

## Paper 1

Questions are applicable for both core and extended candidates

- 1 Which row describes the changes that occur when metals burn in oxygen?

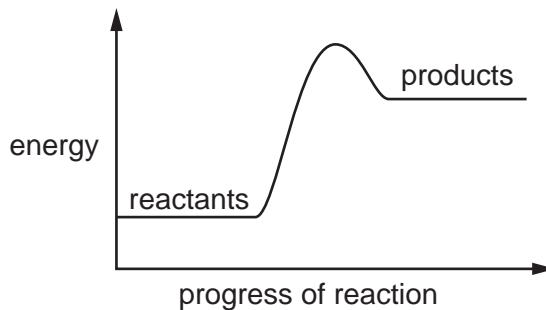
	temperature	metal
A	decreases	oxidised
B	decreases	reduced
C	increases	oxidised
D	increases	reduced

- 2 When calcium carbonate is heated strongly, carbon dioxide gas is produced.

Which words describe the type of change that occurs?

- A endothermic and chemical
- B endothermic and physical
- C exothermic and chemical
- D exothermic and physical

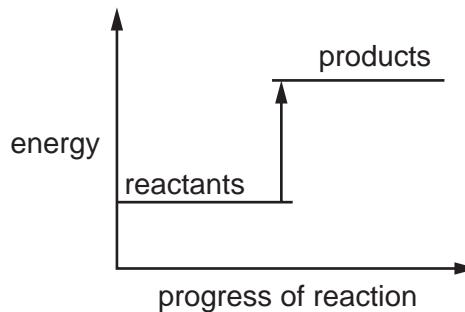
- 3 A reaction pathway diagram is shown.



Which statement about this reaction is correct?

- A The reaction rate increases during the reaction.
- B The reaction is endothermic.
- C The reaction transfers thermal energy to the surroundings.
- D The temperature of the surroundings increases.

4 The reaction pathway diagram for a reaction is shown.



Which statements are correct?

- 1 The reaction is exothermic.
- 2 The reaction is endothermic.
- 3 The temperature of the surroundings increases.
- 4 The temperature of the surroundings decreases.

**A** 1 and 3

**B** 1 and 4

**C** 2 and 3

**D** 2 and 4

5 Which change of state is an exothermic process?

**A** condensation

**B** evaporation

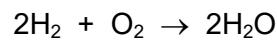
**C** melting

**D** sublimation

6 Which row describes the changes that occur in an endothermic reaction?

	energy change	temperature
<b>A</b>	energy given out to the surroundings	decreases
<b>B</b>	energy given out to the surroundings	increases
<b>C</b>	energy taken in from the surroundings	decreases
<b>D</b>	energy taken in from the surroundings	increases

7 The equation for the reaction when hydrogen is used as a fuel is shown.



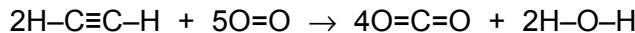
Which statement about this reaction is correct?

- A Energy is given out so the temperature of the surroundings decreases.
- B Energy is taken in so the temperature of the surroundings increases.
- C The reaction is endothermic so the temperature of the surroundings decreases.
- D The reaction is exothermic so the temperature of the surroundings increases.

## Paper 2

Questions are applicable for both core and extended candidates  
unless indicated in the question

- 8 Which statement defines the activation energy,  $E_a$ , for a reaction? (extended only)
- A It is the minimum energy that colliding particles must have to react.
- B It is the minimum energy that endothermic reactions take in from their surroundings.
- C It is the maximum energy that exothermic reactions transfer to their surroundings.
- D It is the maximum energy released when the bonds in the products of a reaction form.
- 9 The equation for the complete combustion of ethyne, H–C≡C–H, is shown.



The bond energies are listed. (extended only)

bond	bond energy in kJ/mol
C≡C	837
C–H	415
O=O	498
C=O	805
O–H	464

What is the enthalpy change of the reaction when 1 mol of ethyne is completely burned?  
(extended only)

- A  $-2472 \text{ kJ/mol}$
- B  $-1236 \text{ kJ/mol}$
- C  $+1236 \text{ kJ/mol}$
- D  $+2472 \text{ kJ/mol}$

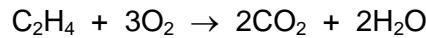
- 10 When powdered sodium carbonate and aqueous ethanoic acid are mixed, the temperature of the mixture falls.

Which statement about this reaction is correct? **(extended only)**

- A The reaction is endothermic and  $\Delta H$  is negative.
- B The reaction is endothermic and  $\Delta H$  is positive.
- C The reaction is exothermic and  $\Delta H$  is negative.
- D The reaction is exothermic and  $\Delta H$  is positive.

- 11 Ethene gas,  $C_2H_4$ , is completely burned in excess oxygen to form carbon dioxide and water.

The equation for this exothermic reaction is shown.



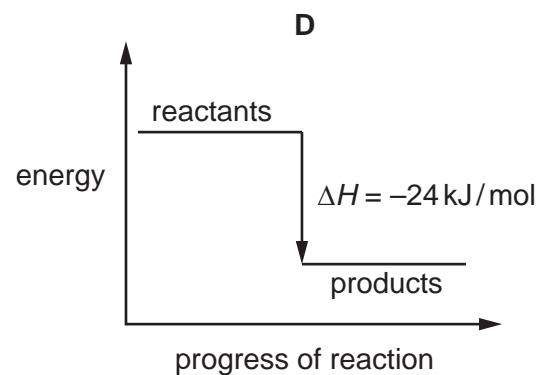
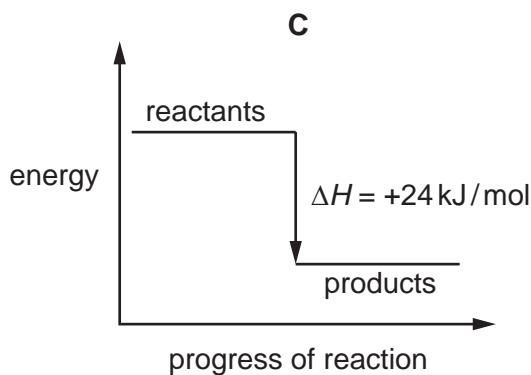
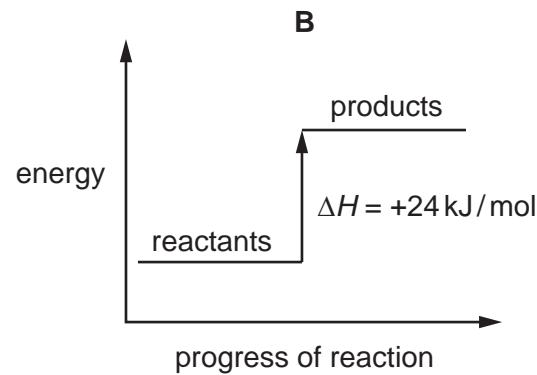
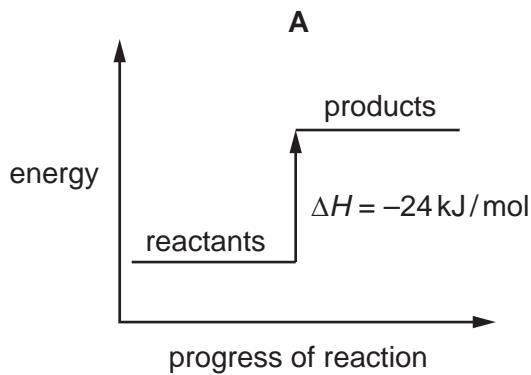
The table shows the bond energies involved in the reaction. **(extended only)**

bond	bond energy in kJ/mol
$C=C$	614
$C-H$	413
$O=O$	495
$C=O$	799
$O-H$	467

What is the total energy change in this reaction? **(extended only)**

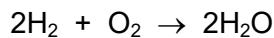
- A  $-954\text{ kJ/mol}$
- B  $-1010\text{ kJ/mol}$
- C  $-1313\text{ kJ/mol}$
- D  $-1369\text{ kJ/mol}$

12 Which reaction pathway diagram represents an endothermic reaction? (extended only)



**13** Hydrogen burns in oxygen.

The equation for the reaction is shown.



The table shows the bond energies involved. **(extended only)**

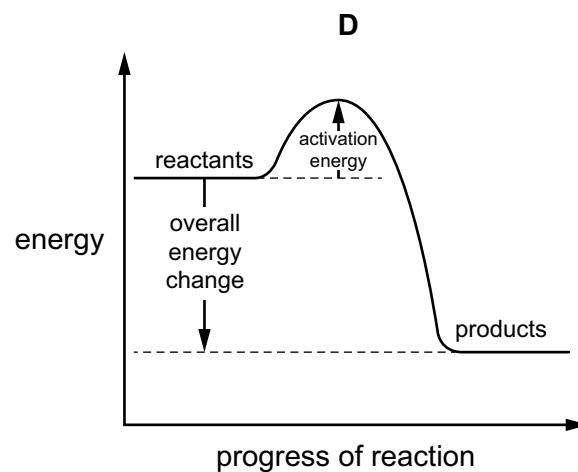
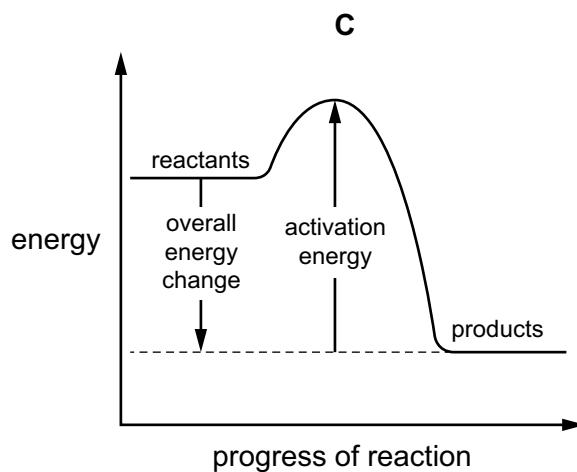
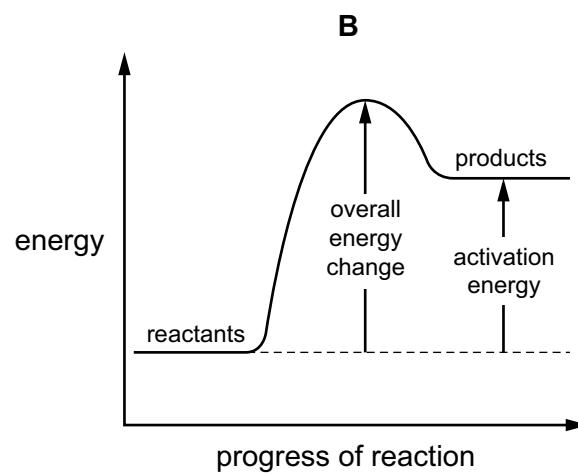
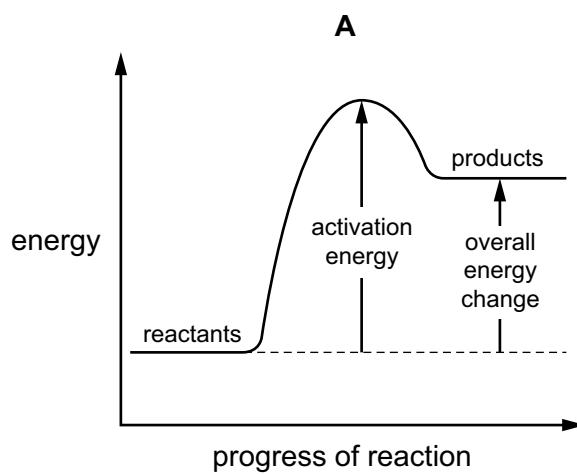
bond	bond energy in kJ/mol
H–H	436
O=O	498
O–H	464

What is the energy given out during the reaction? **(extended only)**

- A** –3226 kJ/mol
- B** –884 kJ/mol
- C** –486 kJ/mol
- D** –442 kJ/mol

14 Which diagram is a correctly labelled reaction pathway diagram for an endothermic reaction?

(extended only)



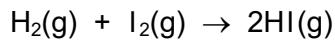
15 Which row describes the changes that occur in an endothermic reaction?

	energy change	temperature
<b>A</b>	energy given out to the surroundings	decreases
<b>B</b>	energy given out to the surroundings	increases
<b>C</b>	energy taken in from the surroundings	decreases
<b>D</b>	energy taken in from the surroundings	increases

16 Which statement about endothermic and exothermic reactions is correct? **(extended only)**

- A In an endothermic reaction, less energy is absorbed in bond breaking than is released in bond forming.
- B In an endothermic reaction, the activation energy is always higher than in an exothermic reaction.
- C In an exothermic reaction, more energy is absorbed in bond breaking than is released in bond forming.
- D In an exothermic reaction, the reactants are higher on an energy level diagram than the products.

17 The equation for the reaction between gaseous hydrogen and gaseous iodine to form gaseous hydrogen iodide is shown.

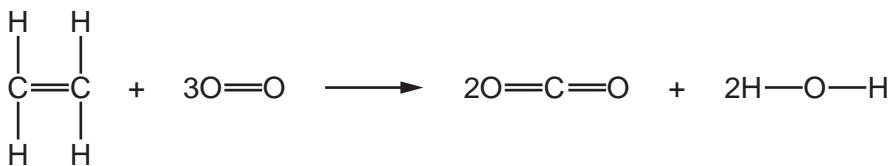


The reaction is exothermic.

Which statement explains why the reaction is exothermic? **(extended only)**

- A Energy is released when H–H and I–I bonds are broken.
- B The bond energies of the reactants are larger than the bond energies of the products.
- C The products are at a higher energy level than the reactants.
- D More energy is released when two HI bonds are formed than is used when the H–H and I–I bonds are broken.

18 Ethene can undergo complete combustion, as shown.



Some bond energies are given in the table. **(extended only)**

bond	bond energy in kJ/mol
C=C	612
C—H	412
O—H	463
O=O	496

The energy change of the reaction is  $-1408 \text{ kJ/mol}$ .

What is the bond energy of the C=O bond in  $\text{CO}_2$ ? **(extended only)**

- A 454 kJ/mol      B 673 kJ/mol      C 826 kJ/mol      D 1619 kJ/mol