

## C3 – Energetics Quiz

1. How do you know if a reaction is endothermic or exothermic?

The temperature rises in an exothermic reaction, but drops in an endothermic reaction. More energy is released in bond making than is needed to break the bonds in an exothermic reaction. The energy of the products is below the energy of the reactants in an exothermic reaction.

2. Is bond breaking exothermic or endothermic?

Endothermic. Bond making is exothermic.

3. How do you calculate the total energy change from bond energy data?

Calculate the total amount of energy needed to break the bonds in the reactants and take away the total amount of energy released when the bonds in the products are made.

4. Define activation energy.

Minimum amount of energy needed to start the reaction. (The energy needed to break the bonds in the reactants).

5. How does a catalyst increase the rate of reaction?

It offers an alternative reaction pathway with a lower activation energy.

6. Why does energy need to be supplied at the start of an exothermic reaction but the reaction continues by itself afterwards?

Existing bonds must be broken first, which is why energy must be supplied. Much more energy is released when new bonds form and this energy is used to continue breaking the reactants' bonds.

7. How do you prevent energy loss in a calorimetry experiment?

Use a lid and/or draught excluders.

8. How do you measure the energy released when a fuel is burned?

Weigh a spirit burner which contains the fuel. Fill a can with 100cm<sup>3</sup> of water and find the temperature. Light the fuel and raise the temperature of the water by 20°C. Reweigh the fuel. Calculate the energy released using  $Q = mc\Delta T$  where  $m$  is the mass of water heated. Work out the moles of fuel burned and divide  $E$  by the moles.

9. A reaction happens rapidly without the help of a catalyst. What does this suggest about the activation energy?

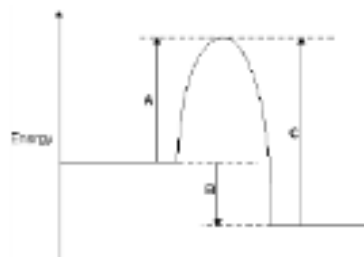
The activation energy is small.

10. Why is hydrogen a good fuel for planes and rockets?

It has a low density, is easy to light, releases plenty of energy and does not produce harmful pollution gases.

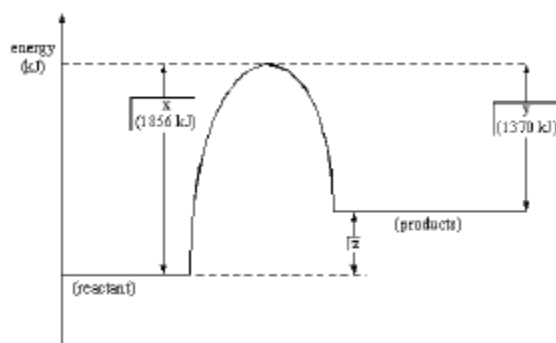
11. Sketch a fully labelled energy profile for an exothermic reaction.

A =  $E_a$  (bonds broken); C = bonds made, B = overall energy change



12. Sketch a fully labelled energy profile for an endothermic reaction.

A:  $x = E_a$  (bonds broken),  $y =$  energy released when bonds are made;  $z =$  overall energy change



13. How does a hydrogen fuel cell work?

Hydrogen molecules lose their electrons and form hydrogen ions at the anode. The electrons travel to the cathode where oxygen molecules take them on and form hydroxide ions. The hydroxide ions move through the electrolyte to the anode where they react with the hydrogen ions to make water. Energy is released.