



IGCSE Chemistry

CHEMICAL ENERGETICS

0620-MCQ

2026 EDITION

Q1

0620/23/M/J/25/Q11

Exothermic reactions - Easy

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.

Q2

0620/21/O/N/22/Q11

Exothermic reactions - Easy

11 When an acid is added to an alkali, the temperature of the reaction mixture rises.

Which words describe this reaction?

- A decomposition and endothermic
- B decomposition and exothermic
- C neutralisation and endothermic
- D neutralisation and exothermic

Q3

0620/22/O/N/23/Q12

Exothermic reactions - Hard

12 The initial and final temperatures of four different reactions are measured.

Which reaction is the **least** exothermic?

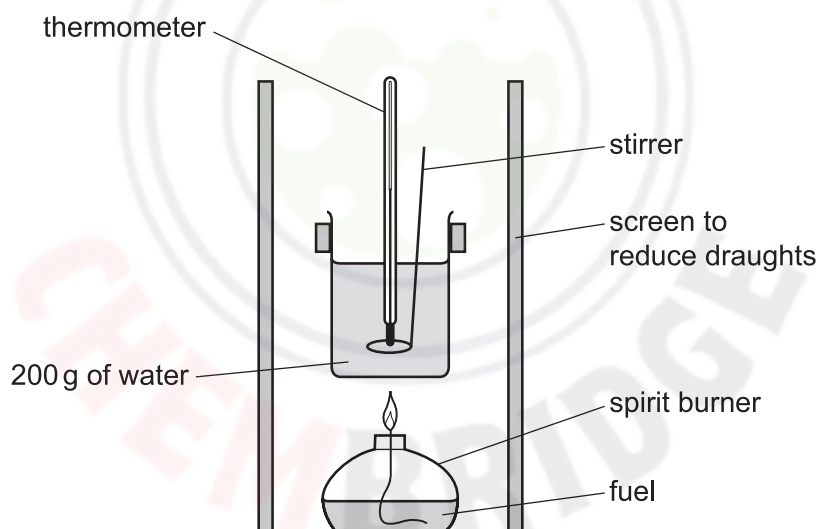
	initial temperature / °C	final temperature / °C
A	19	25
B	21	18
C	22	17
D	22	26

Q4

0620/22/M/J/21/Q12

Exothermic reactions - Hard

12 Four different fuels are used to heat a beaker of water, for the same amount of time, using the apparatus shown.



The initial temperature of the water and the temperature after heating by the fuel are recorded.

Which fuel releases the most heat energy?

	initial temperature / °C	temperature after heating / °C
A	17	46
B	24	52
C	26	61
D	30	62

Q5

0620/22/O/N/25/Q15

Endothermic reactions - Easy

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

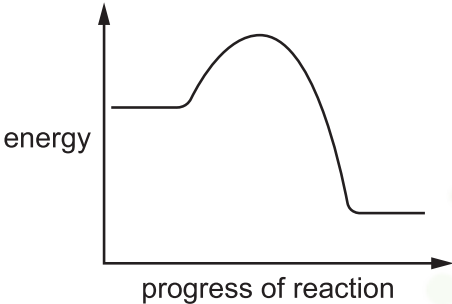
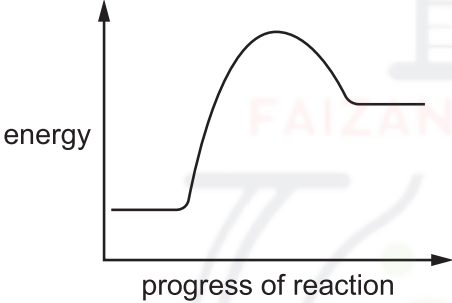
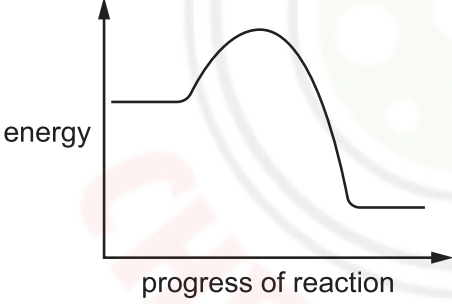
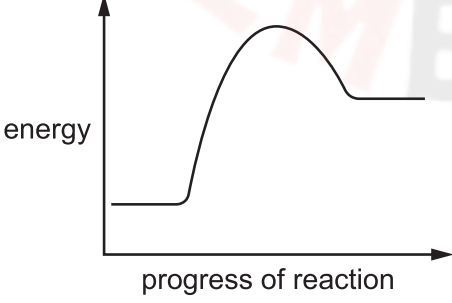


Q6

0620/22/F/M/21/Q13

Endothermic reactions - Hard

13 Which row describes an endothermic reaction?

	energy level diagram	energy transfer
A		energy is transferred from the surroundings to the reaction
B		energy is transferred from the surroundings to the reaction
C		energy is transferred from the reaction to the surroundings
D		energy is transferred from the reaction to the surroundings

Q7

0620/23/M/J/25/Q13

Enthalpy change, ΔH - Easy

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

Q8

0620/22/F/M/23/Q12

Enthalpy change, ΔH - Easy

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

Which statement about this reaction is correct?

- A The reaction is endothermic and ΔH is negative.
- B The reaction is endothermic and ΔH is positive.
- C The reaction is exothermic and ΔH is negative.
- D The reaction is exothermic and ΔH is positive.

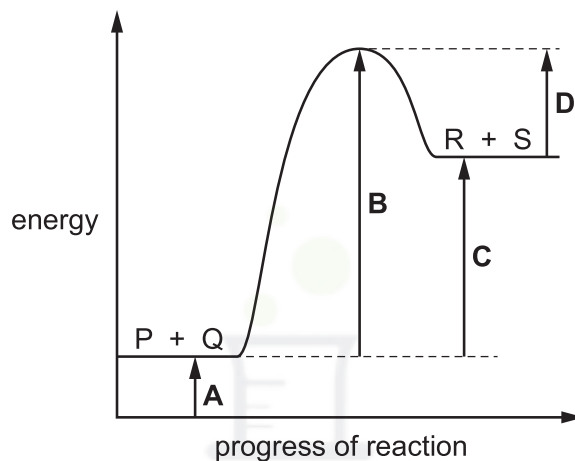
Q9

0620/22/F/M/25/Q16

Enthalpy change, ΔH - Easy

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?



Q10

0620/22/M/J/25/Q15

Enthalpy change, ΔH - Easy

15 Which statement describes the effect of adding a catalyst to a chemical reaction?

- A The activation energy, E_a , of the reaction is increased.
- B The enthalpy change, ΔH , of the reaction stays unchanged.
- C The frequency of collisions between the particles is decreased.
- D The kinetic energy of the particles is increased.

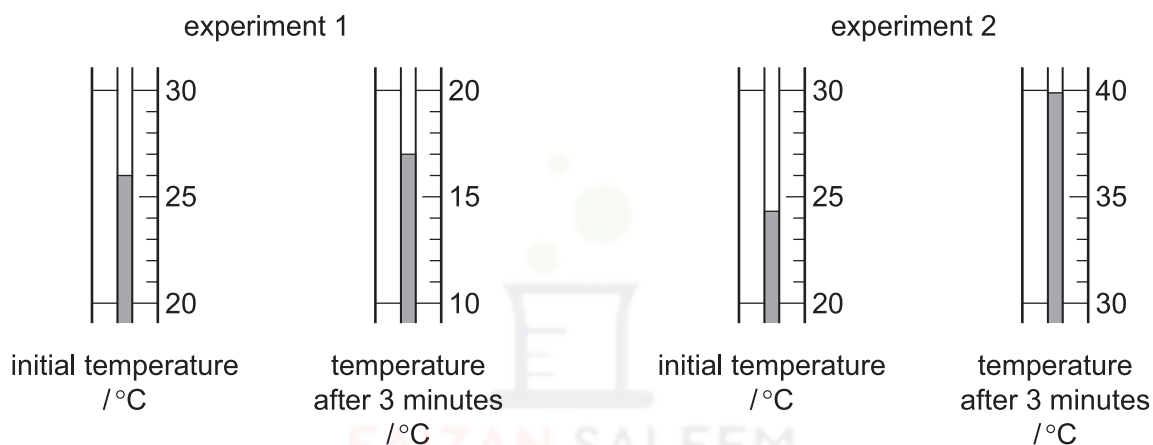
Q11

0620/23/M/J/24/Q13

Enthalpy change, ΔH - Hard

- 13 Two different experiments are done to find the enthalpy change, ΔH , of each reaction.

The temperature of each reaction mixture is measured at the beginning of the reaction and after 3 minutes.



Which row gives the correct sign for the value of ΔH for each experiment and identifies if the reaction is endothermic or exothermic?

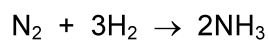
	experiment 1	experiment 2
A	negative and endothermic	positive and exothermic
B	negative and exothermic	positive and endothermic
C	positive and endothermic	negative and exothermic
D	positive and exothermic	negative and endothermic

Q12

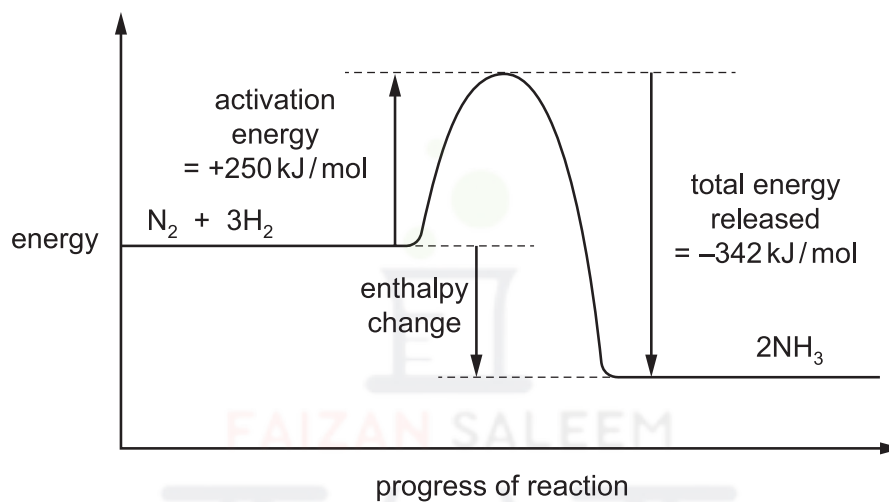
0620/22/O/N/24/Q14

Enthalpy change, ΔH - Hard

14 The equation for the formation of ammonia is shown.



The reaction pathway diagram for the reaction is shown.



What is the enthalpy change for the reaction?

- A -592 kJ/mol
- B -92 kJ/mol
- C +92 kJ/mol
- D +592 kJ/mol

Q13

0620/22/F/M/24/Q14

Activation energy, E_a - Easy

- 14 Which statement defines the activation energy, E_a , for a reaction?
- 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.

Q14

0620/22/M/J/23/Q12

Activation energy, E_a - Easy

- 12 Which change increases the rate of reaction by decreasing the activation energy, E_a ?
- A addition of a catalyst
 - B decrease in size of solid reactants
 - C increase in concentration of solutions
 - D increase in temperature

Q15

0620/22/M/J/24/Q12

Activation energy, E_a - Hard

12 Three statements about activation energy, E_a , are listed.

- 1 Colliding particles must have at least E_a before they can react.
- 2 E_a for exothermic reactions is always greater than for endothermic reactions.
- 3 E_a is always endothermic.

Which statements are correct?

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

Q16

0620/21/M/J/23/Q12

Activation energy, E_a - Hard

12 Which row describes the effect on the activation energy and the frequency of particle collisions when the temperature of a chemical reaction is increased?

	activation energy	frequency of collisions
A	increases	increases
B	no change	increases
C	increases	no change
D	no change	no change

Q17

0620/23/O/N/22/Q30

Activation energy, E_a - Hard

30 Petrol-fuelled cars produce oxides of nitrogen.

Which statement explains how oxides of nitrogen are formed?

- A In the catalytic converter, the elements nitrogen and oxygen combine.
- B Oxygen and nitrogen compounds in petrol combine in the car engine.
- C The high temperatures in the engine provide oxygen and nitrogen with the activation energy needed to react.
- D In the car engine, nitrogen compounds in petrol combine with oxygen.

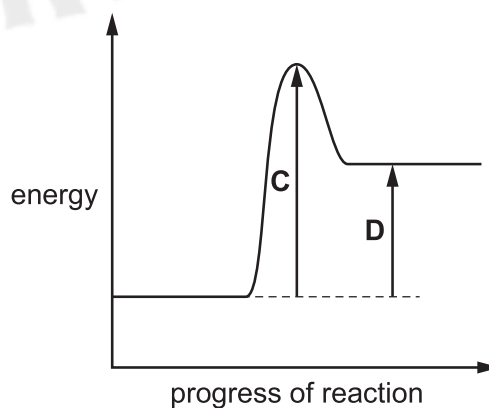
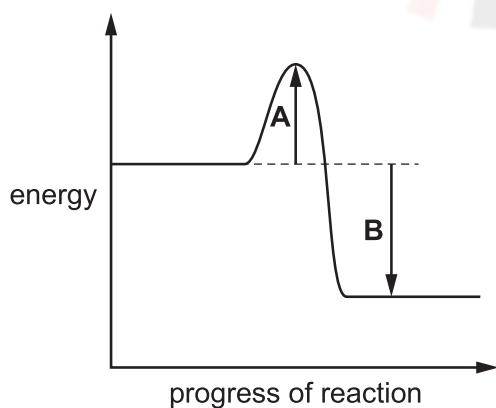
Q18

0620/21/O/N/24/Q14

Activation energy, E_a - Hard

14 Two reaction pathway diagrams are shown.

Which arrow represents the activation energy for a reaction which releases thermal energy?



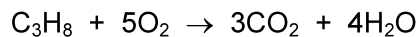
Q19

0620/21/M/J/21/Q12

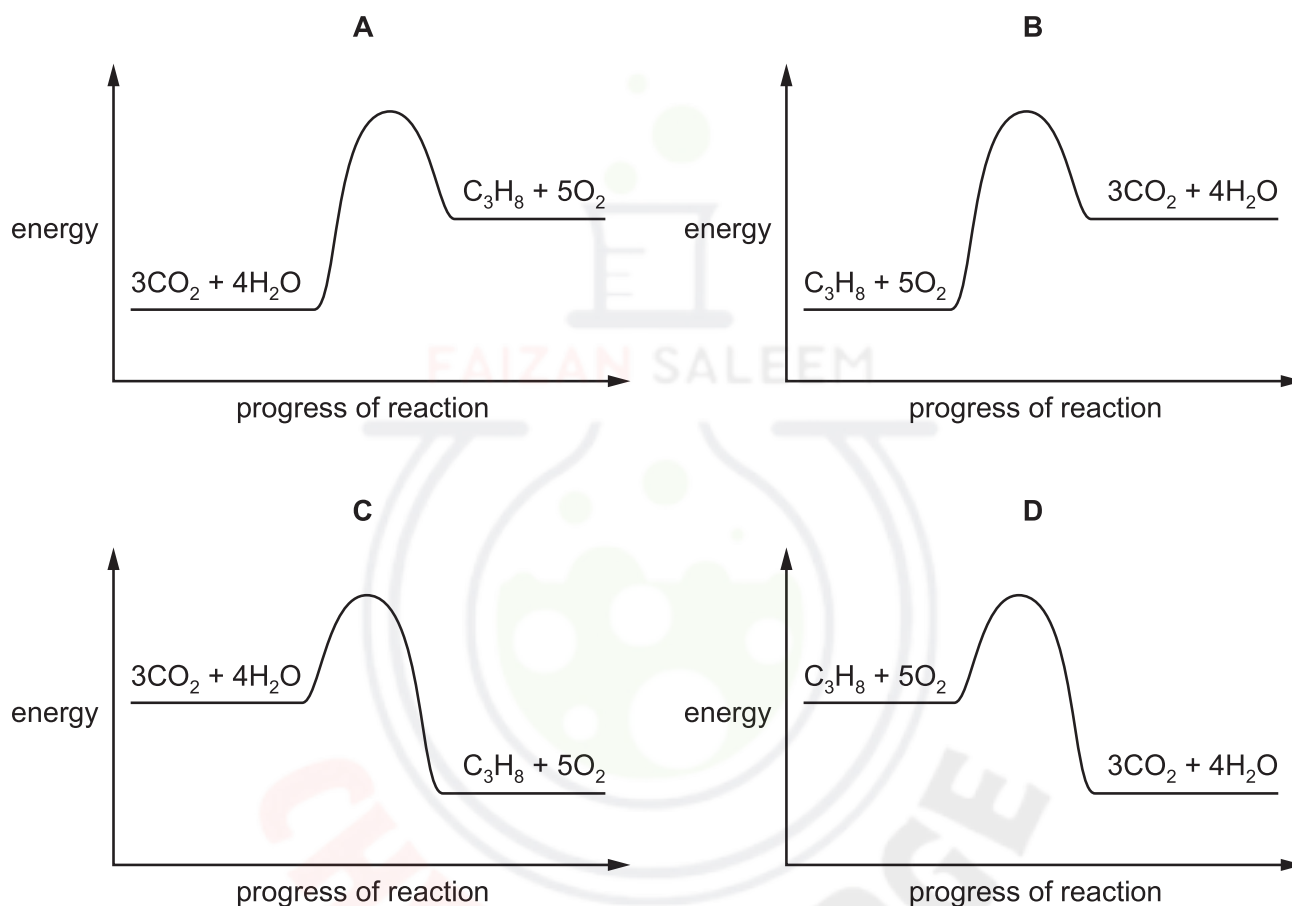
Reaction pathway diagrams - Easy

12 The complete combustion of propane is exothermic.

The equation for this reaction is shown.



Which energy level diagram represents the complete combustion of propane?



Q20

0620/21/M/J/25/Q13

Reaction pathway diagrams - Easy

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?

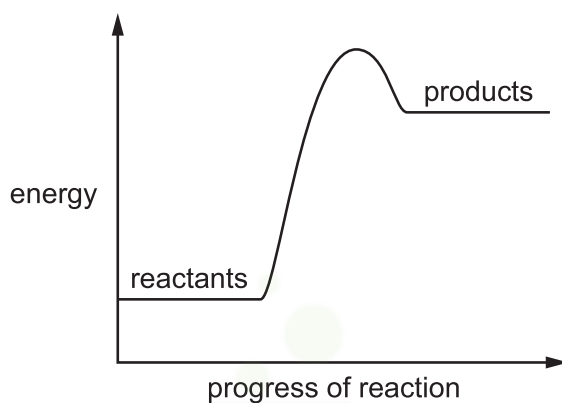
	type of reaction	reaction pathway diagram
A	endothermic	
B	endothermic	
C	exothermic	
D	exothermic	

Q21

0620/22/M/J/25/Q13

Reaction pathway diagrams - Easy

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?

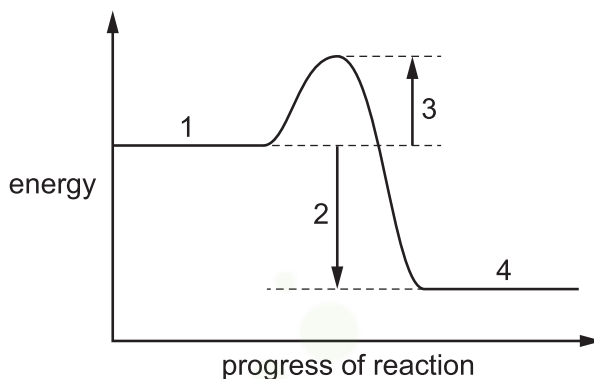
	type of reaction	temperature of the surroundings
A	endothermic	decreases
B	endothermic	increases
C	exothermic	decreases
D	exothermic	increases

Q22

0620/23/M/J/23/Q12

Reaction pathway diagrams - Easy

12 The reaction pathway diagram for an exothermic reaction is shown.



Which row identifies labels 1, 2, 3 and 4?

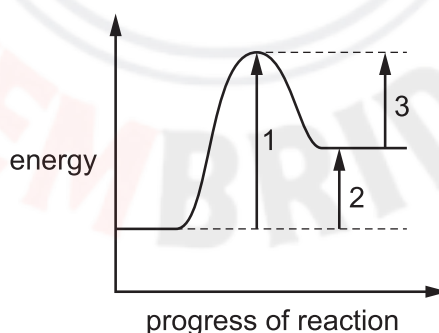
	1	2	3	4
A	reactants	ΔH	E_a	products
B	products	ΔH	E_a	reactants
C	reactants	E_a	ΔH	products
D	products	E_a	ΔH	reactants

Q23

0620/21/O/N/25/Q15

Reaction pathway diagrams - Easy

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

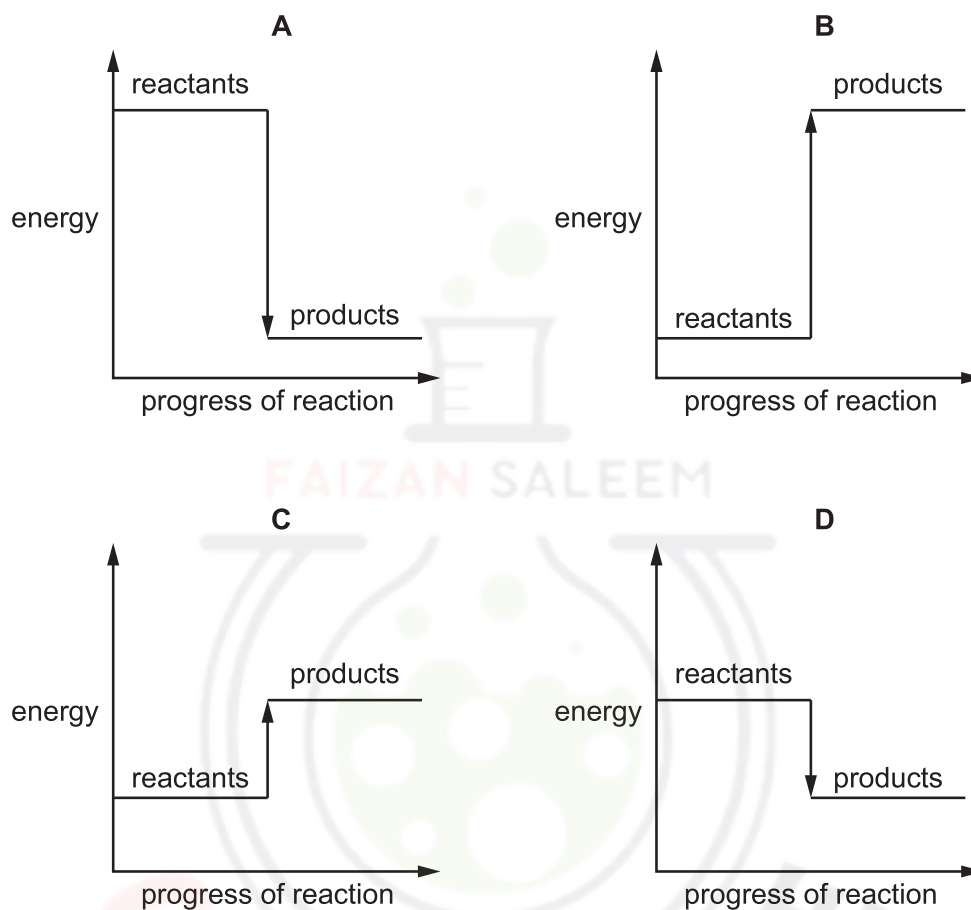
Q24

0620/21/M/J/24/Q16

Reaction pathway diagrams - Hard

16 Which reaction pathway diagram shows the reaction that will give out the most energy?

The scale on the y-axis is the same in each diagram.

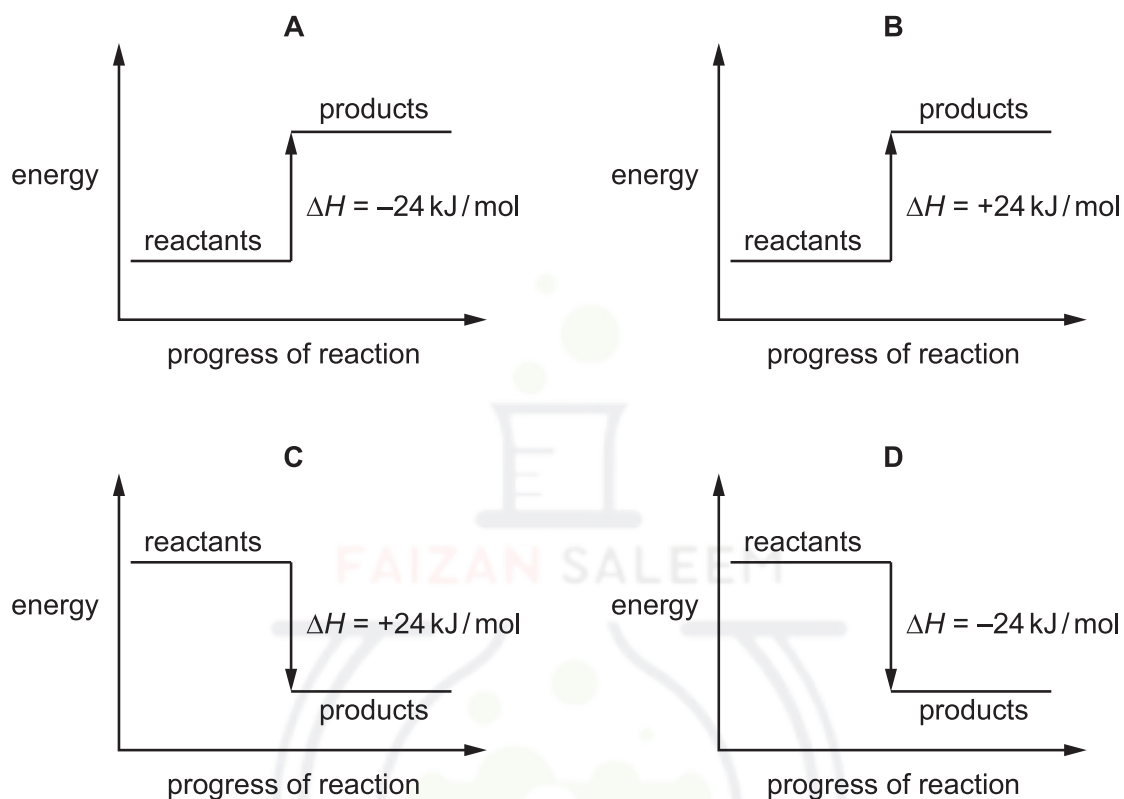


Q25

0620/21/O/N/23/Q10

Reaction pathway diagrams - Hard

10 Which reaction pathway diagram represents an endothermic reaction?

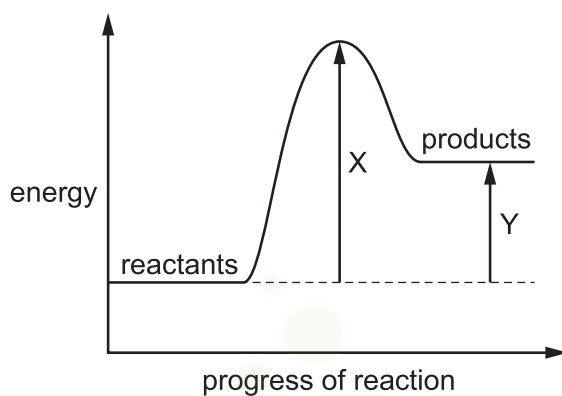


Q26

0620/23/M/J/25/Q14

Reaction pathway diagrams - Hard

14 A reaction pathway diagram is shown.



Which row shows the correct labels for X and Y and the type of reaction taking place?

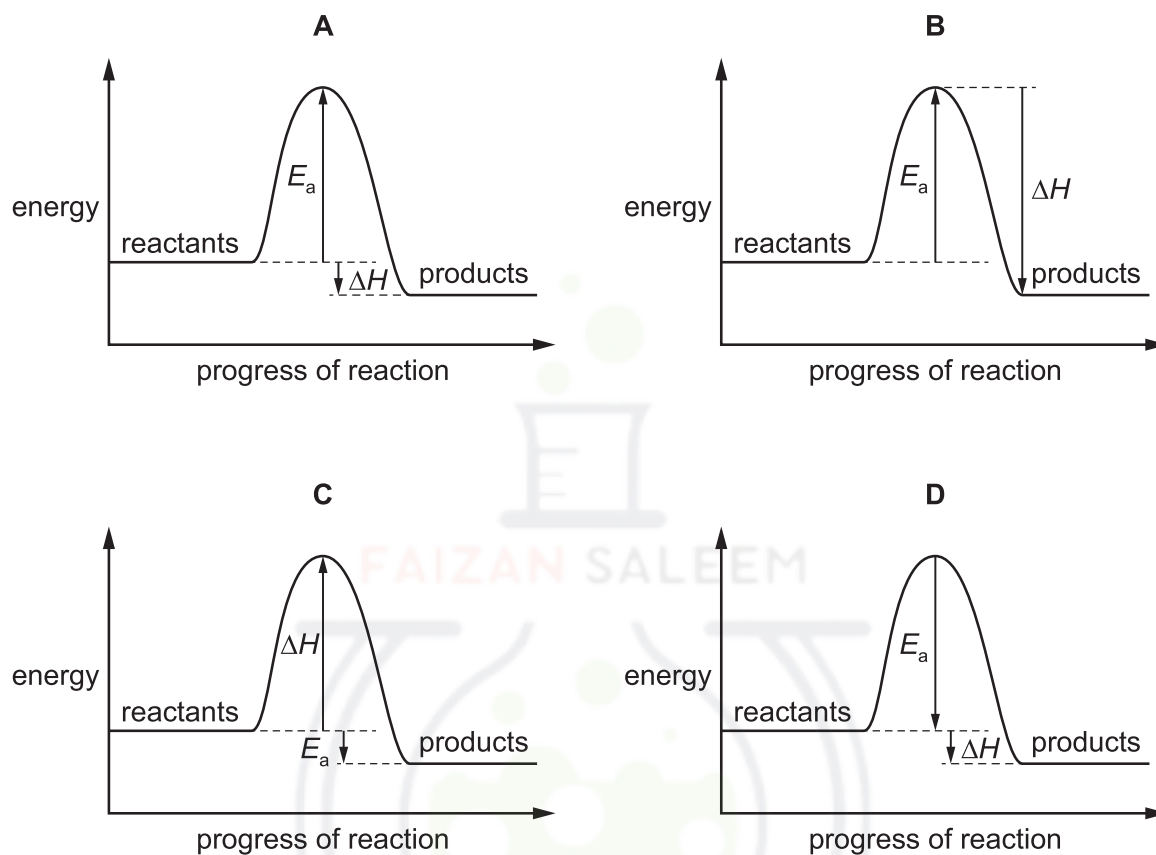
	X	Y	type of reaction
A	enthalpy change	activation energy	exothermic
B	activation energy	enthalpy change	endothermic
C	activation energy	enthalpy change	exothermic
D	enthalpy change	activation energy	endothermic

Q27

0620/23/O/N/24/Q14

Reaction pathway diagrams - Hard

14 Which reaction pathway diagram is correctly labelled?



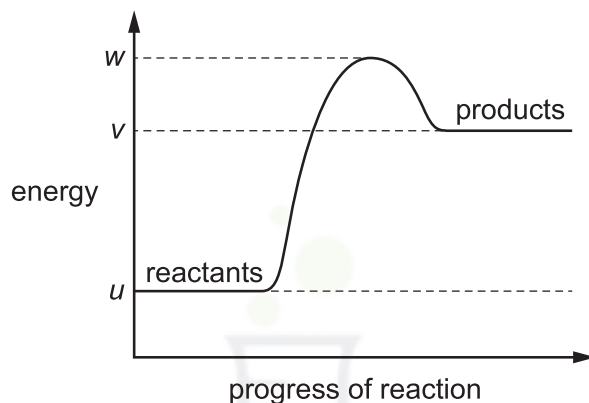
Q28

0620/23/M/J/24/Q14

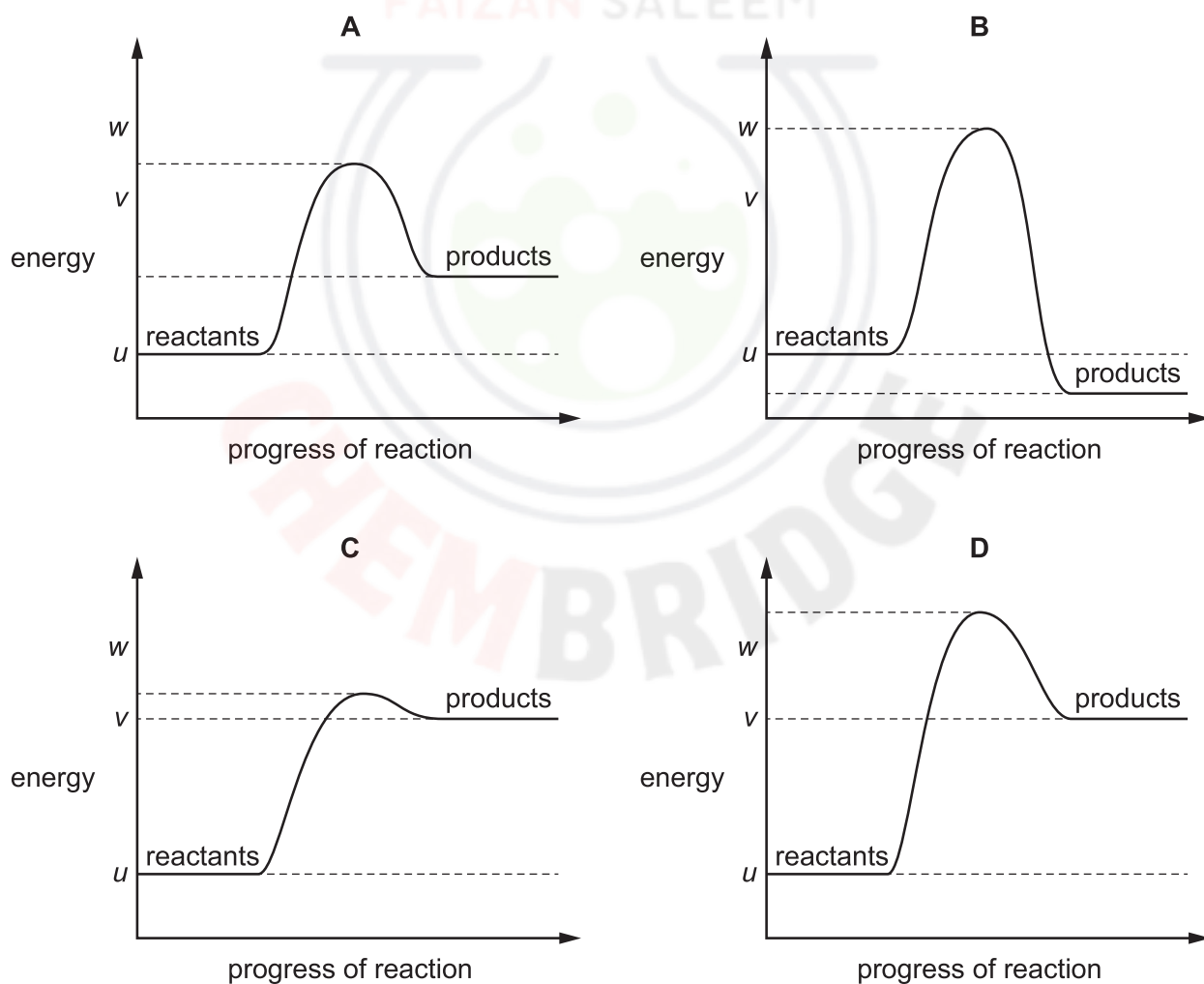
Reaction pathway diagrams - Hard

14 The reaction pathway diagram for an endothermic reaction is shown.

u , v and w are known energy values.



Which diagram shows the reaction pathway diagram when a catalyst is used in the reaction?

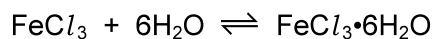


Q29

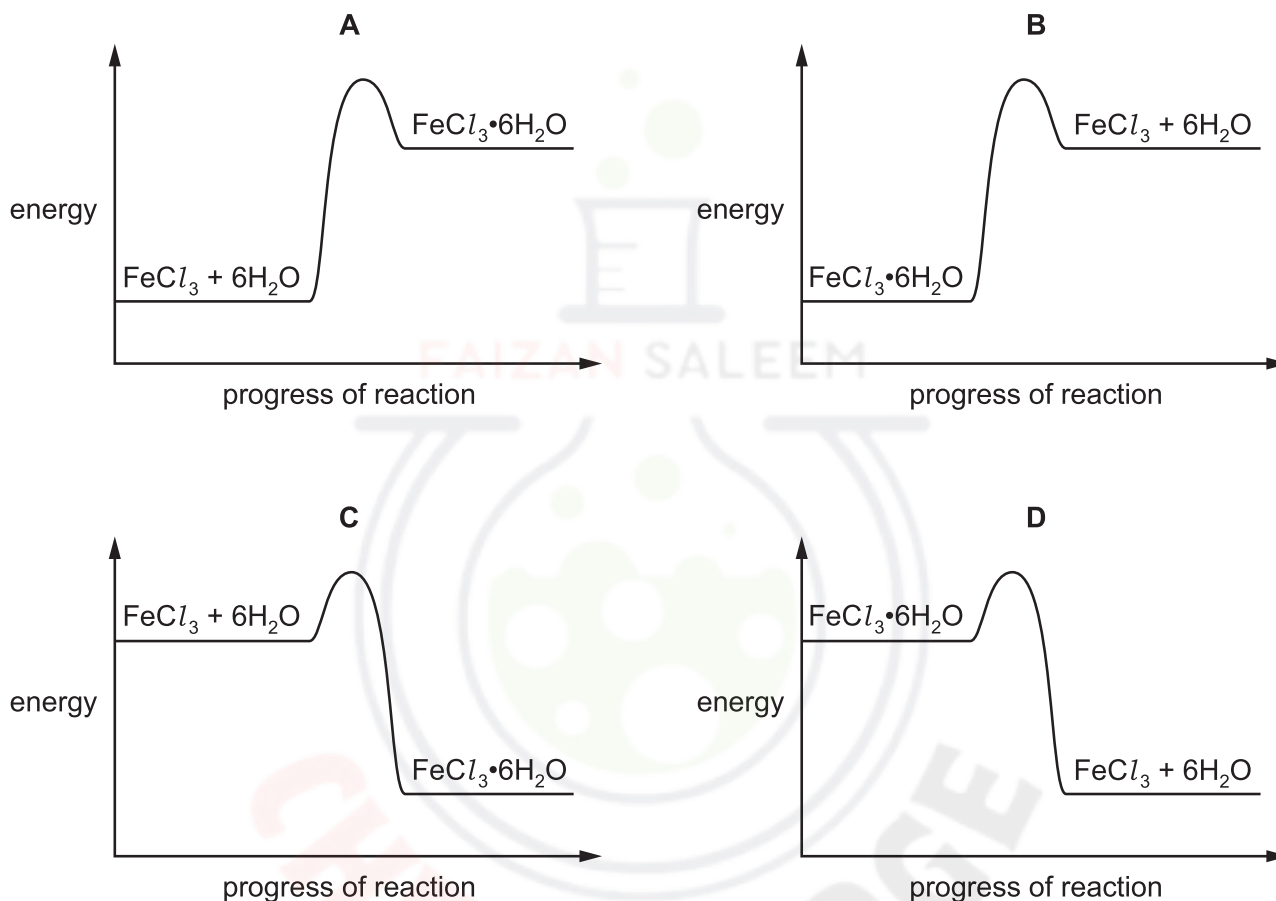
0620/23/O/N/23/Q13

Reaction pathway diagrams - Hard

- 13 When water is added to anhydrous iron(III) chloride, FeCl_3 , hydrated iron(III) chloride, $\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$, is formed and energy is given out.



Which reaction pathway diagram represents the formation of anhydrous iron(III) chloride in the **reverse** reaction?

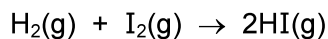


Q30

0620/21/M/J/22/Q13

Bond breaking and bond making - Easy

- 13 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?

- 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.

Q31

0620/23/M/J/24/Q12

Bond breaking and bond making - Easy

- 12 Plant cells use energy from sunlight for photosynthesis.

Which row describes and explains the energy change that occurs?

	type of energy change	explanation of energy change
A	endothermic	less energy is released making bonds than is absorbed to break bonds
B	endothermic	more energy is released making bonds than is absorbed to break bonds
C	exothermic	less energy is released making bonds than is absorbed to break bonds
D	exothermic	more energy is released making bonds than is absorbed to break bonds

Q32

0620/22/F/M/22/Q17

Bond breaking and bond making - Hard

17 Which statement about endothermic and exothermic reactions is correct?

- 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.

Q33

0620/22/O/N/23/Q13

Bond breaking and bond making - Hard

13 Which equation represents an endothermic reaction?

- A $\text{Cl}_2(\text{g}) \rightarrow 2\text{Cl}(\text{g})$
- B $\text{CH}_4(\text{g}) + 2\text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) + 2\text{H}_2\text{O}(\text{l})$
- C $\text{H}(\text{g}) + \text{H}(\text{g}) \rightarrow \text{H}_2(\text{g})$
- D $2\text{K}(\text{s}) + 2\text{H}_2\text{O}(\text{l}) \rightarrow 2\text{KOH}(\text{aq}) + \text{H}_2(\text{g})$

Q34

0620/23/O/N/24/Q15

Bond breaking and bond making - Hard

15 Which row describes a reaction where the overall energy change is exothermic?

	energy needed for breaking bonds / kJ	energy released by forming bonds / kJ	temperature of the surroundings
A	600	300	decreases
B	600	1200	decreases
C	900	300	increases
D	900	1200	increases

Q35

0620/21/O/N/25/Q14

Bond breaking and bond making - Hard

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

Q36

0620/23/O/N/25/Q16

Bond breaking and bond making - Hard

16 Which statement about reactions is correct?

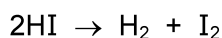
- A A reaction that is vigorous at room temperature has a high activation energy.
- B If ΔH for a reaction is positive, bond making in the formation of the products is endothermic.
- C In an exothermic reaction, the energy required to break bonds is less than the energy released to make bonds.
- D Reactions with a positive enthalpy change always transfer thermal energy to the surroundings.

Q37

0620/23/M/J/21/Q17

Bond energies - Easy

17 The equation for the decomposition of hydrogen iodide is shown.



Some bond energies are shown.

bond	bond energy in kJ/mol
H–H	440
I–I	150
H–I	300

What is the energy change for the reaction?

- A –290 kJ/mol B –10 kJ/mol C +10 kJ/mol D +290 kJ/mol

Q38

0620/22/M/J/21/Q20

Bond energies - Easy

20 The equation shows the reaction between hydrogen and oxygen.



The bond energies are shown.

	bond energy in kJ/mol
H–H	436
O=O	495
O–H	463

Which row shows the energy change and the type of reaction?

	energy change in kJ/mol	type of reaction
A	441	exothermic
B	441	endothermic
C	485	exothermic
D	485	endothermic

Q39

0620/22/M/J/25/Q14

Bond energies - Easy

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

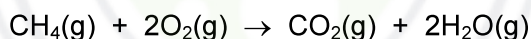
Q40

0620/22/M/J/23/Q11

Bond energies - Easy

11 Methane burns in excess oxygen.

The equation is shown.



Bond energies are shown.

bond	bond energy in kJ/mol
C=O	805
C–H	410
O=O	496
O–H	460

What is the energy change for the reaction?

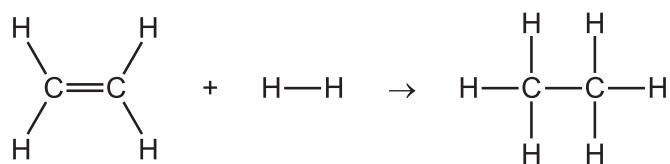
- A $(4 \times 410 + 2 \times 496) - (2 \times 805 + 4 \times 460)$
B $(2 \times 805 + 4 \times 460) - (4 \times 410 + 2 \times 496)$
C $(410 + 2 \times 496) - (805 + 2 \times 460)$
D $(410 + 496) - (805 + 460)$

Q41

0620/23/O/N/25/Q17

Bond energies - Hard

17 Ethene reacts with hydrogen to form ethane.



The bond energies are shown in the table.

bond	bond energy in kJ/mol
C—C	+350
C—H	+410
H—H	+436
C=C	+614

What is the enthalpy change for the reaction?

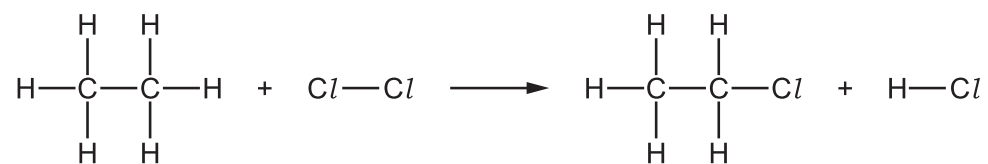
- A −290 kJ/mol
- B −120 kJ/mol
- C +120 kJ/mol
- D +290 kJ/mol

Q42

0620/21/O/N/21/Q11

Bond energies - Hard

11 Chlorine reacts with ethane to produce chloroethane and hydrogen chloride.



The reaction is exothermic.

The bond energies are shown in the table.

bond	bond energy in kJ/mol
C-Cl	+340
C-C	+350
C-H	+410
Cl-Cl	+240
H-Cl	+430

What is the energy change for the reaction?

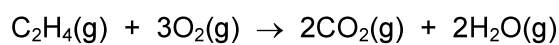
- A -1420 kJ/mol
- B -120 kJ/mol
- C +120 kJ/mol
- D +1420 kJ/mol

Q43

0620/23/M/J/23/Q13

Bond energies - Hard

13 The equation for the complete combustion of ethene is shown.



Some bond energies are listed.

bond	bond energy in kJ/mol
C–H	412
C–C	348
C=C	612
C–O	360
C=O	743
O–O	146
O=O	496
O–H	463

What is the overall energy change when one mole of ethene is completely burned?

A –456

B –1076

C –1340

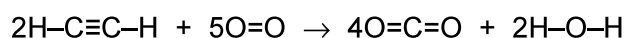
D –2126

Q44

0620/22/F/M/24/Q15

Bond energies - Hard

15 The equation for the complete combustion of ethyne, $\text{H}-\text{C}\equiv\text{C}-\text{H}$, is shown.



The bond energies are listed.

bond	bond energy in kJ/mol
$\text{C}\equiv\text{C}$	837
$\text{C}-\text{H}$	415
$\text{O}=\text{O}$	498
$\text{C}=\text{O}$	805
$\text{O}-\text{H}$	464

What is the enthalpy change of the reaction when 1 mol of ethyne is completely burned?

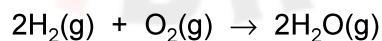
- A -2472 kJ/mol
- B -1236 kJ/mol
- C +1236 kJ/mol
- D +2472 kJ/mol

Q45

0620/21/M/J/24/Q15

Bond energies - Hard

15 The reaction between hydrogen and oxygen releases 486 kJ/mol of energy.



The bond energy of $\text{H}-\text{H}$ is 436 kJ/mol and that of $\text{H}-\text{O}$ is 464 kJ/mol.

What is the bond energy of $\text{O}=\text{O}$?

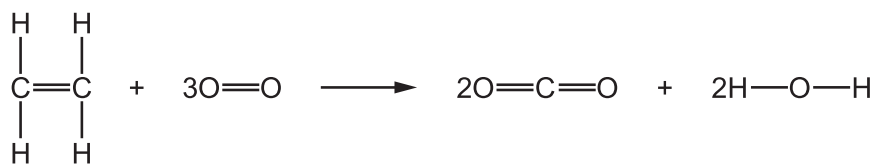
- A 430 kJ/mol
- B 458 kJ/mol
- C 498 kJ/mol
- D 984 kJ/mol

Q46

0620/21/O/N/22/Q13

Bond energies - Hard

13 Ethene can undergo complete combustion, as shown.



Some bond energies are given in the table.

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 kJ/mol.

What is the bond energy of the C=O bond in CO_2 ?

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

MARKING SCHEME

Q	Ans	Paper reference
Q1	A	0620/23/M/J/25/Q11
Q2	D	0620/21/O/N/22/Q11
Q3	D	0620/22/O/N/23/Q12
Q4	C	0620/22/M/J/21/Q12
Q5	A	0620/22/O/N/25/Q15
Q6	B	0620/22/F/M/21/Q13
Q7	D	0620/23/M/J/25/Q13
Q8	B	0620/22/F/M/23/Q12
Q9	C	0620/22/F/M/25/Q16
Q10	B	0620/22/M/J/25/Q15
Q11	C	0620/23/M/J/24/Q13
Q12	B	0620/22/O/N/24/Q14
Q13	A	0620/22/F/M/24/Q14
Q14	A	0620/22/M/J/23/Q12
Q15	C	0620/22/M/J/24/Q12
Q16	B	0620/21/M/J/23/Q12
Q17	C	0620/23/O/N/22/Q30
Q18	A	0620/21/O/N/24/Q14
Q19	D	0620/21/M/J/21/Q12
Q20	C	0620/21/M/J/25/Q13
Q21	A	0620/22/M/J/25/Q13
Q22	A	0620/23/M/J/23/Q12
Q23	A	0620/21/O/N/25/Q15
Q24	A	0620/21/M/J/24/Q16
Q25	B	0620/21/O/N/23/Q10
Q26	B	0620/23/M/J/25/Q14

MARKING SCHEME - CONTINUED

Q	Ans	Paper reference
Q27	A	0620/23/O/N/24/Q14
Q28	C	0620/23/M/J/24/Q14
Q29	B	0620/23/O/N/23/Q13
Q30	D	0620/21/M/J/22/Q13
Q31	A	0620/23/M/J/24/Q12
Q32	D	0620/22/F/M/22/Q17
Q33	A	0620/22/O/N/23/Q13
Q34	D	0620/23/O/N/24/Q15
Q35	B	0620/21/O/N/25/Q14
Q36	C	0620/23/O/N/25/Q16
Q37	C	0620/23/M/J/21/Q17
Q38	C	0620/22/M/J/21/Q20
Q39	A	0620/22/M/J/25/Q14
Q40	A	0620/22/M/J/23/Q11
Q41	B	0620/23/O/N/25/Q17
Q42	B	0620/21/O/N/21/Q11
Q43	B	0620/23/M/J/23/Q13
Q44	B	0620/22/F/M/24/Q15
Q45	C	0620/21/M/J/24/Q15
Q46	C	0620/21/O/N/22/Q13