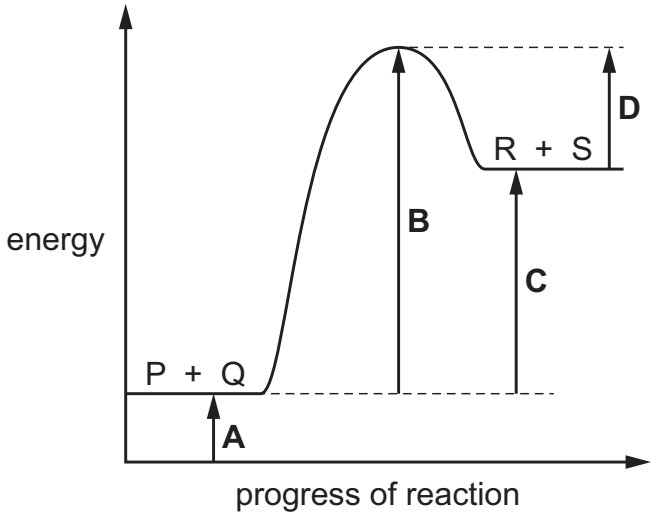
16 The reaction pathway diagram for the reaction between P and Q to form R and S is shown.

Which letter represents the enthalpy change for the reaction?



14 Information about two reactions is given.

- The neutralisation reaction between citric acid and sodium hydrogencarbonate is endothermic.
- The displacement reaction between magnesium and carbon dioxide is exothermic.

Which statements about the two reactions are correct?

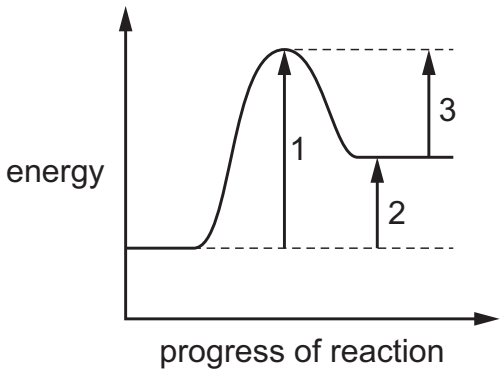
1 The energy of the products formed in the neutralisation reaction is greater than the energy of the reactants.

2 The energy of magnesium and carbon dioxide is greater than the energy of magnesium oxide and carbon.

3 In an exothermic reaction, the energy required to break the bonds is greater than the energy released when the new bonds are formed.

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

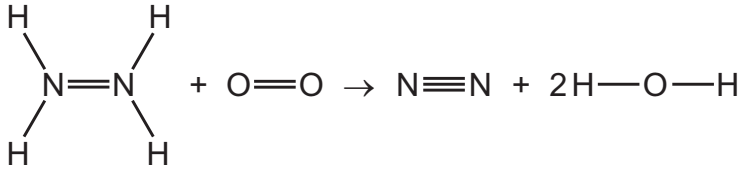
15 The reaction pathway diagram for a reaction is shown.



Which row identifies the activation energy, E_a, and the enthalpy change, ΔH, for this reaction?

	E_a	ΔH
A	1	2
B	1	3
C	2	3
D	3	1

14 The equation for the combustion of hydrazine, N_2H_4, is shown.



bond	bond energy in kJ / mol
N–H	391
N=N	409
N≡N	944
O–H	463
O=O	496

What is the overall enthalpy change for the combustion of one mole of hydrazine?

A –327 kJ / mol

B –111 kJ / mol

C +111 kJ / mol

D +327 kJ / mol

15 Dissolving ammonium chloride in water is an endothermic change.

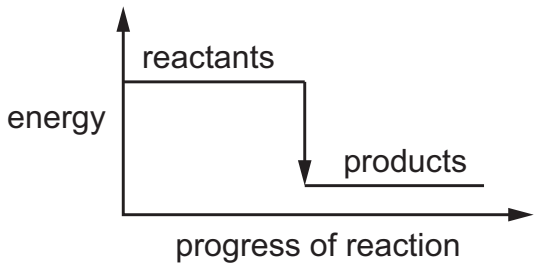
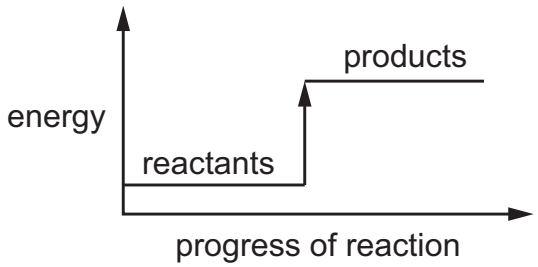
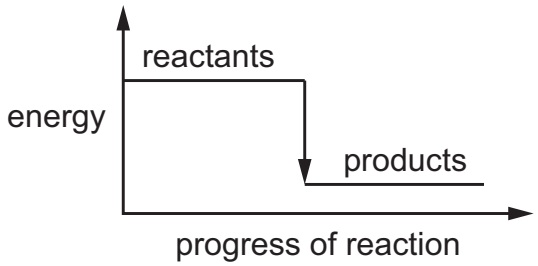
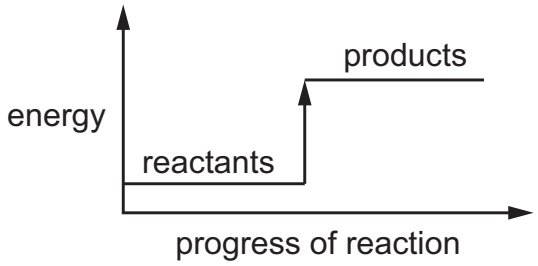
Which row shows the energy change and temperature change of the mixture during the dissolving of ammonium chloride?

	energy change	temperature change
A	energy is absorbed	decrease
B	energy is absorbed	increase
C	energy is released	decrease
D	energy is released	increase

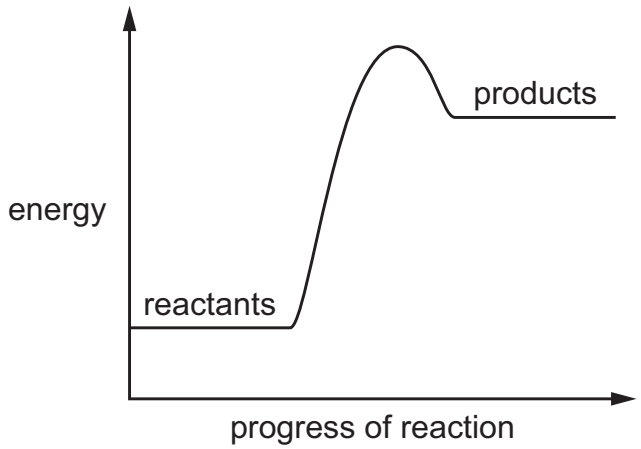
13 Water is added to anhydrous copper(II) sulfate in a test-tube.

The mixture becomes hot.

Which type of reaction and reaction pathway diagram apply to this reaction?

	type of reaction	reaction pathway diagram
A	endothermic	
B	endothermic	
C	exothermic	
D	exothermic	

13 A reaction pathway diagram is shown.



Which row identifies the type of reaction and how the temperature of the surroundings changes during the reaction?

	type of reaction	temperature of the surroundings
A	endothermic	decreases
B	endothermic	increases
C	exothermic	decreases
D	exothermic	increases

14 The average bond energy for the C–H bond is 413 kJ / mol.

What is the enthalpy change when 1.0 mol of methane molecules is formed from carbon and hydrogen atoms?

A –1652 kJ **B** –413 kJ **C** +413 kJ **D** +1652 kJ

11 Two statements about hydrogen are listed.

1 Hydrogen is used as a fuel.

2 When hydrogen burns in the air to form water, thermal energy is produced.

Which conclusion about these statements is correct?

A Both statements are correct, and statement 2 explains statement 1.

B Both statements are correct, but statement 2 does **not** explain statement 1.

C Statement 1 is correct, but statement 2 is **not** correct.

D Statement 2 is correct, but statement 1 is **not** correct.

13 Which row describes an exothermic reaction?

	sign of enthalpy change, ΔH	temperature of the surroundings
A	positive	decreases
B	positive	increases
C	negative	decreases
D	negative	increases