Triple - Chemistry - Key Stage 4

Energy Changes

Review Lesson

Mrs. Begum

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 surroundings?
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 surroundings? **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?
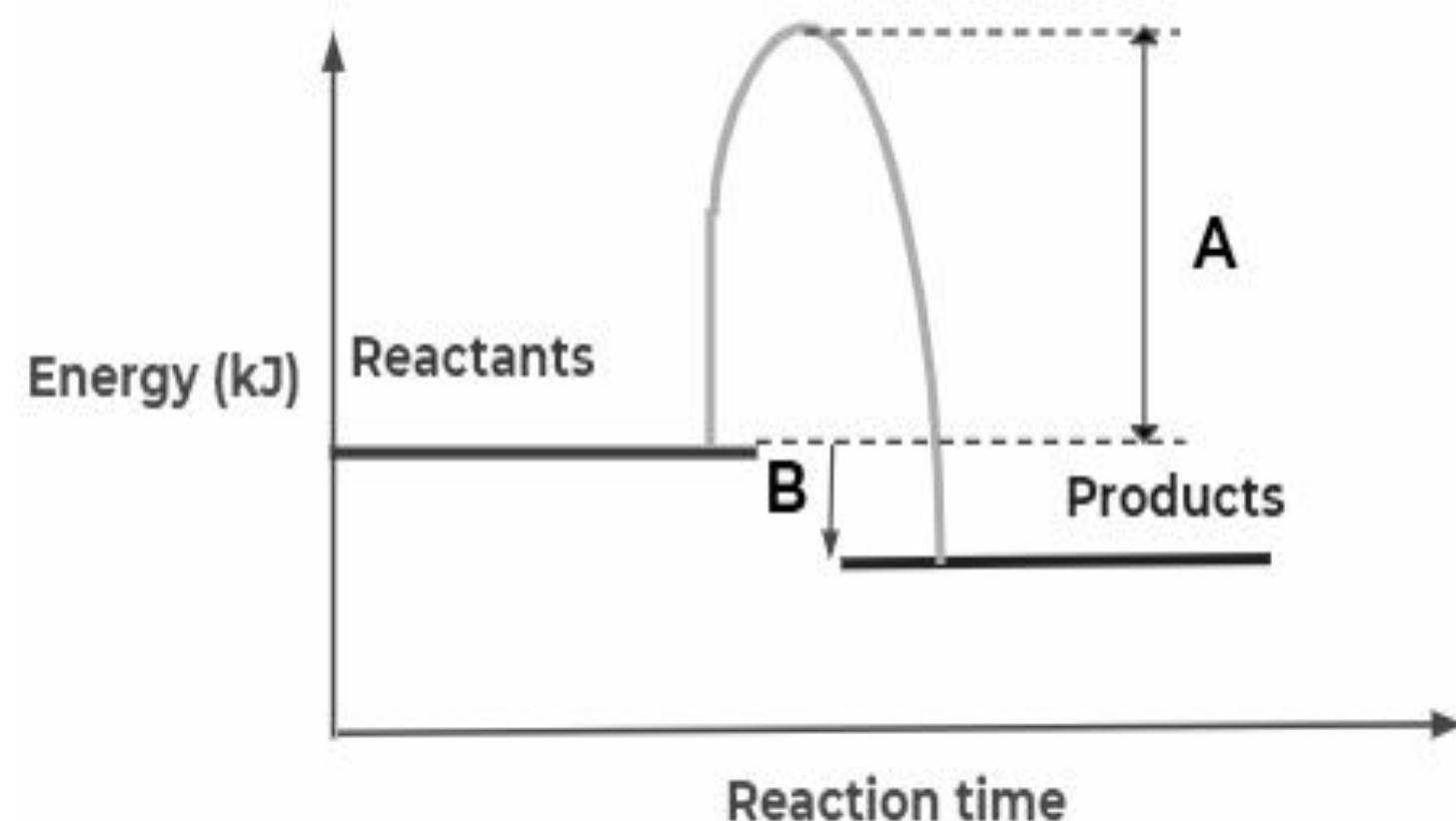5. Why is a reaction overall endothermic?

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

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

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
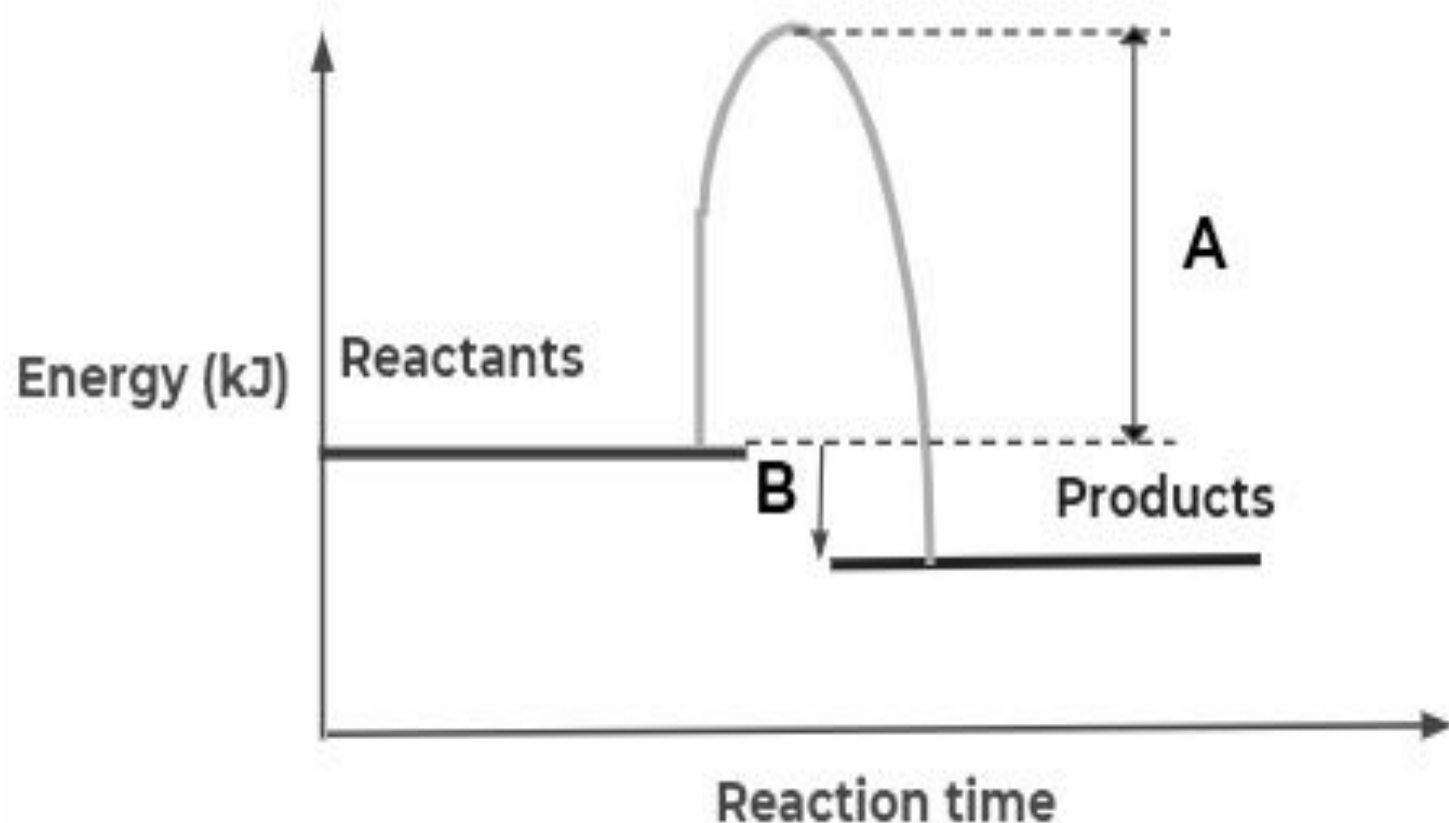
Exam style question 1 answers

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

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.**
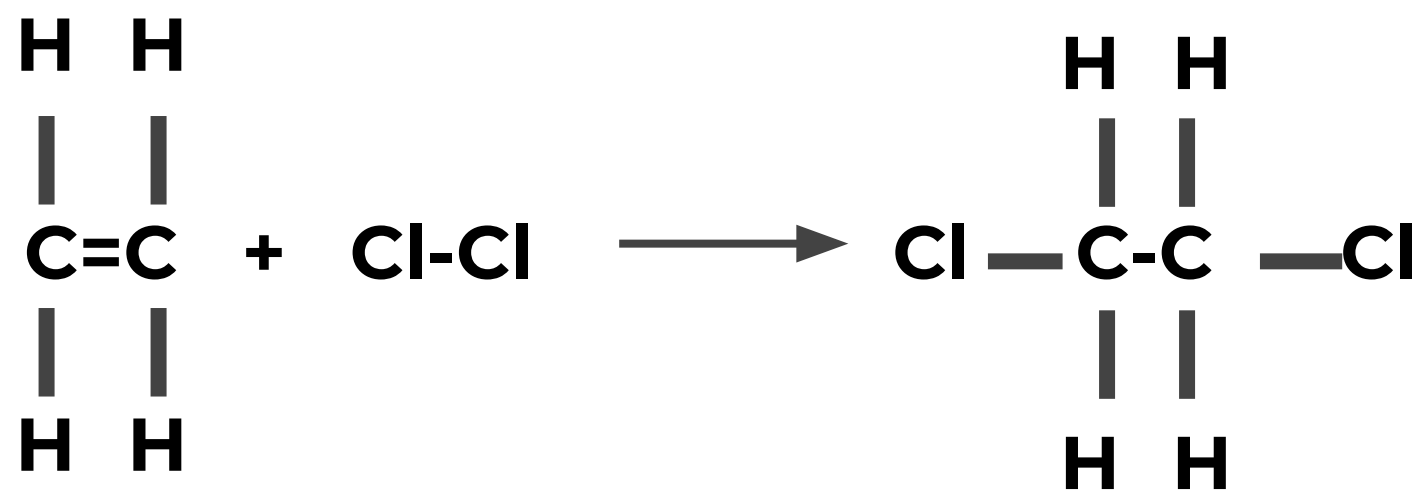
Exam style question 2

The equation for the reaction of ethene and chlorine is:

$$C_2H_4 + Cl_2 \longrightarrow C_2H_4Br_2$$

The reaction is exothermic.

The reaction can be represented as

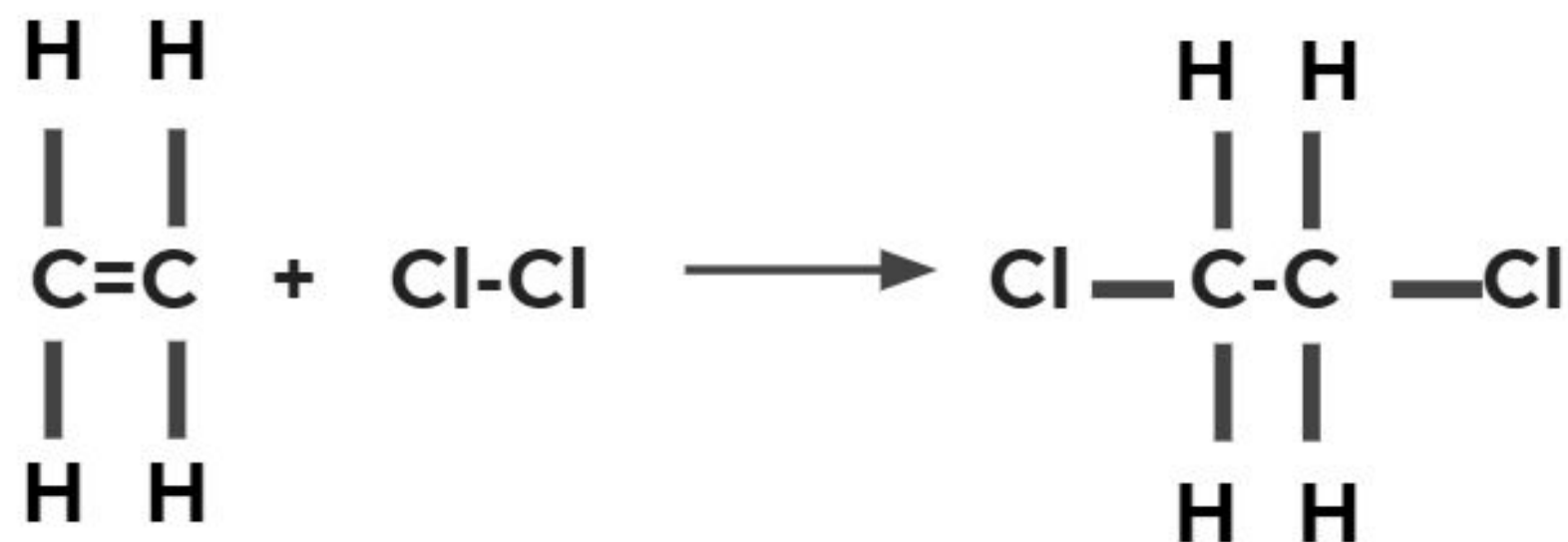| Bond	Energy (kJ/mol)
C–C	348
C=C	614
C–H	413
C–Cl	328

Question
The overall energy change for this reaction is −148 kJ/mol. Use the bond energy values to calculate the bond energy for the Cl–Cl bond.

Exam style question 2 answer

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The overall energy change for this reaction is -148 kJ/mol. Use the bond energy values to calculate the bond energy for the Cl–Cl bond.

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

Bonds broken
614 + (4 x413) + (Cl–Cl)
= 2266 + (Cl–Cl)

Bonds made
348 + (4 x 413) + (2 x 328)
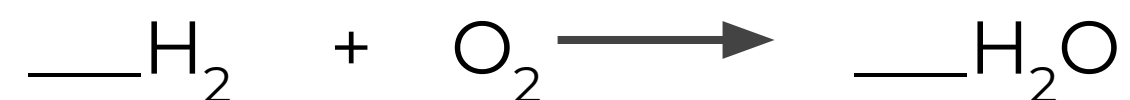= 2656 kJ/mol

2266 + (Cl–Cl) – 2656 = –148
–390 + Cl–Cl = –148
Cl–Cl = –148 –(–390)
Cl–Cl = 242 kJ/mol

Exam style question 3

Alkaline batteries are not rechargeable batteries. They cannot be recharged.

1. Why do they stop working after a while?
2. Why can a rechargeable battery be recharged?
3. Hydrogen fuel cells can be used in cars. Complete the balanced symbol equation for the overall reaction in a hydrogen fuel cell:

   ___H_2 + O_2 ⟶ ___H_2O

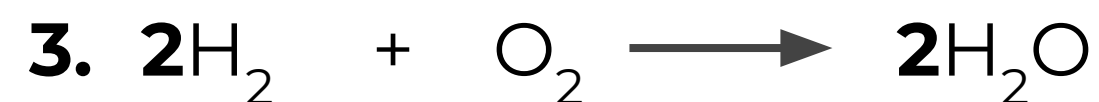| Bond	Energy kJ/mol
H–H	436
O=O	498
O–H	463

1. Using the balanced symbol equation and the bond energy values to calculate the overall energy change for the reaction.
2. Complete an energy level diagram for the reaction, label the overall energy change and the activation energy.

Exam style question 3 answers

1. The electrolyte is used up

2. The chemical reaction is reversible.

3. $2H_2 + O_2 \longrightarrow 2H_2O$

4. Breaking bonds = (436 x 2) + 498 = 1370 kJ/mol
   Making bonds = (4 x 463) = 1852 kJ/mol
   Overall energy change = 1370 – 1852 = –482 kJ/mol

Exam style question answers

5.