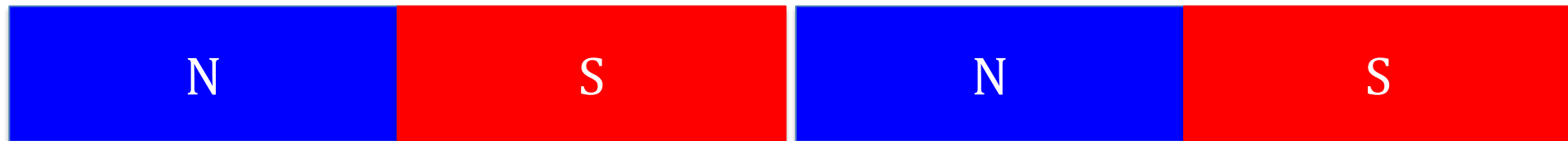


Topic	Bond enthalpies/energies	Level	GCSE (or any course for students aged 11-16)
Outcomes	<ul style="list-style-type: none"> • Understand that when bonds are made in the products, energy is released to the surroundings i.e. it is exothermic • Understand that when bonds are broken in the reactants, energy is required from the surroundings i.e. it is endothermic • Sketch energy level diagrams for simple bond breaking and bond making • Calculate the overall energy change of a reaction using mean bond enthalpies 		
Information for teachers	<p>This activity should only be used once students understand how to draw energy level diagrams for exothermic and endothermic reactions.</p> <p>Enthalpy change and energy change are synonymous terms. The key point of this activity is to help students understand that bond breaking is endothermic and bond making is exothermic. In an exothermic reaction, the energy released from forming new bonds is greater than the energy needed to break existing bonds. In an endothermic reaction, the energy needed to break existing bonds is greater than the energy released from forming new bond.</p> <p>Students then use this understanding to calculate the energy transferred in chemical reactions using bond energies.</p>		

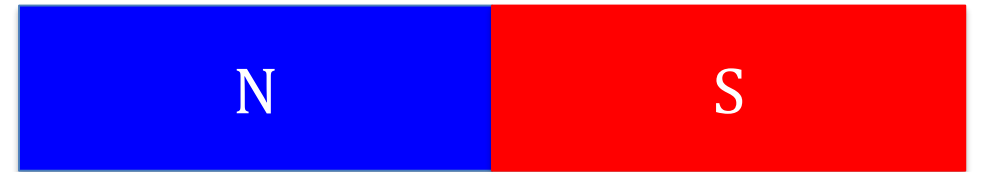
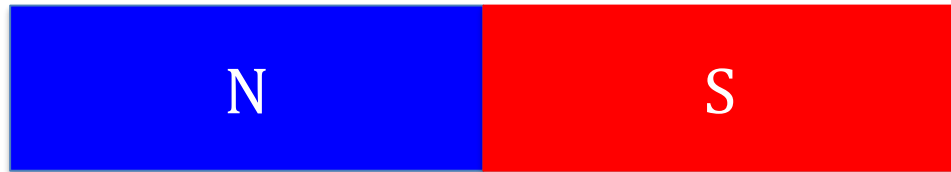
1. What holds these two magnets together?
2. If I wanted to separate these magnets would energy be required or released? Explain your answer.



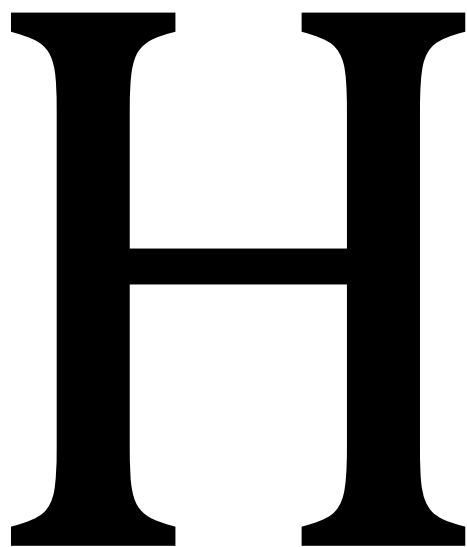
-
1. What holds these two hydrogen atoms together?
 2. If I wanted to separate the hydrogen atoms would energy be required or released? Explain your answer.
 3. Suggest whether bond breaking is exothermic or endothermic? Explain.

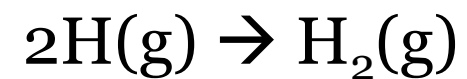


1. If two magnets come together what would you hear?
2. Is energy required or released during this process? Explain.
3. Are the magnets more or less stable after they have come together? Explain.



-
1. Which is more stable, 2 hydrogen atoms or a hydrogen molecule? Explain.
 2. If two hydrogen atoms come together to form a covalent bond is energy released or required?
 3. Is bond breaking exothermic or endothermic? Explain.

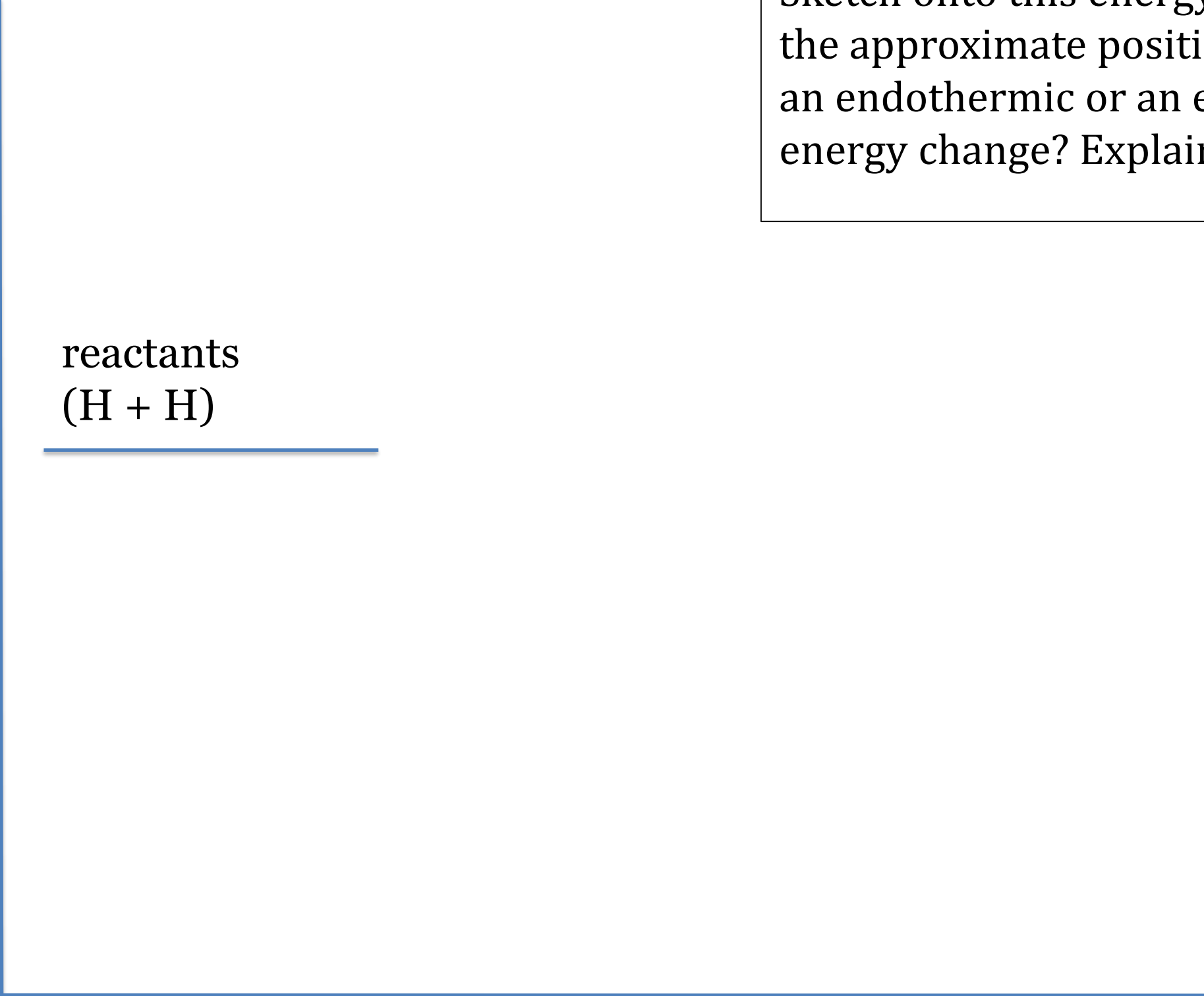




Sketch onto this energy level diagram the approximate position of H_2 . Is this an endothermic or an exothermic energy change? Explain your answer.

Energy (J)

reactants
(H + H)



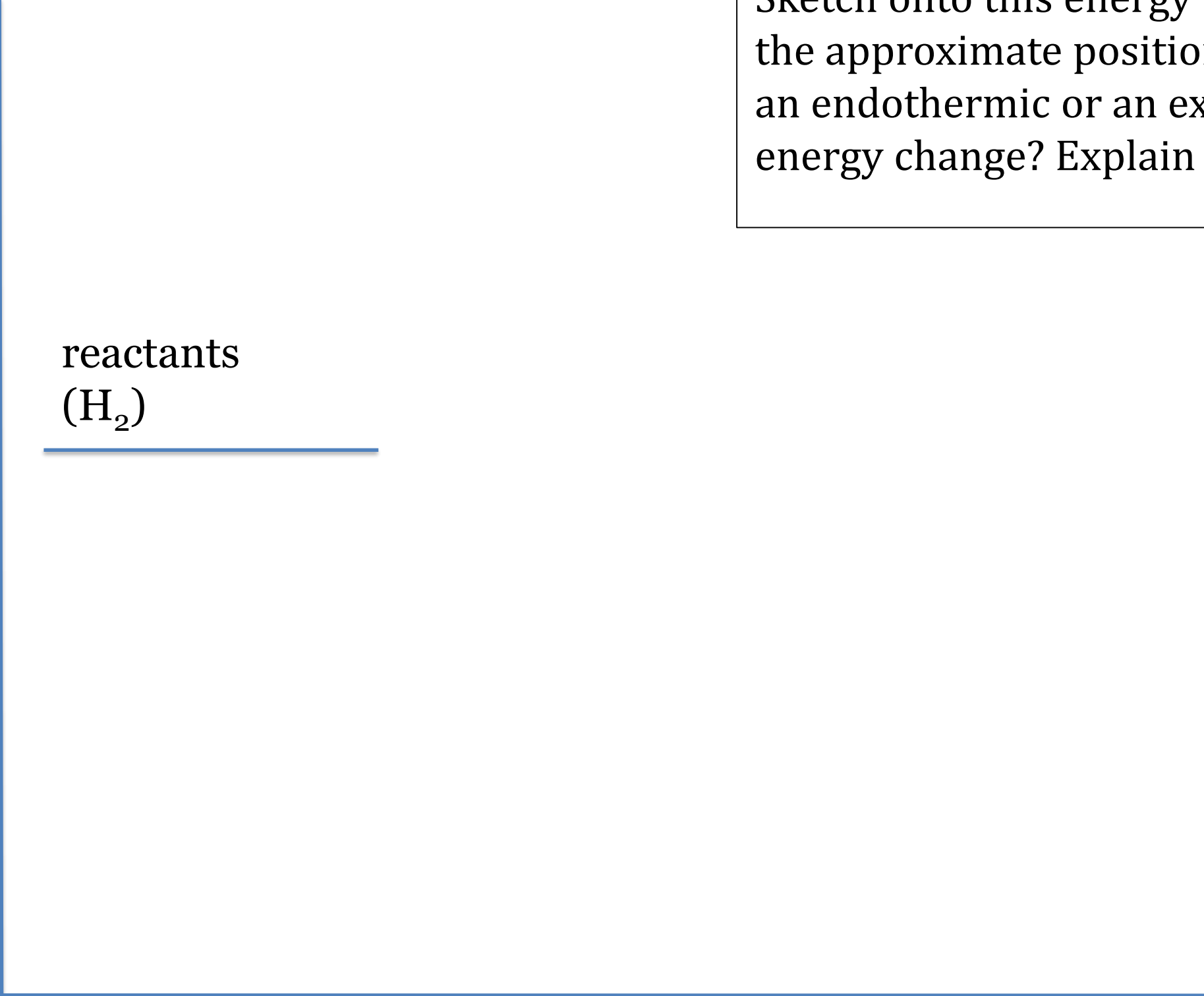
Progress of reaction



Sketch onto this energy level diagram the approximate position of 2H. Is this an endothermic or an exothermic energy change? Explain your answer.

Energy (J)

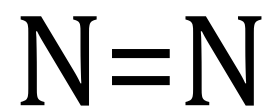
reactants
(H₂)



Progress of reaction

Arrange these bonds in order of increasing strength.

Least
energy
to break

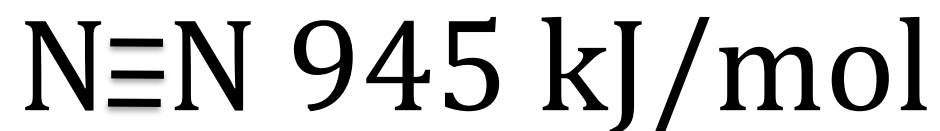


Most
energy
to break



Breaking bonds requires energy. It is endothermic..

Least
energy
to break

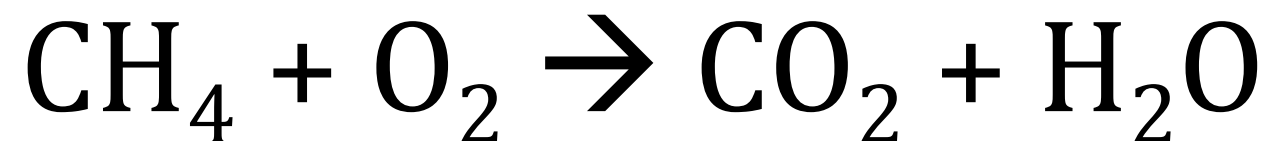


Most
energy
to break



Think deep! How much energy is released when you make one mole of hydrogen gas?

We can use mean bond enthalpies to work out the energy change for a reaction.



How to calculate the energy change using mean bond enthalpies.

1. Write out the equation for the reaction
2. Balance the equation
3. Have a think... do you predict the reaction to be exothermic or endothermic? You won't always be able to tell.
4. Draw the displayed formula for each molecule
5. Calculate the total energy required to break all the bonds in the reactants (this will be endothermic)
6. Calculate the total energy released to make all the bonds the products (this will be exothermic)
7. Overall energy change = energy required to break bonds + energy released when bonds are made. (Remember, energy released will be a negative value)