

Key stage 3 Science Curriculum Overview 2023-24. Based on AQA KS3 Science Syllabus. [aqa.org.uk/ks3sciencesyllabus](https://www.aqa.org.uk/ks3sciencesyllabus)

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What are forces, what are they measured in?

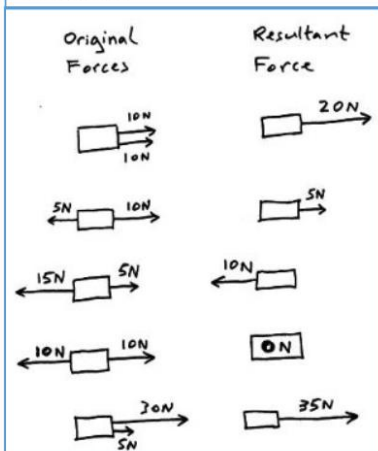


WHAT ARE FORCES?

A force is a push, pull or twist that can change an object's motion.

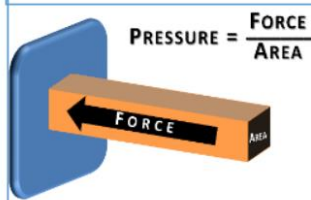


How do forces add, what is a resultant force? Draw some examples



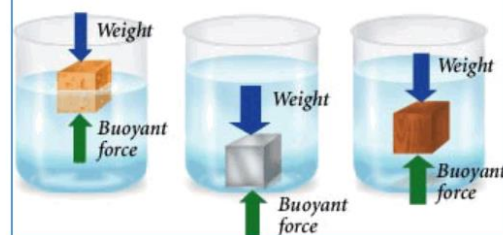
Organiser: FORCES

What is pressure? What is the Equation?

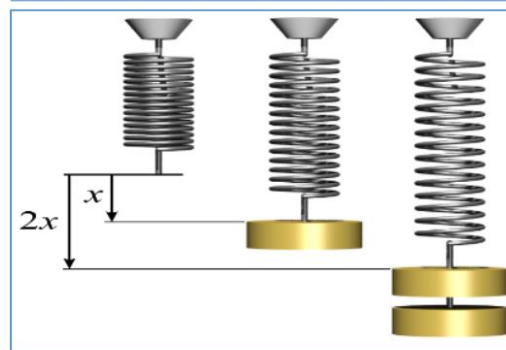


Why do objects float or sink?

Buoyancy

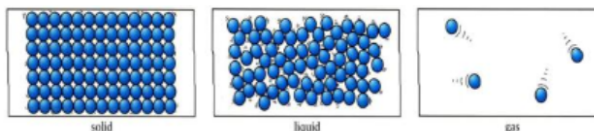


What is Hooke's law, describe a practical to measure it



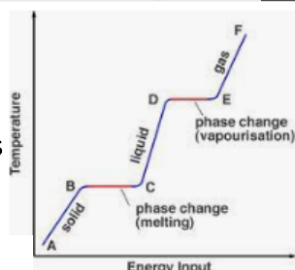
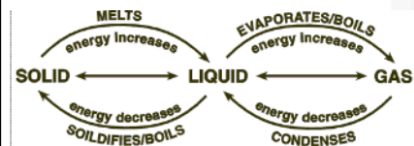
The Particle Models

A substance is a solid below its melting point, a liquid above its melting point and a gas above its boiling point. Properties of solids, liquids and gases can be described in terms of particles in motion but with difference in the arrangement and movement of these same particles: closely spaced and vibrating (solid), in random motion but in contact (liquid), or in random motion and widely spaced (gas).



Changing State

Substances which change temperature or state can be described in terms of particles gaining or losing energy.

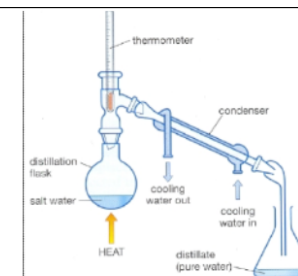


Pure Substances

Pure substances consist of only 1 type of element or compound and has a fixed boiling point. Air, fruit juice and milk are all examples of mixtures.

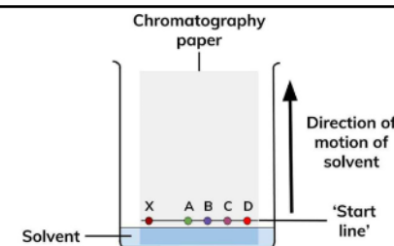
Simple Distillation

Liquids have different boiling points which allows us to separate them using simple distillation. Insoluble solids can be separated with filtration. Soluble solids can be separated out of a liquid through evaporation.



Chromatography

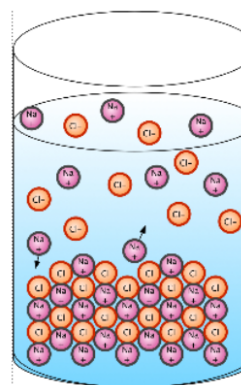
Chromatography can be used to separate soluble liquids such as inks in a pen or colouring in foods.



Organiser: Particle Model and Mixtures

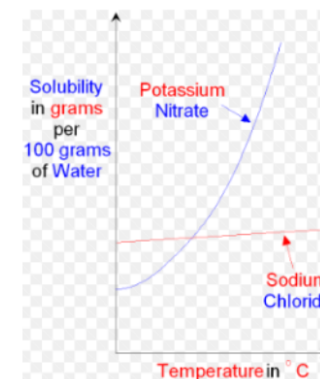
Solubility

Some substances are able to dissolve and this can be represented with the particle model.



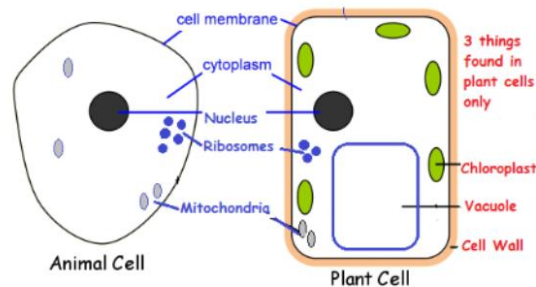
Solubility Curves

Using solubility curves of a solute can be used to explain observations about solutions.

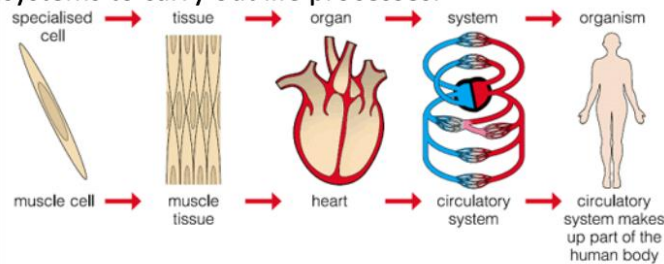


Eukaryotic cells: Plant and animal cells.

Plant and animal cells have a cell membrane, nucleus, cytoplasm, ribosomes and mitochondria. Plant cells also have a cell wall, chloroplasts and usually a permanent vacuole.



Multicellular organisms are composed of cells which are organised into tissues, organs and systems to carry out life processes.



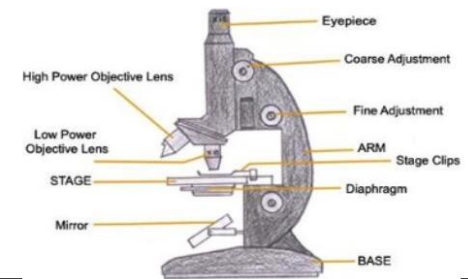
Antagonistic pairs of **muscles** create movement when one contracts and



Light Microscopes

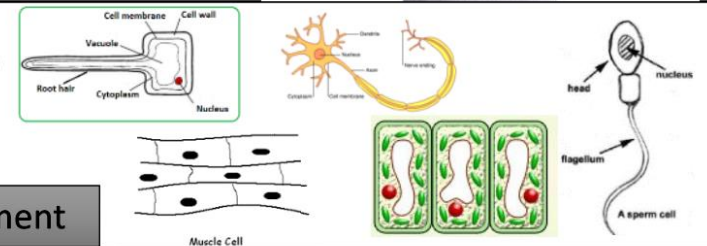
Light microscopes are used to see and compare cells by magnifying them so that they are visible to the human eye.

Plant or animal cells are placed on a slide and fixed with a cover slip to view. Some larger organelles can be seen

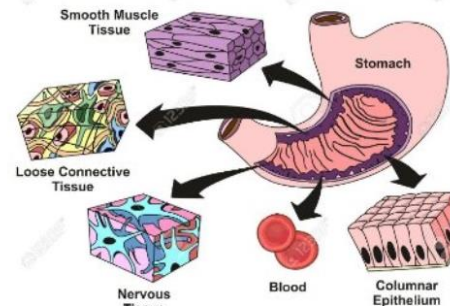


Specialised Cells

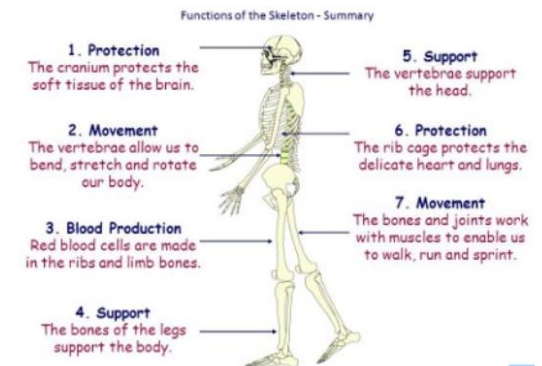
There are many types of cell. Each has a different structure or feature so it can do a specific job.



Organiser: Cells and Movement



The parts of the human **skeleton** work as a system for support, protection, movement and the production of new blood cells.



Organs contain different tissues that work together.

The Arrangement of The Periodic Table.

Metals are generally found on the left side of the table and non-metals on the right. Recognise the symbols for hydrogen, oxygen, nitrogen, carbon, iron, zinc, copper, sulphur, aluminium, iodine, bromine, chlorine, sodium, potassium and magnesium.

The Alkali Metals

Group 1 contains reactive metals called the Alkali metals.

The Noble Gases

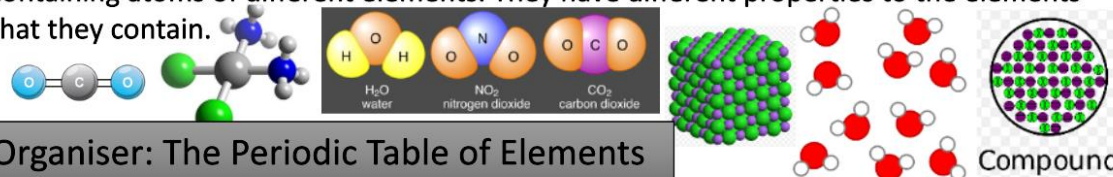
Group 0 contain unreactive gases called the noble

The Halogens

Group 7 contains non-metal elements called the halogens

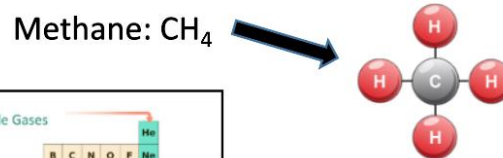
halogen	molecule	structure	model
fluorine	F ₂	F—F 142 pm	
chlorine	Cl ₂	Cl—Cl 198 pm	
bromine	Br ₂	Br—Br 228 pm	
iodine	I ₂	I—I 266 pm	

Compounds – Most substances are not pure elements, but compounds or mixtures containing atoms of different elements. They have different properties to the elements that they contain.



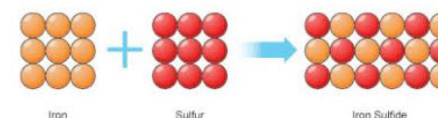
Organiser: The Periodic Table of Elements

Atoms of a compound – Compounds are made of elements that are chemically joined. Formulae of the compound can be used to see which elements are involved and the number of each type of atom.



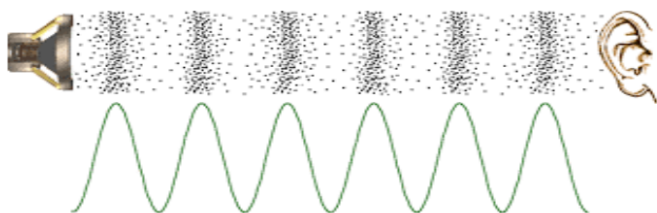
1 carbon atom and 4 hydrogen atoms. Chemically joined.

Properties of elements (Some students) Compare and contrast the properties of elements and compounds and give reasons for their differences.



Sound waves

Sound waves travel through a medium by making the particles vibrate.
Sound waves cannot travel through a vacuum.
The more dense a medium is the faster the sound waves travel.



Transparency

Light travels as transverse waves, like the ripples in a tank of water. Light travels in straight lines.
Unlike sound waves, light waves can travel through a vacuum (empty space). They do not need a substance to travel through, but they can travel through transparent and translucent substances. They cannot travel through opaque objects.

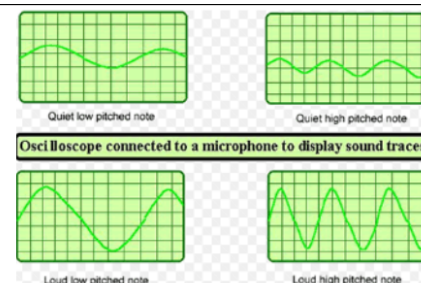
Colours

Objects appear black in white light because they absorb all colours and reflect none. Objects also appear black in any light that is not the same as the light.



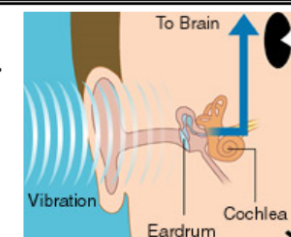
Looking at sound waves

We can use drawings of waves to describe how sound waves change with volume or pitch, this is how the sound appear on an oscilloscope.
Volume changes the wave amplitude, pitch changes the wave frequency.



Loud sounds and the ear

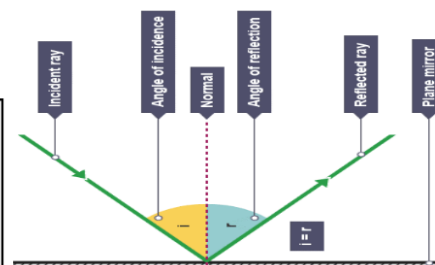
The ear is divided into three parts: The outer, middle and inner ear. Sound waves travel from the outer ear and causes the eardrum to vibrate. This in turn causes three small bones in the middle ear to move. **Loud** bursts of **sound**, such as gunshots or explosions, can rupture the eardrum or damage the bones in the middle ear.



Organiser: Sound and Light

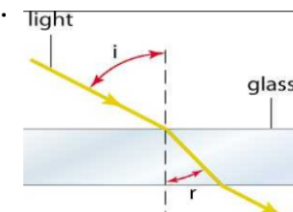
Reflection

When light reaches a mirror, it reflects off the surface: the incident ray is the light going towards the mirror, the reflected ray is the light coming away from the mirror.



Refraction

Light waves change speed when they pass across the boundary between two substances with a different density, such as air and glass. This causes them to change direction, an effect called refraction.



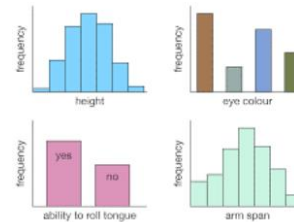
Variation

Organisms show differences or variation. It can be caused by inherited factors – genes or as a result of environment



Displaying data

Variation can be continuous with lots of different values for a characteristic. Or, it can be discontinuous with only a small number of categories. We can show this in graphs



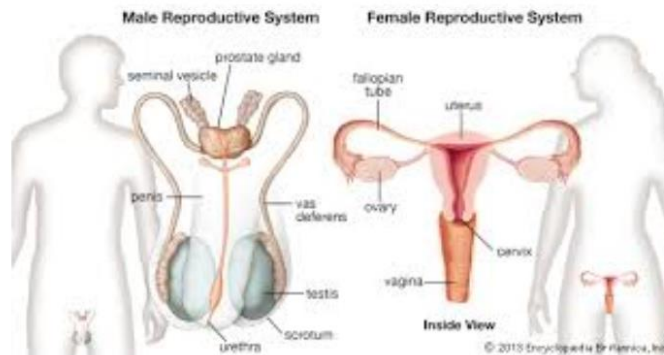
Survival

Variation is important in helping organisms survive in changing environments.



Human body and reproduction

The male and female reproductive systems are specialised to carry out the role of reproduction. Males produce the sperm cells in the testes and females produce eggs or ova in the ovaries.



The menstrual cycle

From puberty onwards females release an egg each month this is called ovulation. If pregnancy does not occur then the female has a period.

Year 7 Variation and reproduction

Pregnancy

Pregnancy lasts for 9 months. During this time the foetus develops in the uterus.

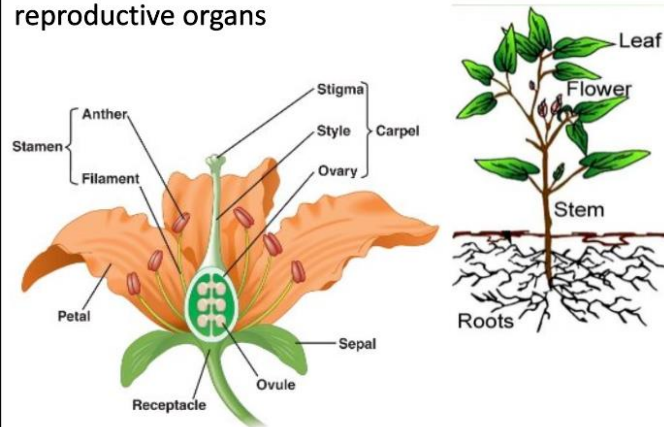


Fertility

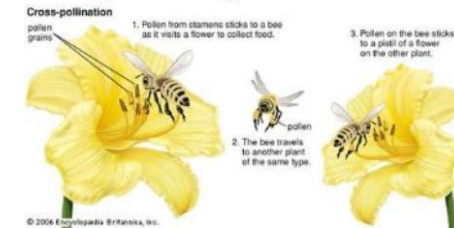
Couples can control when they have a baby by using contraceptives. If they are not able to get pregnant naturally then they may have IVF.



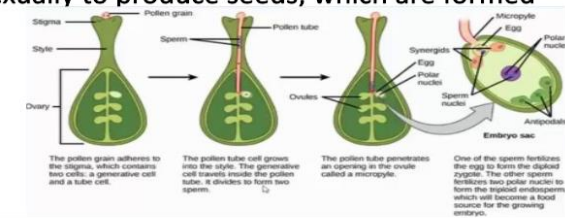
Plant organs - Flowers contain the plants reproductive organs



Pollination - Pollen can be carried by the wind, pollinating insects or other animal. Insects are needed to pollinate food crops.



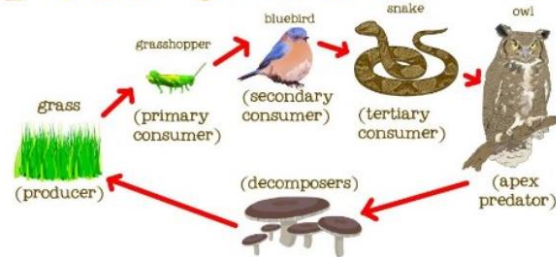
Fertilisation in plants - Plants reproduce sexually to produce seeds, which are formed following fertilisation in the ovary.



Organiser: Plant reproduction & Interdependence

Food chains & food webs - Organisms in a food web (decomposers, producers and consumers) depend on each other for nutrients.

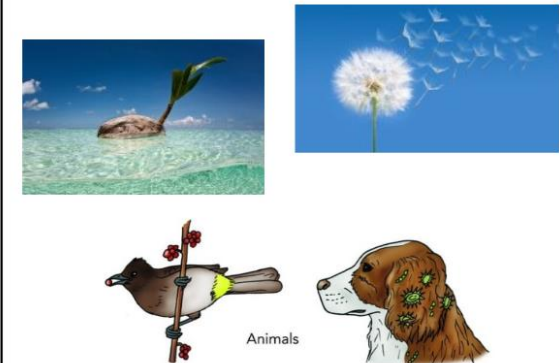
Food Chains



Populations - Population of a species is affected by the number of its predators and prey, disease, pollution, and competition between individuals for limited resources such as water and nutrients.

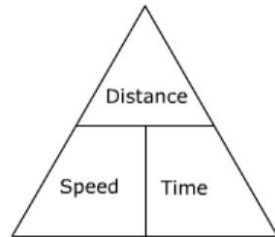


Seed dispersal - Plants have adaptations to disperse seeds using wind, water or animals

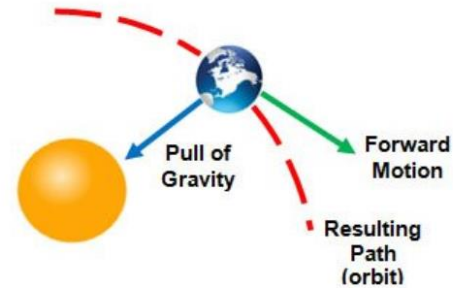


Animals

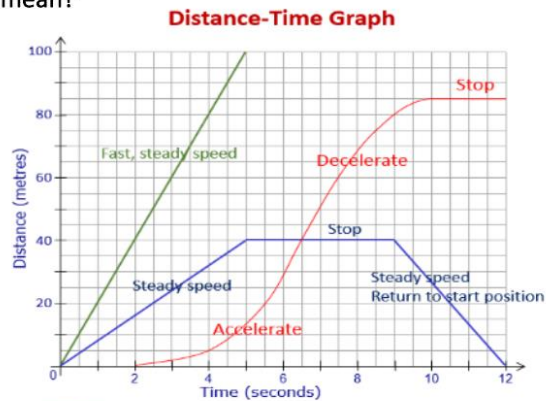
What is the formula for speed?



How are planets kept in orbit?



What do these lines on a distance time graph mean?

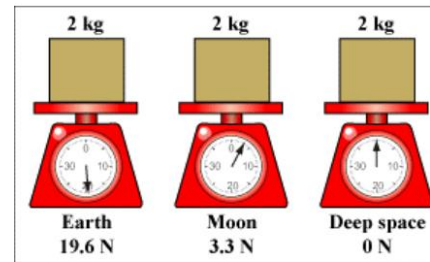


The **green line** shows a fast, steady speed, moving from 0 to 100 m in 5 seconds.
The **blue line** shows a journey with a stop and a return to the starting position.
The **red line** shows a journey starting 2 seconds later than the other two, with an initial acceleration, then a deceleration and then a stop.

What is the difference between weight and mass? What is the formula?

$$W = mg$$

Weight of object = mass of object x acceleration of gravity



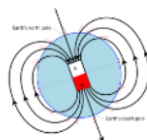
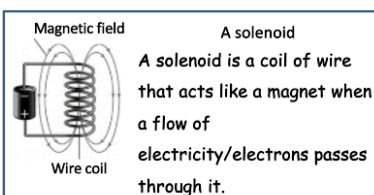
ORGANISER: Y7 SPEED & GRAVITY

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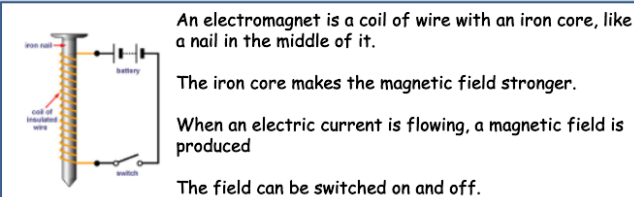
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S	N	N	S	Repel
S	N	S	N	Attract
N	S	S	N	Repel

Some materials are attracted to magnets, for example steel and iron.
Only a magnet can repel another magnet.
This is the test to find out if a material is a magnet.



Magnets and Electromagnets



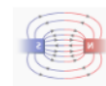
Ways to increase the strength of an electromagnet are

1. Increase the number of turns
2. Increase the current flowing in the wire
3. Place an iron core

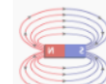
Magnetism is a force that acts only between magnetic materials like iron, steel, cobalt and nickel.

Magnets have 2 poles - a north and a south.

If two magnets are put together the poles that are the same will repel each other. If two magnets are put together the poles that are different will attract each other.



Magnetic field lines flow from _____ to _____



The magnetic field is strongest at the _____



The closer together the magnetic field lines are, the _____ the magnet.

Experiment to show how increasing the number of turns on an electromagnet can make it pick up more paper clips.

Independent variable
the number of turns of wire

Dependent variable
The number of paper clips picked up

Control variables
Use the same current, place the paperclips at the same position on the nail

Conclusion

The larger the number of turns of the wire the larger the number of paperclips that can be picked up

Other variables we could have tested

The effect of increasing the current flowing in the circuit, using cores made of different materials

Electromagnets are useful because :-

They can be turned on and off
Their strength can be changed

Types of Energy

Chemical
Kinetic
Gravitational Potential
Thermal
Sound
Light
Nuclear
Elastic Potential
Electrical

Law of Energy Conservation

Energy Cannot be created or destroyed, just transferred from type to type.

Energy Types and costs

Energy Efficiency

Energy Efficiency is the percentage of the total energy supplied that is transferred into useful energy



Energy Resources

There are many sources of Energy, some are Renewable, other non-renewable. Each resource has it's own advantages and disadvantages

Energy at home

Electrical energy can be expensive, and resources to generate it are running out. We can conserve energy in many ways including loft insulation, cavity wall insulation, draught excluders, lagging the boiler, double glazing.



Electricity Generation

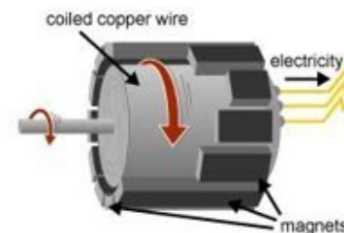
Electricity is generated by transferring energy from one store into kinetic energy which is then transferred into electrical energy in a generator

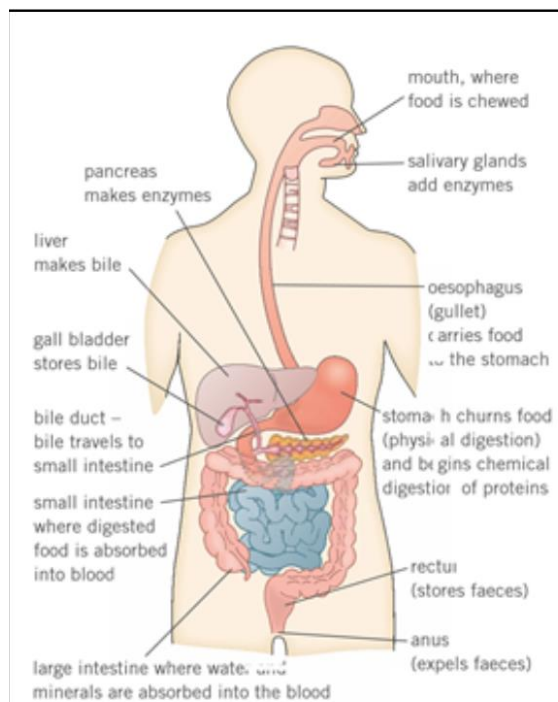
Non-renewable

Coal, Oil, Gas Nuclear.

Renewable

Wind, Wave, Solar, Hydro-electric, Geothermal, Tidal, Biomass





Food tests:

Starch – add a few drops of iodine solution to food. Turns blue-black if positive.

Sugar – add a few drops of Benedict's solution and heat in a water bath. Turns orange-red with sugar.

Protein – add Biurets A and B. Turns lilac purple if protein is present.

Fats (lipids) – rub on paper. Contains fat if the paper becomes translucent.

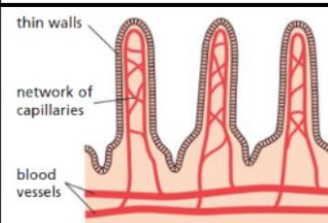
Nutrient	Use in the body	Good sources
Carbohydrate	To provide energy	Cereals, bread, pasta, rice and potatoes
Protein	For growth and repair	Fish, meat, eggs, beans, pulses and dairy products
Lipids (fats and oils)	To provide energy. Also to store energy in the body and insulate it against the cold.	Butter, oil and nuts
Minerals	Needed in small amounts to maintain health	Salt, milk (for calcium) and liver (for iron)
Vitamins	Needed in small amounts to maintain health	Fruit, vegetables, dairy foods
Dietary fibre	To provide roughage to help to keep the food moving through the gut	Vegetables, bran
Water	Needed for cells and body fluids	Water, fruit juice, milk

Stages of digestion:

Food is digested in the **mouth, stomach and small intestine**. Digested food is absorbed into the bloodstream in the small intestine.

Excess water is absorbed back into the body in the **large intestine**.

Any undigested food passes out of the **anus** as faeces when we go to the toilet.



The small intestines

are adapted to help with digestion by increasing the surface area with folding, having thin walls so a shorter pathway for digested food to get into the blood and a good blood supply.

Deficiencies

If you have too little of a particular nutrient, we say that you have a deficiency in that nutrient

1. iron deficiency can cause anaemia, where there are too few red blood cells
2. iodine deficiency can cause a swelling in the neck called goitre
3. vitamin A deficiency can cause blindness
4. vitamin D deficiency causes rickets, which makes the legs bow outwards in growing children
5. vitamin C deficiency causes scurvy, which makes the gums bleed

Enzymes

Food has to be broken down chemically into really small particles before it can be absorbed. Enzymes are the biological catalysts needed to make this happen quickly enough to be useful. Enzymes are proteins that can break large molecules into small molecules. Different types of enzymes can break down different nutrients:

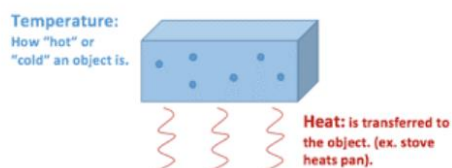
1. amylase and other carbohydrase enzymes break down starch into sugar
2. protease enzymes break down proteins into amino acids
3. lipase enzymes break down lipids (fats and oils) into fatty acids and glycerol

Websites that might be useful:

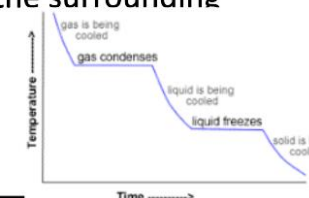
<https://www.bbc.com/bitesize/articles/zmwvgdm>
<https://www.natgeokids.com/uk/discover/science/general-science/digestive-system/>

Temperature And Heat What is the difference?

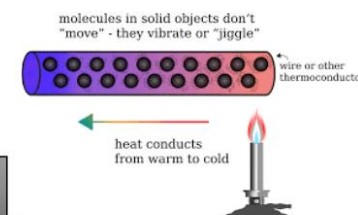
Temperature is a measure of the average energy of the particles in the object. Heat is Thermal Energy, the total amount of energy in the object



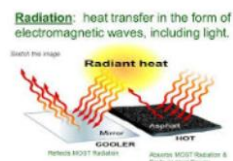
Heating and Cooling. Objects gain or lose thermal energy when heated or cooled. The rate the gain or lose this energy depends on the surrounding temperature, the material and the mass



Conduction Thermal energy can be transferred from particle to particle in conduction. The closer the particles, the better the rate of conduction



Radiation Thermal energy can be transferred directly by radiation. No particles are needed for this to occur. Some surfaces, colours and materials absorb radiation better than others.



Organiser: Heating and Work Done

Work Done This is the amount of energy transferred. It is calculated using $W = F \times d$

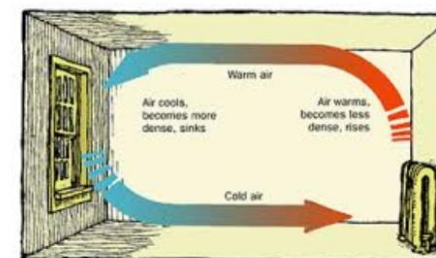
How Much Work???

To find the amount of work done use this formula:

$$\text{Work} = \text{force} \times \text{distance}$$

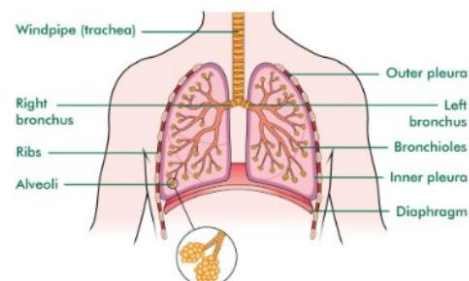


Convection Thermal energy can be transferred by convection if the particles can move and form a convection current. This is only possible in liquids and gases.



Insulation You can reduce the rate of cooling by insulating an object. Preventing convection currents, using poor conductors or using reflective surfaces all affect rates of cooling

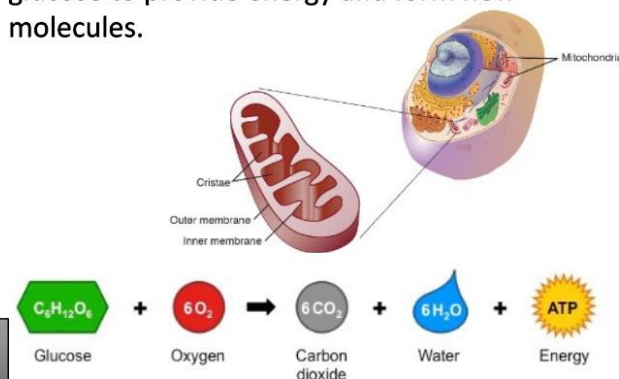
Breathing occurs through the action of muscles in the ribcage and diaphragm. The amount of oxygen required by body cells determines the rate of breathing.



Anaerobic respiration - Most living things use aerobic respiration but switch to anaerobic respiration, which provides less energy, when oxygen is unavailable.

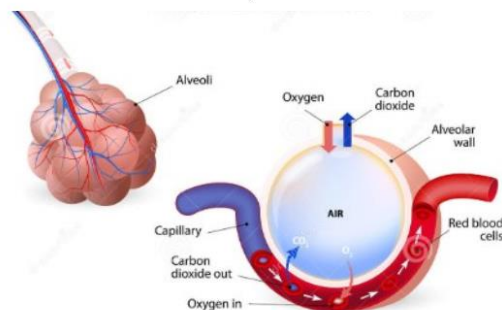


Aerobic respiration - Respiration is a series of chemical reactions, in cells, that breaks down glucose to provide energy and form new molecules.

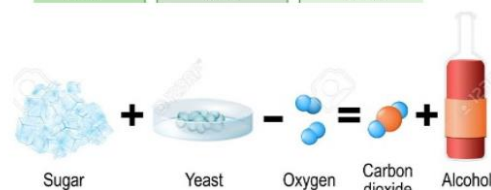


Organiser: Breathing and Respiration

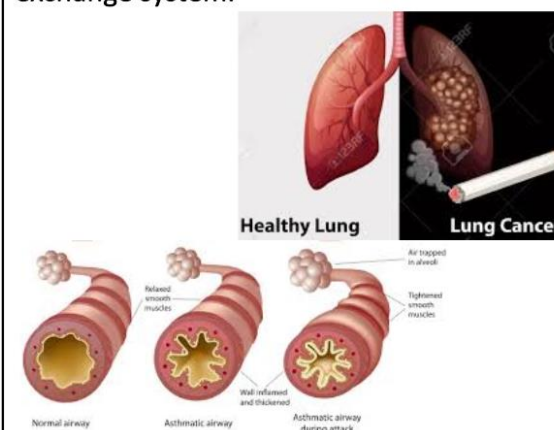
In **gas exchange**, oxygen and carbon dioxide move between alveoli and the blood. Oxygen is transported to cells for aerobic respiration and carbon dioxide, a waste product of respiration, is removed from the body.



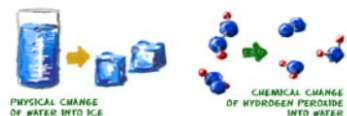
Fermentation - Yeast fermentation is used in brewing and bread-making.



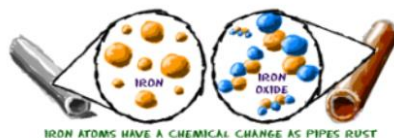
Smoking, asthma and exercise that can change the effectiveness of the gas exchange system.



Chemical and physical reactions.

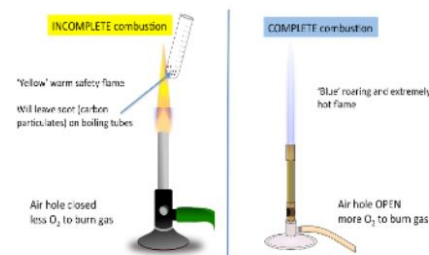


In a chemical reaction a new product is formed.



Physical reactions do not have a change in mass and a new product is NOT made.

Combustion



Fuel + Oxygen = Carbon dioxide + Water
Fuel + Oxygen = Carbon + Carbon Monoxide + water

Complete combustion happens when there is sufficient oxygen present. incomplete combustion is when there is not enough oxygen present.

Fuels

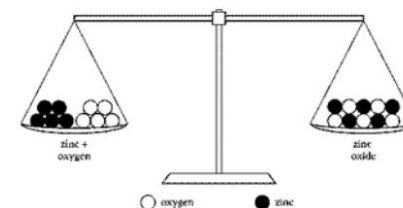


Easy to ignite, provided enough energy, burns with a clean flame.

Conservation of Mass.

During a chemical reaction, atoms are NOT created or destroyed, they just become re-arranged.

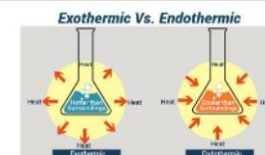
To follow this rule, symbol equations might need to be balanced.



Endothermic / Exothermic reactions

Exothermic reactions get hot as heat is exiting.

Endothermic reactions get colder as heat enters the reaction



Why do chemical reactions happen?

Representing chemical reactions as symbol equations

Elements must always be represented by CAPITAL letters. Take care with elements like Cl, chlorine, not carbon and iodine.

Subscript numbers are only relevant to the element they are directly behind. Pre-fix numbers refer to everything in the compound.

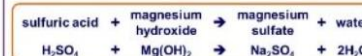
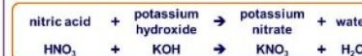
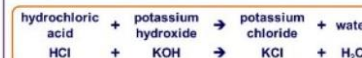
Rules for word equations

Reactants → Products

- 1) All of the reactants go to the left of the arrow and all of the products go to the right of the arrow.
- 2) The arrow must be pointing from the reactants to the products (as it is showing the direction of the reaction).
- 3) The arrow must be an arrow! It is NEVER an equals sign (=).

Making salts: symbol equations

Complete these symbol equations:



Biodiversity

This is the number of organisms of different species living in an ecosystem.



The importance of biodiversity

It is important that we try and conserve species to maintain the balance in an ecosystem. Some species perform services for humans and other species.



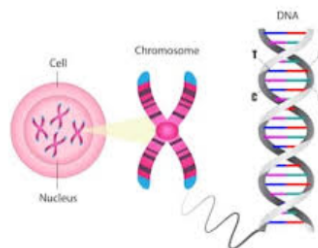
Protecting biodiversity

There are lots of ways we can try and conserve species such as protecting habitats, preventing poaching and captive breeding programmes.

Year 8 Evolution and inheritance

Inheritance and how variation occurs

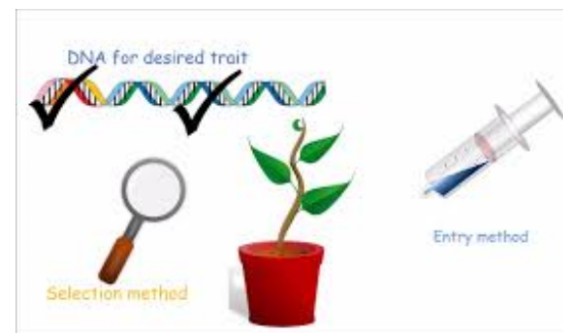
Our features are determined by the DNA we inherit from our parents. Gametes contain half the number of chromosomes compared with a body cell. At fertilisation the male and female gametes fuse together.



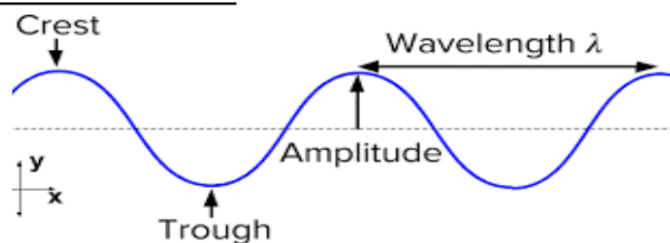
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Genetic modification

Scientists have mapped the genome of many species of plants and animals. This has allowed them to identify where genes are located. They are able to transfer desirable genes from one species to another in a bid to improve outcomes. There are concerns raised by some people about this process.



Features of a wave



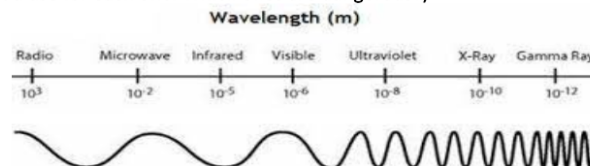
A (**amplitude**) = distance from the center line to the top, **crest** (or bottom, **trough**.)

λ (**wavelength**) is the distance between successive crests, measured in metres

Trough = lowest point **Crest** = highest point

Electromagnetic Spectrum

(list a use for each one. Which ones are dangerous?)



Radio: **Communication**_

Microwaves: **Communication**_, **Cooking** food

Infrared: **Remote** Controls, **Heat** Treatment

Visible: **Seeing**, **Photography**

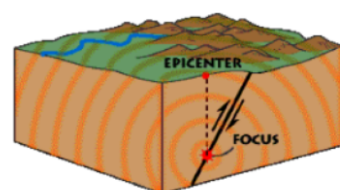
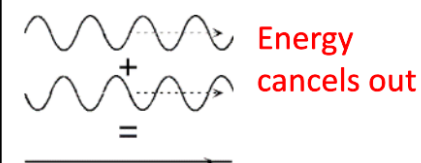
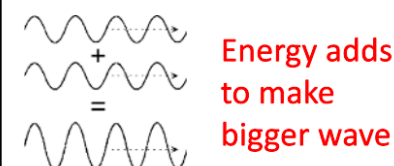
UV: **Sun Tan**, **Security**

X-Ray: **Broken** Bones, Airport **Security**

Gamma Ray: **Killing** **Cancer** Cells

INTERFERENCE

Draw pictures to show how constructive and destructive interference work

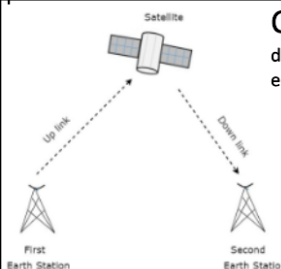
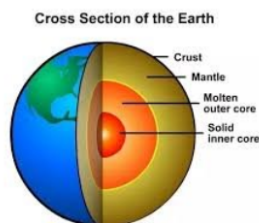


Earthquakes: Explain what those words mean.

Explain how Earthquakes happen. Draw and label a picture of the inside of the Earth.

Focus is point **Under ground** where the rocks **Slip** past each other. The Epicentre is the Point directly **Above** the **Focus**

The **Tectonic** Plates Float on the **Mantle** they collide with each other this causes **Earthquakes**

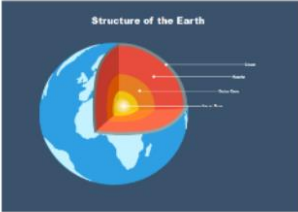

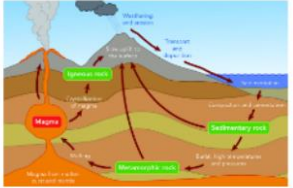
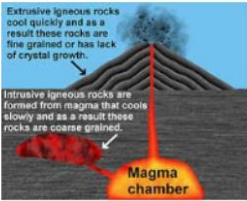
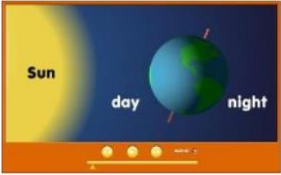
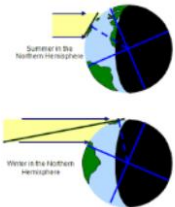


Communications: Explain what a signal is, why we use digital signals. Describe how our voice gets transmitted to someone else

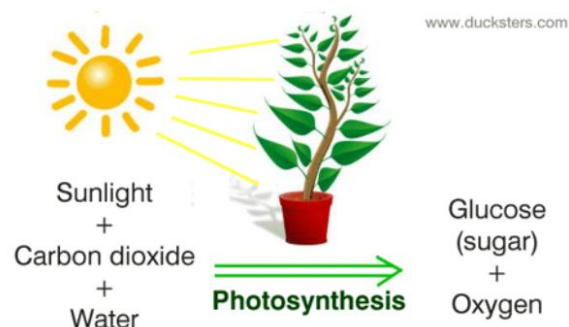
Signal is **Information** on a **Carrier Wave**

Carries more **Information**, can be **Cleaned** up.

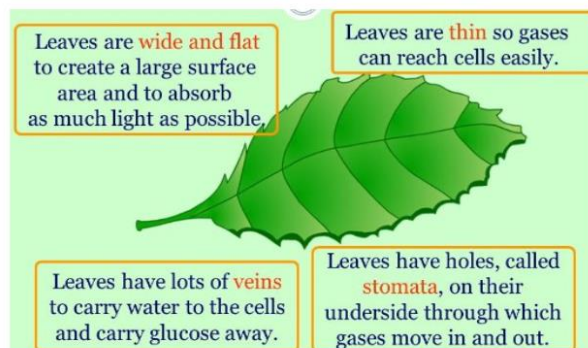
Voice is converted to **Digital** that is **Transmitted** to a **Transmitter** using **Microwaves** to a **Satellite**. Signal is **Cleaned** and **Boosted**, sent to an **Antenna** then sent on to the other **Mobile Phone**. The **Digital** signal is **Converted** to **Analogue**.

<p>Structure of the Earth. Draw the structure of the Earth and label the layers.</p> 	<p>Weathering. List an example of chemical, physical and biological weathering. Chemical – acid rain. Physical – freeze thaw Biological – tree roots.</p> 	<p>Rock cycle. Draw a labelled diagram of the rock cycle</p> 	<p>Rock formation and properties. Draw a diagram of the formation of Igneous rocks.</p> 
<p>Time and space. Draw a diagram of why we have day and night.</p> 	<p>The changing seasons. Draw a diagram to explain why it is hot in summer.</p> 	<p>What is out there. List the key feature of a spiral galaxy. A flat rotating disc of stars with a bulge in the centre containing older stars. Centre contains super massive black hole.</p>	<p>How far have we explored. Make a table listing where manned and unmanned space missions have gone. Manned - Apollo missions to the moon. Unmanned – Mariner (Mars Venus and Mercury).</p>

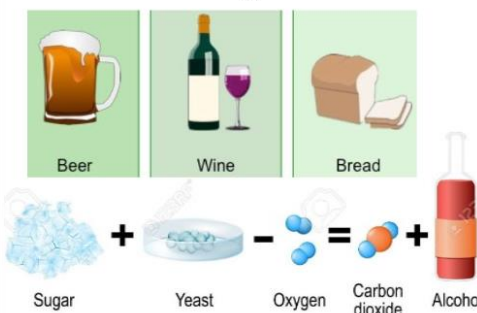
Photosynthesis - Plants either use the glucose as an energy source, to build new tissue, or store it for later use.



Leaves - Plants have specially-adapted organs that allow them to obtain resources needed for photosynthesis. Suggest reasons for particular adaptations of leaves.

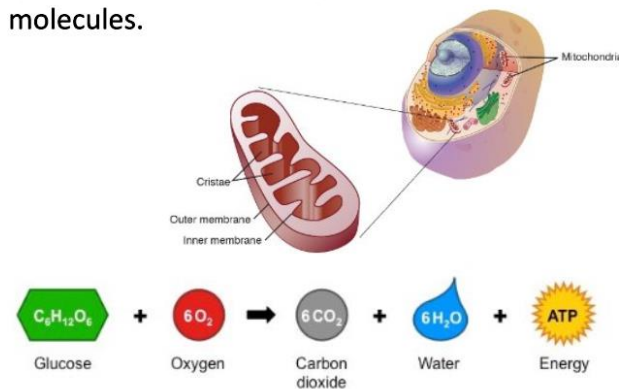


Fermentation - Yeast fermentation is used in brewing and breadmaking.

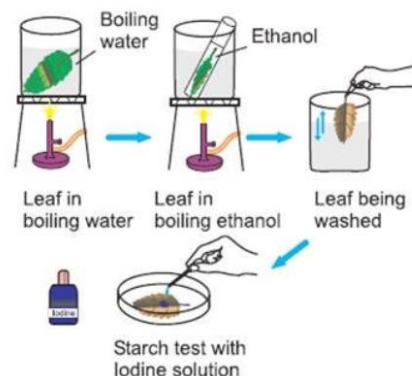


Organiser: Plants

Aerobic respiration - Respiration is a series of chemical reactions, in cells, that breaks down glucose to provide energy and form new molecules.



Testing a leaf for starch - Iodine is used to test for the presence of starch. Blue/black colour shows that starch is present



Anaerobic respiration - Most living things use aerobic respiration but switch to anaerobic respiration, which provides less energy, when oxygen is unavailable.

