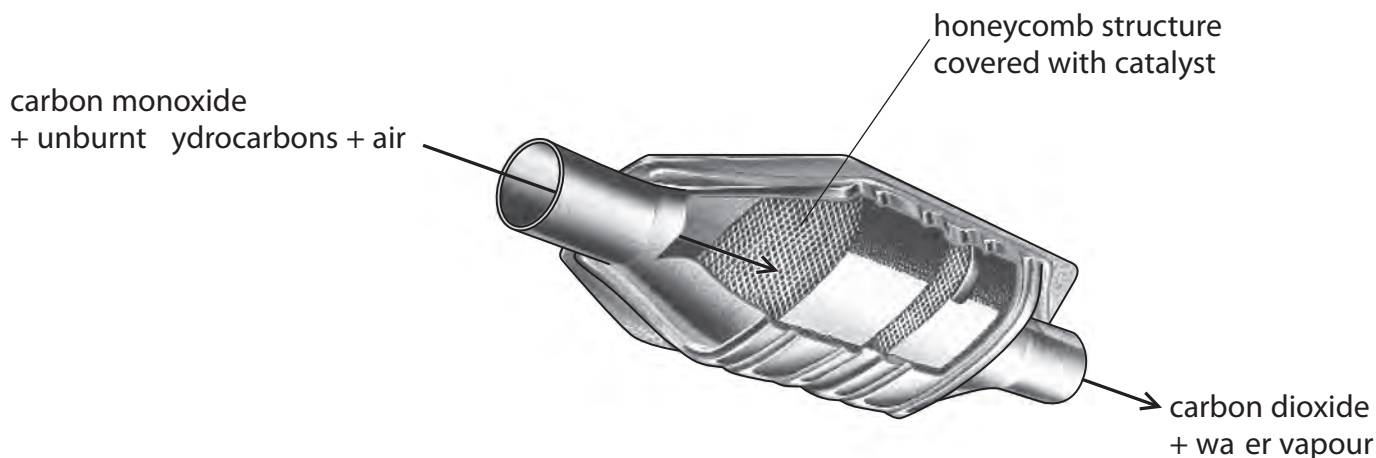


- 1 The diagram shows a catalytic converter used in car exhaust systems. Gases from the car engine pass into the catalytic converter. In the catalytic converter, carbon monoxide and unburnt hydrocarbons are changed into carbon dioxide and water vapour.



(a) What type of reaction occurs in the catalytic converter?

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

(1)

- A cracking
- B displacement
- C oxidation
- D precipitation

(b) It is important that the reactions in the catalytic converter happen quickly.

- (i) Explain why the catalyst is spread onto the honeycomb structure rather than used as large pieces.

(2)

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(ii) Hot gases from the engine pass over the catalyst.

Explain why the catalyst is more effective when the engine has been running for a short time rather than when the engine is first started.

(2)

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(c) Carbon monoxide reacts with oxygen, O_2 , to form carbon dioxide in the catalytic converter.

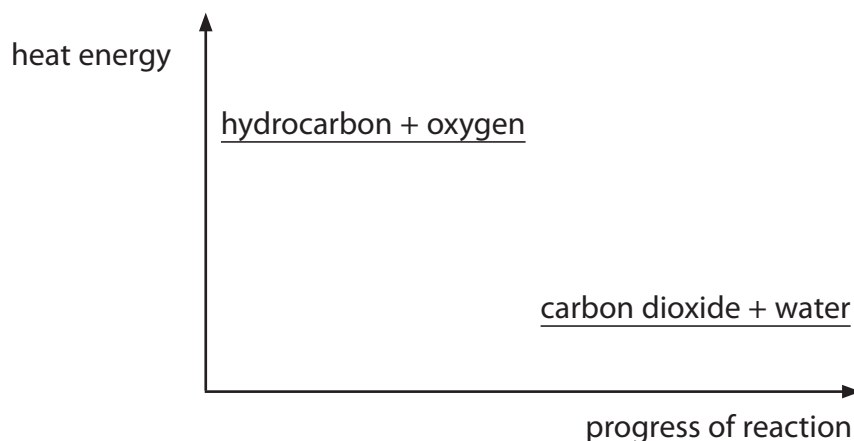
Write the balanced equation for this reaction.

(3)

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(d) In the catalytic converter, a hydrocarbon is converted to carbon dioxide and water.

The diagram shows the heat energies of the reactants and products in this reaction.



Explain what the diagram shows about the type of reaction occurring.

(2)

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(Total for Question 1 = 10 marks)

- 2 (a) An experiment is carried out to measure the temperature change when solid ammonium chloride is dissolved in water.

initial temperature of water = 19 °C
final temperature of solution = 15 °C

Explain what the temperature readings show about the type of heat change occurring when ammonium chloride dissolves in water.

(2)

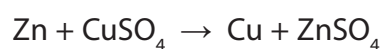
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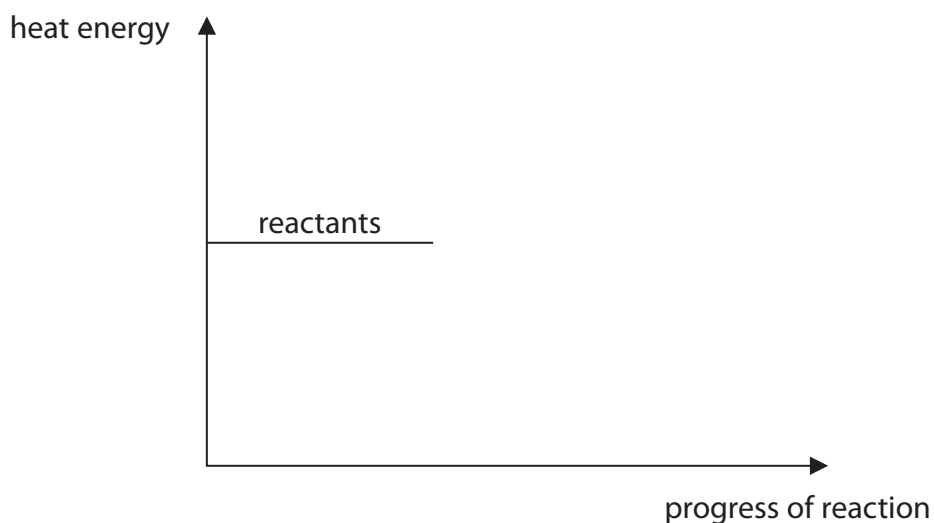
- (b) When zinc reacts with copper sulfate solution, copper and zinc sulfate solution are formed.



This reaction is exothermic.

Use this information to complete the diagram.

(2)



(c) Reactions are accompanied by heat changes.

The heat changes are the results of bonds being broken and bonds being formed.

Which row of the table shows the heat energy changes that occur when bonds are broken and when bonds are formed?

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

(1)

	bonds broken	bonds formed
<input checked="" type="checkbox"/> A	heat energy is released	heat energy is released
<input checked="" type="checkbox"/> B	heat energy is required	heat energy is required
<input checked="" type="checkbox"/> C	heat energy is released	heat energy is required
<input checked="" type="checkbox"/> D	heat energy is required	heat energy is released

*(d) Reactions can occur when particles collide.
Rates of reactions can be altered by changing conditions.

Explain how the rate of reaction between a solid and a liquid is altered by changing the size of the pieces of solid and by changing the temperature of the liquid.

(6)

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(Total for Question 2 = 11 marks)