

Exothermic and endothermic reactions

Q1. (2019)

- 0 2 . 6 Describe a method to investigate how the temperature changes when different masses of ammonium nitrate are dissolved in water.

You do **not** need to write about safety precautions.

[6 marks]

Q2. (2020)

- 0 5 A student investigated the temperature change when magnesium was added to copper sulfate solution.

This is the method used.

1. Pour 30 cm³ of copper sulfate solution into a polystyrene cup.
2. Measure the temperature of copper sulfate solution every minute for 3 minutes.
3. Add magnesium on the fourth minute.
4. Measure the temperature of the mixture at 5 minutes and then every minute up to 14 minutes.

- 0 5 . 1 What is the dependent variable in this investigation?

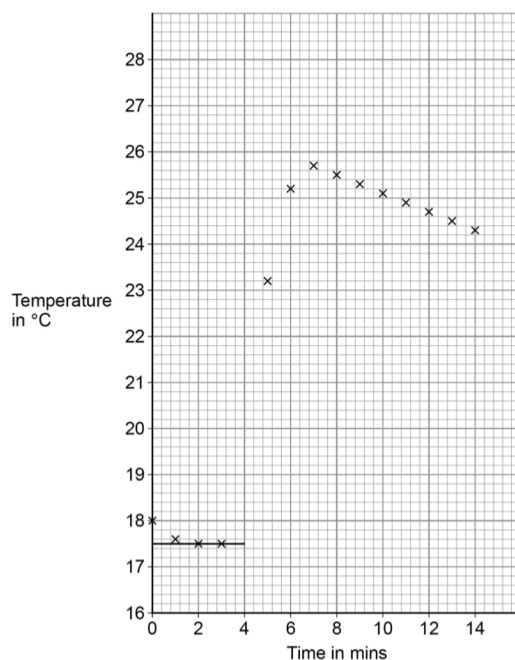
[1 mark]

Q3. (2020)

The student used the results to plot a graph.

Figure 4 shows the graph.

Figure 4



A)

- 0 5 . 2 Suggest why the copper sulfate solution was left for four minutes before adding the magnesium.

[1 mark]

B)

0 5 . 3 Complete **Figure 4** by:

- drawing a line of best fit through all the points after 7 minutes
- extending the line back to 4 minutes.

[2 marks]

C)

0 5 . 4 The temperature change for the reaction is the temperature difference between the two graph lines at 4 minutes.

Determine the temperature change for the reaction.

Use **Figure 4**.**[2 marks]**

Temperature change = _____ °C

D)

0 5 . 5 Explain why the temperature of the mixture decreases after 7 minutes.

[2 marks]

E)

0 5 . 6 The student repeated the experiment with an unknown metal **Q** instead of magnesium.

All the other variables were kept the same.

The student recorded a smaller temperature change.

Suggest the identity of metal **Q**.Give **one** reason for your answer.**[2 marks]**Metal **Q** _____

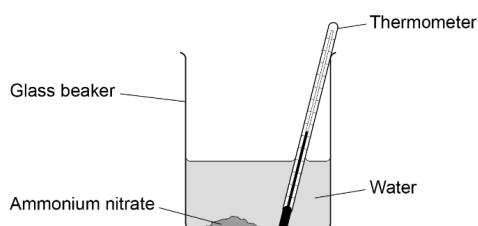
Reason _____

Q4. (2021)

A student investigated the temperature change when 10 g of ammonium nitrate was added to 100 cm³ of water.

This is the method used.

1. Measure the temperature of 100 cm³ of water.
2. Add 10 g of ammonium nitrate.
3. Stir once.
4. Measure the temperature of the solution every minute for 7 minutes.

Figure 3 shows the apparatus.**Figure 3**

A)

0 3 . 1 What is the dependent variable in this investigation?

[1 mark]

B)

0 3 . 2 Give **three** improvements to the investigation to make the results more accurate.

[3 marks]

1 _____

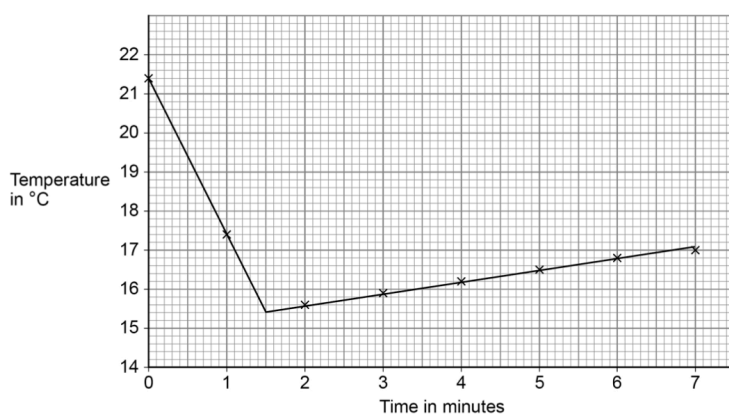
2 _____

3 _____

Q5. (2021)

0 3 . 3 Figure 4 shows the results.

Figure 4



Explain the results.

[4 marks]

Q6. (2021)

0 7 Methane, ethane, propane and butane all react with oxygen to produce carbon dioxide and water.

0 7 . 1 Suggest why a mixture of methane and oxygen does **not** react at room temperature.

Answer in terms of particles.

[2 marks]

Q7. (2021)

0 7 . 2 Table 3 shows the energy released when methane, ethane and propane react with oxygen to produce carbon dioxide and water.

Table 3

	Compound reacted with oxygen		
	Methane	Ethane	Propane
Formula of compound	CH ₄	C ₂ H ₆	C ₃ H ₈
Energy released in kJ/mol	680	1160	1640

Predict the energy released when butane (C₄H₁₀) reacts with oxygen to produce carbon dioxide and water.

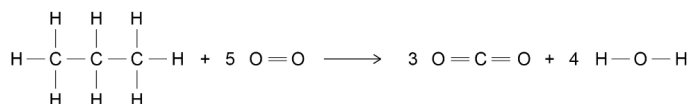
[1 mark]

Energy released = _____ kJ/mol

Q8. (2021)

0 7 . 3 Propane reacts with oxygen to produce carbon dioxide and water.

The displayed formula equation for the reaction is:



The reaction is exothermic.

In the reaction, the energy released when forming new bonds is 1640 kJ/mol greater than the energy needed when breaking bonds.

Table 4 shows bond energies.

Table 4

Bond	H—C	C—C	O=O	C=O	O—H
Bond energy in kJ/mol	410	X	500	740	460

Calculate the C—C bond energy (X).

[5 marks]

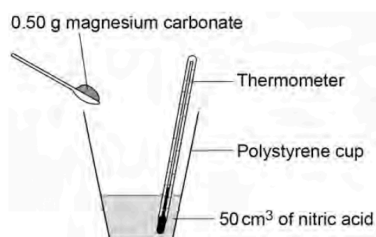
X = _____ kJ/mol

Q9. (2024)

A student investigated the temperature change when different masses of magnesium carbonate were reacted with excess nitric acid.

Figure 6 shows the apparatus.

Figure 6



This is the method used.

1. Pour 50 cm³ of nitric acid into a polystyrene cup.
2. Measure the temperature of the solution.
3. Add 0.50 g of magnesium carbonate.
4. Stir the mixture.
5. Measure the temperature.
6. Repeat steps 1 to 5 with different masses of magnesium carbonate.

0 4 . 7

Give **two** improvements to the **method** to produce more accurate results.

Do **not** refer to improvements to the apparatus in your answer.

[2 marks]

1 _____

2 _____