Science KS4: Blended Learning Booklet

Stewards Academy

C5 Energy changes

Name:

Form:

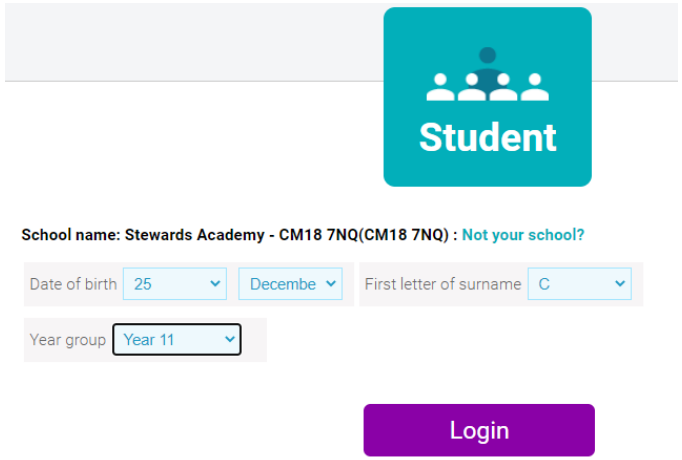
Aim to complete four lessons each week. Watch the videos and follow the four part lesson plan

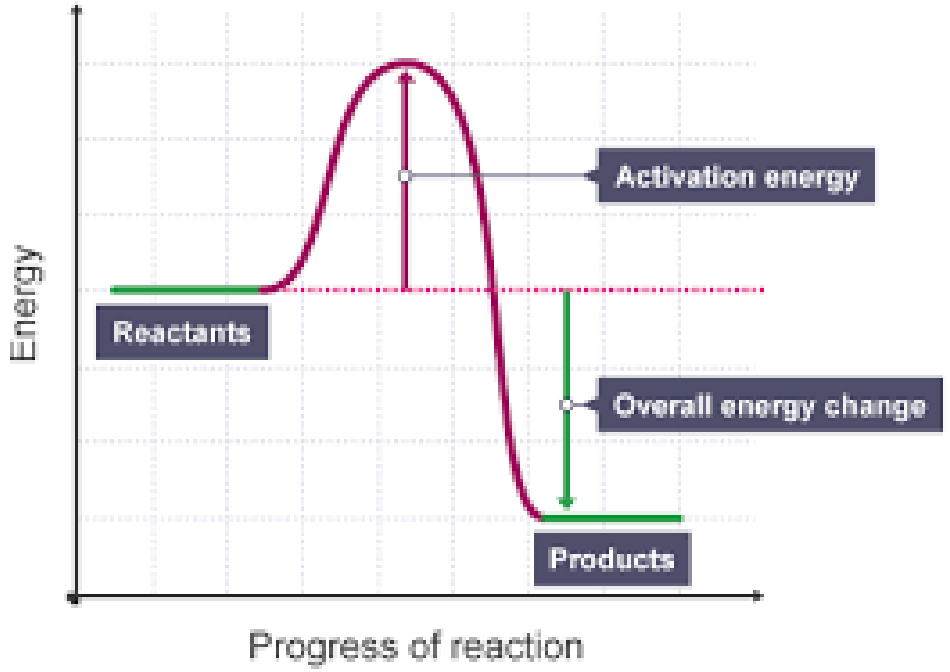
All video clips are online using the ClassCharts link. Upload all work onto ClassCharts for feedback.

The online textbook has all the key information and vocabulary to help you with this unit

To log on to the online textbook:

- https://connect.collins.co.uk/school/portal.aspx
- Type in “stewards” and select Stewards Academy
- Login using your date of birth, initial of your surname and your academic year





Contents

Contents

(T) = Triple scientists only

Big Picture – Year 10 Overview
Science

Unit Test

End of Year Exams

Nest Year

IR emission and absorption (T)

Colour, lenses, images and magnification (T)

The electro-magnetic spectrum

Sound waves and seismic waves (T)

Properties of waves

UNIT P6

Unit Test

Spectroscopy and other instrumental methods (T)

Tests for gases, *metals, hydroxides and anions (T)*

Pure substances and chroma-tography

Polymers and poly-merisation (T)

Waves

I will be able to describe characteristics of waves that can be measured. **I will** be able to measure reflection and refraction of waves and explain why they occur. **I will** be able to place visible light withing the electromagnetic spectrum. ***I will** be able to sound waves can reveal structures (T). **I will** be able to explain how lenses work (T)*

Hydrocarbons & Chemical analysis

I will be able to describe the properties of hydrocarbons. ***I will** be able to describe the properties of alkenes, alcohols, carboxylic acids and polymers (T).* **I will** be able to use techniques to produce and identify a pure substance. ***I will** be able to identify positive and negative ions and evaluate different analysis techniques (T).*

Meiosis and reproduction

Genetics and gene disorders

The work of Gregor Mendel (T)

Unit Test

UNIT C7 & C8

Crude oil, hydrocarbons and fractional distillation

Combustion and cracking of alkanes

Alkenes, alcohols and carboxylic acids (T)

DNA structure and protein production (T)

Genetics

I will be able to explain how we inherit our characteristics as a result of our genes which are made of DNA. **I will** be able to explain how the DNA is replicated and packaged in a specialised way to form the sex cells. ***I will** be able to describe the work by Gregor Mendel around plant genetics*

I will be able to explain how forces affect motion and how an understanding of these forces can make driving safer. ***I will** be able to explain the effects of forces on levers and in creating pressure (T).* I will be able to explain the effects of forces applied to springs.

Forces

DNA, genes and the human genome

UNIT B6

Unit Test

Forces and energy in springs

Moments, levers and pressure (T)

Momentum and road safety

Mass and Weight

Forces, speed and acceleration

UNIT P5

Energy Changes & Reaction Rates

I will be able to describe, explain and represent energy changes in chemical reactions and link them to bond energies and the particle theory. ***I will** be able to explain how dells produce a voltage and how fuel cells work (T).* **I will** be able to measure and calculate the rate of a reaction and describe factors that can affect rate. ***I will** be able to apply Le Chatelier's principle to reactions in equilibrium (T).*

Unit Test

Exo and endo thermic reactions

Reaction profiles

Cells, batteries and fuels cells (T)

Measuring rates of reaction

Factors affecting rates of reaction

Catalysts and collision theory

Reversible reactions and energy changes

Factors affecting equilibrium

UNIT C5 & C6

I will be able to explain how conditions in the body, processes and organ systems are coordinated and controlled. **I will** be able to describe how hormones control sexual development and human reproduction, *as well as how hormones enable plants to respond to stimuli (T)*

Homeostasis

Unit Test

Plant hormones (T)

Human reproduction and IVF

The endocrine system and the kidneys (T)

The nervous system *and the eye (T)*

Homeostasis

UNIT B5

Unit Test

Nuclear fission and fusion (T)

I will be able to reconise an atomic isotope and explain how one isotope can turn into another through three different forms of radioactive decay. **I will** be able to represent radioactive decay using a nuclear equation.

Atomic structure

Hazards and uses of radiation

Titration (T)

Electrolysis

Oxidation and reduction)

Unit Test

UNIT P4

Atomic structure

Radioactive decay

Nuclear equations

Neutralisation

Chemical changes

I will be able to describe why some metals are more reactive than others, **I will** be able to describe how neutralization occurs and how salts are formed. **I will** be able to explain how some metals are extracted by electrolysis rather than oxidation

I will be able to describe how lifestyle choices can affect the risk of catching a non-communicable disease. **I will** be able to explain how communicable diseases are spread and how we can control their spread. ***I will** be able to describe how plants are affected by and protected from disease causing organisms (T).*

Health

Metal reactivity

UNIT C4

Unit Test

Plant diseases & defenses (T)

Protecting the body

Malaria

Pathogens

Health and disease

UNIT B4

Year 10

ZOOM IN...

MY LEARNING JOURNEY:

Subject: Energy Changes Year: 10 Unit: C5

AIMS

Students will build on ideas about bonding, and about chemical changes. Students' will develop abilities to analyse data and to use symbol equations to describe reactions.
This unit will enable students to identify exothermic and endothermic changes, use reaction profiles to describe them, calculate theoretical energy transfers using bond energies and investigate the variables that affect the temperature changes in solutions.

DEVELOPING COURAGE

- **C** Learn how carry out reactions safely
- **O** To carry out some chemical reactions
- **U** Work together to carry out practical
- **R** Use the basic rules of chemistry to explain why reactions take in or give out energy
- **A** That some reactions give out heat whilst some take in heat
- **G** Share our scientific knowledge
- **E** Learning about practical applications

UP NEXT

The rate of chemical change

- Measuring and calculating reaction rates
- Collision theory
- Catalysts
- Reversible reactions and equilibrium

CAREERS

- Synthetic Chemist
- Chemical Engineer
- Lab technician

PREVIOUS LEARNING

Pupils will have some knowledge about energy in chemical reactions and about following and explaining energy changes.

WHAT WE KNOW/ REMEMBER

- .....
- .....
- .....
- .....
- .....

RECOMMENDED READING

1. : What is Chemistry? by Peter Atkins,
2. Reactions: An Illustrated Exploration of Elements, Molecules, and Change in the Universe by Theodore Gray,

PERSONAL OBJECTIVES

- .....
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- .....

Lesson 1: C5.1 – Key concept: Endothermic and exothermic reactions

Connection

Have a look at the topic overview and the C5 zoom in.

Populate what you know and your personal objectives.

Activation

LI: Identify endothermic and exothermic reactions from the temperature change

1. https://www.youtube.com/watch?v=dstRL5xB0Sk
2. Make a note of the title and the LI
3. Read pages 174-175
4. Define the key words on page 174
5. Draw and label figure 5.1 and 5.2 page 174

Demonstration

Attempt questions 1-7
In 15 mins answer as many questions as you can.
Self mark the questions you have done making any necessary corrections in blue pen

Challenge yourself to answer as many as you can:
Green questions to GCSE Level 3
Blue questions to GCSE Level 6
Purple questions to GCSE Level 9

Consolidation

Complete and self assess the relevant past paper question for this topic - From the C5 DIP file

Extension

Make a note of one thing you think you understand well and one thing that you would like to ask your teacher

Answers:C5.1 – Exothermic and endothermic

Connection

1 NA
2 NA
3 NA

Demonstration

1 The temperature increased and heat was given out so this is an exothermic reaction.
2 Plants use the Sun's energy in the form of light to make glucose from carbon dioxide and water. The reaction takes in energy which is endothermic.
3 7.75 g.
4 Volume on the x axis. Draw best fit straight lines through the points going up and going down. They should intersect at about 25 cm3 / 31 o C. As the acid is added, the exothermic neutralisation produces heat and the temperature rises. The peak of temperature rise is where exactly the correct moles of acid has been added to exactly neutralise the alkali (in other words if the ratio of acid to alkali is 1:1 then the same number of moles of acid have been added to the alkali). This occurs at 24 cm3 / 31.5 o C. As further acid is added, the temperature decreases as the heat is just spread out in a greater mass of solution (no further reaction takes place). Note that to accurately work out the end point of the neutralisation from the graph, draw best fit straight lines through the points going up and going down. They should intersect at about 24 cm3 / 31.5 o C.
5 To prevent heat loss – polystyrene is a good insulator.
6 Some suggestions: • Change the starting concentration of the alkali and repeat. Keep the same concentration of acid and same volumes. • Change the concentration of the acid and repeat. Keep the same concentration of alkali and the same volumes. • Repeat the experiment with other strong and weak acids and alkalis. Keep the same volumes.
7 1. Heat loss to the surroundings. Polystyrene is not a perfect insulator and there is no lid. So heat energy is lost to the surroundings. The apparatus can be modified by adding a lid with a hole for the thermometer. 2. The temperature data suggest that the thermometers have an uncertainty of plus or minus 1 o C. Since the temperature changes are not large, an accurate thermometer would be needed (e.g. one that reads to 0.2 o C). 3. The end point may occur in between the volumes of acid added. So to accurately work out the maximum temperature rise, two best fit straight line should be drawn. One as the temperature rises and one as it falls. Then extrapolate the lines. The maximum temperature rise is where the lines intersect. This is the point of neutralisation.

Lesson 2: C5.2 – Required practical: Investigate the variables that affect temperature changes in reacting solutions.

Connection

Q1. State what is meant by exothermic

Q2.State what is meant by endothermic

Q3. Give an everyday example of an exothermic and endothermic reaction

Activation

LI: Use scientific theories and explanations to develop hypotheses

1. https://www.youtube.com/watch?v=tKxcQYZ2YH8
2. Make a note of the title and the LI
3. Read pages 176-177
4. Define the key words on page 176
5. Draw and label figure 5.4 page 177

Demonstration

Attempt questions 1-8
In 15 mins answer as many questions as you can.
Self mark the questions you have done making any necessary corrections in blue pen

Challenge yourself to answer as many as you can:
Green questions to GCSE Level 3
Blue questions to GCSE Level 6
Purple questions to GCSE Level 9

Consolidation

Complete and self assess the relevant past paper question for this topic - From the C5 DIP file

Extension

Make a note of one thing you think you understand well and one thing that you would like to ask your teacher

Answers:C5.2 – Required practical: Investigate the variables that affect temperature changes in reacting solutions such as, acid plus metals, acid plus carbonates, neutralisations, displacement of metals

Connection

1 An exothermic reaction is a reaction where the temperature of the surroundings increases.
Alternatively it can be described as a reaction where the enthalpy change is negative
2 An endothermic reaction is a reaction where the temperature of the surroundings decreases.
Alternatively it can be described as a reaction where the enthalpy change is positive
3 Exothermic – hand warmers, self heating cans
Endothermic – Ice packs, sports injury pack

Demonstration

1 Different reactants will most likely produce different energy changes when they react. So temperature changes are likely to be different. Changing concentration will affect the temperature change. Changing concentration changes the number of "reactions" per volume and therefore the energy change per volume.
2 Type of metal; Type of ions in solution; Concentration of ions in solution; Size of pieces of metal
3 It is necessary to see how experimental results change due to one variable changing. If two are changed at once, it would not be possible to determine the contribution of each variable to the change.
4 The identity of the metal and the acid. The concentration of the acid. The volume of the acid solution. The container for the reaction. The procedure for the experiment.
5 a 7.2, 5.4, 11.1, 3.7. b 11.1 o C. It should be discarded. c As the concentration of the acid increases the temperature change increases when reacting with carbonates. So their hypothesis was correct.
6 The evidence supports the original hypothesis: "As the concentration of the acid increases the temperature change increases when reacting with carbonates". This is clearly seen in the data over 2 trials. They could have gathered more evidence to support their conclusion e.g. use a wider range of concentrations.
7 If lumps of carbonate are used, there may not be the same number or size between trials. This will affect the surface area and therefore rate. Rate can affect heat loss. It cannot be assumed that this will not have an effect on the temperature change.
8 If heat is lost, the temperature increases will be smaller. This will affect the validity of the results.

Lesson 3: C5.3 – Reaction profiles

Connection

Q1. State what is meant by exothermic

Q2.State what is meant by endothermic

Q3. Give an everyday example of an exothermic and endothermic reaction

Activation

LI: Explain the energy needed for a reaction to occur and calculate energy changes

1. https://www.youtube.com/watch?v=yQzJHHQOB8w
2. Make a note of the title and the LI
3. Read pages 178-179
4. Define the key words on page 178
5. Draw and label figure 5.8 and 5.9 page 179

Demonstration

Attempt questions 1-4
In 15 mins answer as many questions as you can.
Self mark the questions you have done making any necessary corrections in blue pen

Challenge yourself to answer as many as you can:
Green questions to GCSE Level 3
Blue questions to GCSE Level 6
Purple questions to GCSE Level 9

Consolidation

Complete and self assess the relevant past paper question for this topic - From the C5 DIP file

Extension

Make a note of one thing you think you understand well and one thing that you would like to ask your teacher

Answers:C5.3 – Reaction profiles

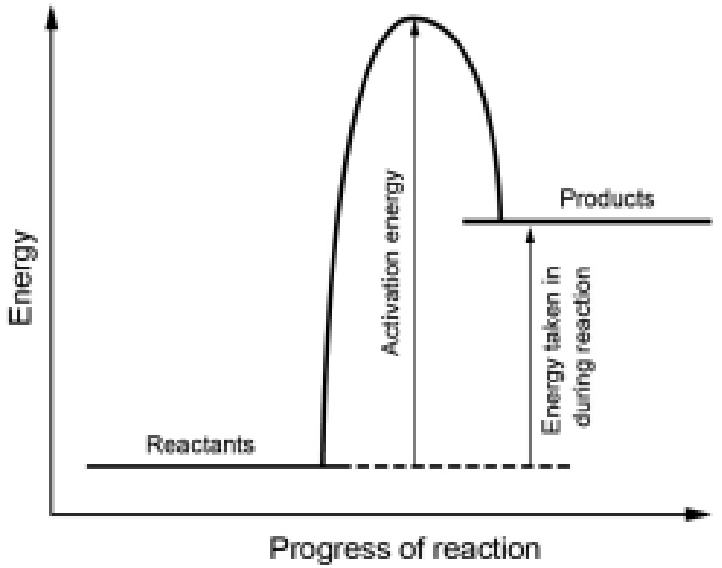
Connection

1 An exothermic reaction is a reaction where the temperature of the surroundings increases.
Alternatively it can be described as a reaction where the enthalpy change is negative
2 An endothermic reaction is a reaction where the temperature of the surroundings decreases.
Alternatively it can be described as a reaction where the enthalpy change is positive
3 Exothermic – hand warmers, self heating cans
Endothermic – Ice packs, sports injury pack

Demonstration

1 Heat energy from the lit fuse.

2



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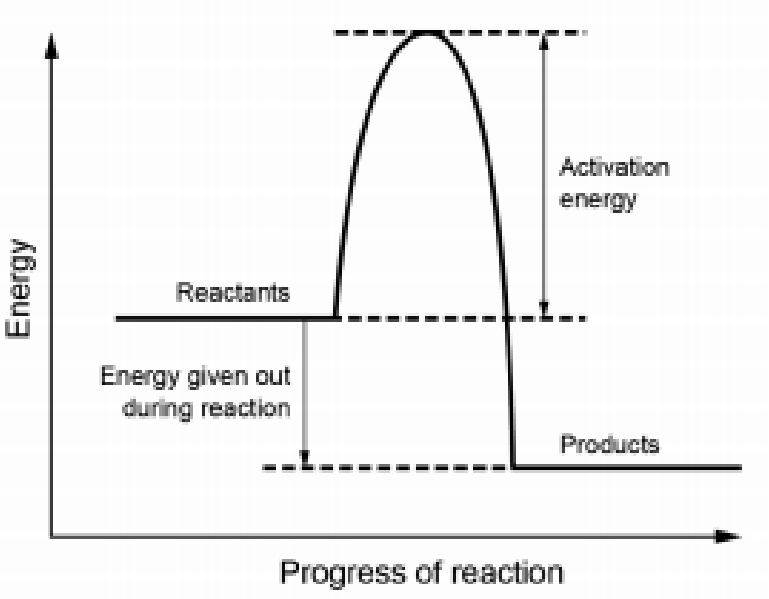


4 2 H–H and 1 O=O reactant bonds have to be broken. This requires energy (endothermic). 4 O–H product bonds (2 H2O) are formed which releases energy (exothermic). Reaction is exothermic because less energy is required to break reactant bonds than is released forming product bonds.

Lesson 4: C5.4 – Energy change of reactions

Connection

Q1. Draw a reaction profile for an exothermic reaction

Q2.State what happens overall to the bonds in an endothermic reaction

Q3. Describe how a reaction starts in terms of collisions

Activation

LI: explain how a reaction is endothermic or exothermic overall

1. https://www.youtube.com/watch?v=it0HGXhxD-s
2. Make a note of the title and the LI
3. Read pages 180-181
4. Define the key words on page 180
5. Draw and label figure 5.11 page 180

Demonstration

Attempt questions 1-4
In 15 mins answer as many questions as you can.
Self mark the questions you have done making any necessary corrections in blue pen

Challenge yourself to answer as many as you can:
Green questions to GCSE Level 3
Blue questions to GCSE Level 6
Purple questions to GCSE Level 9

Consolidation

Complete and self assess the relevant past paper question for this topic - From the C5 DIP file

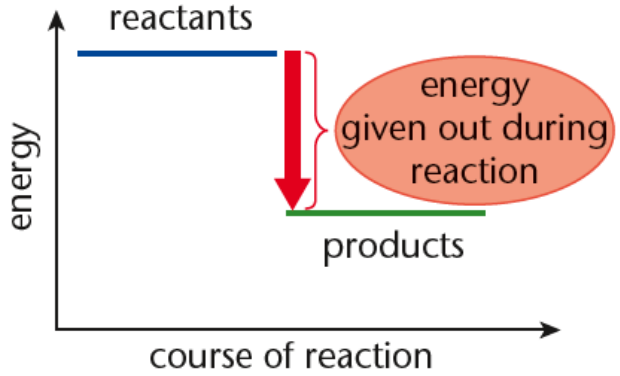
Extension

Make a note of one thing you think you understand well and one thing that you would like to ask your teacher

Answers:C5.4 – Energy change of reactions

Connection

1



2 In an endothermic reactions overall more bonds are broken than formed
3 When two chemicals react their particles have energy and are moving. As the particles meet they collide. Some collisions do not result in a reaction. They are unsuccessful. Some collisions do result in a reaction. They are *successful*. They have enough energy to react

Demonstration

1 The reaction is endothermic as the temperature goes down. Reactant bonds have to be broken. This requires energy (endothermic). Product bonds are formed which releases energy. However, overall reaction is endothermic because more energy is required to break reactant bonds than is released forming product bonds.

2 6452

3 Reactant bonds: 4 × C–C + 12 × C–H + 8 × O=O = 6416 + 3984 = 10400 Product bonds: 10 × C=O + 12 × O–H = 8050 + 5580 = 13630 Energy change = 10400 – 13630 = –3230

4 Reactants: 1 × C=C + 4 × C–H + 1 × H–H = 2694 Products: 1 × C–C + 6 × C–H = 2840 Energy change = –146 kJ/mol

Lesson 5: C5.5 – Cells and batteries (Triple)

Connection

Q1. What is the sum of the bond energies for a molecule of water

Q2.State whether bond breaking is an exothermic or endothermic process

Q3. Butane is often used as a fuel. Calculate the energy change for the combustion reaction (you will need the textbook page 181)

Activation

LI: explain how a voltage can be produced by metals in an electrolyte

1. https://www.youtube.com/watch?v=GoNfZNGkLM8
2. Make a note of the title and the LI
3. Read pages 182-183
4. Define the key words on page 182
5. Draw and label figure 5.14 and fig 5.15 page 182

Demonstration

Attempt questions 1-5
In 15 mins answer as many questions as you can.
Self mark the questions you have done making any necessary corrections in blue pen

Challenge yourself to answer as many as you can:
Green questions to GCSE Level 3
Blue questions to GCSE Level 6
Purple questions to GCSE Level 9

Consolidation

Complete and self assess the relevant past paper question for this topic - From the C5 DIP file

Extension

Make a note of one thing you think you understand well and one thing that you would like to ask your teacher

Answers:C5.5 – Cells and batteries

Connection

1 465x2 = 930 kJ/mol

2 Endothermic

3 $2C_4H_{10} + 13O_2 \rightarrow 8CO_2 + 10H_20$

Reactants:

2X(3x C-C) = 2208

2X(10x C-H) = 8240

13X(1x O=O) = 6474

Total = 16922

Products:

8X(2x C=O) = 12880

10X(2x H-O) = 9300

Total = 22180

Energy change = 5258kJ/mol

Reaction is exothermic

Demonstration

1 Zinc is more reactive than copper. If the metals are placed into an electrolyte, zinc in the zinc electrode loses electrons (and is oxidised) and becomes zinc ions. The electrons travel around the circuit to the copper electrode. This is electrical current. The copper ions in solution accept the electrons from the copper electrode. Copper is deposited on the copper electrode.

2 They can be reused many times which saves on valuable resources. They create less pollution since fewer of them are used compared to disposable batteries. They are cheaper in the long run than disposable batteries because they can be used many times.

3 Rechargeable. Although it has a lower voltage, this is likely to be sufficient for a small toy. The mass is smaller than for B and C which means that it is more suitable for a small toy (a small toy car will need less power if it is lighter). It can be recharged many times which is more convenient than disposable batteries. C could not be used in a toy since it contains acid, which is hazardous and lead which is toxic (as is the voltage). The voltage for B is too high for a toy.

4 Silver. The most negative voltage is between magnesium and silver which suggests that they differ the most widely in reactivity. Magnesium is more reactive than nickel. Nickel is more reactive than silver. 5 Ni is more reactive than silver. So nickel is oxidised. Ni → Ni2+ + 2e– Ag+ + e– → Ag

Lesson 6: C5.6 – Fuel cells(Triple)

Connection

Q1. Describe one disadvantage of a rechargeable battery

Q2. State the difference between a cell and a battery

Q3. Describe one disadvantage of using alkaline batteries

Activation

LI: Describe how a fuel cell works

1. https://www.youtube.com/watch?v=8xeB_O_fyzM
2. Make a note of the title and the LI
3. Read pages 184-185
4. Define the key words on page 184
5. Draw and label figure 5.22 page 185

Demonstration

Attempt questions 1-4
In 15 mins answer as many questions as you can.
Self mark the questions you have done making any necessary corrections in blue pen

Challenge yourself to answer as many as you can:
Green questions to GCSE Level 3
Blue questions to GCSE Level 6
Purple questions to GCSE Level 9

Extension

Make a note of one thing you think you understand well and one thing that you would like to ask your teacher

Consolidation

Complete and self assess the relevant past paper question for this topic - From the C5 DIP file

Answers:C5.6 – Fuel cells

Connection

1 They are more expensive to begin with

2 A battery is made up of two or more cells

3 They are non-rechargeable

Demonstration

1 $2H_2 + O_2 \rightarrow 2H_2O$

2 The energy released is converted into electricity. The hydrogen and oxygen gases are reacting at different electrodes.

3 Not many filling stations sell hydrogen. / Hydrogen is difficult to store. It has to be compressed and liquefied and stored in rugged fuel tanks. / Hydrogen is explosive and there is a hazard associated with this. / A large proportion of hydrogen is produced from fossil fuels which are non-renewable. This requires lots of energy.

4 Hydrogen loses electrons at the negative electrode, which is oxidation. At the positive electrode, hydrogen ions are reduced since they gain electrons.

C5 - Revision

Connection

Q1. What reaction occurs in a fuel cell?

Q2. Give an advantage of a fuel cell

Q3. Fuel cells use a redox reaction. What is reduced and what is oxidised during this reaction?

Activation

LI: Create a topic summary sheet

1. Fold an A3 sheet so it is divided into 8 sections
2. Look back over you lesson and group them into 8 main headings
3. Summarise the key points into each section, use keywords and diagrams and symbols rather than sentences

Demonstration

Test yourself by working with the person sitting next to you by talking though each box on your summary sheet and seeing how many key facts you can remember

Consolidation

Look though the relevant past paper questions for this topic - From the C5 DIP file – see if you can complete any additional questions

Extension

Make a list of anything that you would like to ask your teacher to go over again

Answers Lesson – C5 revision

Connection

1. Hydrogen reacts with oxygen to make water

2. -Direct energy transfer = chemical>electrical reduces energy lost as heat
   -Fewer transfer stages
   - Less polluting (product= water)
   -Fuel cells last larger than normal rechargeable batteries

1. Hydrogen loses electron and is oxidised
   Oxygen gains electrons and is reduced

DART C5 – Exothermic Reactions

A warming life jacket -New liner contains a substance that helps fight heat loss in chilly water

Sometimes the biggest threat from a boat sinking isn't the accident itself. It's not even the sharks that might be swimming nearby. It's a life-threatening loss of body heat from remaining too long in cold water. Now, a South African teen has invented a heat-producing liner for life jackets. It could help delay injuries — or death — until a rescue is possible.

Normal body temperature for people is around 37° Celsius (98.6° Fahrenheit). But when the core body temperature falls below 35° C (95° F), people suffer from something called hypothermia. When this occurs, the body doesn't function quite the way it should, says Danielle Mallabone. She is a 17-year-old junior at St. Teresa's High School in Johannesburg, South Africa.

With mild hypothermia, blood vessels just beneath the skin shrink. This restricts blood flow to help cut the loss of heat from blood. (As blood cools, it speeds the cooling of internal tissues.) Hypothermia also triggers shivering. Those muscle contractions help generate heat to somewhat boost the body's internal temperature, she notes.

During severe hypothermia, things get much worse. People become confused and uncoordinated. They also have difficulty speaking. Eventually, major organ systems such as the heart will fail. This can lead to death.

The body's temperature can drop to dangerous levels even in relatively warm water, explains Mallabone. That's why she designed a heat-producing liner for life jackets. Pockets in the liner hold a powdered chemical called calcium oxide, which gives off heat when it gets wet.

That heat-producing, or exothermic, reaction warms the water between the life jacket and someone's body. This might stave off severe hypothermia long enough to allow for a rescue.

Mallabone tested her own invention by jumping into 50°C water. Each test lasted an hour. The first version of her life jacket liner included only 50 grams (about 1.8 ounces) of the calcium oxide, she notes. "But that amount didn't provide enough heat, and my body temperature dropped to 35° C after just an hour," she says. So the next version included 1 kilogram (2.2 pounds) of the heat-producing chemical. In her test using that liner, her body temperature stayed above 36.1°C.

The chemical reaction between calcium oxide and water generates heat slowly. The reaction began producing heat after 5 minutes, Mallabone found. The liner produced the most heat about 25 minutes after the life jacket was first immersed.

Questions

1a. What is normal body temperature?
b. State the definition for an exothermic reaction
c. What substance, when added to water, produces an exothermic reaction

2a. Explain why this is a useful reaction for a lifejacket
b. Explain, with data from the extract, what changes Mallabone made to her experiment
c. Explain why she made these changes and what the results were

3a. Evaluate the use of a warming life jacket
b. State, with information from the extract, your opinion on using warming life jacket
c. How would you improve the use of warming life jackets?

Answers C5 DART – Exothermic reactions

1a. “Normal body temperature for people is around 37° Celsius (98.6° Fahrenheit).”
1b. An exothermic reaction is any chemical reaction where energy in the form of heat is transferred to the surroundings
1c. “calcium oxide, which gives off heat when it gets wet.”

2a. “That heat-producing, or exothermic, reaction warms the water between the life jacket and someone’s body. This might stave off severe hypothermia long enough to allow for a rescue.”
2b. “Mallabone tested her own invention by jumping into 50°C water. Each test lasted an hour. The first version of her life jacket liner included only 50 grams (about 1.8 ounces) of the calcium oxide, she notes. “But that amount didn’t provide enough heat, and my body temperature dropped to 35° C after just an hour,” she says. So the next version included 1 kilogram (2.2 pounds) of the heat-producing chemical. In her test using that liner, her body temperature stayed above 36.1°C.” - Simplified: increased mass of calcium oxide from 50g to 1kg
2c. Mallabone increased the mass from 50g to 1kg because her body dropped to 35° C after just an hour. However, when she used 1kg of calcium oxide, her body temperature stayed above 36.1° C

3a. Pros
Can help to prevent hypothermia if person falls into cold water
The jacket produces heat slowly, so as to not release it all at once
Cons
Will only generate heat for the top half of your body
Adds an extra 1kg of mass onto lifejacket
Only in experimental stages at the moment
No mention of cost of materials so potentially expensive
3b. Any reasonable opinion using facts from the texts – could use facts from previous answer
3c. Potential answers could include experimenting with different substances to see if same result can be achieved with a lower mass of different substance. Answers could include description of life jacket that covered more surface area of the body to maximise heat distribution
Could also include reference to use of different substance that is not irritating the skin and eyes, which calcium oxide is.

Attainment Band :	C5 Energy Changes AQA) Knowledge and Understanding
Yellow Plus/ Yellow	Recognise that in a chemical reaction energy can be transferred in from the surroundings. Identify endothermic reactions as causing a temperature decrease. Explain and evaluate the uses of some exothermic and endothermic reactions. Explain how the variables investigated affect temperature changes. Explain the idea of activation energy and calculate energy changes in a reaction using an energy level profile. Calculate energy changes in a reaction given information on mass of reactant. Calculate the energy transferred in chemical reactions using bond energies.
Blue	Recognise that in a chemical reaction energy can be transferred to the surroundings. Identify exothermic reactions as causing a temperature rise. Identify examples of endothermic reactions. Investigate the variables that affect temperature changes in reacting solutions. Use reaction profiles to identify reactions as exothermic or endothermic. Calculate the energy change using a given equation. Describe the energy changes in bond breaking as endothermic and bond making as exothermic and explain how the energy of a reaction is calculated overall.
Green	Know that energy is conserved. Identify exothermic and endothermic reactions from temperature changes. Identify examples of exothermic reactions. Investigate changes in temperature of different reactions. Draw simple reaction profiles (energy level diagrams). Calculate the energy change when transferred to 100 g of water using the temperature difference. Recognise that energy transfer during a reaction is due to bonds being broken and then new bonds being made.
White	Some elements of the above have been achieved