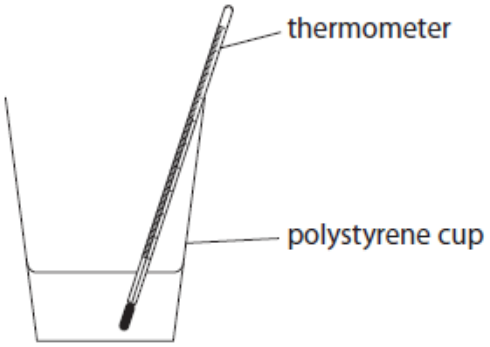


Figure 1

The steps needed to carry out this experiment are **P**, **Q**, **R**, **S** and **T**.
They are shown below.

They are not in the correct order.

P pour the 50 cm^3 water into the polystyrene cup
Q add the solid to the water and stir
R measure 50 cm^3 water using a beaker
S vmeasure the initial temperature of the water
T measure the final temperature of the solution when all the solid has dissolved

State how step **R** could be changed to measure the volume of water more accurately.

(1)

.....

(Total for question = 1 mark)

(**Q03 1SC0/2CF, June 2018**)

Q38.

A student investigates the temperature change when 10 g of solid magnesium chloride is dissolved
in 100 cm^3 of water.

Figure 2 shows the apparatus the student uses.

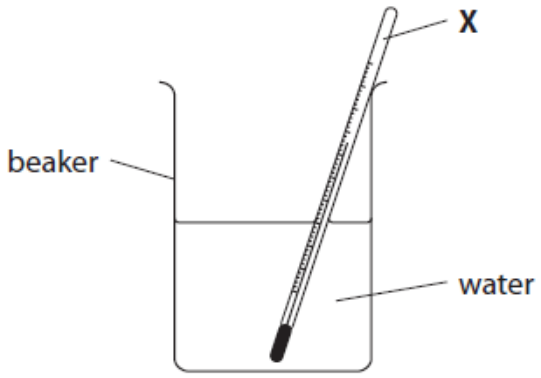


Figure 2

Name the piece of apparatus labelled **X** in Figure 2.

.....

(Total for question = 1 mark)

(**QU02a 1SC0/2CF, June 2025**)

Q39.

When sodium hydroxide solution is neutralised with an acid there is a temperature change.

A student is given dilute hydrochloric acid and dilute ethanoic acid of the same concentration in mol dm^{-3}.

Devise a plan to compare the temperature changes produced when sodium hydroxide solution is neutralised with each of these two acids.

(4)

.....

.....

.....

.....

.....

.....

.....

.....

(Total for question = 4 marks)

(**Q06b 1SC0/2CH, SAM 2016**)

Q40.

When solid ammonium chloride is added to water a colourless solution is formed.

In an experiment the temperature change produced in water by dissolving a different solid can be found.

Give **two** variables that should be kept the same in this experiment, in order to be able to compare this temperature change fairly with the temperature change produced when the ammonium chloride dissolves in water.

(2)

.....

.....

.....

.....

(Total for question = 2 marks)

(**Q02d 1SC0/2CF/S2, SAM**)