a

In an exothermic reaction heat _____ the reaction to the surrounding environment.

The surrounding temperature _____ .

In an endothermic reaction heat _____ the chemical reaction.

The surrounding temperature _____ .

b

Circle the exothermic reactions and underline the endothermic reactions:

combustion
photosynthesis
electrolysis
neutralisation
water reacting with calcium oxide
ammonium chloride reacting with water

Name some every day uses of exothermic reactions.

Give an example of an every day use of an endothermic reaction.

c

What is activation energy?

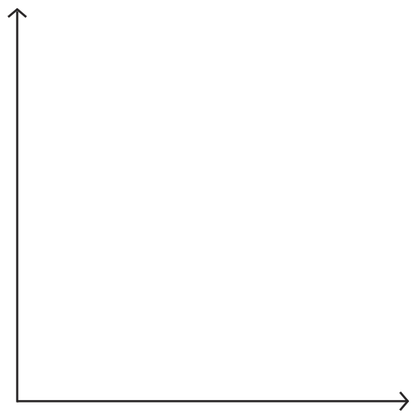
d

Describe how energy transfer can be measured in a practical.

Draw a diagram to show the practical.

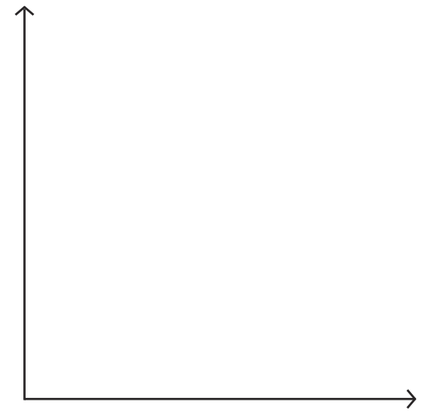
e

Sketch a reaction profile for an endothermic reaction.



f

Sketch a reaction profile for an exothermic reaction.



g

Describe the reaction profile of an endothermic reaction.

Describe the reaction profile of an exothermic reaction.

h

Use the approximate bond energies to calculate the energy change in the following reaction.

$H_2 + Cl_2 \rightarrow 2HCl$

State whether the reaction is endothermic or exothermic.

H–H = 436kJ/mol **Cl–Cl** = 243kJ/mol **H–Cl** = 432kJ/mol

a

What is the difference between a cell and a battery?

_____

_____

_____

_____

b

Compare the difference between non-rechargeable and rechargeable batteries.

_____

_____

_____

_____

d

Put these metals into order of reactivity, from least reactive to most reactive.

zinc, magnesium, silver, copper

_____

How could you test the metals for reactivity?

_____

_____

e

What type of energy is transferred from a hydrogen fuel cell? Tick one answer.

- ☐ chemical
- ☐ thermal
- ☐ electrical
- ☐ elastic

f

Cross out the incorrect word from the bold choices so each sentence is correct.

In a fuel cell, energy is released through **oxidation/reduction** instead of a combustion reaction.

The reaction takes place at a **higher/lower** temperature than if it was to be burned.

The energy is released as **electrical/thermal** energy.

c

Complete the table below.

		Positive Electrode		
		magnesium	zinc	copper
Negative Electrode	magnesium	_____	_____	+2.70
	zinc	-1.60v	0.00v	+1.10v
	copper	_____	_____	_____

Estimate the voltage that would be produced using magnesium for the negative electrode and silver for the positive electrode.

_____

g

Complete the equation to show the reaction at the negative electrode of a fuel cell.

$2H_2$+ _____ → _____ + $4e^-$

Complete the equation to show the reaction at the positive electrode of a fuel cell.

_____ + $2H_2O$ + $4e^-$ → _____

When you add these two half equations together, what is the overall equation for the reaction?

_____

a

In an exothermic reaction heat **exits** the reaction to the surrounding environment.

The surrounding temperature **increases** .

In an endothermic reaction heat **enters** the chemical reaction.

The surrounding temperature **deceases** .

b

Circle the exothermic reactions and underline the endothermic reactions:

combustion **exothermic**
photosynthesis **endothermic**
electrolysis **exothermic**
neutralisation **exothermic**
water reacting with calcium oxide **exothermic**
ammonium chloride reacting with water **endothermic**

Name some every day uses of exothermic reactions.

Hand warmers, self-heating cans, matches, etc.

Give an example of an every day use of an endothermic reaction.

sports injury packs, etc.

c

What is activation energy?

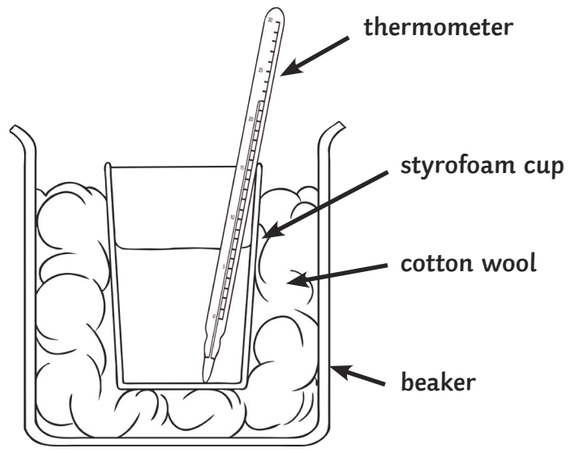
The minimum amount of energy needed by the reactants to start the reaction.

d

Describe how energy transfer can be measured in a practical.

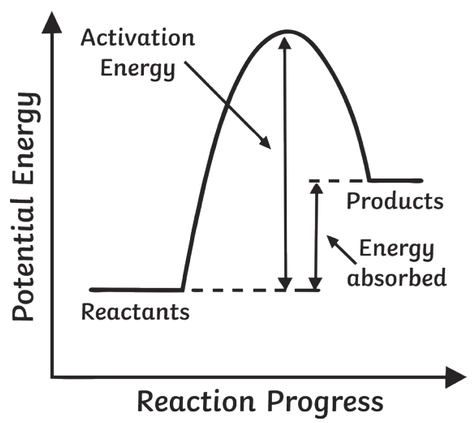
Draw a diagram to show the practical.

1. **Take the start temperature of the reactants.**
2. **Record the highest temperature.**
3. **Record the lowest temperature.**
4. **Take away the temperature from the temperature of the reactants.**



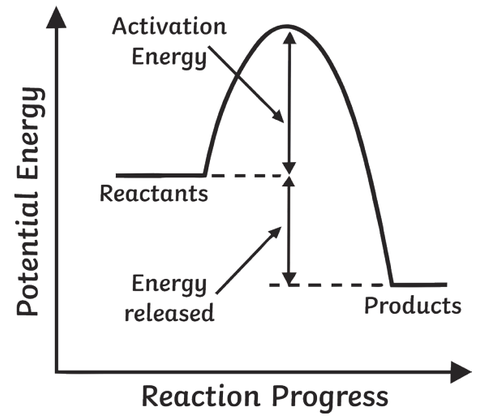
e

Sketch a reaction profile for an endothermic reaction.



f

Sketch a reaction profile for an exothermic reaction.



g

Describe the reaction profile of an endothermic reaction.

The products are at a higher energy level because energy has been transferred from the surroundings into the chemical reaction.

Describe the reaction profile of an exothermic reaction.

The products are at a higher energy level because energy has been transferred from the chemical reaction to the surroundings.

h

Use the approximate bond energies to calculate the energy change in the following reaction.

$H_2 + Cl_2 \rightarrow 2HCl$

State whether the reaction is endothermic or exothermic.

H–H = 436kJ/mol **Cl–Cl** = 243kJ/mol **H–Cl** = 432kJ/mol

436 + 243 → 432 + 432
679 → 864
- 185kJ/mol

The energy change is negative so the reaction is exothermic.

a

What is the difference between a cell and a battery?

A cell is made from two different metals in contact through an electrode. It contains chemicals which react to produce electricity. A battery is two or more cells connected in series and they produce a higher voltage.

b

Compare the difference between non-rechargeable and rechargeable batteries.

In non-rechargeable batteries and cells, once all the reactants have been used, then the reaction stops and the battery no longer works. Alkaline batteries are non-rechargeable.

In rechargeable batteries and cells, the chemical reaction can be reversed by supplying an external electrical current. This recharges the batteries.

d

Put these metals into order of reactivity, from least reactive to most reactive.

zinc, magnesium, silver, copper

silver, copper, zinc, magnesium

How could you test the metals for reactivity?

Place each metal in turn into a clean test tube of water and count the bubbles produced. (The gas can be collected and tested using a lit splint. Listen for a squeaky pop to identify hydrogen gas.)

e

What type of energy is transferred from a hydrogen fuel cell? Tick one answer.

- ☐ chemical
- ☐ thermal
- ☑ **electrical**
- ☐ elastic

f

Cross out the incorrect word from the bold choices so each sentence is correct.

In a fuel cell, energy is released through **oxidation/~~reduction~~** instead of a combustion reaction.

The reaction takes place at a **~~higher~~/lower** temperature than if it was to be burned.

The energy is released as **electrical/~~thermal~~** energy.

c

Complete the table below.

		Positive Electrode		
		magnesium	zinc	copper
Negative Electrode	magnesium	**0.00v**	**1.60v**	+2.70
	zinc	-1.60v	0.00v	+1.10v
	copper	**-2.70v**	**-1.10v**	**0.00v**

Estimate the voltage that would be produced using magnesium for the negative electrode and silver for the positive electrode.

Any reasonable value over 2.70V (the difference in reactivity between magnesium and silver is greater than between magnesium and copper, so the voltage produced will be larger).

g

Complete the equation to show the reaction at the negative electrode of a fuel cell.

$2H_2$ + **$4OH^-$** ⟶ **$4H_2O$** + $4e^-$

Complete the equation to show the reaction at the positive electrode of a fuel cell.

O_2 + $2H_2O$ + $4e^-$ ⟶ **$4OH^-$**

When you add these two half equations together, what is the overall equation for the reaction?

$2H_2 + O_2 \longrightarrow 2H_2O$