Key Words

Biodiversity – A measure of the variety of all different species of organisms on Earth.

Pollution – A substance which has a harmful or poisonous effect on the environment or organisms living in that environment.

Smog - A fog which is made heavier and darker by smoke and chemical pollution.

Acid rain – Rainfall which has become acidic by atmospheric pollutants, which cause the environment harm.

Deforestation – The action of clearing a wide area of trees.

Peat bog – Dense wetlands filled with partially decayed vegetation.

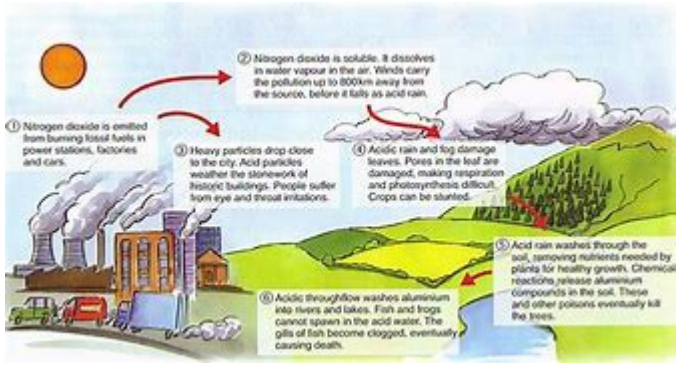
Biomass – The amount of biological material in an organism.

Habitat – The natural home or environment of an animal, plant or other organism.

Quadrat – A sample area used for measuring the abundance and distribution of organisms in the field.

Quantitative sampling – Records the number of organisms rather than just the type of organisms present in an area.

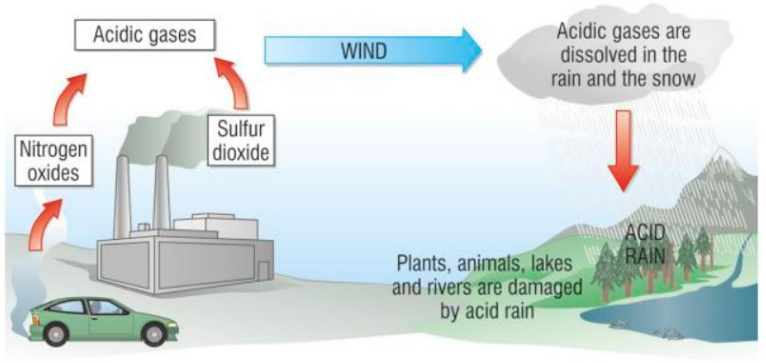
Organism – An individual animal, plant, or single-celled life form.



Scan the QR code with your mobile phone to access a playlist of videos around the biodiversity topic!

The formation of acid rain

- When fossil fuels are burnt in vehicles and factories, acid gases are formed.
- Carbon dioxide is released into our atmosphere.
- Fossil fuels often contain sulfur impurities, which react with oxygen when they burn to form sulfur dioxide gas.
- This can cause breathing issues for humans if the concentration is too high.
- However, acidic sulfur and nitrogen dissolve in rainwater, reacting with oxygen in the air to form dilute sulfuric and nitric acid.
- This produces acid rain – pH of around 2 (more acidic than vinegar)!



SMOG

Caused by smoke and chemicals such as sulfur dioxide and nitrogen oxides. SMOG forms a haze of small particles and acidic gases that can be seen in the air over major cities around the world.

Biodiversity and its importance

Biodiversity is the measure of the variety of all the different species of organisms on Earth.

- High biodiversity ensures the stability of an ecosystem.
- Reduces the dependence of one species on another for food, shelter, and the maintenance of physical environment.

We have come to realise that the future of the human species on Earth relies heavily on us maintaining a good level of biodiversity in the world. Unfortunately, many human activities are reducing biodiversity.

Practice Knowledge Quiz Questions

1. Sulfur impurities often react with oxygen to form what gas?
2. What issues can acid rain cause for the environment?
3. What issues can acid rain cause for animals and humans?
4. What is the pH of acid rain?
5. What is peat bog?
6. What issues does SMOG cause?

Tasks

1. What is biodiversity and why is it important?

2. Find and fix the following statements
   - When renewable fuels are burnt in vehicles and factories, acid gases are formed.
   - Methane is released into our atmosphere.
   - Fossil fuels often contain sulfur impurities, which react with Carbon when they burn to form sulfur dioxide gas.
   - This can cause breathing issues for humans if the concentration is too low.
   - However, acidic sulfur and nitrogen dissolve in rainwater, reacting with oxygen in the air to form dilute sulfuric and hydrochloric acid.
   - This produces acid rain – pH of around 12 (more acidic than vinegar)!

Water pollution is a problem for humans and wildlife.

Explain how human activities are polluting rivers, lakes and seas.

_____

_____

_____

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(Total 6 marks)

Year 11 Chemistry - Term 3: Electrolysis

Key Words

Chemical Change - This occurs when a substance combines with another to form a new substance and are irreversible.

Physical Change - This is a reversible change in the physical properties of a substance. No new substance formed or created.

Anode - The positive electrode in electrolysis.

Cathode - The negative electrode in electrolysis.

O.I.L R.I.G - Oxidation Is Loss(of electrons) / Reduction Is Gain(of electrons)

Bond energy - The energy required to break a specific chemical bond.

Displacement reactions - This is a chemical reaction in which a more reactive element displaces a less reactive element from its compound.

Half equations - An equation that describes reduction or oxidation. (Higher)

pH Scale - A **pH value** is a number from 1 to 14, with 7 as the middle (neutral) point. Values below 7 indicate acidity, 1 being the most acidic.

Ionic compounds - A chemical compound composed of ions held together by electrostatic forces. It is neutral overall. They can only be electrolysed when they are molten or dissolved in water.

Control variable – a factor in an investigation that we must keep the same to prevent errors in our results.

Independent variable – a factor in an investigation that we change i.e. temperature.

Dependent variable – a factor that we observe/ measure in an investigation.

Mean – the average number in a set of data (add the values together and divide this by the number of values you have)

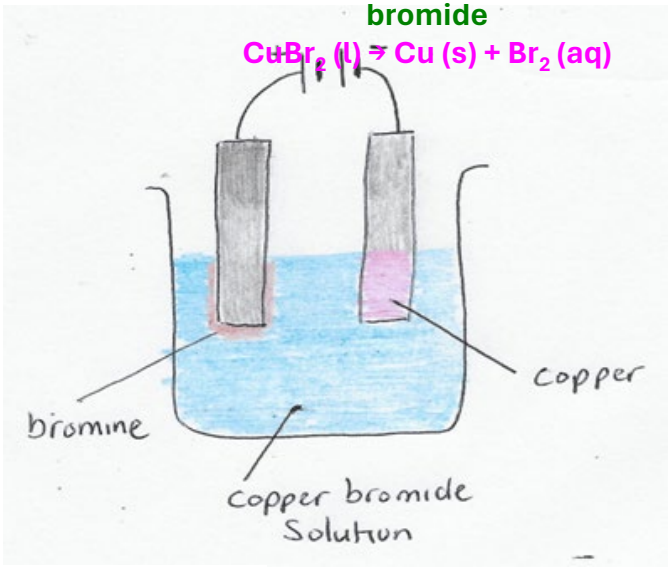
Reproducible – a measurement is reproducible if it is completed by another person and the same results are obtained.

Electrolysis

Electric current is used to break down an ionic compound in electrolysis. After that, the compound which is formed is called the electrolyte. To set up an electric circuit for electrolysis, we have two electrodes that dip into the electrolyte, with a gap between them. The electrodes are conducting rods. One of these is connected to the positive terminal of a power supply. This positive electrode is called the anode. The other one negative electrode is called the cathode.

Copper (ll) bromide → copper + bromide

$CuBr_2$ (l) → Cu (s) + Br_2 (aq)

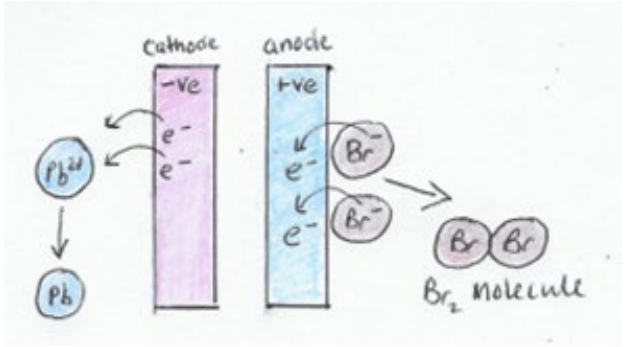


Scan the QR code with your mobile phone to access revision materials.

Half Equations

We represent what is happening at each electrode using **half equations.**

Cathode:
$Pb^{2+} + 2e^- \rightarrow Pb$
Anode:
$2Br^- \rightarrow Br_2 + 2e^-$



The effect of water

In aqueous solutions, electrolysis is more complex, because of the ions formed by water as it ionizes:

H_2O (l) → H^+ (aq) + OH^- (aq)
Water → hydrogen ions + hydroxide ions

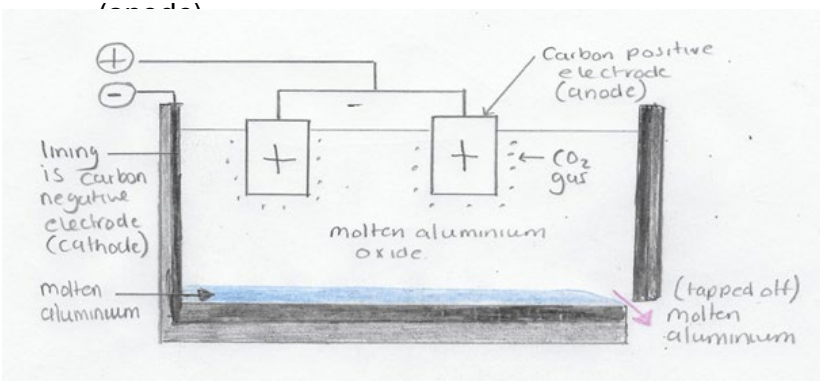
At the cathode (-):
$2H^+$ (aq) + $2e^-$ → H_2 (g)
So the order of discharge at the anode (starting with the easiest) is:
Halide ion>hydroxide>all other negatively charged ions

Electrolysis of Aluminum oxide

Aluminium oxide is mixed with molten cryolite. Cryolite is another ionic compound. The molten mixture can be electrolysed at about 850°C. The large amount of electrical energy that is transferred to the electrolysis cells keeps the mixture molten as shown in below. The overall reaction in the electrolysis cell is:

Aluminium oxide → aluminium + oxygen
$2Al_2O_3$ (l) → 4Al (l) + $3O_2$(g)

Aluminium forms at the negative electrode (cathode).
Oxygen is produced at the positive electrode (anode).



4 x Electrolysis Revision Video (FreeScienceLessons.com)

Remember: If a metal is more reactive than hydrogen in the reactivity series, then hydrogen will be given off at the cathode

Don't **PANIC** –
Positive is **A**node
Negative **I**s **C**athode.

Knowledge Quiz 1.

What is electrolysis?
What is an electrolyte?
What is the name of the negative electrode?
What is the name of the positive electrode?
Oxidation is ...
Reduction is ...
The charge on an anion is ...
The charge on a cation is ...
Draw and label an electrolysis circuit.

Knowledge Quiz 2 - Products from electrolysis.

What happens to ions at the electrode?
Why can ionic compounds conduct electricity?
Name the products from the electrolysis of molten lead bromide.
Name the products from electrolysis of sodium chloride solution.
Name the products from the electrolysis of copper sulfate solution.

Exam Question

This question is about electrolysis.

Some metals are extracted from molten compounds using electrolysis.

Why is electrolysis used to extract some metals?

[1 mark]

_____

_____

Aluminium is produced by electrolysis of a molten mixture.

What **two** substances does the molten mixture contain?

[2 marks]

1 _____

2 _____

Key Words

Carrier waves – Waves used to carry any type of signal.

Charged-coupled device – An electronic device that creates an electronic signal from an optical image formed on the CCD's array of pixels.

Contrast medium – An x-ray absorbing substance used to fill a body organ so the organ can be seen on a radiograph.

Electromagnetic spectrum – The continuous spectrum of electromagnetic waves.

Electromagnetic waves – Electric and magnetic disturbances that transfer energy from one place to another.

Frequency – The number of wave crests passing a fixed point every second.

Ionisation – Any process in which atoms become charged.

Wave speed – The distance travelled per second by a wave crest or trough.

Wavelength – The distance from one wave crest to the next.

X-ray – Electromagnetic waves smaller in wavelength than ultraviolet radiation produced by x-ray tubes.

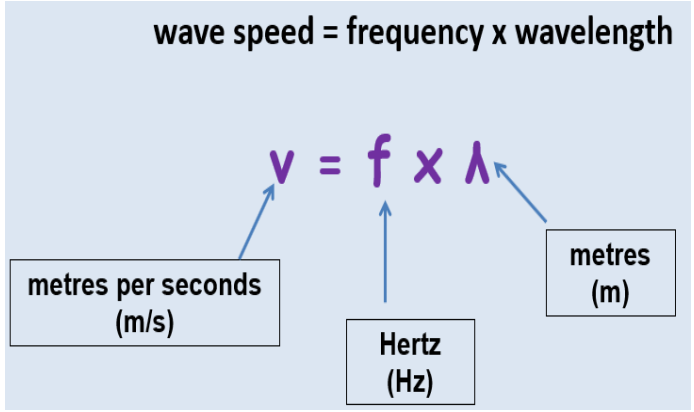
Gamma radiation – Electromagnetic radiation emitted from an unstable nuclei in radioactive substances.

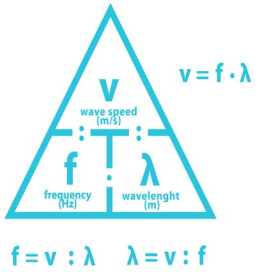
Optical fibre – Thin glass fibre used to transmit light signals.

Radiation dose – Amount of ionising radiation a person receives.

Reflection – The change of direction of a wave at a boundary.

Transmission – A wave passing through a substance.

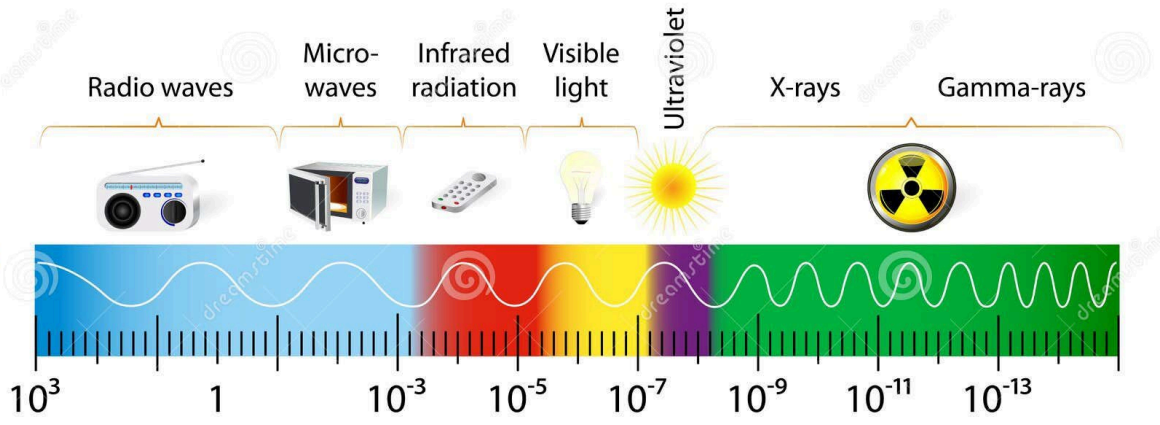


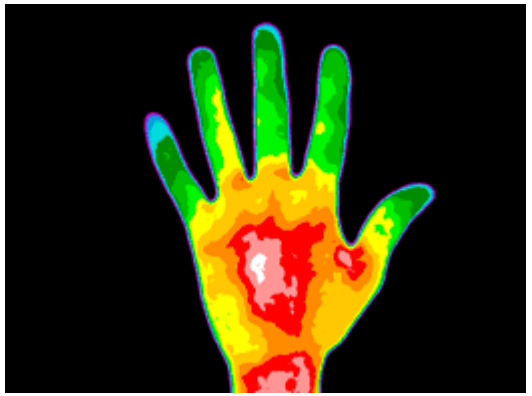


Used to detect breaks in the bones	X-rays
Used in sunbeds	Ultraviolet
Used to treat cancer or sterilise surgical equipment	Gamma rays
Used to communicate with satellites	Microwave
Used in electric fires	Infrared
Used for broadcasting	Radio wave
Reflected so we can see things	Visible light

Scan the QR code with your mobile phone to a YouTube video all about the EM spectrum!

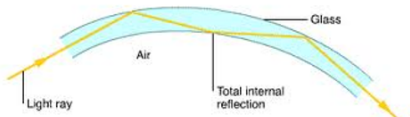
THE ELECTROMAGNETIC SPECTRUM





Optical fibres

These are thin glass fibres that transmit either light or infrared waves.



The rays are totally internally reflected (none leaks out the side) along the fibre.

Compared with radio waves and microwaves:

Optical fibres carry much more information, as light has much shorter wavelength than radio waves, and so can carry more pulses of waves

Optical fibres are more secure because their signals stay within the fibres.

As you go left to right the wavelength gets smaller and frequencies increase.

Practice Knowledge Quiz Questions

1. What is the equation for wave speed?
2. Rearrange the equation to work out wavelength.
3. Rearrange the equation to work out frequency.
4. What is an optical fibre?
5. What does ionisation mean?
6. Why do radiographers stand behind a screen while they x-ray a patient?

Maths: The radio waves emitted from a distant galaxy have a wavelength of 25 metres and a wave speed of 300 000 000. Calculate the frequency of the radio waves emitted.

Tasks

1. Write down what happens to frequency and wavelength as you go from left to right of the EM spectrum.

2. Write down the uses and dangers of each wave of the EM spectrum.

3. Find and fix the following statements
   - Gamma waves have a bigger wavelength than x-rays.
   - Optical fibres are thing pieces of plastic fibres that transmit either light or infrared waves.
   - As you go from right to left on the EM spectrum frequency of wave increases and the wavelength gets smaller.
   - The order of the EM spectrum is as follows:

   Radio waves, Microwaves, Visible light, Infrared, Ultraviolet, X-rays and gamma rays.

(a) Which substance will **not** absorb X-rays?

Tick (✓) **one** box.

Bone ☐ Metal ☐ Skin ☐

(1)

The table below shows the effect of exposure to different doses of radiation.

Dose in mSv	Effect on the human body
100	slightly increased risk of cancer
1000	5% increased risk of cancer
5000	high risk of death

(b) During one X-ray a person receives a dose of 0.100 mSv

Why is this dose unlikely to harm the person?

_____

_____

(1)

(c) A doctor takes an X-ray photograph of a person.

When taking the X-ray photograph, the doctor stands behind a screen.

Suggest why.

_____

_____

(1)