

Combined Science - Chemistry - Key Stage 4

Energy Changes

Review Lesson

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Energy changes

Activation energy: The minimum amount of energy needed to start a reaction.

Combustion: An exothermic reaction in which a fuel is oxidised.

Endothermic reaction: A reaction in which more energy is required to break bonds than is released when bonds are made.

Evaluate: Give the advantages and disadvantages of something. If given data or information to use, explain why this is an advantage.

Exothermic reaction: A reaction in which more energy is released when bonds are made than is required to break bonds in the reactants.

Insulator: A material that does not conduct heat well so will reduce energy transfers.

Neutralisation: A type of chemical reaction where acids are neutralised and energy is released.



Independent task 1 - variables

1. What is an independent variable?
2. What are control variables?
3. What is a dependent variable?
4. What equipment can be used to make sure that heat is not lost to the surrounding?
5. Why do we do repeats?



Independent task 1 - variables - answers

1. What is an independent variable? **The variable that you change**
2. What are control variables? **The variables that you keep the same**
3. What is a dependent variable? **The variable that you measure**
4. What equipment can be used to make sure that heat is not lost to the surrounding? **Polystyrene cup or insulation around a beaker or a lid**
5. Why do we do repeats? **To identify anomalies and calculate the mean**



Independent task 2

1. Is bond making endothermic or exothermic?
2. Is bond breaking endothermic or exothermic?
3. What is activation energy?
4. Why is a reaction overall exothermic?
5. Why is a reaction overall endothermic?

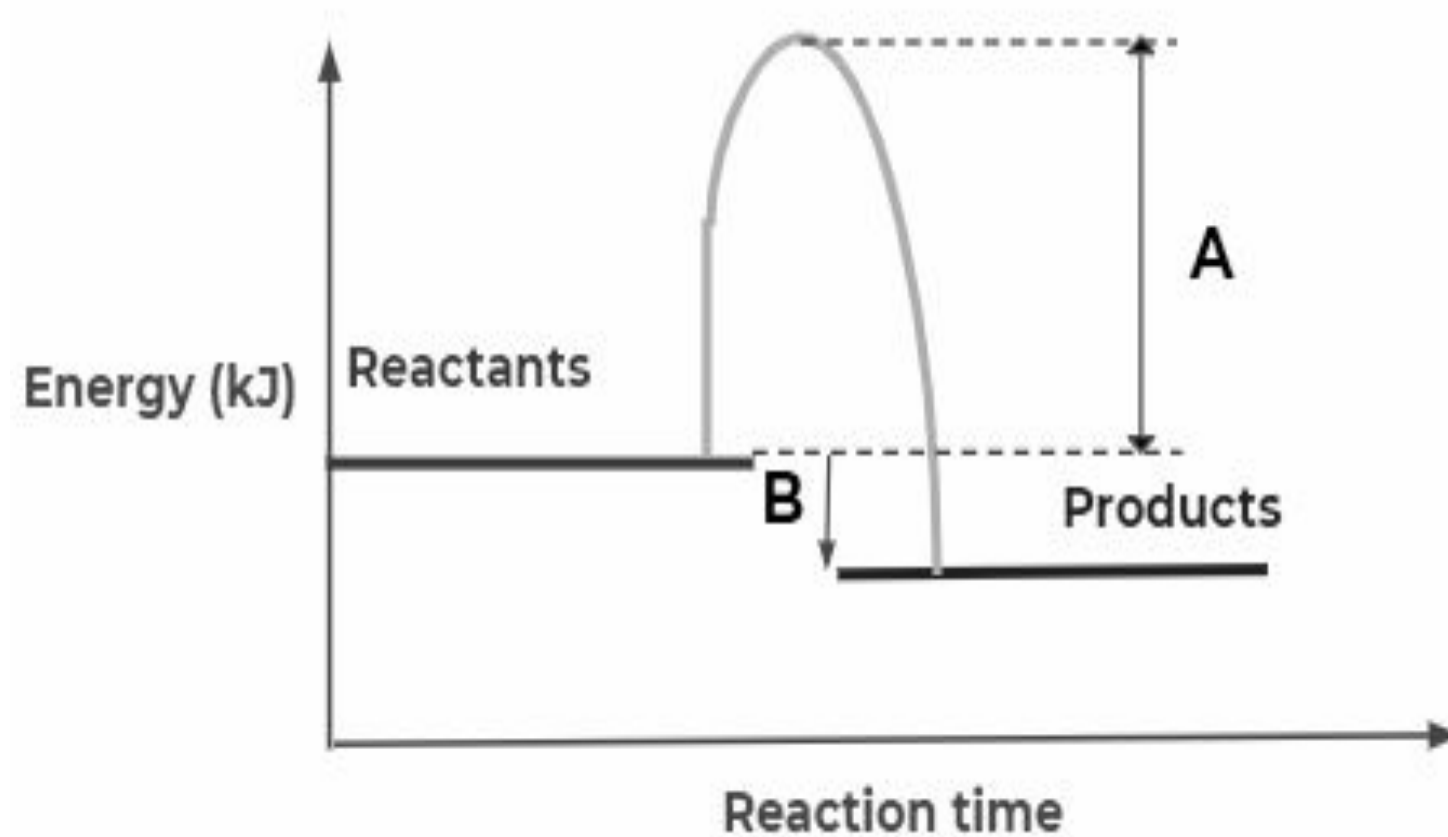


Independent task 2 answers

1. Is bond making endothermic or exothermic? **Exothermic**
2. Is bond breaking endothermic or exothermic? **Endothermic**
3. What is activation energy? **The minimum energy needed to start a reaction**
4. Why is a reaction overall exothermic? **More energy has been released during bond making than has been used for bond breaking**
5. Why is a reaction overall endothermic? **More energy has been used during bond breaking than has been released during bond making**



Exam style question 1



Questions

1. What do letters A and B represent?
2. What type of reaction is it? Explain how you know by the reaction profile.
3. Explain what is happening in terms of bond breaking and bond making.

Figure 1 shows the reaction profile diagram for the reaction between hydrogen and fluorine.



Exam style question 1 answers

Questions

1. What do letters A and B represent? **A = activation energy; B = overall energy change**
2. What type of reaction is it? Explain how you know by the reaction profile. **Exothermic. The products have less energy than the reactants and the overall energy change is negative.**
3. Explain what is happening in terms of bond breaking and bond making. **More energy has been released during bond making than has been used for bond breaking.**

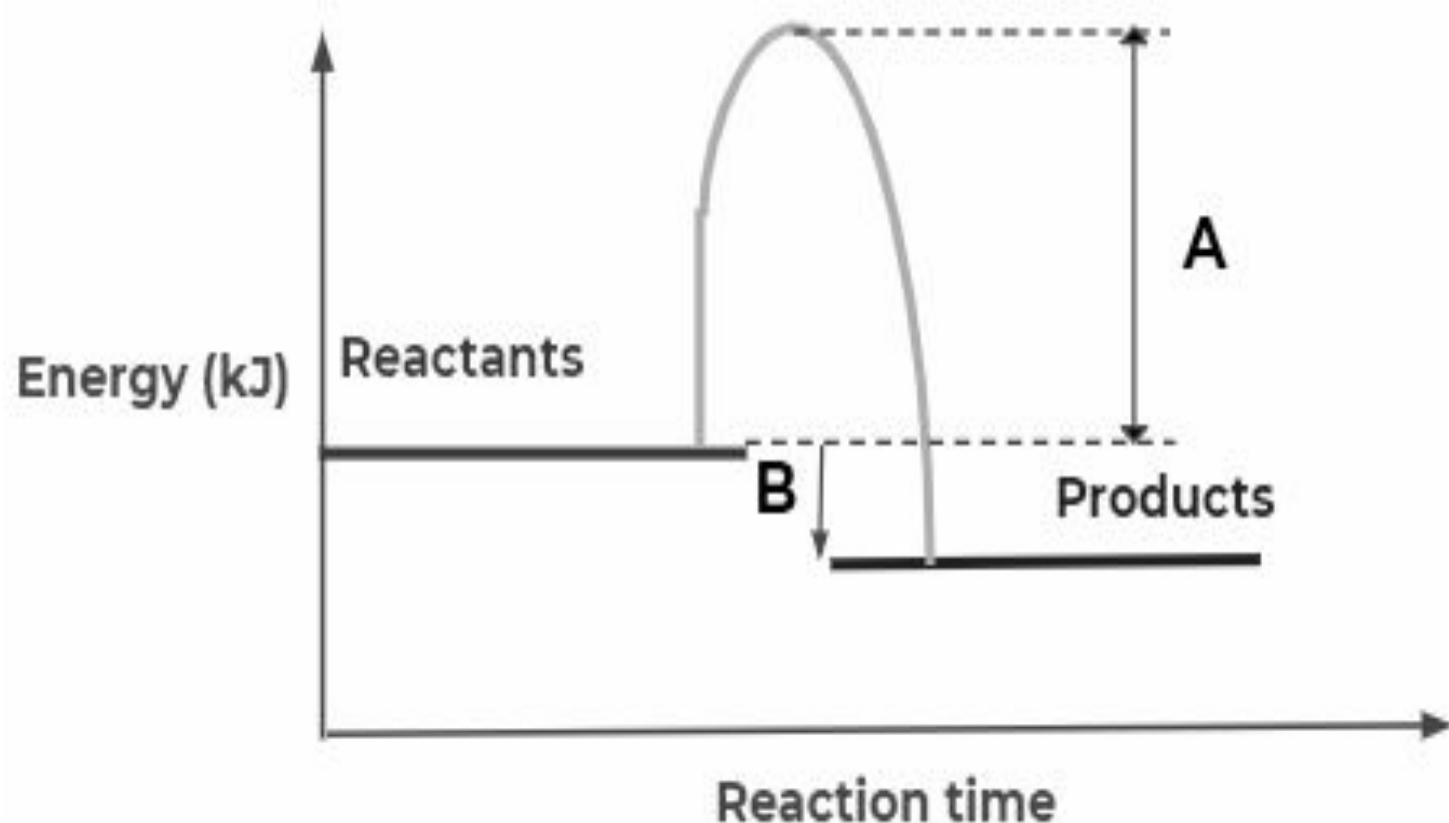


Figure 1 shows the reaction profile diagram for the reaction between hydrogen and fluorine.



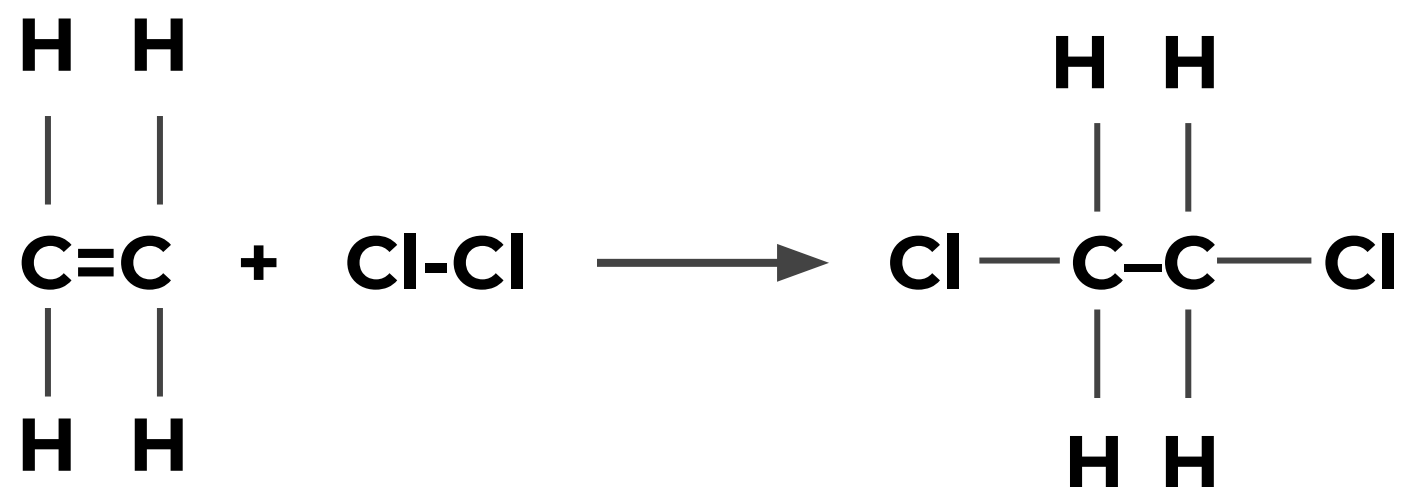
Exam style question

The equation for the reaction of ethene and chlorine is:



The reaction is exothermic.

The reaction can be represented as:



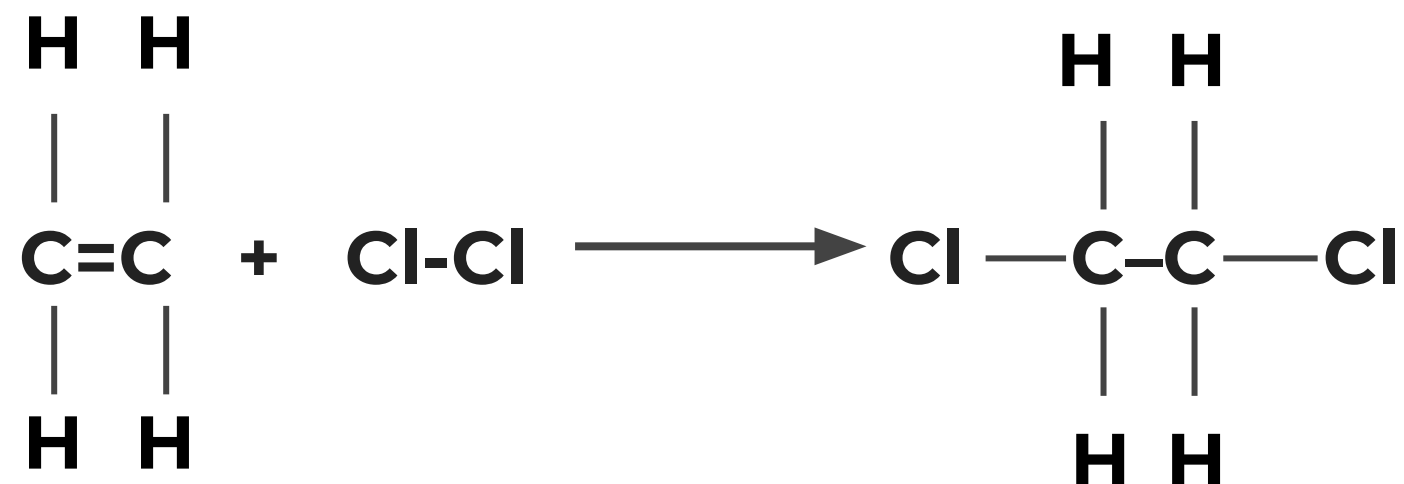
Bond	Energy (kJ/mol)
C–C	348
C=C	614
C–H	413
C–Cl	328
Cl–Cl	242

Question

Use the bond energy values in the table to show that the overall energy change is -148 kJ/mol .



Exam style question 2 answers



Bonds broken

$$614 + (4 \times 413) + 242 \\ = 2508 \text{ kJ/mol}$$

Bonds made

$$342 + (4 \times 413) + (2 \times 328) \\ = 2656 \text{ kJ/mol}$$

Bond	Energy (kJ/mol)
C-C	348
C=C	614
C-H	413
C-Cl	328
Cl-Cl	242

Question

Use the bond energy values in the table to show that the overall energy change is -148 kJ/mol.

$$\text{Overall energy} = 2508 - 2656$$

$$\text{Overall} = -148 \text{ kJ}$$

