SOLUTIONS

AQA ADDITIONAL Science - Exothermic and Endothermic reactions

1. A chemical reaction involves the transfer of: ***(Circle the correct answer)***

A. Atoms

B. Energy

C. Chemicals

D. Mass

(1 mark)

2. Complete the sentences with the words in the box below. ***The words may be used once, more than once or not at all.***

reversible	endothermic	oxidation	energy
exothermic	corrosion	decomposition	irreversible

When a chemical reaction releases energy we call it an exothermic reaction. An example of this type of reaction is oxidation . When a reaction takes in energy we call it an endothermic reaction. An example of this type of reaction is thermal decomposition. (4 marks)

3. Hydrochloric acid and sodium hydroxide together in a neutralisation reaction, as represented below.

Hydrochloric acid + sodium hydroxide → sodium chloride + water

Lisa adds 30 cm^3 of hydrochloric acid to 30 cm^3 of sodium hydroxide and records the temperature before and after the reaction in the following table:

Chemical substance	Temperature (◦C)
Hydrochloric acid (before being mixed)	22
Sodium hydroxide (before being mixed)	22
Mixture (directly after being mixed)	48
Mixture (2 hours of after being mixed)	22

a) Is the neutralisation reaction is exothermic or endothermic? Exothermic -1

b) Explain how Lisa's results show the neutralisation reaction is exothermic or endothermic

The temperature has increased/The temperature rose by 26◦C/The temperature was 22◦C before mixing and 48◦C after mixing -1 (OWTTE)

(2 marks)

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Solutions

4. Cold packs are used to treat sports injuries. They usually contain ammonium nitrate and water and when the pack is shaken the ammonium nitrate dissolves in the water and gets cold.
Explain why the pack gets cold and how it works.

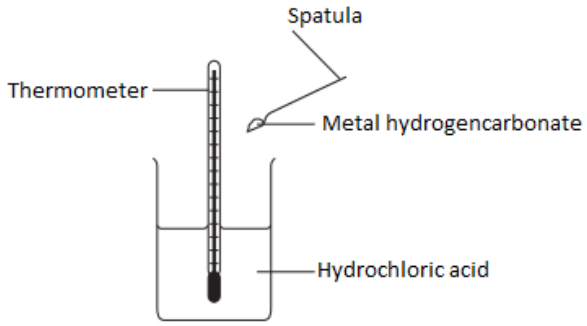
When ammonium nitrate dissolves it takes energy from the surroundings/Heat is taken in from the surroundings -1 (OWTTE)

This makes the surrounding colder/the coldness reduces the swelling and numbs the pain - 1 (OWTTE)

(2 marks)

5. **QWC - In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate**

A group of students completed an experiment to find the change in temperature when different metal hydrogencarbonates reacted with hydrochloric acid. They used the following apparatus:



(Diagram relabeled from http://filestore.aqa.org.uk/subjects/AQA-CH2HP-QP-JUN13.PDF)

Write a plan the student could use. In your plan you should:

- Describe how you would carry out the investigation and make it a fair test
- Describe the measurements you would make.

(6 marks)

QWC Suggested marking guidance (Total 6 marks)			
Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Teachers should and apply a 'best-fit' approach to the marking.			
0 marks	**Level 1 (1-2 marks)**	**Level 2 (3-4 marks)**	**Level 3 (5-6 marks)**
No relevant content	A simple plan with an attempt to measure the temperature OR attempt at fair test	A plan including variables and attempt at measuring temperature change AND fair test	A workable plan, including all variables, how to measure the temperature change AND fair test

PLAN:
Measure the start, end and calculate temperature difference
Change only the type of metal hydrogen carbonate
Add the metal hydrogen carbonate to the hydrochloric acid and measure the (lowest) temperature change
CONTROL VARIABLE:
Amount/mass/surface area of metal hydrogen carbonate
Volume/Amount of acid
Start temperature

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6. a) In some chemical reactions, the products can turn back into the reactants. This type of reaction is called:

(Circle the correct answer)

A: Reversible **B:** Exothermic **C:** Irreversible **D**: Endothermic

(1mark)

b) In this type of reaction, the amount of energy released in the forward direction compared to the energy absorbed in the opposite direction must be:

(Circle the correct answer)

A: Less **B:** The same **C:** More

(1mark)

7. Hydrochloric acid and sodium hydroxide together in a neutralisation reaction, as represented below.

Hydrochloric acid + sodium hydroxide → sodium chloride + water

Lisa adds 30 cm^3 of hydrochloric acid to 30 cm^3 of sodium hydroxide and records the temperature before and after the reaction in the following table:

Chemical substance	Temperature (◦C)
Hydrochloric acid (before being mixed)	22
Sodium hydroxide (before being mixed)	22
Mixture (directly after being mixed)	48
Mixture (2 hours of after being mixed)	22

a) Is the neutralisation reaction exothermic or endothermic? Exothermic

(1mark)

b) Explain how Lisa's results show the neutralisation reaction is exothermic or endothermic

The temperature increased/the temperature went up by 26◦C - OWTTE

(1mark)

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8. When ammonium nitrate is added to water it dissolves. Kate adds the two reactants together and records the temperature of the solution every 30 seconds for three minutes. The results are recorded in the following table:

Time (s)	0	30	60	90	120	150	180	210	240	270	300	330	360
Temperature (◦C)	20	19	18	17	17	20	16	15	13	12	10	10	10

a) What is the pattern to the results?

The temperature decreases - OWTTE

(1mark)

b) Which result is anomalous?

150 seconds

(1mark)

c) What do you predict the temperature of the solution to be after an hour? Explain your answer.

20◦C, as the solution will have stabilised to room temperature

(1mark)

9. Explorers often use self heating cans or self heating foods on their journeys. One such product uses energy released when calcium oxide reacts with water. The reaction is as follows:

Calcium oxide + water → calcium hydroxide

a) Is the reaction exothermic or endothermic? Exothermic

(1mark)

b) Give **one** advantages of using these types of self heating cans/foods?

Hot food drink can be achieved when there are no other means of heating (eg: gas/electrcity) - OWTTE

(1mark)

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10. **QWC - In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.**

A group of students completed a displacement experiment. They added five different metals to copper chloride solution and measured the temperature change.

Write a plan the student could use to show which metal was the most reactive. In your plan you should:

- Describe how you would carry out the investigation and make it a fair test
- Describe the measurements you would make

(6 marks)

QWC Suggested marking guidance (Total 6 marks)			
Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Teachers should and apply a 'best-fit' approach to the marking.			
0 marks	**Level 1 (1-2 marks)**	**Level 2 (3-4 marks)**	**Level 3 (5-6 marks)**
No relevant content	A simple plan with an attempt to measure the temperature OR attempt at fair test	A plan including variables and attempt at measuring temperature change AND fair test	A workable plan, including all variables, how to measure the temperature change AND fair test

PLAN:
Measure the start, end and calculate temperature difference
The metal with the biggest temperature change should indicate the metal with the highest reactivity
Change only the type of metal
Add the metal to the copper chloride solution and measure the (highest) temperature change
CONTROL VARIABLE:
Amount/mass/surface area of metal
Volume/Amount of copper chloride solution
Start temperature

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