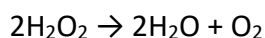


EXOTHERMIC REACTIONS, ENDOTHERMIC REACTIONS & BOND ENERGIES 4

Q1. The symbol equation for the decomposition of hydrogen peroxide is:

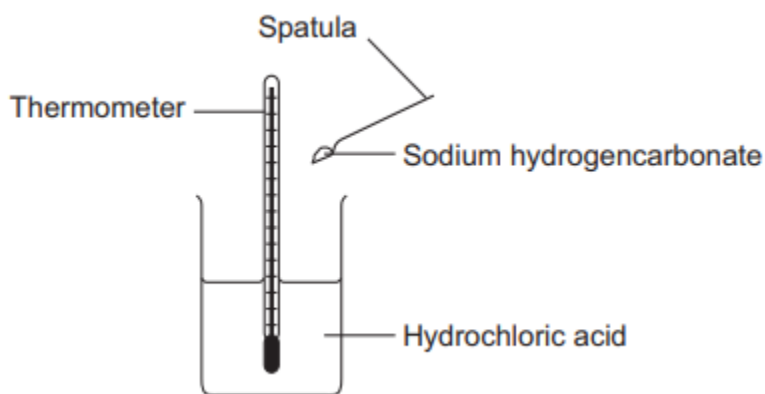


This reaction is exothermic.

What is an exothermic reaction?

(1 mark)

Q2. Some students did an experiment to find the temperature change when hydrochloric acid reacts with sodium hydrogen carbonate.



The results are in the table.

Number of spatula measures of sodium hydrogen carbonate	Start temperature in °C	Final temperature in °C	Change in temperature in °C
2	20	16	4
4	20	14	6
6	19	11	8
8	20	10	10

10	19	9	10
12	20	10	10

(i) Describe, as fully as you can, the trends shown in the students' results.

(3 marks)

(ii) State the type of energy transfer for this reaction.

(1 mark)

Q3. Instant cold packs are used to treat sports injuries.



One type of cold pack has a plastic bag containing water. Inside this bag is a smaller bag containing ammonium nitrate.

The outer bag is squeezed so that the inner bag bursts. The pack is shaken and quickly gets very cold as the ammonium nitrate dissolves in the water.

(a) One of the statements in the table is correct.

Put a tick (✓) next to the correct statement.

Statement	(✓)
The bag gets cold because heat energy is given out to the surroundings.	
The bag gets cold because heat energy is taken in from the surroundings.	
The bag gets cold because plastic is a good insulator.	

(1 mark)

(b) Draw a ring around the word that best describes the change when ammonium nitrate dissolves in water.

electrolysis

endothermic

exothermic

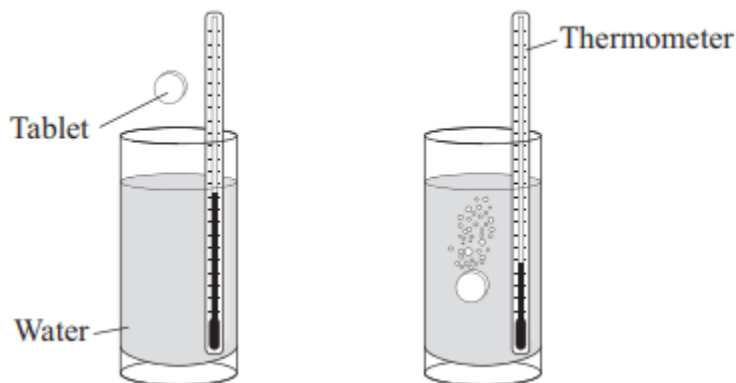
(1 mark)

(c) Suggest and explain why the pack is shaken after the inner bag has burst.

(2 marks)

Q4. An indigestion tablet contains sodium hydrogen carbonate and citric acid.

When the tablet is added to cold water a chemical reaction takes place and there is a lot of fizzing.



This chemical reaction is endothermic.

(i) Tick (✓) the statement which describes what happens to the temperature of the solution.

Statement	Tick (✓)
The temperature of the solution will increase.	
The temperature of the solution will decrease.	
The temperature of the solution will stay the same.	

(1 mark)

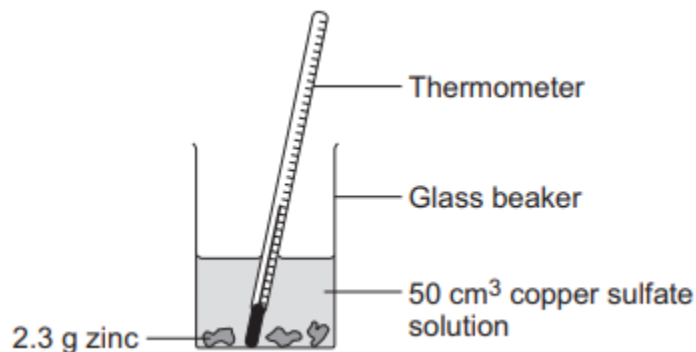
(ii) Tick (✓) the statement which describes what happens to the energy during the reaction.

Statement	Tick (✓)
Energy is given out to the surroundings.	
Energy is taken in from the surroundings.	
No energy is given out to or taken from the surroundings.	

(1 mark)

Q5. A student investigated the temperature change when zinc reacts with copper sulfate solution. The student used a different concentration of copper sulfate solution for each experiment.

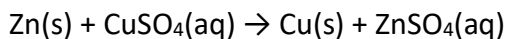
The student used the apparatus shown in the figure.



The student:

- measured 50 cm³ copper sulfate solution into a glass beaker
- measured the temperature of the copper sulfate solution
- added 2.3 g zinc
- measured the highest temperature
- repeated the experiment using copper sulfate solution with different concentrations.

The equation for the reaction is:



(a) The thermometer reading changes during the reaction. Give one other change the student could see during the reaction.

(1 mark)

(b) Suggest one improvement the student could make to the apparatus in the figure. Give a reason why this improves the investigation.

(2 marks)

(c) In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

The student's results are shown in the table.

Experiment number	Concentration of copper sulfate in moles per dm ³	Increase in temperature in °C
1	0.1	5
2	0.2	10
3	0.3	12
4	0.4	20
5	0.5	25
6	0.6	30
7	0.7	35
8	0.8	35
9	0.9	35
10	1.0	35

Describe and explain the trends shown in the student's results.

(6 marks)

Total marks(20)