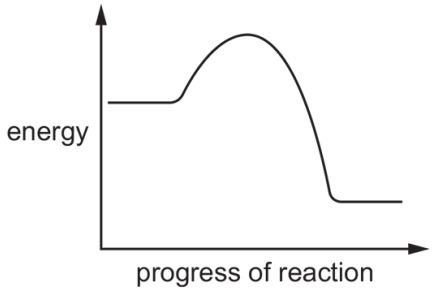
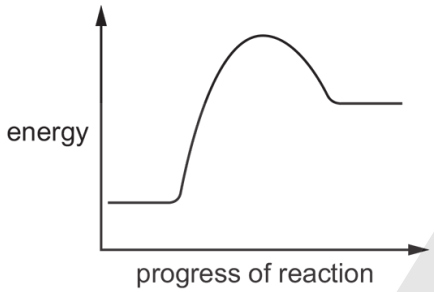
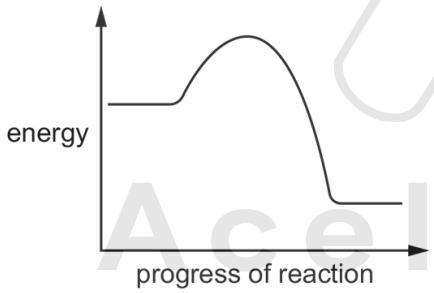
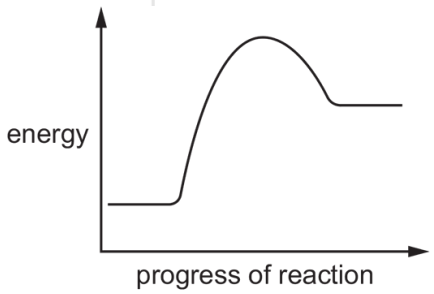
6.1 Energetics of a reaction

01. 0620_m21_qp_22 Q: 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

02. 0620_m21_qp_22 Q: 14

The equation for the complete combustion of methane is shown.

$$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(g)$$

The bond energies are shown in the table.

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

What is the energy change for the reaction?

A –818 kJ / mol **B** –359 kJ / mol **C** –323 kJ / mol **D** +102 kJ / mol

---

03. 0620_m21_qp_22 Q: 37

The formula of a hydrocarbon is C_xH_y.

The equation for its complete combustion is shown.

$$C_xH_y + 8O_2 \rightarrow 5CO_2 + 6H_2O$$

What are the values of x and y?

	x	y
A	5	6
B	5	12
C	6	5
D	12	5

---

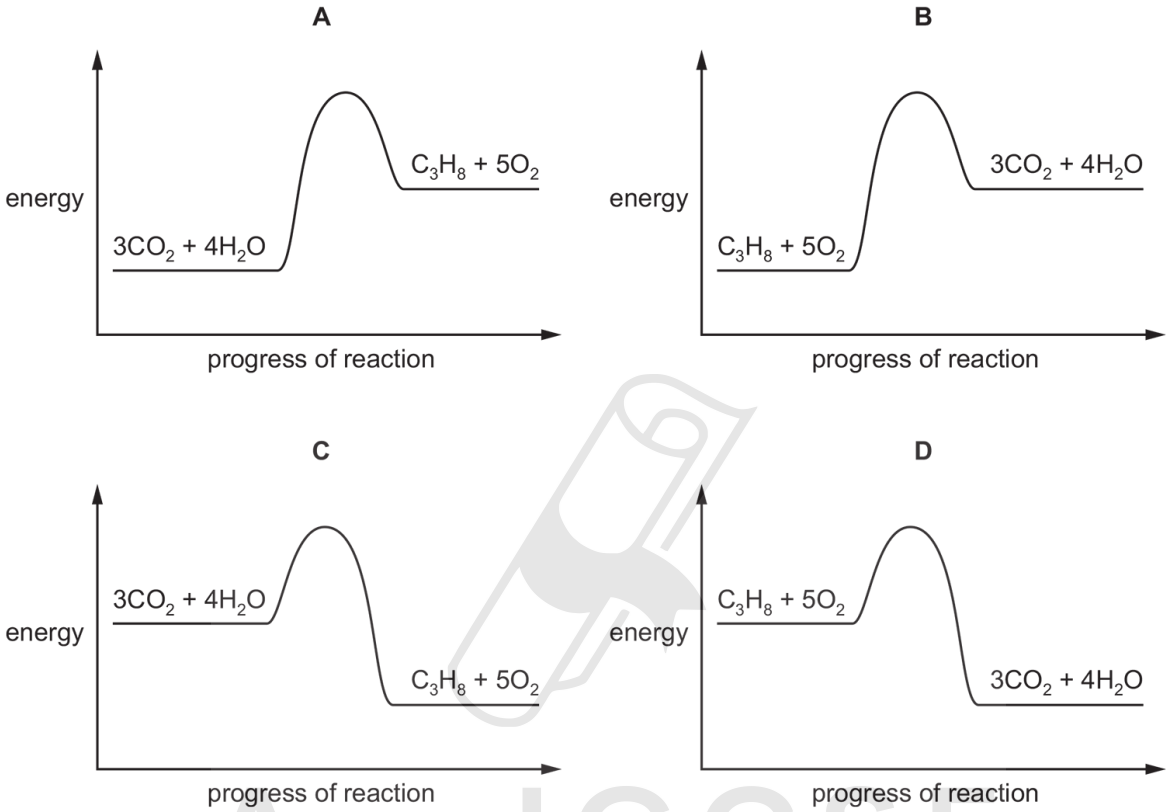
04. 0620_s21_qp_21 Q: 12

The complete combustion of propane is exothermic.

The equation for this reaction is shown.

$$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$$

Which energy level diagram represents the complete combustion of propane?



05. 0620_s21_qp_21 Q: 13

Which equation represents a reaction that takes place in a fuel cell?

A $C + O_2 \rightarrow CO_2$

B $2H_2 + O_2 \rightarrow 2H_2O$

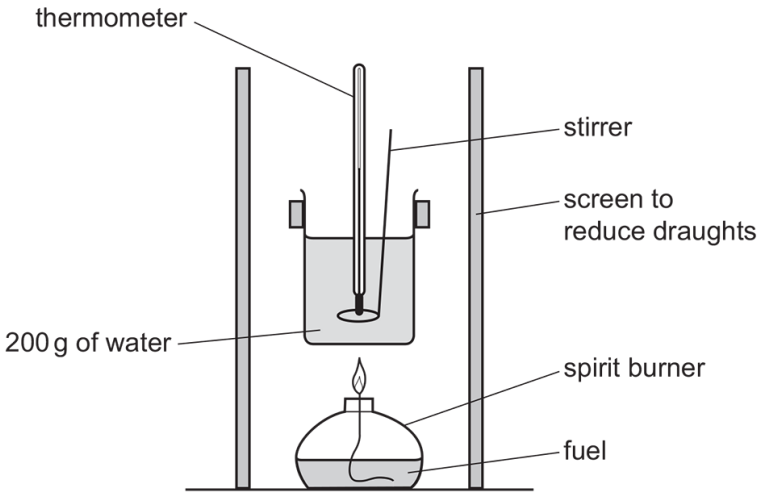
C $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

D $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$

---

06. 0620_s21_qp_22 Q: 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

07. 0620_s21_qp_22 Q: 20

The equation shows the reaction between hydrogen and oxygen.

$$2\ H–H\ +\ O=O\ \rightarrow\ 2\ H–O–H$$

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

---

08. 0620_s21_qp_23 Q: 17

The equation for the decomposition of hydrogen iodide is shown.

$$2HI\ \rightarrow\ H_2\ +\ I_2$$

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

---

09. 0620_w21_qp_21 Q: 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–C*l*	+340
C–C	+350
C–H	+410
C*l*–C*l*	+240
H–C*l*	+430

What is the energy change for the reaction?

A –1420 kJ / mol

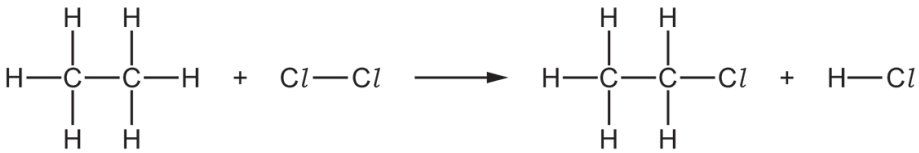
B –120 kJ / mol

C +120 kJ / mol

D +1420 kJ / mol

10. 0620_w21_qp_22 Q: 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–C*l*	+340
C–C	+350
C–H	+410
C*l*–C*l*	+240
H–C*l*	+430

What is the energy change for the reaction?

A –1420 kJ / mol

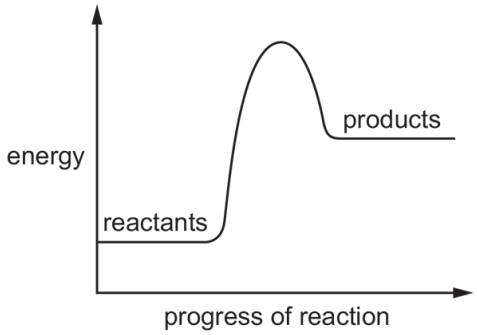
B –120 kJ / mol

C +120 kJ / mol

D +1420 kJ / mol

11. 0620_w21_qp_23 Q: 11

The energy level diagram for a chemical reaction is shown.



Which statement about this reaction is correct?

A The reaction is endothermic and energy is given out to the surroundings.

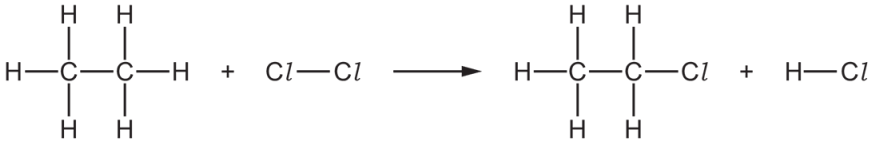
B The reaction is endothermic and energy is taken in from the surroundings.

C The reaction is exothermic and energy is given out to the surroundings.

D The reaction is exothermic and energy is taken in from the surroundings.

12. 0620_w21_qp_23 Q: 12

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–C*l*	+340
C–C	+350
C–H	+410
C*l*–C*l*	+240
H–C*l*	+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

---

13. 0620_m20_qp_22 Q: 12

Nitrogen trifluoride, NF_3, is used in the manufacture of certain types of solar panels. The equation for the formation of nitrogen trifluoride is shown.

$$N_2 + 3F_2 \rightarrow 2NF_3$$

type of bond	bond energy ($kJ\,mol^{-1}$)
N≡N	+950
F–F	+150
N–F	+280

Using the table of bond energies, what is the energy change for this reaction?

A $-560\,kJ\,mol^{-1}$

B $-280\,kJ\,mol^{-1}$

C $+280\,kJ\,mol^{-1}$

D $+3080\,kJ\,mol^{-1}$

---

14. 0620_p20_qp_20 Q: 16

Water can be used to produce hydrogen gas.

$$2H_2O \rightarrow 2H_2 + O_2$$

Which row describes bond breaking in the reactant?

A	endothermic	heat absorbed
B	endothermic	heat released
C	exothermic	heat absorbed
D	exothermic	heat released

---

15. 0620_s20_qp_21 Q: 12

The equation for the complete combustion of methane gas is shown.

$$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(g)$$

Bond energies are shown.

bond	bond energy in kJ / mol
C–H	412
H–O	463
C=O	743
O=O	498

What is the overall energy change, in kJ / mol, for the above reaction?

A –1192 **B** –694 **C** +694 **D** +1192

---

16. 0620_s20_qp_22 Q: 12

Methane burns in excess oxygen.

The equation is shown.

$$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(g)$$

Bond energies are shown.

bond	bond energy / kJ mol^{-1}
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 $(2 \times 805 + 2 \times 460) - (410 + 2 \times 496)$

C $(410 + 2 \times 496) - (805 + 2 \times 460)$

D $(410 + 496) - (805 + 460)$

---

17. 0620_s20_qp_23 Q: 12

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.

$$C_2H_4 + 3O_2 \rightarrow 2CO_2 + 2H_2O$$

The table shows the bond energies involved in the reaction.

bond	bond energy (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?

A –954 kJ / mol

B –1010 kJ / mol

C –1313 kJ / mol

D –1369 kJ / mol

---

18. 0620_w20_qp_21 Q: 15

Sodium nitrate is added to water in a beaker and stirred until it dissolves.

At the end of the experiment, the beaker feels cold.

Which row describes the reaction?

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

---

19. 0620_w20_qp_22 Q: 14

The combustion of methane is exothermic.

$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$$

Which statement about this reaction is correct?

A The energy needed to break the bonds in methane and oxygen is greater than the energy released in making new bonds in carbon dioxide and water.

B The energy needed to break the bonds in methane and oxygen is less than the energy released in making new bonds in carbon dioxide and water.

C The energy released in breaking bonds in methane and oxygen is greater than the energy needed to make new bonds in carbon dioxide and water.

D The energy released in breaking bonds in methane and oxygen is less than the energy needed to make new bonds in carbon dioxide and water.

---

20. 0620_w20_qp_22 Q: 15

Hydrogen reacts with oxygen in a fuel cell.

$$2H_2 + O_2 \rightarrow 2H_2O$$

The reaction is exothermic.

286 kJ of energy is released for every mole of water formed.

Which volume of hydrogen gas, measured at room temperature and pressure, would react with oxygen with the release of 7000 J of energy?

A 587 cm^3 **B** 1175 cm^3 **C** 587 dm^3 **D** 1175 dm^3

---

21. 0620_w20_qp_23 Q: 14

Which substance does **not** require oxygen in order to produce energy?

A coal

B hydrogen

C natural gas

D ^{235}U

---

22. 0620_w20_qp_23 Q: 15

Ethanol is used as a fuel.

$$\text{ethanol} + \text{oxygen} \rightarrow \text{carbon dioxide} + \text{water}$$

Which statements are correct?

1 The reaction is endothermic.

2 The products have more energy than the reactants.

3 The oxygen for this reaction comes from the air.

4 The temperature of the reaction mixture rises during this reaction.

A 1 and 2 **B** 1 and 3 **C** 2 and 4 **D** 3 and 4

---

23. 0620_m19_qp_22 Q: 12

10 g of ammonium nitrate is added to water at 25 °C and the mixture stirred.

The ammonium nitrate dissolves and, after one minute, the temperature of the solution is 10 °C.

Which word describes this change?

A endothermic

B exothermic

C neutralisation

D reduction

---

24. 0620_m19_qp_22 Q: 13

Hydrogen reacts with chlorine according to the following equation.

$$H_2(g) + Cl_2(g) \rightarrow 2HCl(g)$$

The reaction is exothermic.

Which statement about this reaction is correct?

A Energy absorbed for bond breaking is greater than the energy released in bond making.

B Energy absorbed for bond breaking is less than the energy released in bond making.

C Energy released in bond breaking is greater than the energy absorbed in bond making.

D Energy released in bond breaking is less than the energy absorbed in bond making.

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25. 0620_s19_qp_21 Q: 12

Nitrogen reacts with hydrogen to produce ammonia.

$$N_2 + 3H_2 \rightarrow 2NH_3$$

The reaction is exothermic. The bond energies are shown in the table.

bond	bond energy in kJ / mol
N≡N	945
H–H	436
N–H	390

What is the energy change for this reaction?

A –1473 kJ / mol

B –87 kJ / mol

C 87 kJ / mol

D 1473 kJ / mol

---

26. 0620_s19_qp_22 Q: 12

Two elements, X and Y, react together to form a covalent molecule as shown.

The reaction is exothermic.

$$X_2(g) + Y_2(g) \rightarrow 2XY(g)$$

The bond energies are shown in the table.

bond	bond energy in kJ / mol
X–X	436
Y–Y	242
X–Y	431

What is the energy change for the reaction?

A +184 kJ / mol **B** –184 kJ / mol **C** +247 kJ / mol **D** –247 kJ / mol

---

27. 0620_s19_qp_23 Q: 12

Methane burns in oxygen to form carbon dioxide and water.

$$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(l)$$

The bond energies are shown in the table.

bond	bond energy in kJ / mol
C–H	410
C–O	360
C=O	805
O–H	460
O–O	146
O=O	496

What is the energy change for this reaction?

A –818 kJ / mol **B** –102 kJ / mol **C** +102 kJ / mol **D** +818 kJ / mol

---

28. 0620_w19_qp_21 Q: 13

Which statements about endothermic reactions are correct?

1 The energy of the products is greater than the energy of the reactants.

2 The energy of the reactants is greater than the energy of the products.

3 The temperature of the surroundings increases during the reaction.

4 The temperature of the surroundings decreases during the reaction.

A 1 and 3 only **B** 1 and 4 only **C** 2 and 3 only **D** 2 and 4 only

---

29. 0620_w19_qp_22 Q: 13

The temperature of the water in two beakers, X and Y, is measured as 21.5 °C.

5 g of sodium chloride is dissolved in the water in beaker X. The temperature changes to 18.0 °C.

5 g of calcium oxide is dissolved in the water in beaker Y. The temperature changes to 29.4 °C.

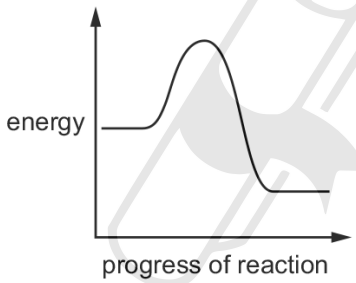
Which types of process are occurring in beakers X and Y?

	X	Y
A	endothermic	endothermic
B	endothermic	exothermic
C	exothermic	endothermic
D	exothermic	exothermic

---

30. 0620_w19_qp_23 Q: 13

An energy level diagram for a reaction is shown.



Which statement and explanation about this reaction are correct?

	statement	explanation
A	the reaction is endothermic	the products have more energy than the reactants
B	the reaction is endothermic	the products have less energy than the reactants
C	the reaction is exothermic	the products have more energy than the reactants
D	the reaction is exothermic	the products have less energy than the reactants

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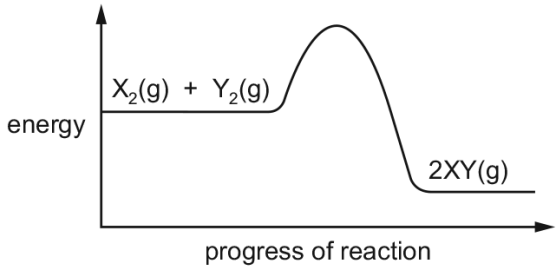
31. 0620_m18_qp_22 Q: 11

The energy level diagram for the reaction between X_2 and Y_2 to form XY gas is shown.



Which statement is correct?

A Energy is released when X_2 and Y_2 bonds are broken.

B Energy is needed to form XY bonds.

C The energy change, ΔH, for the reaction is negative.

D The reaction is endothermic.

---

32. 0620_m18_qp_22 Q: 12

Methane burns in oxygen to form carbon dioxide and water.

$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$$

The bond energies are shown in the table.

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

What is the energy change for the reaction?

A –818 kJ / mol

B –323 kJ / mol

C +323 kJ / mol

D +818 kJ / mol

---

33. 0620_s18_qp_21 Q: 12

Plant cells use energy from sunlight for photosynthesis.

Which row describes and explains the energy change that occurs?

	type of energy change	explanation
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

---

34. 0620_s18_qp_21 Q: 13

Hydrogen bromide decomposes to form hydrogen and bromine. The equation is shown.

$$2HBr(g) \rightarrow H_2(g) + Br_2(g)$$

The bond energies are shown in the table. The reaction is endothermic.

bond	bond energy in kJ / mol
Br–Br	+193
H–Br	+366
H–H	+436

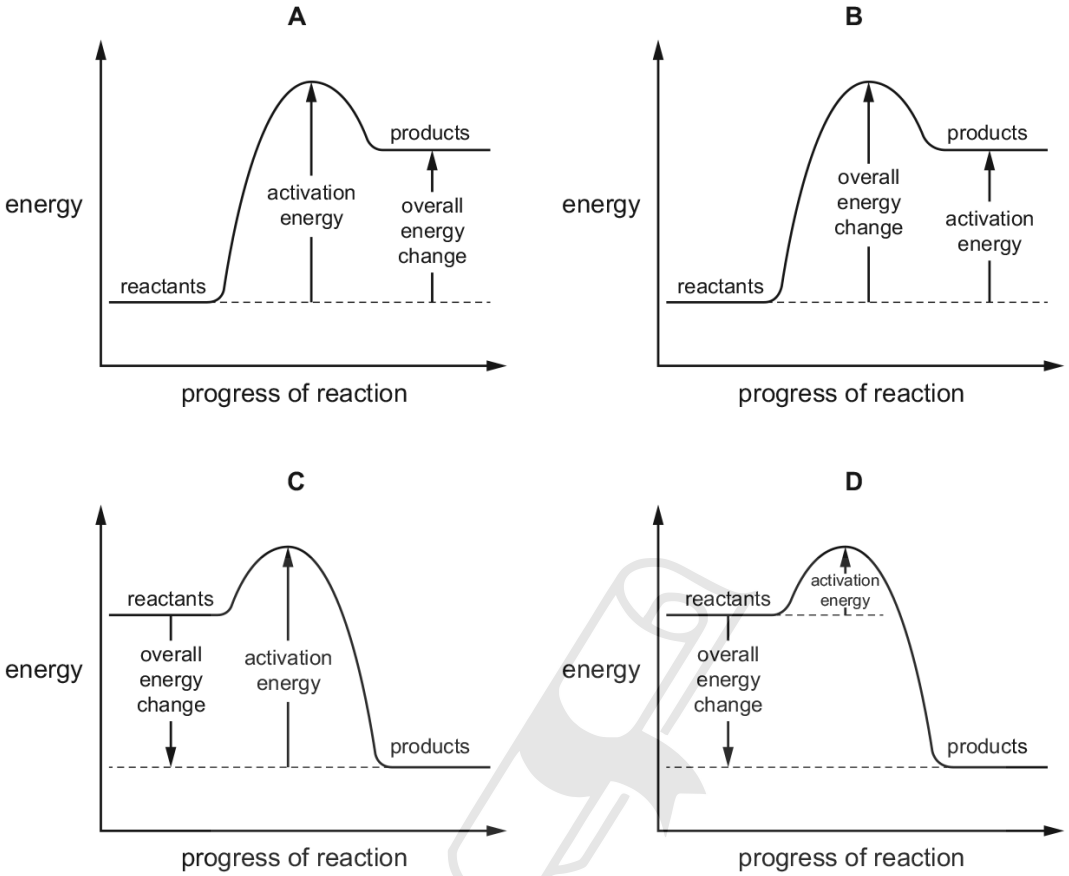
What is the energy change for the reaction?

A +263 kJ / mol **B** +103 kJ / mol **C** –103 kJ / mol **D** –263 kJ / mol

---

35. 0620_s18_qp_22 Q: 12

Which diagram is a correctly labelled energy level diagram for an endothermic reaction?



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36. 0620_s18_qp_22 Q: 13

The equation for the complete combustion of methane is shown.

$$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(g)$$

The bond energies are shown in the table.

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

What is the energy change for the reaction?

A –818 kJ / mol **B** –359 kJ / mol **C** –323 kJ / mol **D** +102 kJ / mol

---

37. 0620_s18_qp_23 Q: 12

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

---

38. 0620_s18_qp_23 Q: 13

Ethene reacts with hydrogen. The equation is shown.

$$CH_2{=}CH_2 + H_2 \rightarrow C_2H_6$$

The bond energies are shown in the table. The reaction is exothermic.

bond	bond energy in kJ/mol
C–C	+350
C=C	+610
C–H	+410
H–H	+436

What is the energy change for the reaction?

A –560 kJ/mol **B** –124 kJ/mol **C** +486 kJ/mol **D** +5496 kJ/mol

---

39. 0620_w18_qp_21 Q: 12

Methane burns in an excess of oxygen. The equation is shown.

$$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(g)$$

The bond energies are shown in the table.

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

What is the energy change for the reaction?

A +818 kJ / mol

B +102 kJ / mol

C –359 kJ / mol

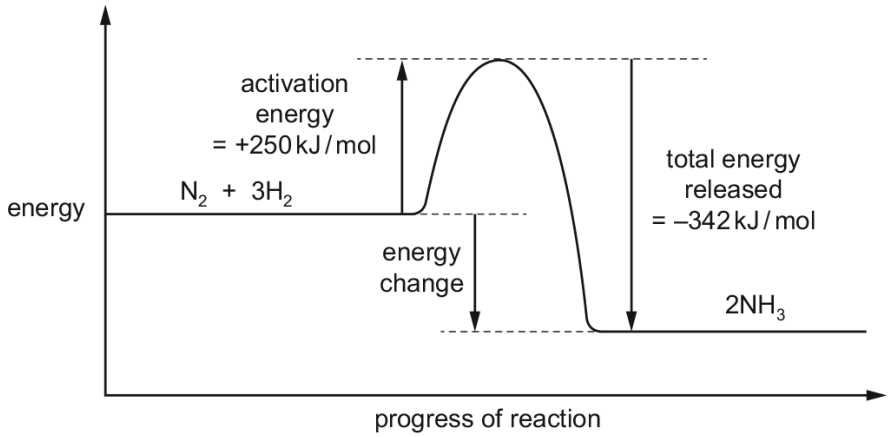
D –818 kJ / mol

40. 0620_w18_qp_21 Q: 13

The equation for the formation of ammonia is shown.

$$N_2 + 3H_2 \rightarrow 2NH_3$$

The energy level diagram for the reaction is shown.



What is the energy change for the reaction?

A –592 kJ / mol

B –92 kJ / mol

C +92 kJ / mol

D +592 kJ / mol

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41. 0620_w18_qp_22 Q: 12

Hydrogen peroxide, H–O–O–H, decomposes to form water and oxygen.

$$2H_2O_2(g) \rightarrow 2H_2O(g) + O_2(g)$$

The bond energies are shown in the table. The reaction is exothermic.

bond	bond energy in kJ / mol
O–H	+460
O–O	+150
O=O	+496

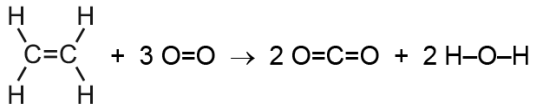
What is the energy change for the reaction?

A –346 kJ / mol **B** –196 kJ / mol **C** +196 kJ / mol **D** +346 kJ / mol

---

42. 0620_w18_qp_23 Q: 12

Ethene burns in oxygen to form carbon dioxide and water vapour.



The bond energies are shown in the table.

bond	bond energy in kJ/mol
C=C	+610
C–H	+410
O=O	+497
C=O	+805
O–H	+460

What is the energy change for the reaction?

A –2959 kJ/mol

B –2313 kJ/mol

C –1319 kJ/mol

D –399 kJ/mol

---

43. 0620_m17_qp_22 Q: 12

Ammonia is made by reacting nitrogen with hydrogen in the presence of an iron catalyst.

The reaction is exothermic.

The equation for the reaction is shown.

$$N_2 + 3H_2 \rightarrow 2NH_3$$

The bond energies are shown in the table.

bond	bond energy in kJ/mol
H–H	436
N–H	390
N≡N	945

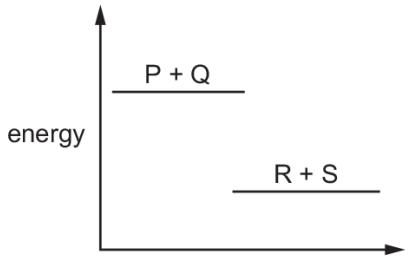
What is the energy given out during this reaction?

A –4593 kJ/mol **B** –1083 kJ/mol **C** –959 kJ/mol **D** –87 kJ/mol

---

44. 0620_m17_qp_22 Q: 13

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

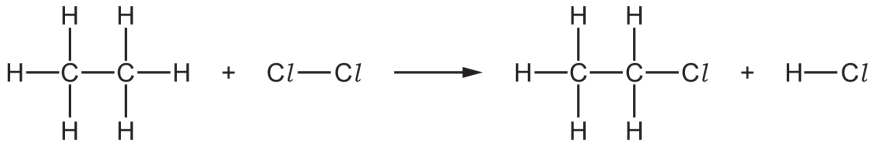


Which row describes the energy changes involved and the type of reaction?

	energy changes involved	type of reaction
A	more energy is given out when the bonds in the products are formed than is needed to break the bonds in the reactants	endothermic
B	more energy is given out when the bonds in the products are formed than is needed to break the bonds in the reactants	exothermic
C	more energy is needed to break the bonds in the reactants than is given out when the bonds in the products are formed	endothermic
D	more energy is needed to break the bonds in the reactants than is given out when the bonds in the products are formed	exothermic

45. 0620_s17_qp_21 Q: 13

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–C*l*	+340
C–C	+350
C–H	+410
C*l*–C*l*	+240
H–C*l*	+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

46. 0620_s17_qp_22 Q: 13

The equation for the reaction between hydrogen and chlorine is shown.

$$H_2(g) + Cl_2(g) \rightarrow 2HCl(g)$$

The reaction is exothermic.

The bond energies are shown in the table.

bond	bond energy in kJ / mol
Cl–Cl	+240
H–Cl	+430
H–H	+436

What is the energy change for the reaction?

A –1536 kJ / mol

B –184 kJ / mol

C +184 kJ / mol

D +246 kJ / mol

---

47. 0620_s17_qp_23 Q: 13

Hydrogen and chlorine react to form hydrogen chloride.

The reaction is exothermic.

$$H_2(g) + Cl_2(g) \rightarrow 2HCl(g)$$

The overall energy change for this reaction is –184 kJ / mol.

The table gives some of the bond energies involved.

bond	bond energy in kJ / mol
H–Cl	+430
H–H	+436

What is the energy of the Cl–Cl bond?

A –240 kJ / mol

B –190 kJ / mol

C +190 kJ / mol

D +240 kJ / mol

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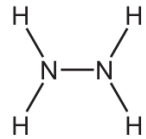
48. 0620_w17_qp_21 Q: 11

The compound hydrazine is used as a rocket fuel. It has the structural formula shown.



One of the reactions of hydrazine is shown. This reaction is exothermic.

$$N_2H_4 \rightarrow N_2 + 2H_2$$

The bond energies are shown in the table.

	bond energy in kJ / mol
H–H	+436
N–H	+390
N–N	+160
N≡N	+945

What is the energy change for this reaction?

A –339 kJ / mol **B** –97 kJ / mol **C** +97 kJ / mol **D** +339 kJ / mol

---

49. 0620_w17_qp_21 Q: 12

Which statement describes an exothermic reaction?

A The energy absorbed for bond breaking is greater than the energy released by bond formation.

B The energy absorbed for bond breaking is less than the energy released by bond formation.

C The energy released by bond breaking is greater than the energy absorbed for bond formation.

D The energy released by bond breaking is less than the energy absorbed for bond formation.

---

50. 0620_w17_qp_22 Q: 11

The equation for the combustion of methane is shown.

$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$$

The energy change for the combustion of methane is –890 kJ / mol.

The bond energies are shown in the table.

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

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

A +49 kJ / mol **B** +841 kJ / mol **C** +1301 kJ / mol **D** +1335 kJ / mol

---

51. 0620_w17_qp_23 Q: 11

Some bond energies are shown in the table.

bond	bond energy in kJ / mol
H–H	+436
O=O	+496
H–O	+460

Hydrogen reacts with oxygen. The reaction is exothermic.

$$2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$$

What is the energy change for the reaction?

A –3208 kJ / mol

B –908 kJ / mol

C –472 kJ / mol

D –448 kJ / mol

---

52. 0620_m16_qp_22 Q: 13

Which row describes an endothermic reaction?

	energy needed to break bonds / kJ	energy released by forming bonds / kJ	temperature
A	400	200	decreases
B	400	800	decreases
C	600	200	increases
D	600	800	increases

---

53. 0620_p16_qp_20 Q: 16

Water can be used to produce hydrogen gas.

$$2H_2O \rightarrow 2H_2 + O_2$$

Which row describes bond breaking in the reactant?

A	endothermic	heat absorbed
B	endothermic	heat released
C	exothermic	heat absorbed
D	exothermic	heat released

---

54. 0620_s16_qp_21 Q: 13

Hydrogen burns exothermically in oxygen.

The equation for the reaction is:

$$2H_2 + O_2 \rightarrow 2H_2O$$

The table shows the bond energies involved.

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

What is the energy given out during the reaction?

A –3226 kJ / mol

B –884 kJ / mol

C –486 kJ / mol

D –442 kJ / mol

---

55. 0620_s16_qp_23 Q: 13

Hydrazine, N_2H_4, decomposes as shown.

The energy change for this reaction is –95 kJ / mol.

The table shows some bond energies involved.

bond	bond energy in kJ / mol
N≡N	945
N–H	391
H–H	436

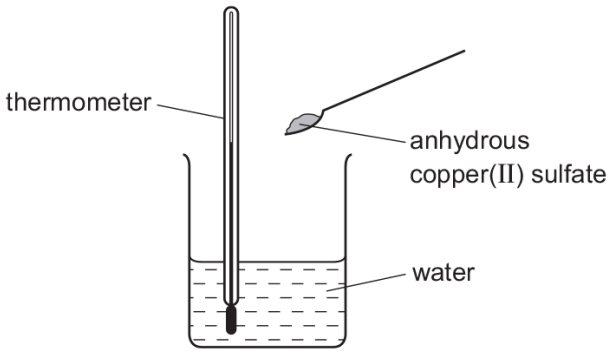
What is the bond energy of the N–N bond?

A 158 kJ / mol **B** 315 kJ / mol **C** 348 kJ / mol **D** 895 kJ / mol

---

56. 0620_w16_qp_21 Q: 12

When anhydrous copper(II) sulfate is added to water a solution is formed and heat is given out.



Which row shows the temperature change and the type of reaction taking place?

	temperature change	type of reaction
A	decrease	endothermic
B	decrease	exothermic
C	increase	endothermic
D	increase	exothermic

---

57. 0620_w16_qp_22 Q: 12

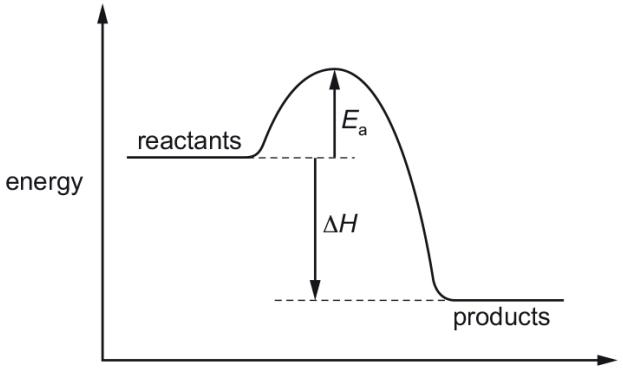
Which experiment is the most exothermic?

	initial temperature / °C	final temperature / °C
A	20	5
B	20	32
C	25	12
D	25	34

---

58. 0620_w16_qp_22 Q: 13

The energy level diagram for a reaction is shown.



Which row is correct?

	sign of ΔH	overall energy change	sign of E_a
A	–	exothermic	–
B	+	endothermic	+
C	+	endothermic	–
D	–	exothermic	+

---

59. 0620_w16_qp_23 Q: 12

10 g of ammonium nitrate are added to water at 25 °C and the mixture stirred. The ammonium nitrate dissolves and, after one minute, the temperature of the solution is 10 °C.

Which word describes this change?

A endothermic

B exothermic

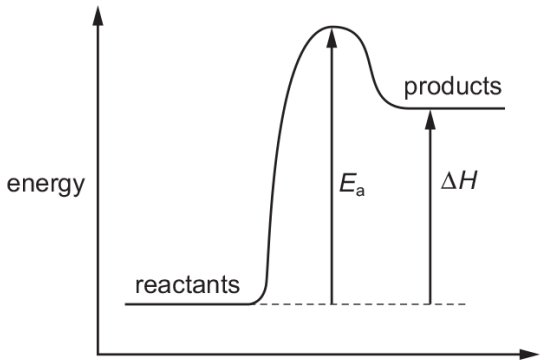
C neutralisation

D reduction

---

60. 0620_w16_qp_23 Q: 13

The energy level diagram for a reaction is shown.



Which row is correct?

	sign of ΔH	overall energy change	sign of E_a
A	–	exothermic	–
B	+	endothermic	+
C	+	endothermic	–
D	+	exothermic	+

SN	Paper	Q. No.	Answer
01	0620_m21_qp_22	13	B
02	0620_m21_qp_22	14	A
03	0620_m21_qp_22	37	B
04	0620_s21_qp_21	12	D
05	0620_s21_qp_21	13	B
06	0620_s21_qp_22	12	C
07	0620_s21_qp_22	20	C
08	0620_s21_qp_23	17	C
09	0620_w21_qp_21	11	B
10	0620_w21_qp_22	11	B
11	0620_w21_qp_23	11	B
12	0620_w21_qp_23	12	B
13	0620_m20_qp_22	12	B
14	0620_p20_qp_20	16	A
15	0620_s20_qp_21	12	B
16	0620_s20_qp_22	12	A
17	0620_s20_qp_23	12	C
18	0620_w20_qp_21	15	A
19	0620_w20_qp_22	14	B
20	0620_w20_qp_22	15	A
21	0620_w20_qp_23	14	D
22	0620_w20_qp_23	15	D
23	0620_m19_qp_22	12	A
24	0620_m19_qp_22	13	B
25	0620_s19_qp_21	12	B
26	0620_s19_qp_22	12	B
27	0620_s19_qp_23	12	A
28	0620_w19_qp_21	13	B
29	0620_w19_qp_22	13	B
30	0620_w19_qp_23	13	D
31	0620_m18_qp_22	11	C
32	0620_m18_qp_22	12	A
33	0620_s18_qp_21	12	A
34	0620_s18_qp_21	13	B
35	0620_s18_qp_22	12	A
36	0620_s18_qp_22	13	A
37	0620_s18_qp_23	12	B
38	0620_s18_qp_23	13	B
39	0620_w18_qp_21	12	D
40	0620_w18_qp_21	13	B
41	0620_w18_qp_22	12	B
42	0620_w18_qp_23	12	C
43	0620_m17_qp_22	12	D
44	0620_m17_qp_22	13	B
45	0620_s17_qp_21	13	B
46	0620_s17_qp_22	13	B
47	0620_s17_qp_23	13	D
48	0620_w17_qp_21	11	B
49	0620_w17_qp_21	12	B

SN	Paper	Q. No.	Answer
50	0620_w17_qp_22	11	B
51	0620_w17_qp_23	11	C
52	0620_m16_qp_22	13	A
53	0620_p16_qp_20	16	A
54	0620_s16_qp_21	13	C
55	0620_s16_qp_23	13	A
56	0620_w16_qp_21	12	D
57	0620_w16_qp_22	12	B
58	0620_w16_qp_22	13	D
59	0620_w16_qp_23	12	A
60	0620_w16_qp_23	13	B