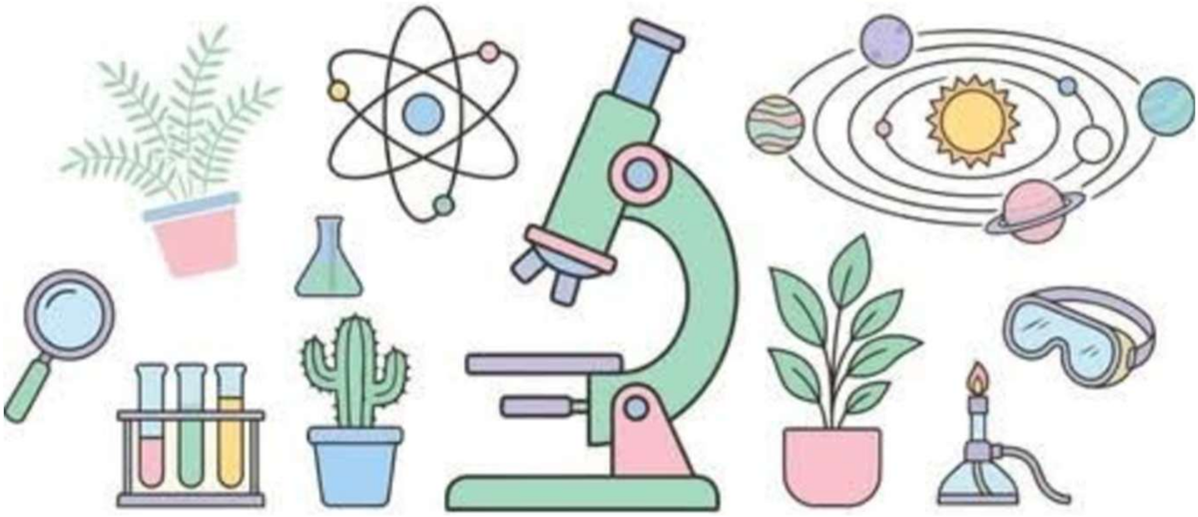
GCSE Combined Science
AQA



Y11 form time revision pack
preparation for paper 1 mocks

Name:	Form:

Student instructions:

- Each knowledge organiser page has a retrieval practise activity overleaf.
- Read the knowledge organiser page and then write 20 questions and answers based on that specific content.
- Fold the question page down the centre and then flip to test yourself.

SHELFIELD SCIENCE

Biology paper 1

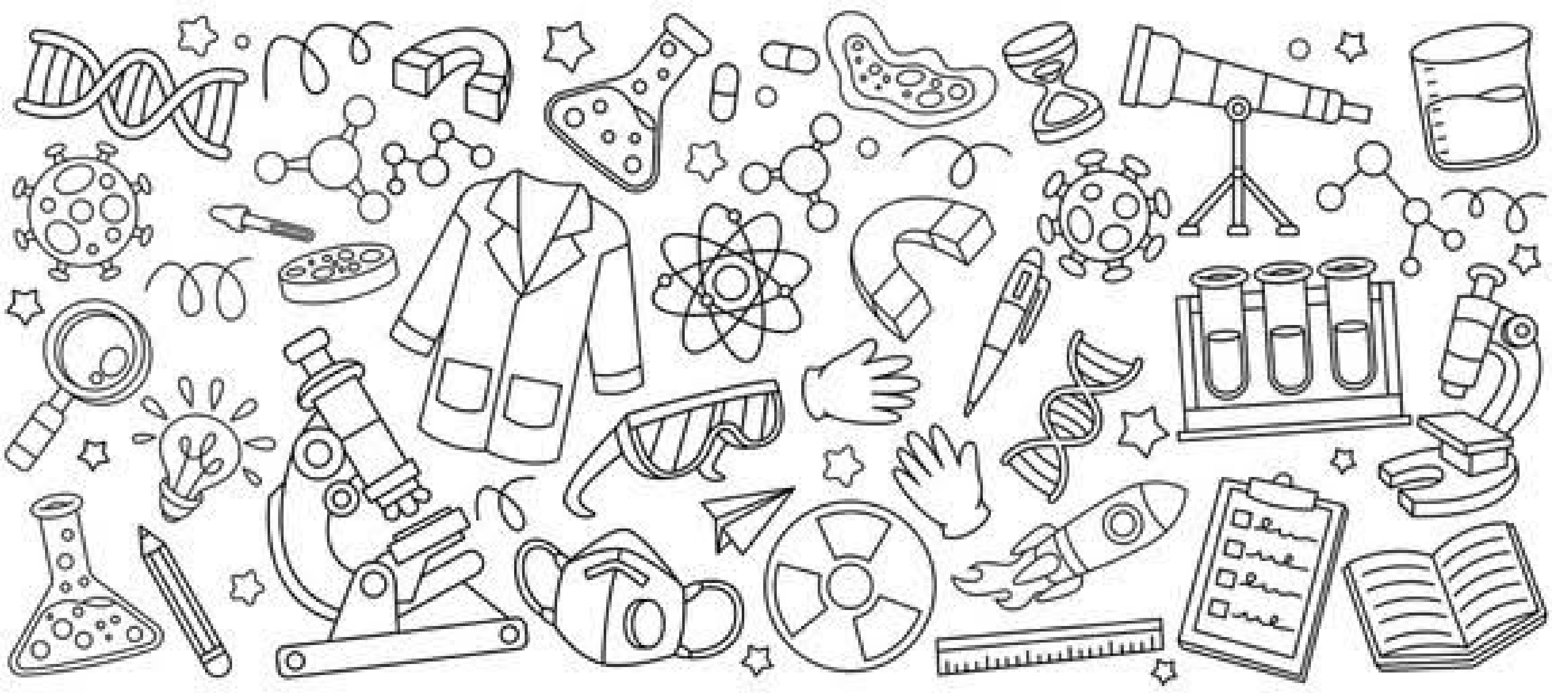
Topics:

1. Cell biology
   https://www.bbc.co.uk/bitesize/topics/z2mttv4

2. Organisation
   https://www.bbc.co.uk/bitesize/topics/zwj22nb

3. Infection & response
   https://www.bbc.co.uk/bitesize/topics/z9kww6f

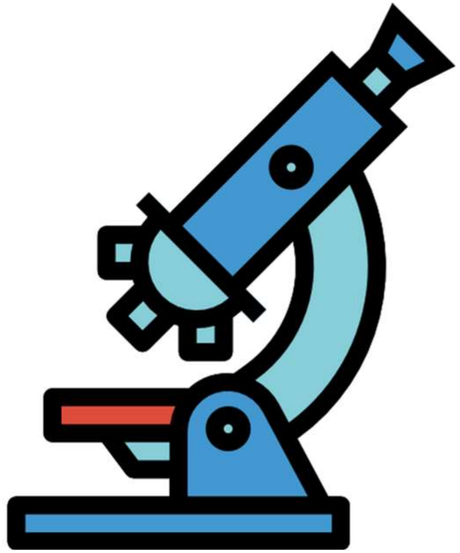
4. Bioenergetics
   https://www.bbc.co.uk/bitesize/topics/zgr997h



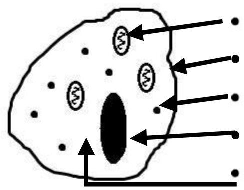
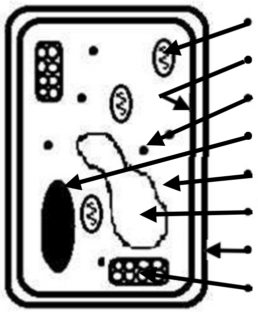
Trilogy: B1 Cell structure and transport

Collins Revision Guide: Cell Biology

Knowledge Organiser



Key points to learn

1. Early light microscopes	Use light and lenses. Have magnifications of 100 to 2 000
2. Electron microscope	Modern. Use a beam of electrons. Magnifications of up to 2 000 000
3. Magnification	How much bigger an image appears than the real object eg Magnification of 100, image looks 100 times bigger than object $magnification = \frac{size\ of\ image}{size\ of\ object}$
4. Resolving power	Smallest size microscope can show
5. Typical Animal cell	
6. Typical Plant cell	
7. Photo-synthesis	Reaction plants use to make glucose from light, H_2O and CO_2
8. Specialised animal cells	1. Sperm – tail to swim 2. Nerve – carry electrical impulses 3. Muscle – contract and relax
9. Specialised plant cells	1. Root hair - absorb water and ions 2. Xylem – carry water and minerals 3. Phloem – carry glucose to cells

Key points to learn

10. Mitochondria	Perform respiration to release energy
11Cell membrane	Controls movement in/out of cell
12 Ribosomes	Makes proteins by protein synthesis
13Nucleus	Controls activities of cell. Contains genes to build new cells
14 Cytoplasm	Liquid where most reactions happen
15 Vacuole	Sack filled with sap. Keeps cell rigid
16 Cell wall	Made of cellulose. Supports cell
17 Chloroplasts	Green and full of chlorophyll
18 Chlorophyll	Absorbs light for photosynthesis
19 Eukaryotic cells	Animal cells and plant cells. Have cell membrane, cytoplasm and nucleus
20 Prokaryotic cells	Bacteria. Do not have a nucleus. Genetic material is looped
21 Diffusion	Particles spreading out in gas/liquid Move from high→low concentration
	Dissolved substances like O_2 and CO_2 move in/out of cells by diffusion
22 Factors affecting diffusion	1. Difference in concentration (concentration gradient) 2. Temperature 3. Surface area to diffuse through
23 Osmosis	Diffusion of water through partially permeable membrane (surface that only lets small particles through). Moves from dilute solution → more concentrated solution
24 Active transport	Moves substances from low→high concentration. Needs energy

Background

Big or small, all organisms are made of cells. Normally too small to see without a microscope, they are the building blocks of all life: animals, plants, insects, microbes and us.

Maths skills

Prefix	Meaning	Standard form
Mega (M)	x 1000000	x 10^6
kilo (k)	x 1 000	x 10^3
milli (m)	÷ 1 000	x 10^{-3}
nano (n)	÷ 1 000 000 000	x 10^{-9}

20 questions retrieval practice

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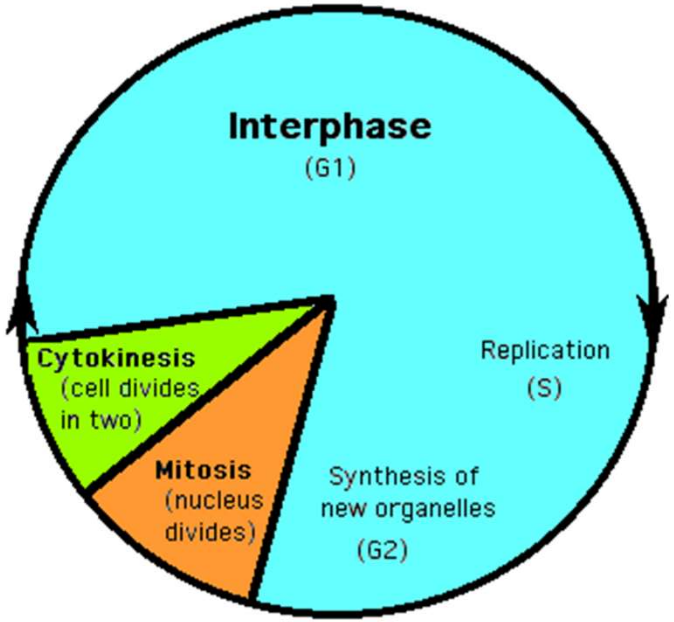
Trilogy B2: Cell Division

Collins Revision Guide: Cell Biology

Knowledge Organiser



Key points to learn

1. Cell cycle	Process by which body cells divide. Three stages: 1. Copy: Two copies of chromosomes and internal cell structures 2. Mitosis: Copies of chromosomes move and form two nuclei 3. Split: cytoplasm and cell membranes split to make two identical cells
2. Mitotic cell division	Makes two identical copies of cells. Used in growth and repair
3. Asexual reproduction	Form of reproduction using mitotic cell division to make clone cells
4. Chromosome	Contains large number of genes. Made of DNA molecules
	Human body cells contain 23 pairs of chromosomes
5. Genes	Instructions for a characteristic
6. DNA	Molecules that make genes
7. Cell differentiation	Stem cells can form different types of specialised cells
	Most animal stem cells differentiate early
	Many plant stem cells can differentiate at any time
8. Clone	Genetically identical copy of a cell or organism

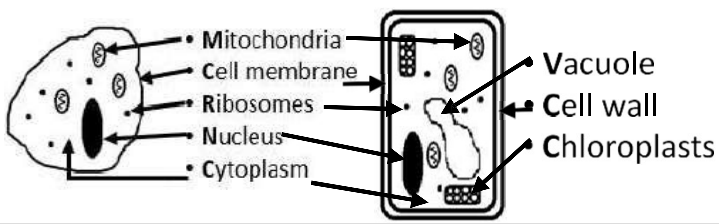
Key points to learn

9. Stem cells	Not differentiated. Can become any type of cell that is needed
10. Human stem cells	1. From embryos can become most types of human cell 2. From adult bone marrow can form many cells like red blood cells
	May be able to help conditions like diabetes and paralysis
	Issues with use: • Potential spread of virus or immune response • Some people have ethical or religious objections
11. Meristem cells	Plant stem cells. Can become any type of plant cell at any time
	Used to clone: • rare plants from extinction • crops with desirable features
12. Specialised animal cells	1. Sperm – tail to swim 2. Nerve – carry electrical impulses 3. Muscle – contract and relax
13. Specialised plant cells	1. Root hair - absorb water and ions from soil 2. Xylem – carry water and minerals from roots 3. Phloem – carry glucose to cells
14. Ethical objections	Related to what a person thinks is morally good or ok

Background

Taste buds are replaced approximately every 10days, skin cells every 14 days and your lungs every 6 weeks. How can this happen and how old are we really?

Additional information



20 questions retrieval practice

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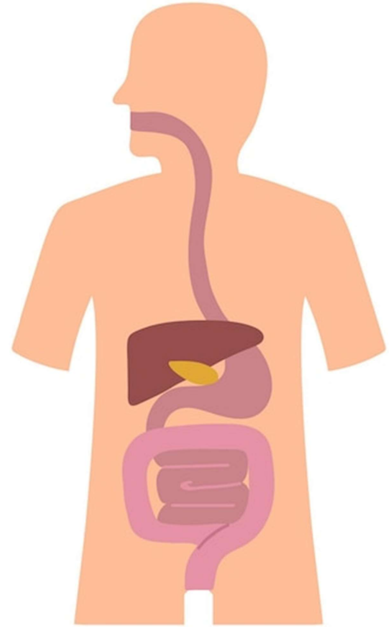
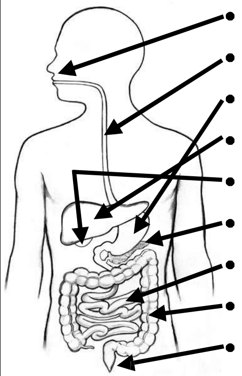
Trilogy B3: Organisation and the digestive system

Collins Revision Guide: Organisation

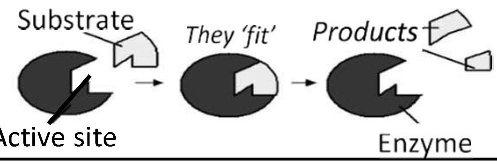
Knowledge Organiser



Key points to learn

1. Specialised animal cells	1. Sperm – tail to swim 2. Nerve – carry electrical impulses 3. Muscle – contract and relax
2. Tissue	Group of similar cells
3. Organ	Group of tissues working together
4. Organ systems	Group of organs which work together in organism
5. Digestive system	A group of organs that digest and absorb food
6. Digestion	Breaking large food molecules into small soluble ones
7. Human digestive system	 Mouth Gullet Stomach Liver Gall-bladder Pancreas Small intestine Large intestine Anus
8. Carbohydrate	Types of sugars: glucose, starch, cellulose. Used for energy
	Test: Starch turns iodine bluey black
9. Proteins	Used to make enzymes, tissues and cells. Found in meat, fish, pulses, milk
	Test: Biuret reagent turns from blue to purple
10. Lipids	Fats and oils made of fatty acids and glycerol

Key points to learn

11. Mouth	Chews food, releases saliva
12. Stomach	Churns food. Partial digestion here
13. Liver	Makes bile to be stored in gall bladder
14 Pancreas	Releases enzymes in small intestine
15. Small intestine	Majority of digestion happens here. Makes lots of enzymes
16. Large intestine	Absorbs water
17. Bile	Alkaline to neutralise stomach acid. Added at start of small intestine. Emulsifies fat into small droplets
18. Catalyst	Chemical which speeds up a reaction without being used itself
19. Enzyme	Biological catalysts Like a specific temperature and pH
20. Lock and key theory	Model showing how enzymes work. Substrates fit the enzyme active site, then react, turning into products  Substrate They 'fit' Products Active site Enzyme
21 Metabolism	The sum of all the reactions in a cell or the body of an organism
22 Protease	Enzyme breaks down protein. Made in stomach, pancreas, small intestine
23 Lipase	Enzyme breaks down lipids. Made in pancreas, small intestine
24 Amylase	Type of carbohydrase enzyme. Breaks down glucose. Made in salivary glands, pancreas, sma l intestine

Background

Have you ever wondered why the human body temperature is 37°C or why the male testes are outside the body? The answer is enzymes. They are also crucial for digestion…

Key points to learn

25. Why you can't kill an enzyme	They are not alive so can't die.
	But they will change shape and 'denature' at the wrong temperature or acidity (pH) Each one has an ideal temperature and pH they work best at.

20 questions retrieval practice

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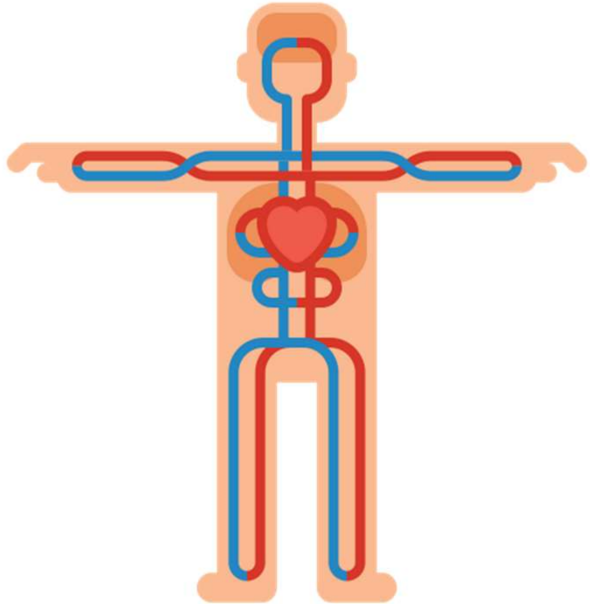
Trilogy B4: Organising animals and plants

Collins Revision Guide: Organisation

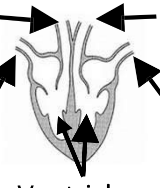
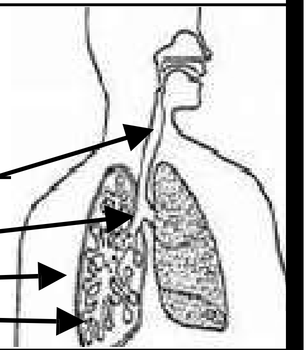
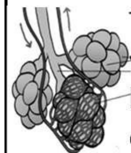
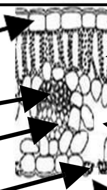
Knowledge Organiser



Key points to learn

1. Blood	A tissue of plasma, red blood cells, white blood cells and platelets
2. Plasma	Yellow liquid that transports: • Red and White Blood cells • Waste carbon dioxide to lungs • Urea from liver to kidneys • Digested nutrients to cells
3. Red blood cells	Biconcave discs with no nucleus. Packed with red haemoglobin that carries oxygen to body cells
4. White blood cells	Part of the body's defence against microorganisms
5. Platelets	Small pieces form scabs over cuts
5. Circulatory system	Transports substances to/from body cells. Made up of: • Blood • Blood vessels (arteries, veins and capillaries) • The Heart
6. Arteries	Carry blood away from your heart at high pressure
7. Veins	Carry blood back to your heart. Use valves to stop reverse blood flow
8. Capillaries	Network of tiny, thin vessels connecting to every individual cell. Substances diffuse in/out of blood
9. Coronary arteries	Blood vessels that supply heart with oxygen
10. (Aerobic) Respiration	Process by which all living things get energy from glucose and oxygen
	Glucose + Oxygen → Carbon dioxide + Water

Key points to learn

11. The Heart	Organ made of muscle that pumps blood in two loops around body
	
12. The Lungs	Organs for gas exchange. Take in O_2 release CO_2 
13. Alveoli	 Thin sac-like structures within the lungs. Covered in blood vessels to help gas exchange
14. Plant organs	Leaf – carries out photosynthesis Stem – supports Roots – take in water and minerals
15. Leaf structure cross-section	
16. Transport within plant	• Phloem – moves sugars • Xylem – moves water and ions
17. Transpiration	Evaporation from leaf pulls water through plant xylem. Affected by temperature, humidity, wind, light

Background

All living cells need glucose and oxygen for respiration. Getting these ingredients to the organism is only part of the struggle. How do you get them to the cells, keep them and get rid of waste products? This topic finds out

Additional information

The heart was first labelled from behind. This means the left and right sides are reversed.

20 questions retrieval practice

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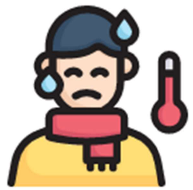
Trilogy B5: Communicable diseases

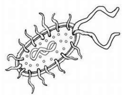
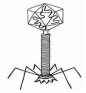
Collins Revision Guide: Infection and response

Knowledge Organiser

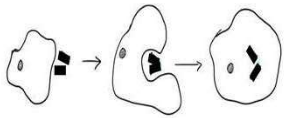
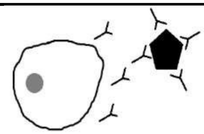
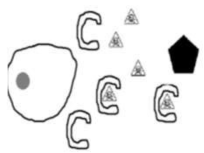





Key points to learn

1. Bacteria	Large microbe Living 
	Divide by splitting in two
	May produce toxins to make us ill
	Cause: • Salmonella – food poisoning • Gonorrhoea – sexually transmitted disease (STD)
2. Viruses	Smallest microbe Not alive 
	Live and reproduce inside cells
	Cause: • Measles – can be fatal • HIV – can turn into AIDS • Tobacco mosaic virus (TMV) affects photosynthesis in plants
3. Fungi	The other type of microbe. Living
	Cause: • Rose black spot – affects photosynthesis in plants
4. Pathogens	Microbes/microorganisms that cause diseases
	Spread by air, contact and water
5. Communicable diseases	Infectious diseases that can be passed from one person to another
	Caused by pathogens
6. Malaria	Is a protist disease. Spread by mosquito bites

Key points to learn

7. Causes of ill health	Pathogens, diet, stress, life situations/conditions
8. Non-communicable diseases	Cannot be transmitted from one person to another
	Eg heart disease, arthritis
9. Ignaz Semmelweis	Doctor in mid-1850s who persuaded doctors to wash their hands
10. Louis Pasteur	Showed that microbes caused disease. Developed vaccines
11. Vaccines	An inactive form of a pathogen used to prepare your immune system
12. Human defences against pathogens	1. Skin barrier - covers your body 2. Nose - hair and mucus act as trap 3. Trachea and bronchi – covered in cilia and mucus 4. Stomach - makes acid to destroy 5. Immune system – white blood cells defend us in three ways
13. Trachea	Pipe from mouth to bronchi
14. Bronchi	Pipe into each lung
15. Cilia	Tiny hair-like cells
16. White blood cells	1. Phagocytosis ingest microbes 
	2. Produce antibodies chemicals to destroy microbes 
	3. Produce antitoxins chemicals to cancel-out toxins made by pathogens 

Background

Nobody likes getting ill. To better avoid diseases, we need to understand what causes and how our bodies try and defend us from them.

Additional information

This topic links really well with B6 which is all about how we can further defend against these diseases.

20 questions retrieval practice

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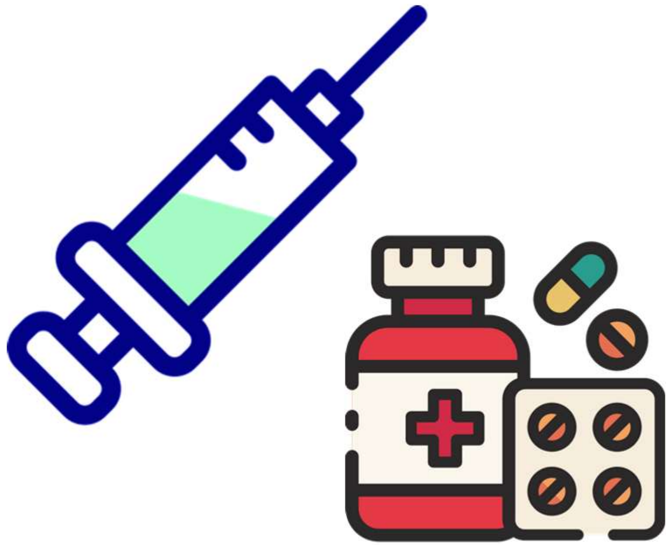
Trilogy: B6 Preventing and treating diseases

Collins Revision Guide: Infection and response

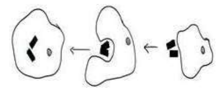
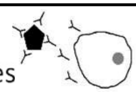
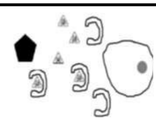
Knowledge Organiser



Key points to learn

1. Bacteria	Large microbe. Living
	Divide by splitting in two
	May produce toxins to make us ill
	Cause: - Salmonella - Gonorrhoea
2. Viruses	Smallest microbe. Not alive
	Live and reproduce inside cells
	Cause: - Measles - HIV - Tobacco mosaic virus (TMV)
3. Pathogens	Microbes/microorganisms that cause diseases
	Spread by air, contact and water
4. Communicable diseases	Infectious diseases that can be passed from person to person
	Caused by pathogens
5. Louis Pasteur	Showed that microbes caused disease. Developed vaccines
6. Painkillers	No effect on the pathogens but do reduce the symptoms of illness. Eg aspirin and paracetamol
7. Destroying viruses	Is very difficult without damaging body tissue as they live inside cells
8. Discovery of new drugs	Medicines used to be extracted from plants and microorganisms eg • Heart drug *digitalis* from foxglove • Painkiller aspirin from willow tree • Penicillin from mould
9. Placebo	A tablet with no active medicine content

Key points to learn

10. Vaccines	An inactive form of a pathogen used to prepare your immune system
	White blood cells are able to respond quickly to prevent infection
	MMR is a vaccine against mumps, measles and rubella
11. Antibiotics	Medicines that kill specific bacteria. Greatly reduced deaths from bacterial diseases
	Cannot kill viruses
	Some bacteria are becoming resistant which is very concerning
	Alexander Fleming discovered penicillin
12. Making new medicines	Need to be checked for toxicity (safety), efficacy (effectiveness) and dose
	First trials are done using cells, tissues and live animals
	Clinical trials use healthy volunteers and patient: 1. Very low doses at start of trial 2. If safe, more trials done 3. In double blind trial some patients given placebo
13. White blood cells	<u>1. Phagocytosis</u> ingest microbes 
	<u>2. Produce antibodies</u> chemicals to destroy microbes 
	<u>3. Produce antitoxins</u> chemicals to cancel-out toxins made by pathogens 

Background

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Additional information

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20 questions retrieval practice

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Trilogy B7: Non-communicable diseases

Collins Revision Guide: Organisation

Knowledge Organiser

Key points to learn

1. Non-communicable diseases	Cannot be transmitted from one person to another
	Eg heart disease, arthritis
2. Causes of ill health	Pathogens, diet, stress, life situations/conditions
3. Communicable diseases	Infectious diseases that can be passed from one person to another
	Caused by pathogens (microbes)
4. Coronary heart disease	Layers of fat build up inside coronary arteries, reducing blood flow and oxygen for the heart
	Stents used to keep arteries open
	Statin medicines used to reduce blood cholesterol levels which reduces rate of fatty build up
5. Heart failure	A failed heart can be replaced by a donor heart
6. Faulty heart valves	Can be replaced by biological/mechanical valves
7. Coronary arteries	Blood vessels that supply the heart
8. Cancer	Uncontrolled growth and division of cells
	Lifestyle and genetic factors can increase risks of some cancers
9. Tumour	Lump or growth in a part of the body
10. Health	State of physical and mental well-being

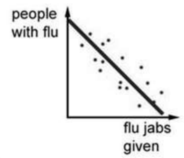
Key points to learn

11. Malignant tumour	
	Invade neighbouring tissues and spread throughout body forming secondary tumours
12. Benign tumour	
	Growths of abnormal cells in one area that do not invade other parts of the body
13. Different diseases can interact	• A defective immune system can lead to more infections • Viruses can trigger cancer • Pathogens can trigger allergies • Physical ill health can lead to depression and mental illness
14. Smoking and risk of disease	Carbon monoxide harms unborn babies
	Carcinogens increase risk of cancers
	Increases risk of coronary heart disease
	Increases risk of lung disease and lung cancer
15. Risks of diet, exercise and obesity	Increases risk of coronary heart disease and high blood pressure
	Obesity can lead to Type 2 diabetes
16. Alcohol and risk of disease	Damages the liver and carcinogens increase risk of liver cancer
	Affects brain function
	Passes to and harms unborn babies
17. Exposure to ionising radiation	EM Waves (UV rays, X-rays Gamma rays) and radioactive material
	Can increase risk of cancers

Background

A reported 25% of people in the UK are now obese. Around 17% of adults smoke and many more consume alcohol. So, what are the risks of these lifestyle choices?

Maths skills



Use scatter diagrams to identify correlation between factors.

Using samples to estimate population trends

20 questions retrieval practice

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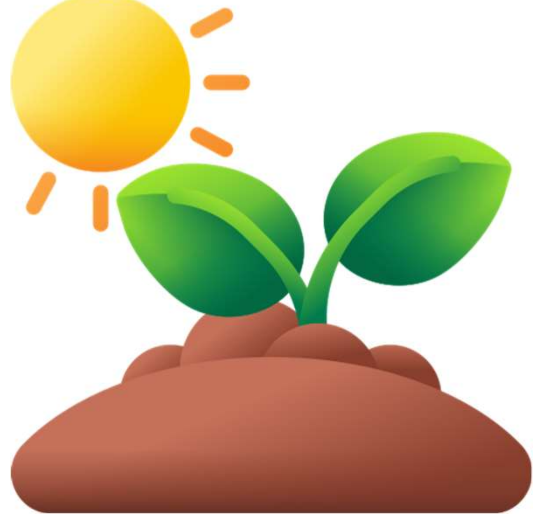
Trilogy B8: Photosynthesis

Collins Revision Guide: Bioenergetics

Knowledge Organiser



Background

Plants and algae are both amazing as they can make their own food. This process means that they are an essential part of every food chain.

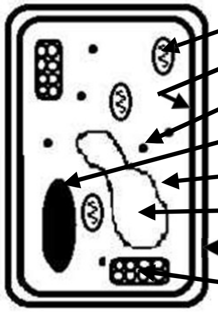
Maths skills

Interpreting sketch graphs

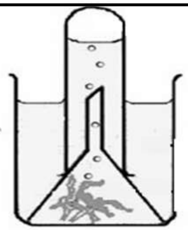
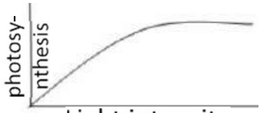
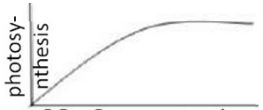
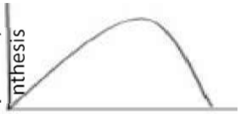
Additional information

The photosynthesis and respiration equations are the same, but the arrow is reversed. This means you only really need to remember one of them!

Key points to learn

1. Plant leaf cell	
2. Mitochondria	Perform respiration to release energy
3. Cell membrane	Controls movement in/out of cell
4. Ribosomes	Makes proteins by protein synthesis
5. Nucleus	Controls activities of cell. Contains genes to build new cells
6. Cytoplasm	Liquid where most reactions happen
7. Vacuole	Sack filled with sap. Keeps cell rigid
8. Cell wall	Made of cellulose. Supports cell
9. Chloroplasts	Green and full of chlorophyll
10 Chlorophyll	Absorbs light for photosynthesis
11. Photosynth-esis	The process of chloroplasts making their food (glucose) using light
	The reverse of respiration
	Absorbs light energy Carbon dioxide + Water → Glucose + Oxygen
	Endothermic reaction – light energy is absorbed

Key points to learn

12. Leaf adaptations for photosynth-esis	• Big surface area – to catch light • Thin - helps diffusion of gases • Chloroplasts – contain chlorophyll • Veins – bring water through xylem and move glucose through phloem • Air spaces – help diffusion of gases • Guard cells – open and close stomata to control gas movement
13. Rate of Photosynth-esis	Can be measured by using pond weed and counting number of oxygen bubbles released 
	Affected by light intensity 
	Affected by CO_2 concentration 
	Affected by temperature 
14. How plants use glucose	In respiration – provides energy Glucose + Oxygen → Carbon dioxide + Water
	Store it as insoluble starch
	Make fat or oil for storage
	Make cellulose to strengthen cell wall
	To produce amino acids for protein synthesis and making DNA
15 Nitrate ions	Also needed to make amino acids

20 questions retrieval practice

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Trilogy B9: Respiration

Collins Revision Guide: Bioenergetics

Knowledge Organiser

Key points to learn

1.Breathing	Not the same as respiration. Method of obtaining oxygen from the air
2. Aerobic respiration	Process by which all living things get energy from glucose and oxygen
	Happens continuously in plants an animals. Provides lots of energy
	Glucose + Oxygen → Carbon dioxide + Water
	$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$
	Exothermic reaction - gives off heat
	Occurs within mitochondria in cells
3. Response to exercise	During exercise body needs more energy so rate of aerobic respiration increases. This needs: 1. Heart rate increases - blood carries glucose and oxygen faster 2. Breathing rate and volume increases – lungs obtain more oxygen 3. Glycogen stores turned into glucose – more glucose available
	More respiration means you get hotter and may need to cool down
4 Anaerobic respiration	Provides energy from glucose if there is not enough oxygen available
5. Anaerobic respiration in plants and yeast	Called fermentation. Used to make bread and alcohol
	Glucose → Ethanol + Carbon dioxide
6. Enzymes	Biological catalyst. Helps reactions to happen in living things

Key points to learn

7. Anaerobic respiration in animal cells	Glucose → Lactic acid
	Much less energy provided than aerobic respiration
8. Lactic acid	Leads to an oxygen debt which requires more oxygen after exercise is complete to break down the lactic acid
	Causes muscles to tire and cramp
9. Metabolism	The sum of all the reactions in a cell or the body of an organism
	Energy provided by respiration is used in these metabolic reactions to make new molecules
10. Metabolic reactions	Includes these 5 reactions: 1. Turning glucose into starch, glycogen and cellulose 2. Making lipids from glycerol and fatty acids 3. Using glucose and nitrate ions to make amino acids 4. Respiration 5. Turning excess proteins into urea
11. Metabolic rate	The rate at which reactions happen in an organism
12. Lipids	Fats and oils
13. Starch	Carbohydrate store in plants
14. Glycogen	Carbohydrate store in animals
15. Cellulose	Makes cell walls in plants
16. Urea	Waste product from liver

Background

It is one of the R's in MRS GREN. All living things do it, all of the time. Every single one of your 10 trillion living body cells are doing it right now. As are the 100trillion microbes living in your intestines!

Additional information

The five metabolic reactions are all covered in more detail in this course. Remember that they all use enzymes.

'Aerobic respiration' is often known as just 'respiration'. It is photosynthesis in reverse.

20 questions retrieval practice

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Chemistry paper 1

Topics:

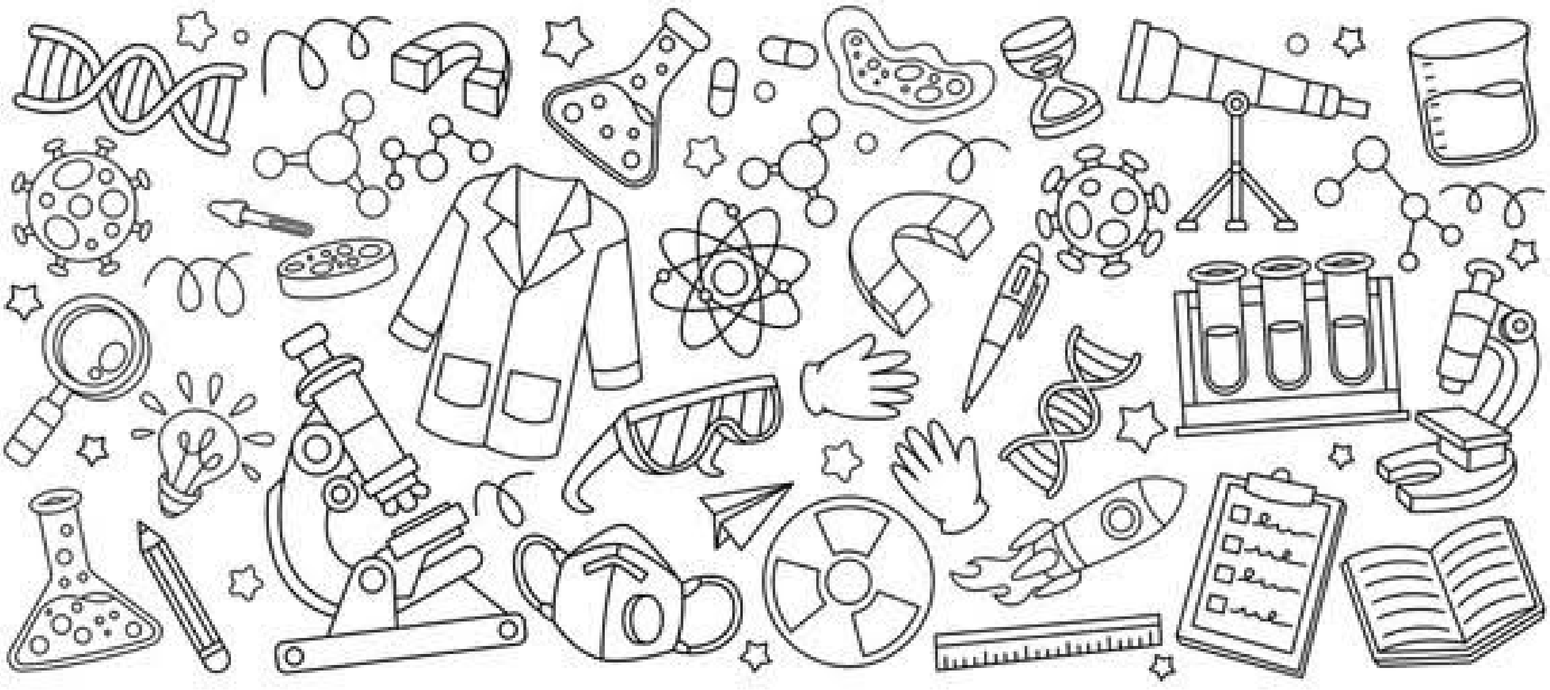
1. Atomic structure & periodic table
   https://www.bbc.co.uk/bitesize/topics/zcckk2p

2. Bonding, structure and the properties of matter
   https://www.bbc.co.uk/bitesize/topics/z33rrwx

3. Quantitative chemistry
   https://www.bbc.co.uk/bitesize/topics/zsnyy4j

4. Chemical changes
   https://www.bbc.co.uk/bitesize/topics/zt6ppbk

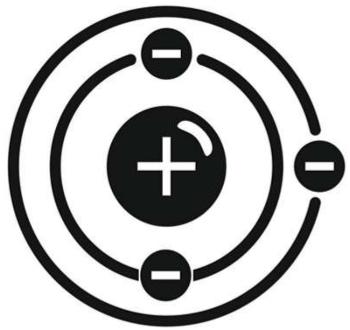
5. Energy Changes
   https://www.bbc.co.uk/bitesize/topics/z27xxfr



Trilogy C1: Atomic structure

Collins revision guide: Atomic structure and the periodic table

Knowledge Organiser



Background

Atoms are the building blocks of us, our world and our universe. Everything that we can touch is made of atoms.

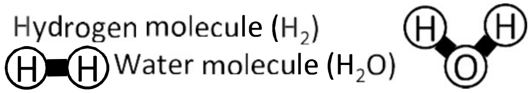
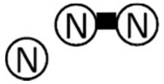
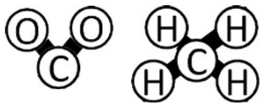
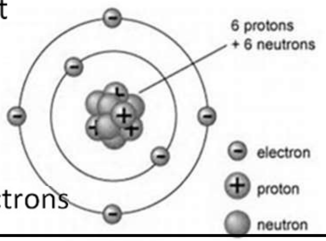
The Periodic Table organises them into a way that helps us make sense of the physical world.

Even though they make everything atoms are mostly (99.9%) empty space. If an atom was as big as Wembley, the nucleus would be pea-sized.

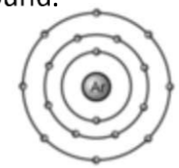
Additional information

A great deal of this topic is also covered in your Paper 1, Physics lessons during Electricity and Radioactivity.

Key points to learn

1. Atom	Smallest part of an element that can exist
	Hydrogen atoms (4H) 
2. Molecule	Two or more atoms chemically bonded
	Hydrogen molecule (H_2) Water molecule (H_2O) 
3. Element	Only one type or atom present. Can be single atoms or molecules
	Both examples of the Nitrogen element (N_2) (N) 
4. Compound	Two or more different elements chemically bonded
	Carbon dioxide (CO_2) Methane (CH_4) 
5. Nuclear atom model	• Electrons orbit • Protons and neutrons in nucleus • Number of protons = electrons 
6. Nucleus	The centre of the atom. Contains neutrons and protons
7. Proton	Charge of +1. Mass of 1. Found inside the nucleus
8. Neutron	Charge of 0. Mass of 1. Found inside the nucleus
9. Electron	Charge of -1. Mass of almost 0. Found orbiting around the nucleus

Key points to learn

10. Mixture	Two or more chemicals not chemically bonded
11. Separation techniques	Used to separate mixtures. Ones you need to know: Filtration - get an insoluble solid from a liquid Crystallisation - get a soluble solid from a liquid by evaporating liquid off Distillation - get a pure liquid from a mixture of liquids Chromatography - separate mixtures of coloured compounds
12. Electron energy levels	Where electrons are found. The shells can each hold this many electrons maximum: 2,8,8 
13. Periodic Table	A list of all the elements in order or atomic number. Columns called **Groups**. Rows called **Periods**
14.Conservat-ion of mass	In a chemical reaction the total mass of reactants = total mass of products
15. Mass number	Number of neutrons + protons ⇨ 6 Neutrons + 5 Protons $^{11}_{5}B$
16. Atomic number	Number of protons ⇨ 5 Protons
17. Isotope	Same number of protons different number of neutrons
18. Ion	Atom where number of protons is not equal to electrons (+'ve or –'ve)
19 Plum pudding atom model	Early model: ball of positive charge with electrons in it 

20 questions retrieval practice

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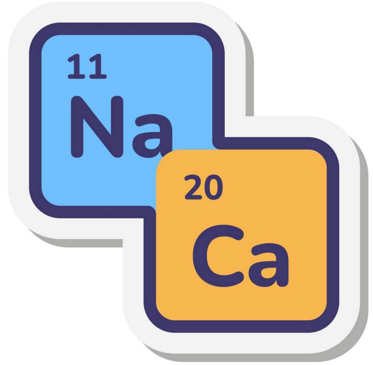
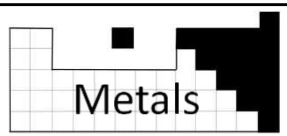
Trilogy C2: The Periodic Table

Collins revision guide: Atomic structure and the periodic table

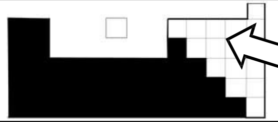
Knowledge Organiser



Key points to learn

1. Chemical symbol	An abbreviated name for every element. Maximum of two letters always starts with a capital letter
2 Reactivity	How easily an element will react
3. Group	Columns in the Periodic Table. Elements in the same group have similar properties
	Tells you how many electrons that atom has in its outer shell
4. Period	Rows in the periodic table
	Tells you how many electron shells that atom has
5. Mass number	Number of neutrons + protons (4 Neutrons + 3 Protons) $^{7}_{3}Li$
6. Atomic number	Number of protons (3 Protons)
7. Ion	Atom where number of protons is not equal to electrons (+'ve or –'ve)
8. Mendeleev	Scientist who placed elements in order of atomic weight but left gaps for undiscovered elements
9. Metals	Have delocalised (free) electrons that can move
	Atoms lose electrons and become positive (+'ve) ions
	

Key points to learn

10. Non-metals	Have electrons that cannot move
	Nearly always gain electrons and become (negative -'ve) ions
	
11. Group 0 Noble gases	He, Ne, Ar, Kr, Xe, Rn
	Unreactive: full outer shell
	Boiling point increases as you go down the group
12. Group 1 Alkali metals	Li, Na, K, Rb, Cs, Fr
	Very reactive: only one electron in their outer shell
	Reactivity increases as you go down the group
	React with oxygen to give metal oxides eg MgO
	React with water to give metal hydroxide (alkali) and hydrogen eg MgOH
	React with chlorine to give metal chloride eg MgCl
13. Group 7 Halogens	F, Cl, Br, I
	Melting and boiling point increase as you go down group
	Reactivity decreases as you go down the group
	A more reactive halogen will displace a less reactive one

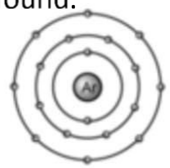
Background

The periodic table is amazing because it allows us to predict and explain the properties of elements even before they are discovered.

Maths skills

Losing –'ve charge makes you more +'ve.
Gaining –'ve charge makes you more –'ve.

Additional information

Remember Electron energy levels	Where electrons are found. The shells can each hold this many electrons maximum: 2,8,8 

20 questions retrieval practice

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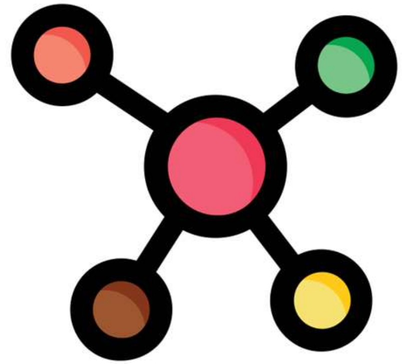
Trilogy C3: Structure and bonding

Collins revision guide: Bonding, structure and the properties of matter

Knowledge Organiser



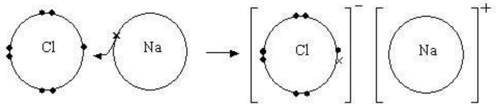
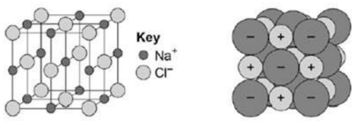
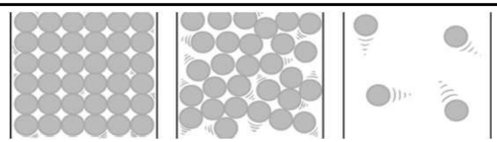
Background

Chemical reactions are a crucial part of all our lives. Without them the Universe as we know it could not exist.
This topic considers the three type of chemical bonds. All involve atoms trying to fill or empty their outer shells. Together these bonds are responsible for the wide range of different properties we see around us.

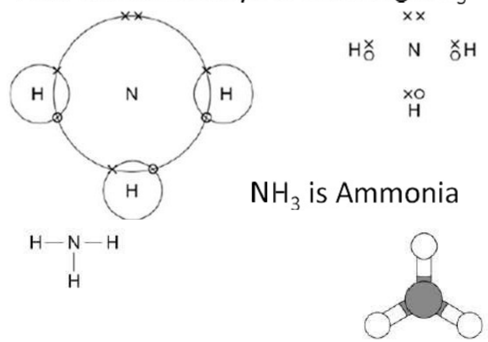
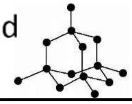
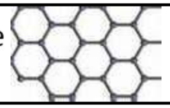
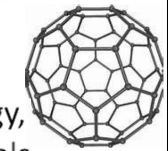
Additional information

You need to be clear which elements are metals and non-metals (see C2: Periodic table) also a good knowledge of the electron energy levels will help (see C1: Atomic structure).

Key points to learn

1. Chemical bonds	Hold atoms together in a molecule after a reaction
2. Ionic bonding	Metal + Non metal
	Metal loses electrons and becomes a positive ion. Non metal gains the electrons and becomes a negative ion
	 Cl + Na → NaCl
3. Giant ionic structures	Drawing salt (NaCl) 
	High melting and boiling points
	Conduct electricity when melted or dissolved in water
4. Metallic bonding	Metal + Metal
	Giant structures with free electrons moving throughout
5. Conductors	Metals conduct electricity because they have free electrons
6. Graphite	Non-metal that conducts electricity
7. Alloys	A mixture of different metals. Which are then harder
8. States of matter	 Solid Liquid Gas

Key points to learn

9. Covalent bonding	Non-metal + Non metal
	Atoms share electrons
	Four different ways of drawing NH_3  NH_3 is Ammonia
10. Giant covalent structures	Examples are diamond and silicon dioxide 
	Solids. Very high melting points
11. Small molecules	Usually gases or liquids. Do not conduct electricity
12. Polymers	Long chain molecules linked by strong covalent bonds
13. Particle theory	Particles are held together by intermolecular forces that get weaker as particles gain energy
14. State symbols	(s) solid; (l) liquid; (g) gas; (aq) aqueous solution
15. Graphene	A single layer of graphite used in electronics 
16. Fullerenes	Molecules of carbon with hollow shapes  Used in nanotechnology, electronics and materials

20 questions retrieval practice

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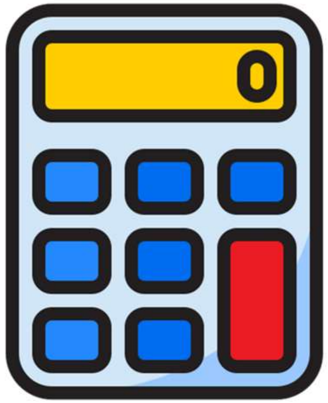
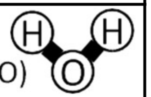
Trilogy C4: Chemical calculations

Collins rev. guide: Quantitative chemistry

Knowledge Organiser



Key points to learn

1. Atom	Smallest part of an element that can exist
	Hydrogen atoms (4H) 
2. Molecule	Two or more atoms chemically bonded
	Hydrogen molecule (H_2)  Water molecule (H_2O) 
3. Element	Only one type or atom present. Can be single atoms or molecules
	Both examples of the Nitrogen element (N_2)  (N) 
4. Compound	Two or more different elements chemically bonded
	Carbon dioxide (CO_2)  Methane (CH_4) 
5. Mass number	Number of neutrons + protons — 6 Neutrons + 5 Protons $^{11}_{5}B$
6. Atomic number	Number of protons — 5 Protons
7. Relative Atomic Mass	A_r The mass number of an atom. Eg A_r of O is 16 and H is 1
8. Relative Formula Mass	M_r The mass of all the atoms of a molecule added together. Eg M_r of H_2O is (2 x 1) + 16 = 18
9. Mole	An amount where either the A_r or M_r is written in grams. Eg one mole of water has a mass of 18g
10. Solute	Solid that has been dissolved

Key points to learn

11. Isotope	Same number of protons different number of neutrons
12. Numbers in reaction equations	Big numbers in front of a chemical tell us how many molecules/atoms of that chemical there are
13. Balancing equations	The number of atoms in the reactants must equal the number of atoms in the products
	Steps to balance an equation 1) $Mg + O_2 \rightarrow MgO$ *Needs another O on product side* 2) $Mg + O_2 \rightarrow \mathbf{2}MgO$ *Only add big numbers in front* *Now needs more Mg on reactants* 3) $\mathbf{2}Mg + O_2 \rightarrow 2MgO$ *Only add big numbers in front*
	The table you you will have drawn to help Mg: $\cancel{1}$ 2 → $\cancel{1}$ 2 O: 2 → $\cancel{1}$ 2
14. Chemical reaction	Reactants → Products *'turn into'*
Conservation 15 of mass	In a chemical reaction the total mass of reactants = total mass of products
16 If mass seems to be lost/gained	Conservation of mass always applies but sometimes the mass of a gas being used/made is missed
17. Concentration	The mass of solute in a given volume of solution
	Concentration [g/dm³] = $\frac{\text{mass of solute [g]}}{\text{volume of solution [dm}^3\text{]}}$
18. Solution	Liquid containing dissolved solute

Background

Want to make enough pancakes for everyone? Then you need to know quantities. Chemical reactions are the same (cooking is a chemical reaction!). This topic explores in more detail.

Maths skills

Steps to balance an equation:

1. Write down the symbols of each element then count how many are on each side of the equation
2. Leave Hydrogen and Oxygen till last if it's complicated
3. Start with an element that appears in the least molecules first (usually a metal)
4. Only add big numbers to the left of each chemical. You can't change molecules

20 questions retrieval practice

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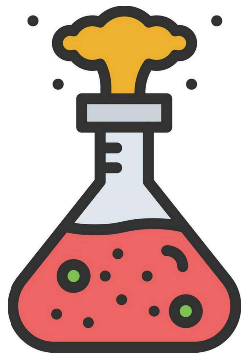
Trilogy C5: Chemical Changes

Collins rev guide: Chemical Changes

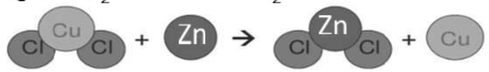
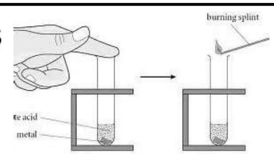
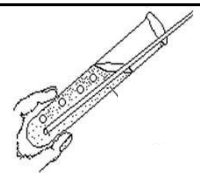
Knowledge Organiser



Key points to learn

1 Chemical reaction	Reactants → Products *'turn into'*
2 Oxidation	Losing electrons (or gaining oxygen)
3 Reduction	Gaining electrons (or losing oxygen)
4. OiL RiG	Oxidation is Loss of electrons Reduction is Gain of electrons
5 Reactivity Series	List of metals with most reactive at top and least reactive at bottom The most reactive metals are most likely to lose electrons
6. Metals and oxygen	**Metal + Oxygen → Metal Oxide** Eg Iron + oxygen → iron oxide
7. Metals and water	**Metal + Water → Metal + Hydrogen hydroxide** Eg Sodium + Water → Sodium + Hydrogen hydroxide
8. Metals and acid	**Metal + Acid → Metal salt + hydrogen** Eg Zinc + Hydrochloric acid → Zinc + Hydrogen chloride
9. Metal carbonates and acids	**Metal + Acid → Metal + Water + Carbon carbonate salt dioxide** Eg Lead + Nitric → Lead + Water + Carbon carbonate acid nitrate dioxide
10. Metal salts	• Hydrochloric acid makes ...chloride • Sulfuric acid makes ....sulfate • Nitric acid makes ...nitrate
11. State symbols	(s) solid; (l) liquid; (g) gas; (aq) aqueous solution

Key points to learn

12. Displacement reaction	A more reactive metal will displace a less reactive metal from a chemical compound
	Eg $CuCl_2 + Zn \rightarrow ZnCl_2 + Cu$ 
13. Ion	Atom where number of protons is not equal to electrons (+'ve or –'ve)
Neutralisation reaction 14	Acid + Alkali → Metal + Water salt
15. pH scale	1 – Strong acid 7 – Neutral 14 – Strong alkali
16. Universal indicator	• Turns red in strong acid • Turns green in neutral • Turns purple in strong alkali
17. Acids	Contains H^+ ions. Opposite of a base
18. Base	Usually contains OH^- ions. Opposite of an acid
19. Alkali	A base that has dissolved in water
20. Test for hydrogen	Hydrogen makes a squeaky 'pop' when lit with a splint 
21. Test for carbon dioxide	If you bubble carbon dioxide through limewater it will turn milky (cloudy white)  *Clear → milky*
22. Ionic equation	Ions making neutral product Eg $Cu^{2+}_{(aq)} + 2OH^-_{(aq)} \rightarrow Cu(OH)_{2\,(s)}$

Background

In the past, scientists would discover reactions by trial and error. This was time-consuming and dangerous. Today we can use patterns to predict the outcomes of a whole range of reactions. This has allowed us to develop new materials and understand reactions that happen inside all living things.

Additional information

You need to be able to work out how many electrons an atom wants to lose or gain using the periodic table group number. This will be its ion charge.

20 questions retrieval practice

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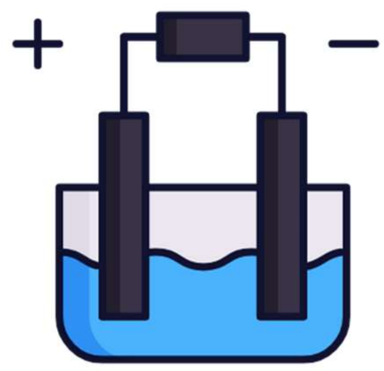
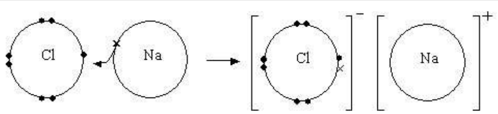
Trilogy C6: Electrolysis

Collins rev guide: Chemical Changes

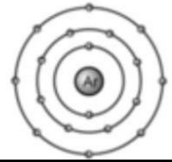
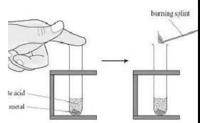
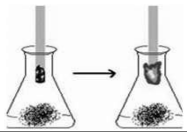
Knowledge Organiser



Key points to learn

1. Electrolysis	Breaking down a substance using electricity
2. Electrolyte	The ionic compound that is broken down in electrolysis.
	Must be an ionic compound in liquid form (either molten or dissolved in water)
3. Electrode	Connected to the power supply
4. Anode	The +'ve electrode
5. Cathode	The –'ve electrode
6. Ion	Atom where number of protons is not equal to electrons (+'ve or –'ve)
7. Positive (+'ve) ions	Metals and hydrogen. Collect at the cathode (-'ve electrode)
8. Negative (-'ve) ions	Non-metals except hydrogen. Collect at the anode (+'ve electrode)
9. Ionic bonding	Metal + Non metal
	Metal loses electrons and becomes a positive ion. Non metal gains the electrons and becomes a negative ion.
	 $Cl + Na \rightarrow NaCl$
10. Group	Column number in the Periodic Table. Tells you how many electrons in outer shell of atom. Used to work out charge of ion

Key points to learn

11. Half equations	Equation showing what happens to electrons at each electrode Eg Lead ions gaining 2 electrons at the cathode to be come lead atoms $Pb^{2+} + 2e^- \rightarrow Pb$
12. Oxidation	Losing electrons (or gaining oxygen)
13. Reduction	Gaining electrons (or losing oxygen)
14. OiL RiG	Oxidation is Loss of electrons Reduction is Gain of electrons
15. Electron shells	Where electrons are found. The shells can each hold this many electrons maximum: 2,8,8 
16. Aluminium	Obtained from molten bauxite ore
	Extracted by electrolysis mixed with cryolite to reduce melting temperature
17. Cryolite	Used to extract aluminium
18. Ore	Rock containing enough metal to be worth extracting
19. Brine	Salt water (sodium chloride solution)
	Can be separated using electrolysis to produce chlorine, hydrogen and sodium hydroxide
20. Test for hydrogen	Hydrogen makes a squeaky 'pop' when lit with a splint 
21. Test for oxygen	Oxygen will relight a glowing splint. 

Background

Electrolysis is important to our lives as allows us to obtain reactive metals from their ores. It is likely to become even more important over the next 10 years as we separate hydrogen from water for use in fuel cells.

Maths skills

Balance the charges on both sides of a half equation. You can only add big numbers in front of the number of the electrons

eg $2O^{2-} - 4e^- \rightarrow O_2$

Additional information

You need to be able to work out how many electrons an atom wants to lose or gain using the group number. This will be its ion charge.

20 questions retrieval practice

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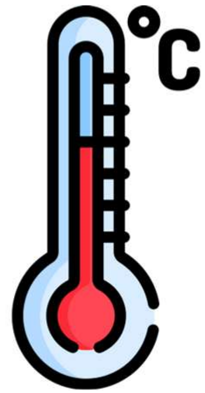
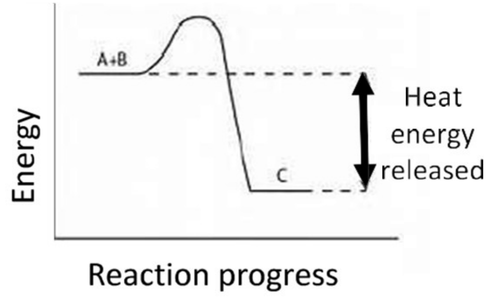
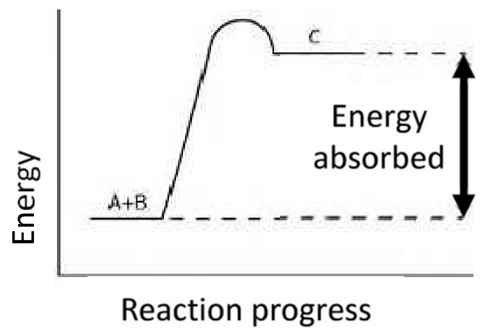
Trilogy C7: Energy Changes

Collins rev guide: Energy Changes

Knowledge Organiser



Key points to learn

1. Exothermic reaction	One that transfers energy to the surroundings so the temperature of the surroundings increases
	
	Used in handwarmers and self-heating cans
	Examples: combustion, respiration, oxidation, neutralisation
2. Endothermic reaction	One that absorbs energy from the surroundings so the temp. of the surroundings decreases
	
	Used in cold packs for injuries
	Examples: Photosynthesis, thermal decomposition, citric acid and sodium hydrogen carbonate

Key points to learn

3. Reactant	Used in a reaction
4. Product	Made in a reaction
5. Conservation of energy	Energy is never created or destroyed it is just transferred from one form to another
6. Activation Energy	Is the energy required to start a reaction
7. Catalyst	Chemical which speeds up a reaction without being used itself
	Reduces the activation energy required to start a reaction
8. Breaking and making bonds	This is what happens during a chemical reaction
	Require energy in to break bonds (Endothermic)
	Energy is released when bonds are made (Exothermic)
	Bonds between different atoms need different amounts of energy

Additional information

- Collision theory: chemical reactions occur when particles collide with enough energy
- Chemical reactions are all due to electrons moving or being shared
- An enzyme is a biological catalyst
- *Higher Tier content is written in italics*

Background

The interaction of particles in chemical reactions often involves transfers of energy. These produce heating or cooling effects that are used in a range of everyday applications.

Maths skills

- *Using bond energies, calculate energy difference in a reaction eg*

$2H_2 + O_2 \rightarrow 2H_2O$

Reactants bond energy (kJ/mol)

$(2x436) + 498) = 1370$

Products bond energy (kJ/mol)

$2x(2x464) = 1856$

Energy released (kJ/mol)

1370-1856 = –486 kJ/mol

Therefore exothermic

Bond	Bond energy (kJ/mol)
H-H	436
O=O	498
H-O	464

20 questions retrieval practice

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Physics paper 1

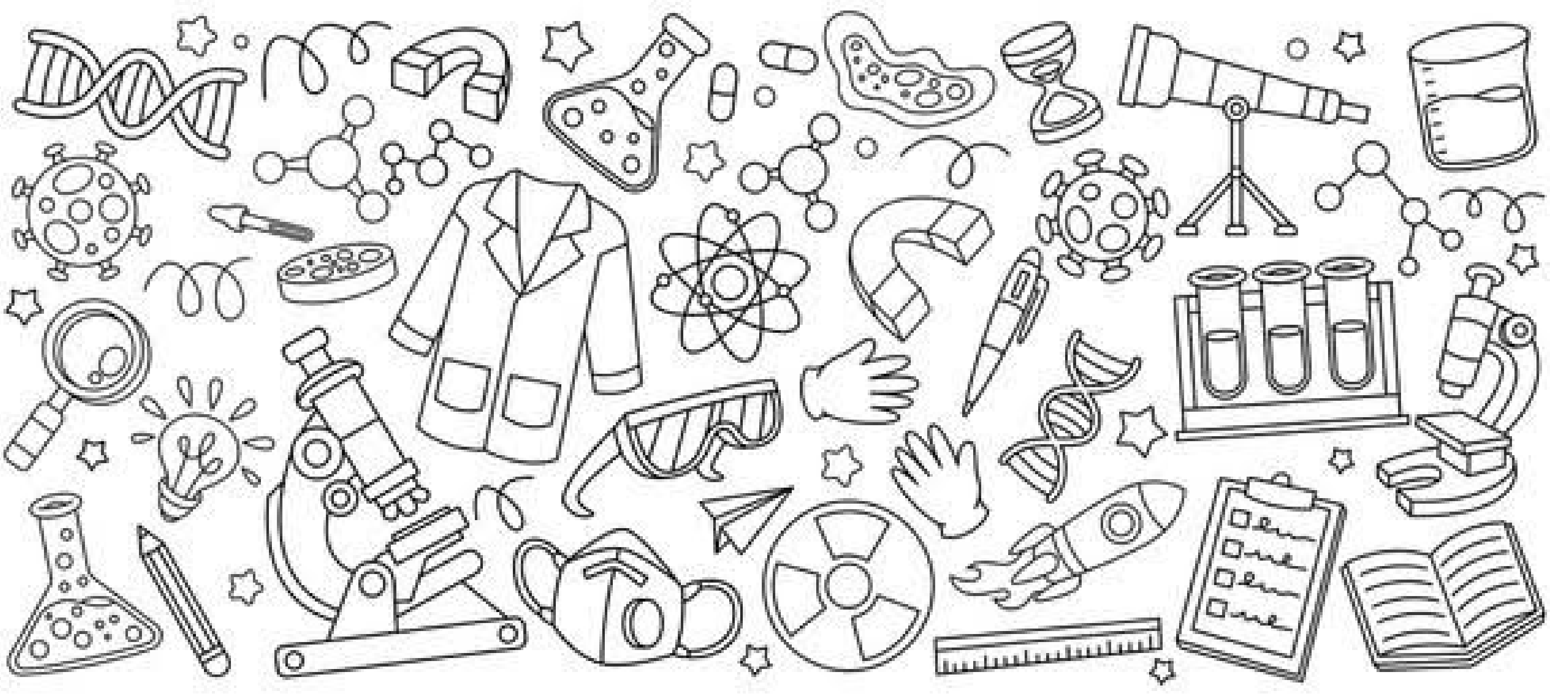
Topics:

1. Energy
   https://www.bbc.co.uk/bitesize/topics/z89ddxs

2. Electricity
   https://www.bbc.co.uk/bitesize/topics/zcg44qt

3. Particle model of matter
   https://www.bbc.co.uk/bitesize/topics/z3ybb82

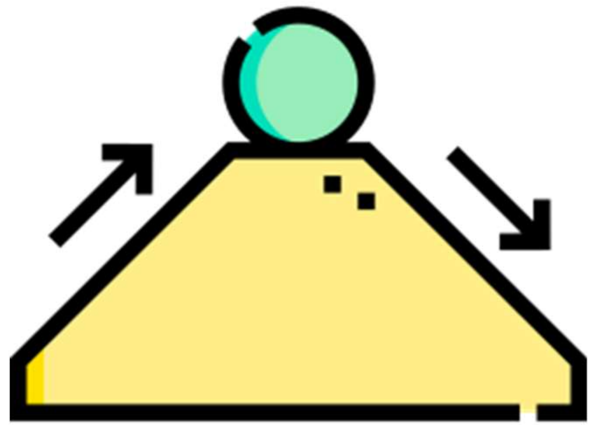
4. Atomic model
   https://www.bbc.co.uk/bitesize/topics/zshssrd



Trilogy P1: Conservation and dissipation of energy

Collins revision guide: Energy

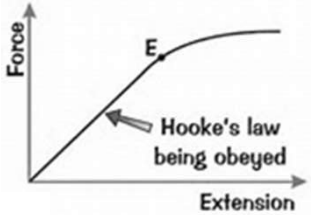
Knowledge Organiser



Key points to learn

1. Energy stores [J]	Chemical energy
	Kinetic energy
	Gravitational potential energy
	Elastic potential energy
2. Chemical energy [J]	Transferred during chemical reactions eg fuels, foods, or in batteries
3. Kinetic energy [J]	All moving objects have it.
	k.e = 0.5 x mass x $(\text{speed})^2$ E_k = ½ x m x v^2 [J] [kg] [m/s]
4 Gravitational potential energy [J]	Stored in an object lifted up.
	g.p.e = mass x g x height E_p = m x g x h [J] [kg] [N/kg] [m]
5. Elastic potential energy [J]	Energy stored in a springy object
	e.p.e = 0.5 x spring constant x $(\text{extension})^2$ E_e = ½ x k x e^2 [J] [N/m] [m] *(You are given this equation)*
6. Energy can be transferred by…	Heating (thermal energy always flows from hot to cold objects)
	An electrical current flowing
	A force moving an object
7. Useful energy [J]	Energy transferred to the place and in the form we need it.
8. Wasted energy [J]	Not useful. Eventually transferred to surroundings

Key points to learn

9. Work done [J]	Equal to the energy transferred.
	When a force moves an object.
	Work done = Force x distance moved W = F x s [J] [N] [m]
10. Energy flow diagram	Show energy transfers eg for a torch lamp:
	Chemical → Light + Heat
11. Conservation of energy	Energy cannot be created or destroyed. It can only be transferred usefully, stored or dissipated.
12. Dissipated energy [J]	Wasted energy, usually spread to the surroundings as heat.
13. Hooke's Law and k the spring constant	The extension of a spring is proportional to the force on it.
	The gradient of this graph is known as k, the spring constant. 
14. Efficiency	Proportion of input energy transferred to useful energy. 100% means no wasted energy. Efficiency = useful energy ÷ total input energy
15. Power [W]	Energy [J] transferred in 1 second.
	Power [W] = Energy [J] ÷ time [s]
16. Wasted power [W]	Total power in – useful power out

Background

Energy is the capacity of something to make something happen.

The Universe and everything in it is constantly changing energy from one form into another.

Maths skills

You should be able to recall, use and rearrange all the equations on this page except number 5.

g is Earth's acceleration due to gravity. It has a constant value of approximately $9.8 m/s^2$

You need to remember the units for each quantity. They are in [ ] next to equations.

You should be able to calculate the gradient of a Force – extension graph.

20 questions retrieval practice

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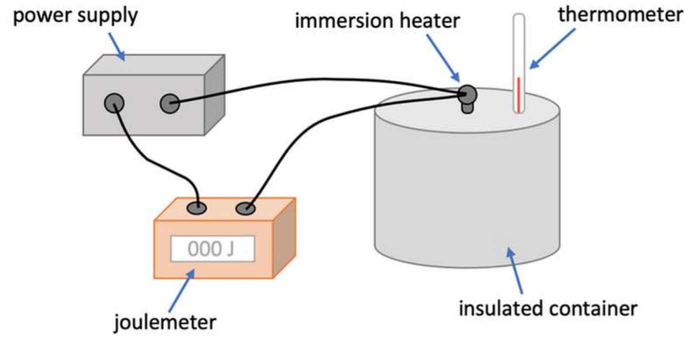
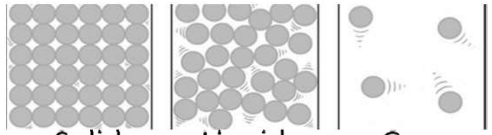
Trilogy P2: Energy transfer by heating

Collins revision guide: Energy

Knowledge Organiser



Key points to learn

1. States of matter	
2. Solid	Particles held together in fixed positions by strong forces. Least energetic state of matter.
3. Liquid	Particles move at random and are in contact with each other. More energy than solids, less than gas
4. Gas	Particles move randomly and are far apart. Weak forces of attraction. Most energetic.
5. Vacuum	No particles at all. Space is a vacuum
6. Metals	Have free electrons which makes them good conductors
7. Non-metals	Have fixed electrons which makes them good insulators
8. Conductor	Is good at carrying heat energy or electrical energy
9. Thermal conductivity	A measure of how good something is at conducting
10. Insulator	A poor conductor
11. Friction	Two surfaces rubbing together
	Causes energy to be transferred as heat
	Can be reduced by using a lubricant
12. Lubricant	Fluid (eg oil) that smooths contact points between surfaces

Key points to learn

13. More energy loss from a building	If walls are thin
	If walls have high thermal conductivity
	Big temperature difference between inside and outside
14. Reduce heat loss by	Using material with low thermal conductivity ie an insulator
	Make insulator thicker
15. Specific heat capacity, c [J/kg°C]	Amount of energy needed to change temperature of 1kg by 1°C
	$E = mc\ \ \theta$ *(You are given this equation)* • E: Change in energy [J] • m: mass of object • c: *specific heat capacity* • θ: change in temperature [°C]
	Objects with high specific heat capacity take a long time to heat up and cool down. They are good at storing heat energy.
16. Loft insulation	Fibreglass which traps air which is a good insulator.
17. Cavity wall insulation	Traps air pockets in gaps which is a good insulator
18. Double glazing	Traps air in gaps between glass which is a good insulator
19. Foil behind radiator	Reflects heat away from wall back into room

Background

Not wasting heat energy in your home is important for the environment and for your finances. This topic will help you make more informed decisions so that you can save even more.

Maths skills

You should be able to use the specific heat capacity equation to find energy change and the specific heat capacity when given all other variables. Rearranging to make c the subject:

$$c = \frac{E}{m\ \ \theta}$$

20 questions retrieval practice

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Trilogy P3: Energy Resources

Collins revision guide: Energy

Knowledge Organiser

Background

It is hard to imagine a World without electricity. It reaches into every aspect of our lives. But where do we get the energy to make it from? Will they run out? Have we got a backup plan?

Additional

To make electricity, we usually spin a turbine which we then attach to a generator. Making that turbine spin, is the problem…
The most common way is by burning fuels to boil water, then shooting the steam at the turbine. But there are issues with this, as you will find out.

Key points to learn

1.Fuel	Substance that we burn to release heat energy
	Stores chemical energy
2. Fossil fuels	Coal, oil and gas
	Remains of ancient organisms. Millions of years to form.
	Are non-renewable
	Release carbon dioxide when burnt
3. Non-renewable	Are used quicker than they are made. So will run out.
4. Renewable fuels	Made quicker than they are used. Will not run out
	These energy sources are renewable: • Biofuel • Wind and Wave • Geothermal • Hydroelectric and Tidal • Solar
5. Biofuel	Fuel made from living organisms eg vegetable oil, ethanol, wood
	Are considered carbon-neutral because CO_2 released is balanced by amount taken in by photosynthesis
	Reliable – can even be used fossil fuel power stations
	Reduces land available for food growth
	Renewable
6. Burning fuels	Releases carbon dioxide which contributes to the greenhouse effect and global warming.

Key points to learn

7. Decommission	Take apart and make safe at the end of its life
8. Wind and wave power	Kinetic energy of the air/water turns turbines
	Unreliable as both need wind
	Renewable
9. Geothermal power	Use heat energy from deep underground instead of fuel
	Not available everywhere
	Renewable
10. Hydroelectric and Tidal power	Water stored high up in dams then released to spin a turbine
	Very quick start-up time
	Can destroy habitats for animals
	Renewable
11. Solar power	Use light or heat energy from the Sun
	Unreliable as needs sun
	Renewable
12. Nuclear fuel	Energy stored in nucleus as nuclear energy. Uranium or Plutonium.
	Heat release in reactor core
	High energy yield
	Very slow start-up time as potentially dangerous
	Fuel and waste is radioactive
	Very expensive to set up and decommission

20 questions retrieval practice

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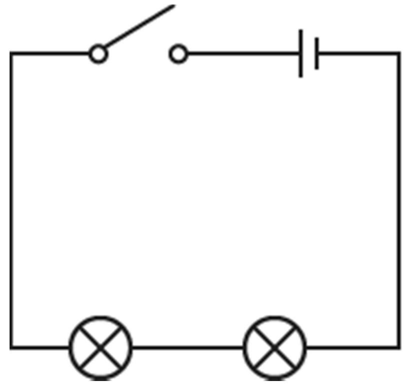
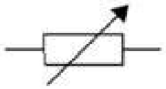
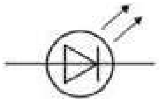
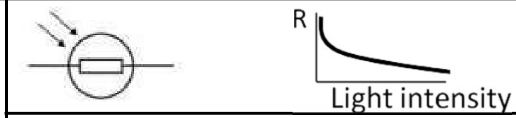
Trilogy P4: Electric circuits

Collins revision guide: Electricity

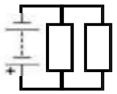
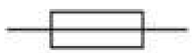
Knowledge Organiser



Key points to learn

1. Diode	
	Current only flows one way. Very high resistance in other direction.
2. Resistor (Ohmic conductor)	
	Resistance stays constant. Current proportional to pd.
3. Variable resistor	Resistance can be set by a human. Used in dimmer switches. 
4. LED	A diode that gives off light. 
5. Lamp	
	Resistance increases as the temperature increases.
6. Thermistor	
	Resistance decreases as the temperature increases.
	Used in thermostats.
7. LDR	
	Resistance decreases as the light intensity increases (gets brighter).
	Used in automatic lights.

Key points to learn

8. Cell and battery	Provides the potential difference (pd) and energy for a circuit. 
9. Current, I	Rate of flow of electrical charge. Measured in Amps (A)
10. Charge, Q	Measured in Coulombs (C)
11. Potential difference, V	pd. Energy transferred per unit charge. Measured in Volts (V)
12.Resistance R	Ability to slow current. Measured in Ohms (Ω)
13. Series circuit	Current has only one route.
	Current is the same all the way around. Potential difference is shared across components.
	Resistances are added together.
14. Parallel circuit	Current has different paths it could take. 
	Current is shared through each branch. Potential difference is the same across each branch.
	Total resistance is lower than the smallest single resistor.
15. Voltmeter	Measures pd across a component 
16. Ammeter	Measures current through a component 
17. Fuse	Resistor that melts if current is too high. 

Background

Electrical power fills the modern world with light and sound, information and entertainment, remote sensing and control. Its use was identified and explored by scientists of the 19th century but it becomes more important every day.

Maths skills

- $Q = I \times t$
  Charge = Current x time
  [C] [A] [s]
- $V = I \times R$
  Potential difference = Current x Resistance
  [V] [A] [Ω]

(You need to be able to remember and use these)

20 questions retrieval practice

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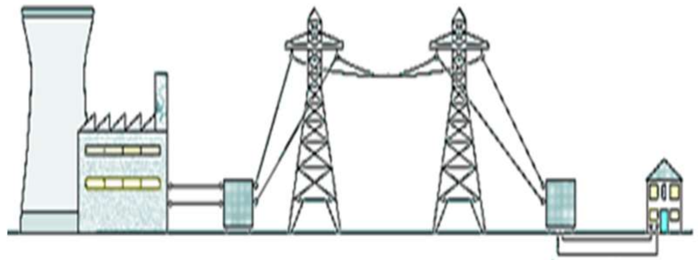
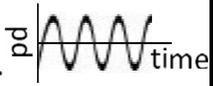
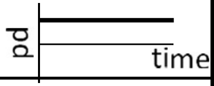
Trilogy P5: Electricity in the home

Collins revision guide: Electricity

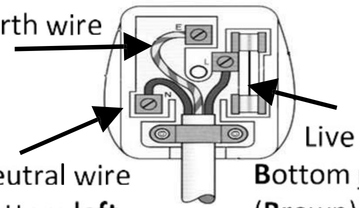
Knowledge Organiser



Key points to learn

1. ac	Alternating current Found in mains
	Has an alternating potential difference (voltage) negative to positive. 
2. dc	Direct current Found in batteries 
	Has a constant potential difference (voltage)
3. UK mains	AC supply of 230Volts and frequency of 50Hz
4. Power, P	Energy [J] transferred in one second. Measured in Watts (W)
5. Potential difference, V	Also known as voltage. Measured in volts (V)
6. Energy transferred, E	Depends on the power of the appliance and the time it is on for. Also called work done.
7. Energy transfer diagram	Energy input → Useful energy + Wasted energy
8. Work done, E	Energy transferred when current flows in a circuit.
9. National grid	System of cables and transformers.
10. Step-up transformer	Increase potential difference so that less heat energy is wasted.
11. Step-down transformer	Decrease potential difference to make electric more easily used.

Key points to learn

12. Current, I	Measured in Amps (A)
13. Resistance, R	Measured in ohms (Ω)
14. Live wire	Brown. Connects to fuse.
	Carries the alternating potential difference from the supply.
	About 230V.
15. Neutral wire	Blue wire
	Completes the circuit.
	Around 0V
16. Earth wire	Green and yellow striped wire.
	Carries current safely to Earth if there is a fault.
	Normally 0V.
17. Electrical plug	Made of plastic as it is a good insulator.
	

- $P = V \times I$
  power [W] = potential difference [V] × current [A]
- $P = I^2 \times R$
  power [W] = current^2 [A] × resistance [Ω]

Background

We use electricity in all aspects of modern life. But how is it moved from power stations to our homes and then to our devices? This topic answers that question as well as investigating how power companies measure our electricity usage.

Maths skills

- $E = P \times t$
  Work done = Power x time
  [J] [W] [s]
  [kWh] [kW] [hr]

(You need to remember and be able to use all of the equations on this sheet.)

- $E = Q \times V$
  Work done = Charge flow x potential difference
  [J] [C] [V]

20 questions retrieval practice

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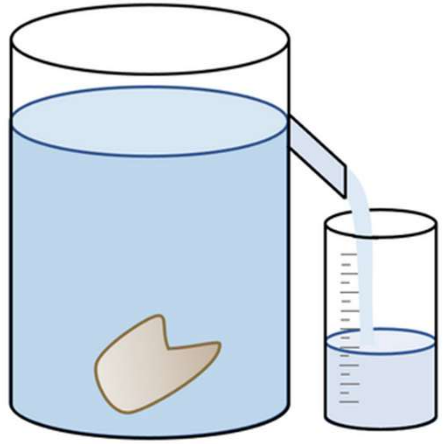
Trilogy: Molecules and matter

Collins rev guide: Particle model of matter

Knowledge Organiser



Background

The particle model is widely used to predict the behaviour of solids, liquids and gases. It helps us to design vehicles from submarines to spacecraft. It even explains why it is difficult to make a good cup of tea high up a mountain!

Maths skills

$$density = \frac{mass}{Volume}$$

$$[kg/m^3] \quad \rho = \frac{m}{V} \quad \frac{[kg]}{[m^3]}$$

(You need to remember this.)

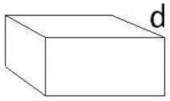
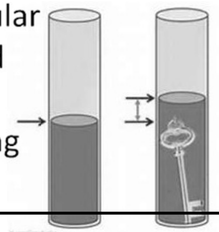
Latent heat: $Energy = mass \times specific\ latent\ heat$

$$E = m \times L$$

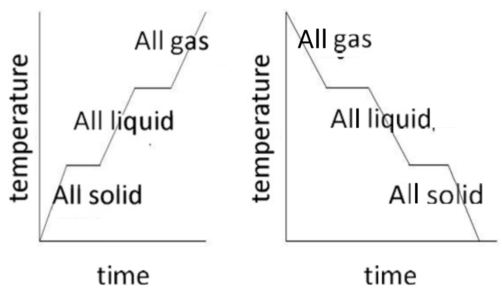
[J] [kg] [J/kg]

(You are given this)

Key points to learn

1. Mass, m	Amount of matter in something. Measured in kg
2. Volume, V	Amount of space something takes up. Measured in m^3
	Volume of a cuboid = w x d x h 
	Volume of an irregular object can be found by dropping in a liquid and measuring displacement. 
3. Density, ρ	Mass per unit volume. Measured in kg/m^3
	$density = \frac{mass}{volume}$
4. Floating	An object that has a lower density than the fluid will float
5. Sinking	An object that has a higher density than the fluid will sink
6 Evaporation	Happens at any temperature
7 Sublimation	Solid turns straight into gas
8. Solid	Particles held together in fixed positions by strong forces. Least energetic state of matter.
9. Liquid	Particles move at random and are in contact with each other. More energy than solids, less than gas
10. Gas	Particles move randomly and are far apart. Weak forces of attraction. Most energetic.

Key points to learn

11. Melting point	Temperature when solid turns into liquid. Same as freezing point.
12. Boiling point	Temperature when liquid turns into gas. Same as condensation point.
13. Condensation point	Temperature when gas turns into liquid. Same as boiling point.
14. Freezing point	Temperature when liquid turns into solid. Same as melting point.
15. Latent heat	Energy transferred when a substance changes state but temperature doesn't change
16. Specific latent heat of fusion	Energy needed to melt 1kg of solid into liquid
17. Specific latent heat of vaporisation	Energy needed to boil 1kg of liquid into gas
18. At state changes...	Temperature and kinetic energy of particles stays constant.
	Internal energy increases due to an increase in potential energy as particles move further apart
19. Heating and cooling curves	
20. Gas pressure	Caused by particles hitting surfaces. Increases when temperature increases

20 questions retrieval practice

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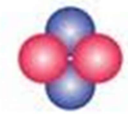
Trilogy P6: Radioactivity

Collins rev guide: Atomic Structure

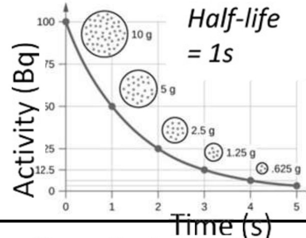
Knowledge Organiser

α		$^{4}_{2}He$
β		$^{0}_{-1}e$
γ		energy

Key points to learn

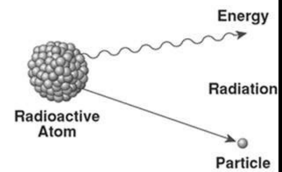
1. Radioactive decay	Unstable nuclei emitting a type of radiation (α, β , γ or neutron)
2. Random event	You cannot predict or change when decay might happen.
3. Ionising	The ability to charge atoms
4. Alpha particle (α) $^{4}_{2}He$	Two neutrons and two protons. The same as a helium nucleus.
	Stopped by paper or skin.
	Range of a couple of cm in air
	Highly ionising: has charge of +2
	Parent atom mass drops by 4 and atomic number drops by 2.
5. Beta particle (β) $^{0}_{-1}e$	A high speed electron made when a neutron turns into a proton.
	Stopped by thin aluminium.
	Range of up to one metre.
	Mid ionising: has charge of -1.
	Parent atom mass remains same and atomic number rises by 1
6. Gamma ray (γ) $^{0}_{0}\gamma$	An electromagnetic wave.
	Stopped by thick lead.
	Unlimited range.
	Low ionising: has no charge.
	Parent atom mass and atomic number remains same.
7. Neutron (n)	Neutron ejected from the nucleus

Key points to learn

8. Activity	Rate of unstable nuclei decay. Measured in Becquerel (Bq)
9. Irradiated	Exposed to radiation but does not become radioactive.
10. Radioactive contamination	Unwanted presence of radioactive material.
11 Geiger counter	Nuclear radiation detector.
12. Half-life	Time it takes for the radioactive nuclei to halve. Or, the time it takes for the activity to halve. 
13. Nuclear model of the atom	Very small, radius of ≈1x10^{-10}m Most of mass in the nucleus. Number of electrons = protons
14. Mass number	Number of neutrons + protons
15. Atomic number	Number of protons $^{4}_{2}He$
16. Isotope	Same number of protons different number of neutrons.
17. Ion	Atom where number of protons is not equal to electrons (+'ve or –'ve)
18. Plum pudding atom model	Early model: ball of positive charge with electrons stuck in it.
19. Bohr Model	Idea that electrons have to be at certain distances from nucleus.
20. Chadwick	Discovered neutrons

Background

Researched by Henri Becquerel and Marie Curie around 1900 it remains mysterious and frightening.

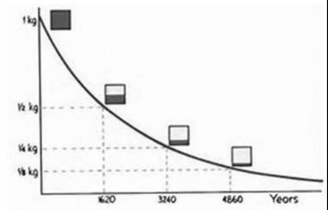


Maths skills

- *Nuclear decay equations:* Balance top and bottom numbers on RHS and LHS.

$$^{226}_{88}\mathrm{Ra} \rightarrow {}^{4}_{2}\mathrm{He} + {}^{222}_{86}\mathrm{Rn}$$

- *Finding Half-life using a graph*
  Find how long It takes until you have half what you started with



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