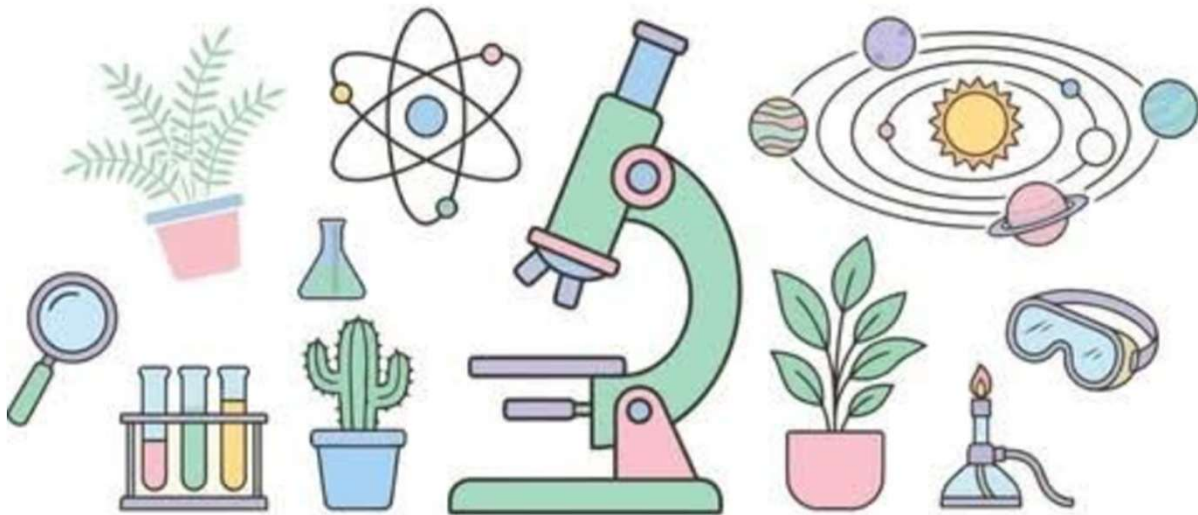


GCSE Combined Science AQA



Y10 form time revision pack

Name:	Form:
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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.



<https://www.bbc.co.uk/bitesize/topics/z2mttv4>

<https://www.bbc.co.uk/bitesize/guides/zsncsr/d/revision>

<https://www.bbc.co.uk/bitesize/topics/zh24h4j>

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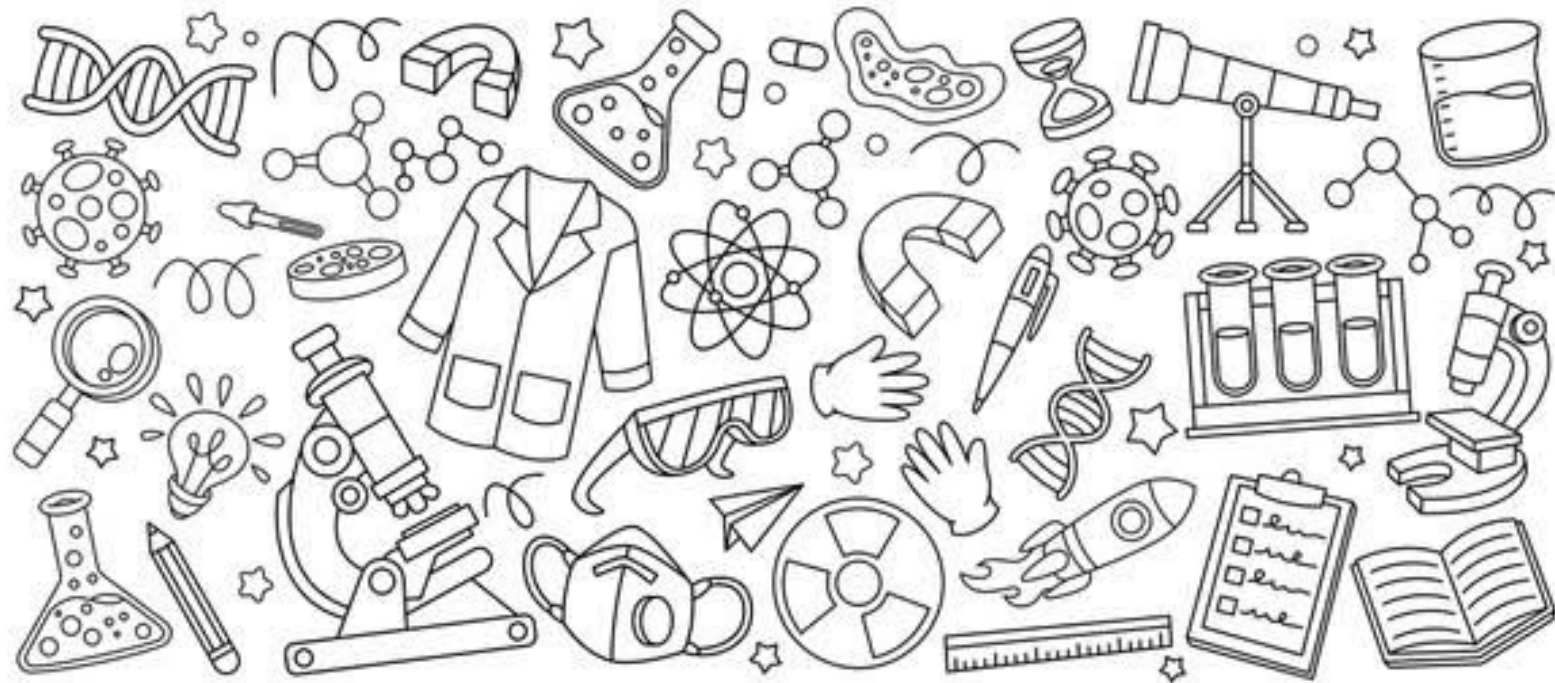
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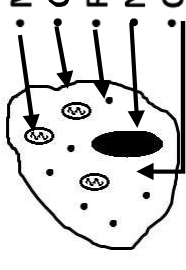
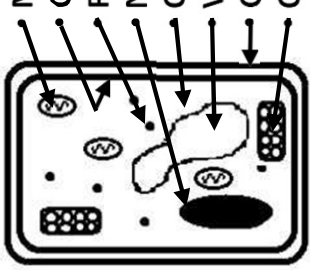
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<https://www.bbc.co.uk/bitesize/topics/zjd3239>

<https://www.bbc.co.uk/bitesize/topics/zyybb82>



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 $\text{magnification} = \frac{\text{size of image}}{\text{size of object}}$
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 ₂ O 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

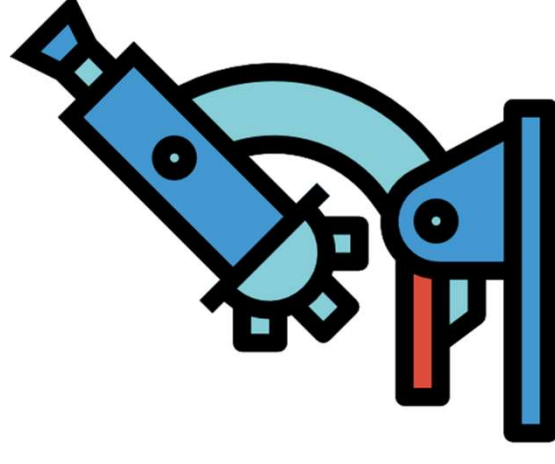
Key points to learn

10. Mitochondria	Perform respiration to release energy
11 Cell membrane	Controls movement in/out of cell
12 Ribosomes	Makes proteins by protein synthesis
13 Nucleus	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

Trilogy: B1 Cell structure and transport

Collins Revision Guide: Cell Biology

Knowledge Organiser



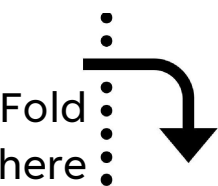
Background

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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Key points to learn

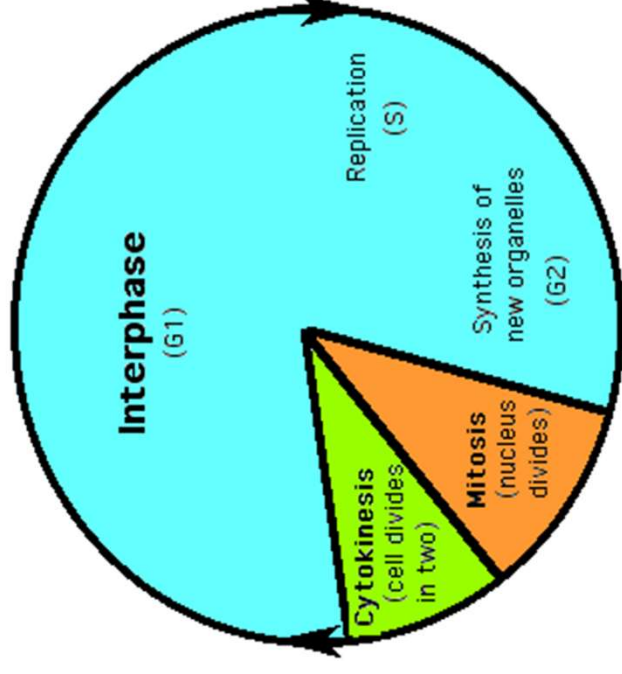
1. Cell cycle	Process by which body cells divide. Three stages: - Copy: Two copies of chromosomes and internal cell structures - Mitosis: Copies of chromosomes move and form two nuclei - Split: cytoplasm and cell membranes split to make two identical cells
2. Mitotic cell division	Makes two identical 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	- From embryos can become most types of human cell - 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 Plant stem cells. Can become any type of plant cell at any time Used to clone: - rare plants from extinction - crops with desirable features
11. Meristem cells	
12. Specialised animal cells	- Sperm – tail to swim - Nerve – carry electrical impulses - Muscle – contract and relax
13. Specialised plant cells	- Root hair - absorb water and ions from soil - Xylem – carry water and minerals from roots - Phloem – carry glucose to cells
14. Ethical objections	Related to what a person thinks is morally good or ok

Trilogy B2: Cell Division

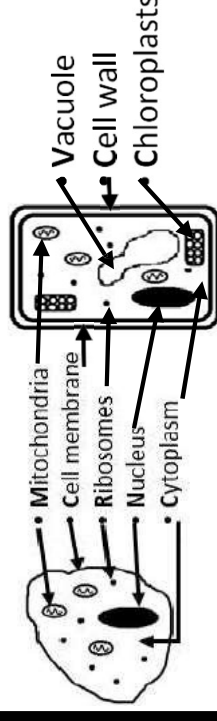
Collins Revision Guide: Cell Biology Knowledge Organiser



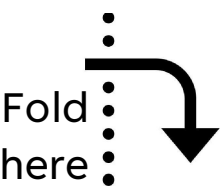
Background

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

Additional information

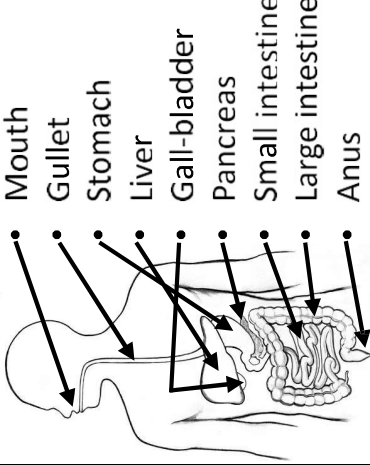


20 questions retrieval practice

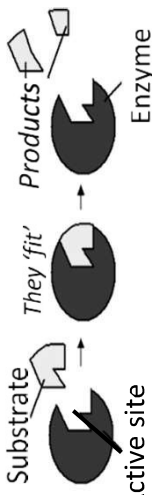


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Key points to learn

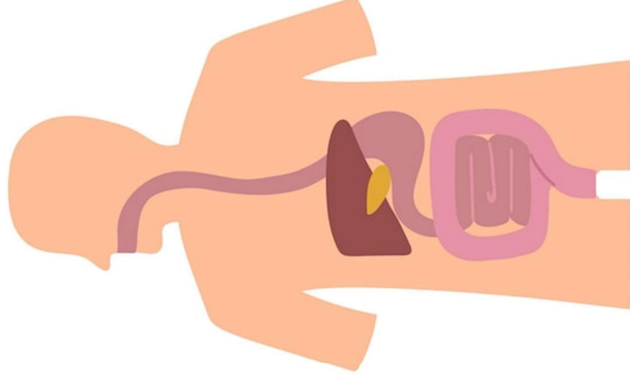
1. Specialised animal cells	1. Sperm – tail to swim 2. Nerve – carry electrical impulses 3. Muscle – contract and relax
2. Tissue	Group of similar cells
3. Organ	Group of tissues working together
4. Organ systems	Group of organs which work together in organism
5. Digestive system	A group of organs that digest and absorb food
6. Digestion	Breaking large food molecules into small soluble ones
7. Human digestive system	
8. Carbohydrate	Types of sugars: glucose, starch, cellulose. Used for energy Test: Starch turns iodine blue/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 
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, small intestine

Trilogy B3: Organisation and the digestive system

Collins Revision Guide: Organisation Knowledge Organiser



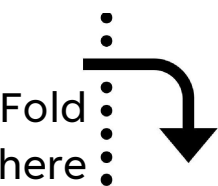
Background

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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Key points to learn

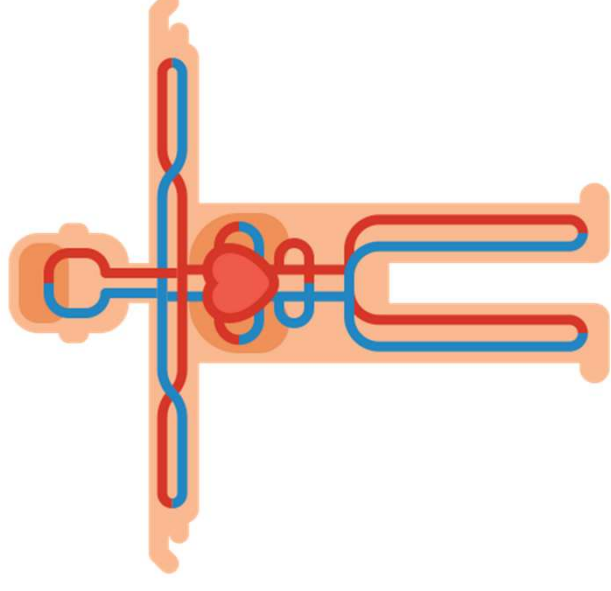
1. Blood	A tissue of plasma, red blood cells, white blood cells and platelets
2. Plasma	Yellow liquid that transports: • Red and White Blood cells • Waste carbon dioxide to lungs • Urea from liver to kidneys • Digested nutrients to cells
3. Red blood cells	Biconcave discs with no nucleus. Packed with 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 + Water dioxide

Key points to learn

11. The Heart	Organ made of muscle that pumps blood in two loops around body Right (thin wall) Pulmonary artery (to lungs) Vena cava (from body) Left (thick wall) Aorta (to body) Pulmonary vein (from lungs) Ventricles
12. The Lungs	Organs for gas exchange. Take in O ₂ release CO ₂ Trachea Bronchi Lung Alveoli
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	• Epidermal tissue • Xylem • Phloem • Guard cells • Palisade mesophyll • Spongy mesophyll • Stomata
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

Trilogy B4: Organising animals and plants

Collins Revision Guide: Organisation Knowledge Organiser



Background

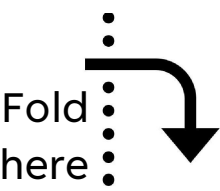
All living cells need glucose and oxygen for respiration. Getting these ingredients to the organism is only part of the struggle. How do you get them to the cells, keep them and get rid of waste products? This topic finds out



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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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 and animals. Provides lots of energy
	Glucose + Oxygen → Carbon + Water dioxide
	$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$
3. Response to exercise	Exothermic reaction - gives off heat
	Occurs within mitochondria in cells
	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
8. Lactic acid	Much less energy provided than aerobic respiration
	Leads to an oxygen debt which requires more oxygen after exercise is complete to break down the lactic acid
9. Metabolism	Causes muscles to tire and cramp
	The sum of all the reactions in a cell or the body of an organism
10. Metabolic reactions	Energy provided by respiration is used in these metabolic reactions to make new molecules
	Includes these 5 reactions:
11. Metabolic rate	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
	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

Trilogy B9: Respiration

Collins Revision Guide: Bioenergetics
Knowledge Organiser



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!

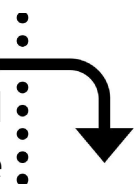
Additional information

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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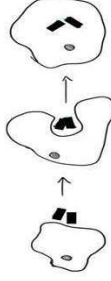


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Key points to learn

1. Bacteria	Large microbe  Divide by splitting in two May produce toxins to make us ill Cause: - Salmonella – food poisoning - Gonorrhoea – sexually transmitted disease (STD) 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 The other type of microbe. Living
2. Viruses	Cause: - Measles – can be fatal - HIV – can turn into AIDS - Tobacco mosaic virus (TMV) affects photosynthesis in plants The other type of microbe. Living
3. Fungi	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
9. Ignaz Semmelweis	Eg heart disease, arthritis
10. Louis Pasteur	Doctor in mid-1850s who persuaded doctors to wash their hands
11. Vaccines	Showed that microbes caused disease. Developed vaccines
12. Human defences against pathogens	An inactive form of a pathogen used to prepare your immune system
13. Trachea	- Skin barrier - covers your body - Nose - hair and mucus act as trap - Trachea and bronchi – covered in cilia and mucus - Stomach - makes acid to destroy - Immune system – white blood cells defend us in three ways
14. Bronchi	Pipe from mouth to bronchi
15. Cilia	Pipe into each lung
16. White blood cells	Tiny hair-like cells  <u>Phagocytosis</u> ingest microbes <u>Produce antibodies</u> chemicals to destroy microbes <u>Produce antitoxins</u> chemicals to cancel-out toxins made by pathogens  

Trilogy B5: Communicable diseases

Collins Revision Guide: Infection and response

Knowledge Organiser



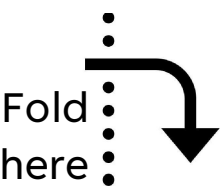
Background

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



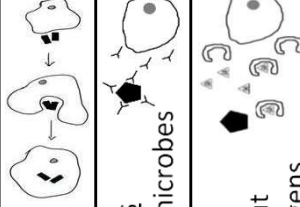
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Key points to learn

1. Bacteria	Large microbe. Living
	Divide by splitting in two
	May produce toxins to make us ill
2. Viruses	Cause: - Salmonella - Gonorrhoea
	Smallest microbe. Not alive
	Live and reproduce inside cells
3. Pathogens	Cause: - Measles - HIV - Tobacco mosaic virus (TMV)
	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 <i>digitalis</i> from foxglove - Painkiller aspirin from willow tree - Penicillin from mould
	A tablet with no active medicine content
9. Placebo	

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: - Very low doses at start of trial - If safe, more trials done - In double blind trial some patients given placebo
13. 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



Trilogy: B6 Preventing and treating diseases

Collins Revision Guide: Infection and response

Knowledge Organiser



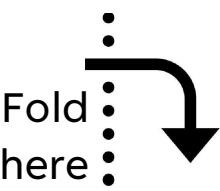
Background

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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Key points to learn

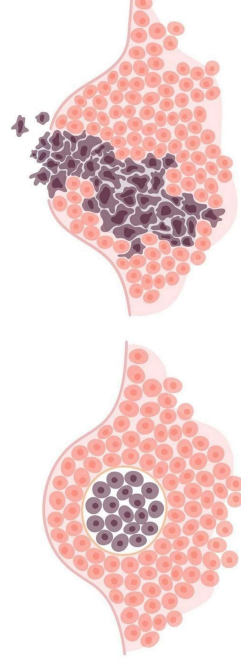
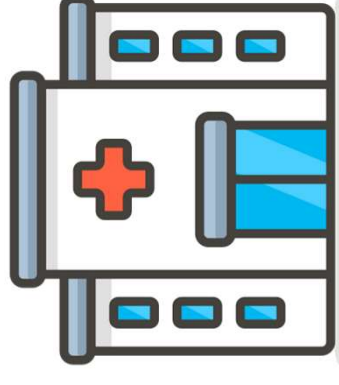
1. Non-communicable diseases	Cannot be transmitted from one person to another
2. Causes of ill health	Eg heart disease, arthritis
3. Communicable diseases	Pathogens, diet, stress, life situations/conditions
	Infectious diseases that can be passed from one person to another
4. Coronary heart disease	Caused by pathogens (microbes)
	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	Invasive 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
15. Risks of diet, exercise and obesity	Increases risk of lung disease and lung cancer
	Increases risk of coronary heart disease and high blood pressure
16. Alcohol and risk of disease	Obesity can lead to Type 2 diabetes
	Damages the liver and carcinogens increase risk of liver cancer
	Affects brain function
17. Exposure to ionising radiation	Passes to and harms unborn babies
	EM Waves (UV rays, X-rays Gamma rays) and radioactive material
	Can increase risk of cancers

Trilogy B7: Non-communicable diseases

Collins Revision Guide: Organisation Knowledge Organiser

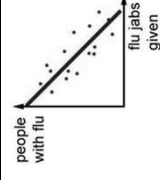


Background

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?

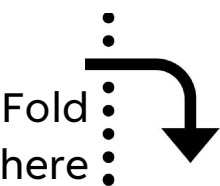
Maths skills

Use scatter diagrams to identify correlation between factors.



Using samples to estimate population trends

20 questions retrieval practice



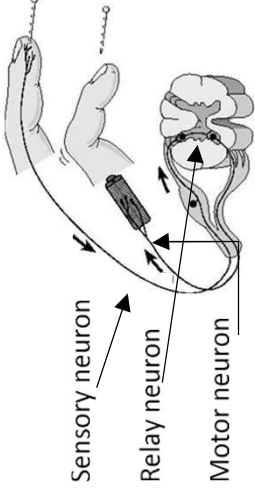
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Key points to learn

Key points to learn

Trilogy B10: The human nervous system

1. Catalyst	Increase rate of reaction without being used up themselves
2. Enzyme	Biological catalysts. Work at a specific temperature and Ph
3. Homeostasis	Automatic control of conditions inside a cell or organism so that enzymes and cells work effectively
	In the human body it controls: 1. Blood glucose concentration 2. Body temperature 3. Water levels
	Uses receptors, coordination centres and effectors
4. Receptors	Cells that detect changes (stimuli)
5. Coordination centres	Use information from receptors
	Brain, spinal cord and pancreas
6. Effectors	Bring about response to changes
	Muscles or glands
7. Pancreas	Monitors and controls blood glucose levels
8. Glands	Make hormones which act as chemical messages in the body
9. Stimuli	A change noticed by a sensory receptor. Can be changes in: 1. Temperature 2. Taste 3. Touch 4. Sound 5. Light 6. Smell
	Specialised cell that carries electrical impulse in nervous system

11. CNS	Central Nervous System. Brain and spinal cord
12. Reflex actions	Automatic, rapid actions that do not use conscious part of brain
	Safety mechanism for our body Eg. Blinking, jumping at loud sounds
13. Reflex arc	The sequence in a reflex action eg tasting something sour 1. Stimulus – sour taste 2. Receptor – taste bud cell 3. <u>Sensory neuron</u> – carries impulse to coordinator 4. <u>Relay neuron</u> in Coordinator – spinal cord 5. <u>Motor neuron</u> – carries impulse to effector 6. Effector – muscle in face 7. Response – muscle contracts
	 Sensory neuron Relay neuron Motor neuron
14. Synapse	Gap between two neurons. Chemicals diffuse across gap instead of electrical impulse
15. Muscle	Tissue that can contract or relax to cause movement

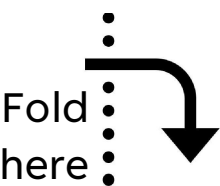
Background

Cells in the body need very specific conditions to survive and operate. How does our nervous system ensure that these conditions are monitored and controlled?

Additional information

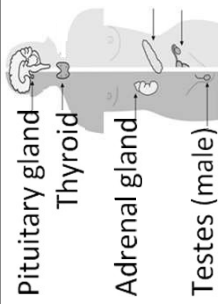
Remember that our bodies operate at 37°C. It's so that our enzymes work best and do not denature.

20 questions retrieval practice



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Key points to learn

1. Endocrine system	Contains glands that secrete hormones into the bloodstream 
2. Hormones	Chemical messages in the body.
3. Pituitary gland	'Master gland' that secretes hormones that act on other glands
4. Pancreas	Monitors and controls blood glucose levels
	Releases insulin hormone if blood glucose concentration too high
	Releases glucagon if blood glucose concentration too low
5. Insulin (hormone)	Causes cells to take glucose from blood. Liver and muscle cells store as glycogen
6. Glucagon (hormone)	Converts glycogen into glucose. Interacts with insulin in negative feedback cycle to control glucose
7. Adrenaline (hormone)	From adrenal gland. Increases heart rate in fight or flight response
8. Contraception (to stop pregnancy)	- Oral (pill) - FSH stops eggs maturing - Injection/implant – progesterone to stop maturation and release of eggs - Spermicides – chemicals kill sperm - Barrier – stop sperm reaching egg - Abstinence – No sexual intercourse - Surgical – remove/cut reproductive organs

Key points to learn

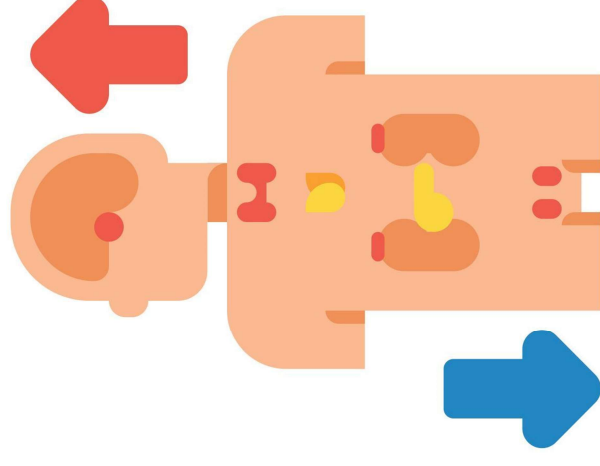
9. Type 1 diabetes	Pancreas does not produce enough insulin when glucose concentration too high. Needs insulin injections
10. Type 2 diabetes	Body no longer responds to insulin. Controlled by diet and exercise Obesity a risk factor for this diabetes
11. Thyroxine (hormone)	From the thyroid gland. Controls the body's metabolic rate. Important in growth and development Controlled by negative feedback
12 Oestrogen (hormone)	Main female reproductive hormone. From ovaries
13. Ovulation	Once a girl has gone through puberty she releases an egg every 28 days during the menstrual cycle
14. Hormones during menstrual cycle	FSH (Follicle Stimulating Hormone) causes an egg to mature in ovary. Stimulates ovary to make oestrogen
	LH (Luteinising Hormone) triggers release of egg (ovulation)
	Oestrogen: causes uterus lining to grow; stops release of FSH; starts release of LH
Testosterone 15 (hormone)	Progesterone: maintains uterus lining; stops production of both FSH and LH Main male reproductive hormone. From testes. Starts sperm production
16. Infertility treatment (to help pregnancy)	- FSH and LH can be taken to stimulate egg development and release. - IVF (In Vitro Fertilisation) uses eggs that are removed, fertilized and re-implanted into uterus

Trilogy B11: Hormonal

coordination

Collins Rev. Guide: Homeostasis and response

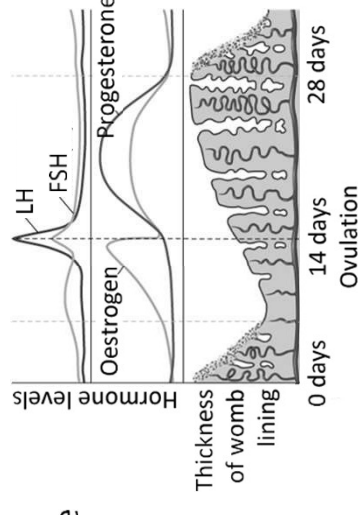
Knowledge Organiser



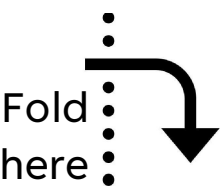
Background

The journey from a child into an adult is (adolescence) is a difficult time for all living things. It's all because of our hormones.

Here are the hormones that change and control the female menstrual cycle.



20 questions retrieval practice



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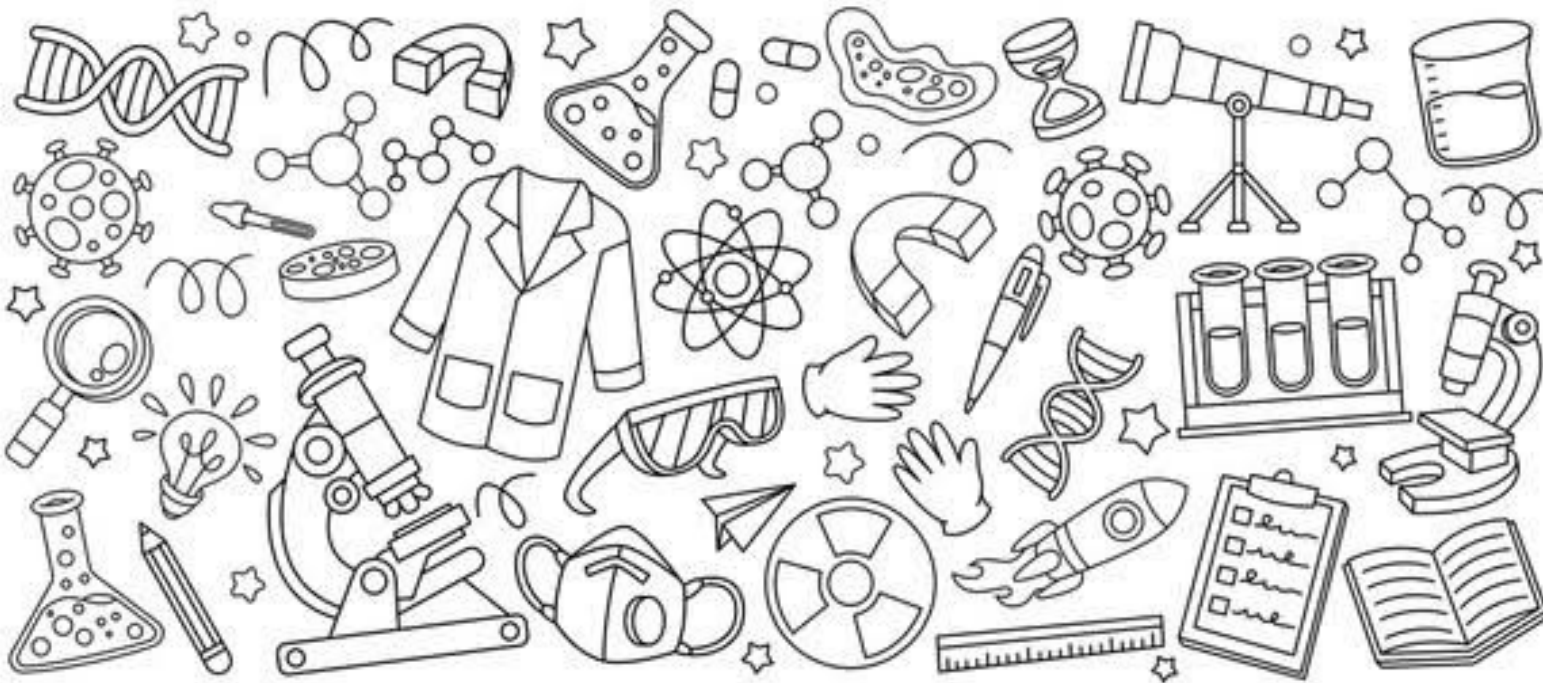
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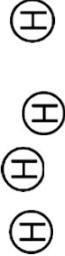
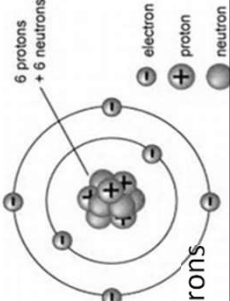
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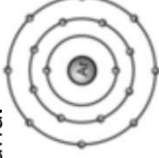
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Key points to learn

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 ₂ O) 
3. Element	Only one type or atom present. Can be single atoms or molecules
	Both examples of the (N ₂)  Nitrogen element (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

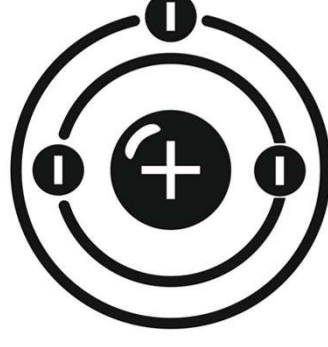
Key points to learn

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 of atomic number. Columns called Groups . Rows called Periods
14. Conservation of mass	In a chemical reaction the total mass of reactants = total mass of products
15. Mass number	Number of neutrons + protons $\Rightarrow$ $^{11}_{5}\text{B}$ $6 \text{ Neutrons} + 5 \text{ Protons}$
16. Atomic number	Number of protons $\Rightarrow$ $^{11}_{5}\text{B}$ 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 

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.

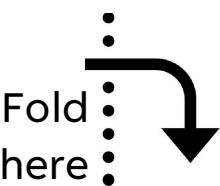
The Periodic Table organises them into a way that helps us make sense of the physical world.

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.

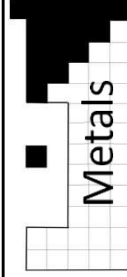
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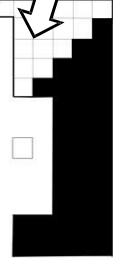
Key points to learn

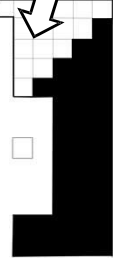
1. Chemical symbol	An abbreviated name for every element. Maximum of two letters always starts with a capital letter
2 Reactivity	How easily an element will react
3. Group	Columns in the Periodic Table. Elements in the same group have similar properties
	Tells you how many electrons that atom has in its outer shell
4. Period	Rows in the periodic table
	Tells you how many electron shells that atom has
5. Mass number	Number of $4 \text{ Neutrons} + 3 \text{ Protons}$
6. Atomic number	Number of protons $\Rightarrow 7 \text{ Li}$ $\Rightarrow 3 \text{ Protons}$
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



Metals

Key points to learn

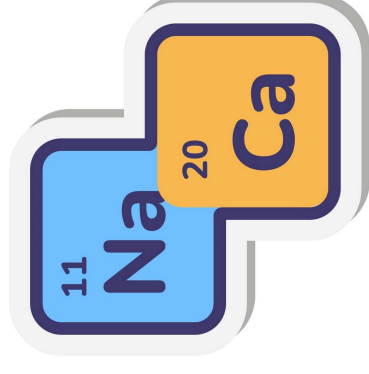
10. Non-metals	Have electrons that cannot move
	Nearly always gain electrons and become (negative $-ve$) ions
11. Group 0	 Non-metals
	He, Ne, Ar, Kr, Xe, Rn
12. Group 1	Unreactive: full outer shell
	Boiling point increases as you go down the group
13. Group 7	Li, Na, K, Rb, Cs, Fr
	Very reactive: only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



Trilogy C2: The Periodic Table

Collins revision guide: Atomic structure and the periodic table

Knowledge Organiser



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 $+ve$.

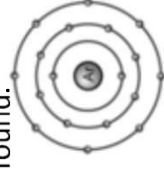
Gaining $-ve$ charge makes you more $-ve$.

Additional information

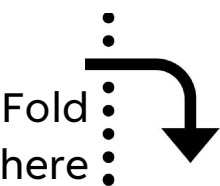
Where electrons are found.

The shells can each hold this many electrons maximum: 2,8,8

Remember Electron energy levels

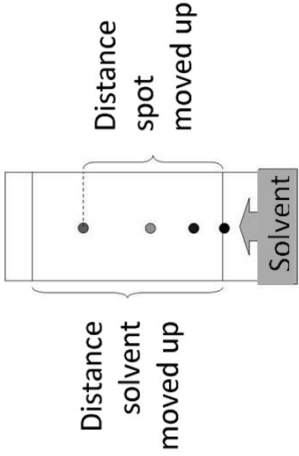


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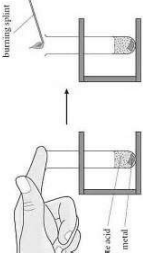
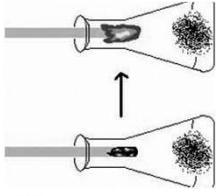
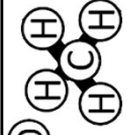


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Key points to learn

1. Melting point	The temperature at which substances melt or freeze
2. Boiling point	The temperature at which substances boil or condense
3. Pure	Made of one substance. Can be an element or compound
4. Impure	Made of a mixture of substances
5. Fixed points	Melting and boiling points of a pure substance Eg. Water 0°C and 100°C
6. Formulation	A mixture designed to produce a useful product
	Examples: paints, washing liquids, fuels, alloys, fertilisers, cosmetics
7. Paper Chromatography	A separation techniques where a solvent moves up a material and carries different substances up different heights with it
	
	Each substance has a unique Retention factor (R_f) at the same temperature in the same solvent $R_f = \frac{\text{distance moved by substance}}{\text{distance moved by solvent}}$

Key points to learn

8. Test for hydrogen	Hydrogen makes a squeaky 'pop' when lit with a splint 
9. Test for oxygen	Oxygen will relight a glowing splint. 
10. Test for carbon dioxide	If you bubble carbon dioxide through limewater it will turn milky (cloudy white)  Clear → milky
11. Test for chlorine gas	Chlorine gas will turn blue litmus paper white Need to be very careful as chlorine gas is toxic(poisonous)
12. Element	Only one type or atom present. Can be single atoms or molecules Both examples of the (N ₂)  Nitrogen element (N) 
13. Compound	Molecule containing more than one type of atom Carbon  dioxide (CO ₂) Methane  (CH ₄)
14. Mixture	Two or more chemicals not chemically combined

Trilogy C10: Chemical analysis

Collins rev guide: Chemical analysis

Knowledge Organiser



Background

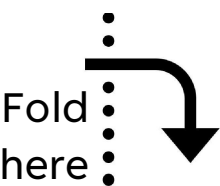
Some things are useful, some are harmful. It's important that we can test to see what is in a substance or what is made in a reaction. Here are some of the methods we use in Science. You will have come across most of them earlier in school.

Maths skills

Rearrange and use the R_f chromatography equation

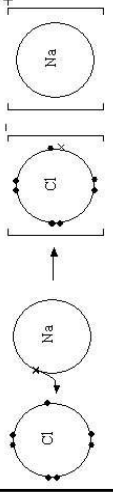
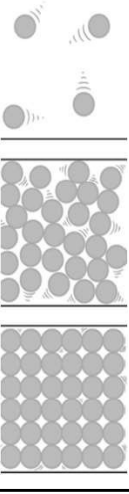
$$R_f = \frac{\text{distance moved by substance}}{\text{distance moved by solvent}}$$

20 questions retrieval practice

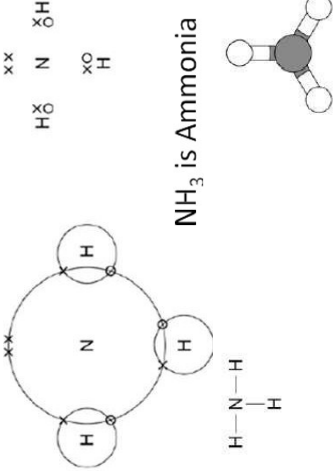


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Key points to learn

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  $\text{Cl} + \text{Na} \rightarrow \text{NaCl}$ Drawing salt (NaCl) Key: Na^+ Cl^-
3. Giant ionic structures	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 Metals conduct electricity because they have free electrons Non-metal that conducts electricity
5. Conductors	
6. Graphite	
7. Alloys	A mixture of different metals. Which are then harder
8. States of matter	 Solid Liquid Gas

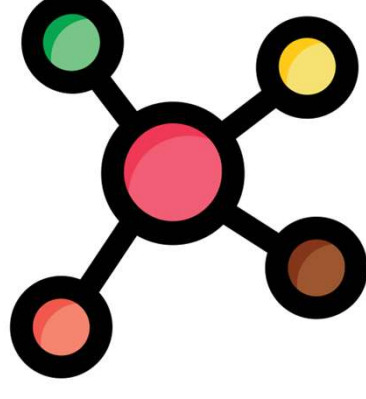
Key points to learn

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

Trilogy C3: Structure and bonding

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

Knowledge Organiser



Background

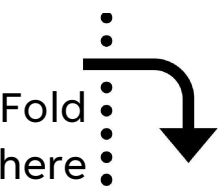
Chemical reactions are a crucial part of all our lives. Without them the Universe as we know it could not exist.

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

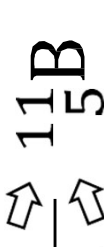
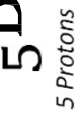
You need to be clear which elements are metals and non-metals (see C2: Periodic table) also a good knowledge of the electron energy levels will help (see C1: Atomic structure).

20 questions retrieval practice



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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 ₂ O) 
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. Atomic number	Number of 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 ₂ O 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

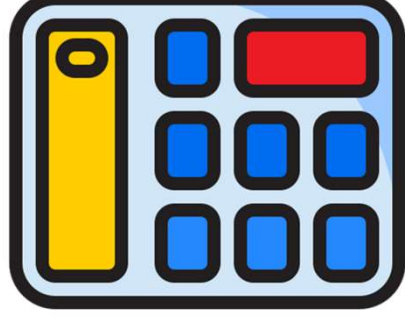
11. Isotope	Same number of protons different number of neutrons
12. Numbers in reaction equations	Big numbers in front of a chemical tell us how many molecules/atoms of that chemical there are
13. Balancing equations	The number of atoms in the reactants must equal the number of atoms in the products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

Trilogy C4: Chemical

calculations

Collins rev. guide: Quantitative chemistry

Knowledge Organiser



Background

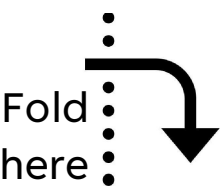
Want to make enough pancakes for everyone? Then you need to know quantities. Chemical reactions are the same (cooking is a chemical reaction!). This topic explores in more detail.

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

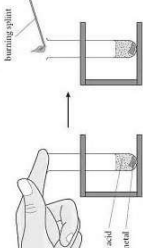


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Key points to learn

1 Chemical reaction	Reactants → Products 'turn into'
2 Oxidation	Losing electrons (or gaining oxygen)
3 Reduction	Gaining electrons (or losing oxygen)
4. OIL RiG	<u>O</u> xidation is <u>L</u> oss of electrons <u>R</u> eduction is <u>G</u> ain 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 dioxide Eg Lead carbonate + Nitric acid → Lead + Water + Carbon dioxide nitrate
10. Metal salts	- Hydrochloric acid makes ...chloride - Sulfuric acid makessulfate - Nitric acid makes ...nitrate
11. State symbols	(s) solid; (l) liquid; (g) gas; (aq) aqueous solution

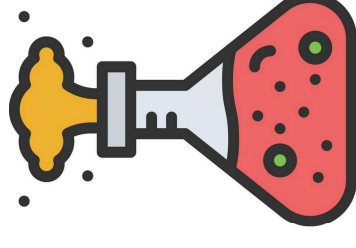
Key points to learn

12. Displacement reaction	A more reactive metal will displace a less reactive metal from a chemical compound Eg $\text{CuCl}_2 + \text{Zn} \rightarrow \text{ZnCl}_2 + \text{Cu}$ 
13. Ion	Atom where number of protons is not equal to electrons (+ 've or - 've)
Neutralisation reaction	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 burning 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 $\text{Cu}^{2+}_{(\text{aq})} + 2\text{OH}^{-}_{(\text{aq})} \rightarrow \text{Cu}(\text{OH})_2 (\text{s})$

Trilogy C5: Chemical Changes

Collins rev guide: Chemical Changes

Knowledge Organiser



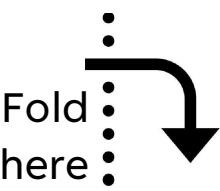
Background

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

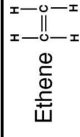
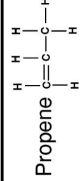


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Key points to learn

1. Mixture	Not pure. Different compounds / elements not chemically bonded
2. Hydrocarbon	Compound containing only hydrogen and carbon eg CH ₄
3. Crude oil	Fossil fuel mixture of hydrocarbons
4. Distillation	Separating liquid from a mixture by evaporation and condensation
5. Compound	Two or more different elements chemically bonded
6. Molecule	Two or more atoms chemically bonded
7. Fractions	Hydrocarbons with similar boiling points separated from crude oil
8. Alkanes	Hydrocarbon with only single covalent bonds eg C-C
	Known as saturated hydrocarbons
	Methane (CH ₄) 
	Ethane (C ₂ H ₆) 
	Propane (C ₃ H ₈) 
9. Boiling point	Butane (C ₄ H ₁₀) 
	Temperature liquid turns to gas. (Long hydrocarbons have higher)
10. Volatility	How easily it evaporates (Long hydrocarbons have lower)
11. Flammability	How easily it lights and burns (Long hydrocarbons have lower)

Key points to learn

12. Viscosity	The resistance of a liquid to flowing or pouring. (Long hydrocarbons have higher)
13. Fractional distillation	Separating liquids from a mixture by boiling then condensing at different temperatures
14. Burning hydrocarbons	Hydrocarbon + Oxygen → Water + Carbon Dioxide eg CH ₄ + 2O ₂ → 2H ₂ O + CO ₂
15. Oxidised	Oxygen added or electrons lost
16. Test for CO ₂	Turns limewater cloudy
17. Incomplete combustion	When a fuel burns with insufficient oxygen. Produces toxic Carbon Monoxide (CO)
18. Cracking	Breaking large alkanes into smaller, more useful ones
19. Thermal decomposition	Breaking down a compound by heating it
20. Catalyst	Chemical which speeds up a reaction without being used itself
21. Alkenes	Hydrocarbon with a double covalent bond eg C=C
	Known as unsaturated hydrocarbons
	Has twice as many H as C atoms eg  Ethene  Propene
22. Testing for alkenes	Unsaturated hydrocarbons turn bromine water colourless

Trilogy C9: Crude Oil and Fuels

Collins rev guide: Organic Chemistry

Knowledge Organiser



Background

Fossil fuels are non-renewable which means they are running out. But why is oil so useful? This topic explores that very question.

Additional

Remember that non-metals bond by covalent bonding (sharing electrons) and that Carbon is in group 4 so needs 4 electrons to fill its outer shell.

Maths skills

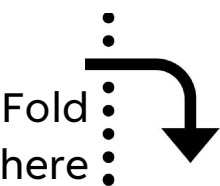
Balancing equations:

Number of atoms on reactant side = Number of atoms on product side

Alkane general formula: C_nH_{2n+2}

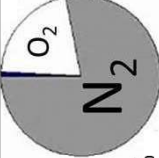
Alkene general formula: C_nH_{2n}

20 questions retrieval practice



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Key points to learn

1 Atmosphere	Layer of gas around Earth
2. Earth's early atmosphere theory	Volcanos released carbon dioxide (CO ₂), water vapour (H ₂ O) and nitrogen (N ₂)
3. Photosynthesis	Similar to Mars and Venus
	We think it was responsible for changing early atmosphere
	Removes carbon dioxide and makes oxygen
4. Fossil fuels	Carbon + Water → Oxygen + Glucose Dioxide
	Coal, crude oil and natural gas. Formed from fossilised remains of plants and animals
5. Carbon 'locked into' rock	Carbon stored in shells and skeletons turned into limestone
	Carbon in living things was also locked away as fossil fuels
6. Ammonia and methane	Removed from atmosphere by reactions with oxygen
7. Earth's atmosphere today	 Nitrogen: 78% Oxygen: 21% Argon: 0.9% Carbon dioxide: 0.04% Trace amounts of other gases
8. Ozone layer	Nothing to do with Global warming or the Greenhouse Effect. A layer of O ₃ protecting us from UV rays
9. Incomplete combustion	If not enough oxygen is available then poisonous carbon monoxide and soot are produced

Key points to learn

10. Greenhouse effect	Greenhouse gases stop heat escaping from the Earth into space. This results in Earth getting hotter
11. Greenhouse gases	1. Carbon dioxide: released from burning fossil fuels 2. Methane: released from swamps, rice fields 3. Water vapour (eg steam and clouds)
12. Risks of global climate change	1. Rising sea levels as a result of melting ice caps 2. Extreme weather eg storms 3. Changes to temperature and rainfall patterns 4. Ecosystems under threat
13 Issues with reducing greenhouse gas emission	1. It will cost money 2. There is still disagreement that it is a problem 3. It is difficult to implement
14. Carbon footprint	The CO ₂ released as a result of a persons activities over a year
15. Ideas for reducing our carbon footprint	1. Burn less fossil fuels 2. Carbon capture 3. Reduce demand for beef 4. Planting more trees
16. Carbon capture	Pumping and storing CO ₂ underground in rocks
17. Nitrogen oxide	Released by burning fossil fuels. Causes acid rain and breathing issues
18 . Sulfur dioxide	Released by burning fossil fuels. Causes acid rain

Trilogy C11: The Earth's atmosphere

Collins revision guide: Chemistry of the atmosphere

Knowledge Organiser



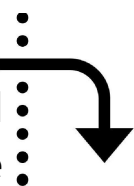
Background

The bubble of gas around our planet that we call Earth's atmosphere does far more than provide the oxygen we need for respiration. In Europe, winters are almost two weeks shorter than they were 40 years ago. Extreme weather seems more common than ever. Cases of asthma and respiratory difficulties increase year-on-year and we are always looking at ways of making our air cleaner .

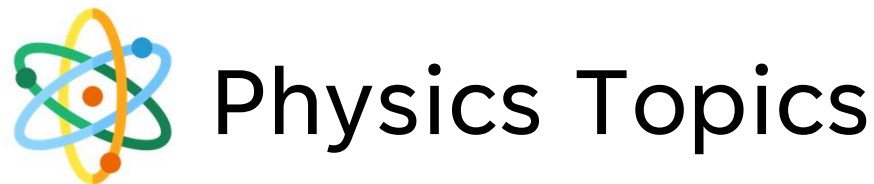


20 questions retrieval practice

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Physics Topics

1. Defining Force

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<https://www.bbc.co.uk/bitesize/guides/zcxcfcw/revision>

<https://www.bbc.co.uk/bitesize/guides/z232k2p/revision>

<https://www.bbc.co.uk/bitesize/guides/z9hk3k7/revision>

2. Energy and the particle model

<https://www.bbc.co.uk/bitesize/topics/z3ybb82>

<https://www.bbc.co.uk/bitesize/topics/z6yxcxs>

3. Electricity

<https://www.bbc.co.uk/bitesize/guides/zgvg4qt/revision>

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4. Forces & motion

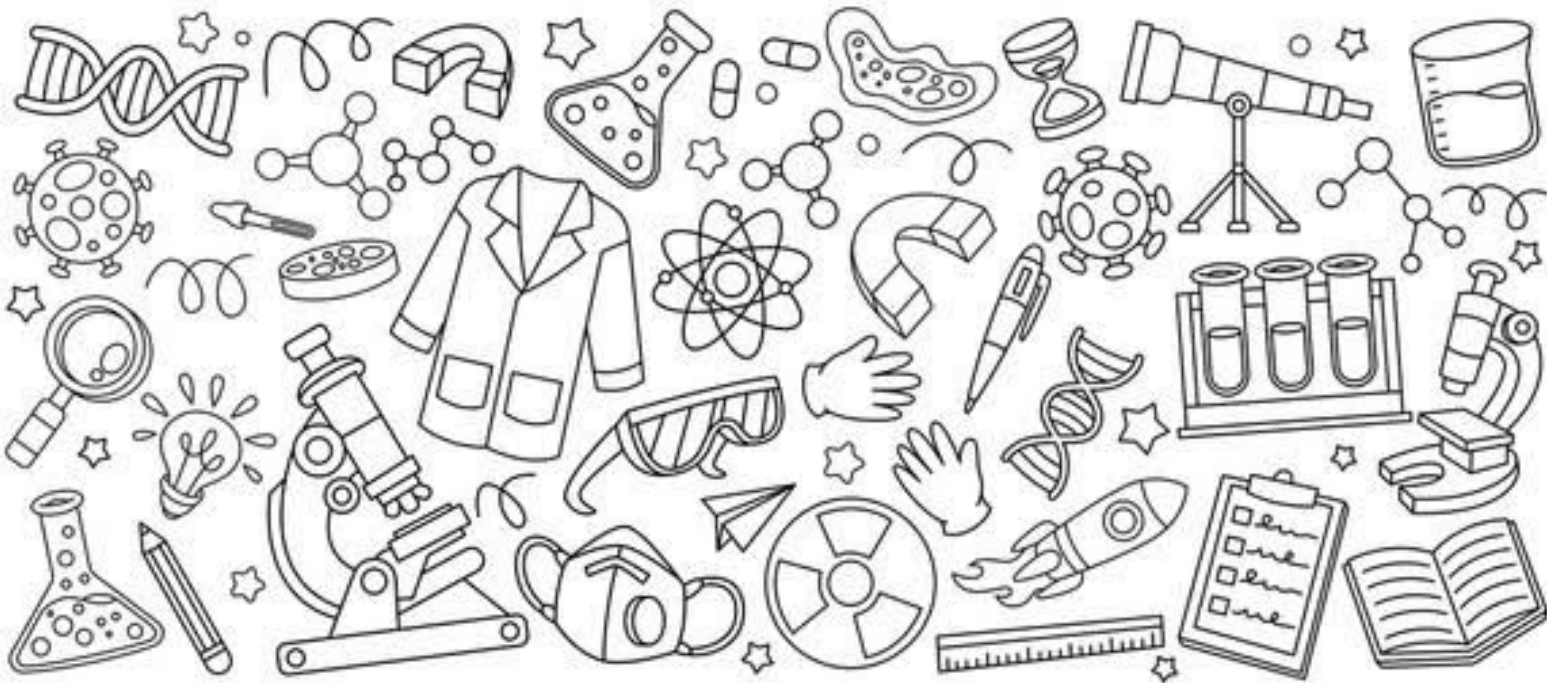
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5. Waves

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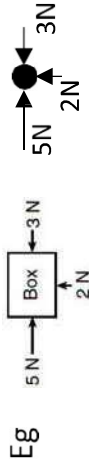
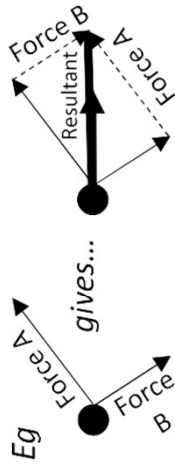
<https://www.bbc.co.uk/bitesize/topics/zsrndnb>



Key points to learn

1. Scalar	Magnitude only eg speed
2. Vector	Magnitude and direction eg velocity, force
3. Displacement	Can be drawn as an arrow →
4 Magnitude	Distance away from start point in a straight line
5 Force, F [N]	Size of a quantity
6. Contact force	Push or a pull acting on an object
7. Non-contact force	Forces that act though touch eg friction, air resistance, tension
8. Newton's Third Law	Forces that act without need for touch eg magnetic force, gravity, electrostatic force
9. Driving force	When two objects interact they exert an equal and opposite force on each other
10. Friction	A force that makes a vehicle move
11. Resultant force	A force that tries to stop an object moving. Generates heat
12. Newton's First Law	The force you have if you replaced all the forces on an object with one single force
	If it is zero, forces are balanced
	If the forces on an object are balanced the object will either:
	1. Remain still
	2. Keep moving same velocity

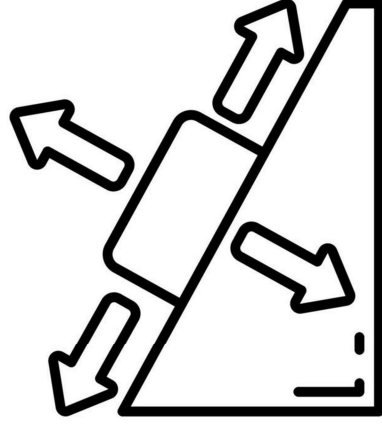
Key points to learn

13. Free body force diagram	Shows the forces as arrows acting on an object. Object represented as a dot on centre of mass Eg 
14. Centre of mass	Point at which mass of an object appears to be concentrated All objects will hang with their centre of mass below the pivot The centre of mass of a regular shape is at the centre
15. The parallelogram of forces	Used to find the resultant of two forces that are not parallel. Eg 
16. Resolving forces	Drawing two forces at right angles to represent a single resultant force Eg 
17. Weight, W [N]	Force acting on a mass due to gravity (Weight = mass x gravity)
18 Mass, m [kg]	The amount of matter in an object
19. Normal contact force	Push between solids. Acts at right angle to the surface at the point of contact

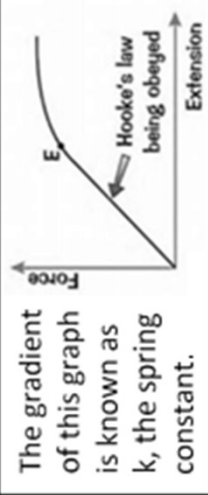
Trilogy P7: Forces in balance

Collins rev guide: Forces

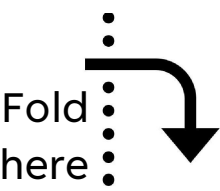
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Key points to learn

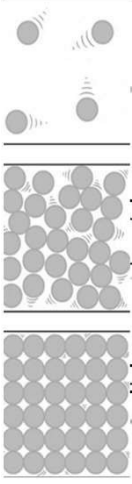
20. Elastic	Will return to original shape
21. Inelastic	Will not return to original shape
22. Hooke's Law	A springs extension/compression is proportional to the force on it
	The gradient of this graph is known as k, the spring constant.
	
	Force = spring constant x extension $F = k \times e$ [N] [N/m] [m]

20 questions retrieval practice



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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

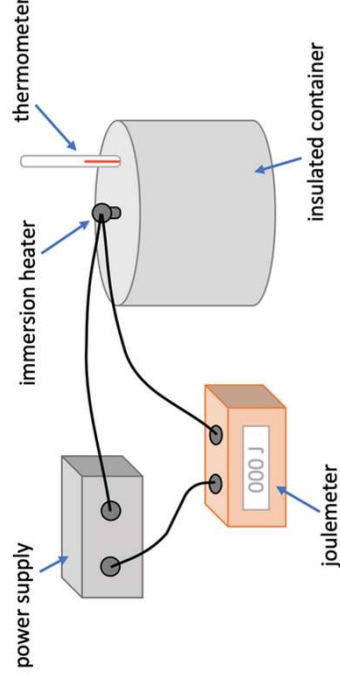
Key points to learn

13. More energy loss from a building	If walls are thin If walls have high thermal conductivity Big temperature difference between inside and outside Using material with low thermal conductivity ie an insulator Make insulator thicker 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: <i>specific heat capacity</i> 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.
14. Reduce heat loss by	
15. Specific heat capacity, c [J/kg°C]	Fibreglass which traps air which is a good insulator. Traps air pockets in gaps which is a good insulator Traps air in gaps between glass which is a good insulator Reflects heat away from wall back into room
16. Loft insulation	
17. Cavity wall insulation	
18. Double glazing	
19. Foil behind radiator	

Trilogy P2: Energy transfer by heating

Collins revision guide: Energy

Knowledge Organiser



Background

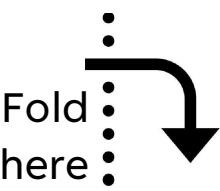
Not wasting heat energy in your home is important for the environment and for your finances. This topic will help you make more informed decisions so that you can save even more.

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:

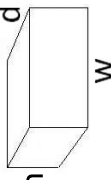
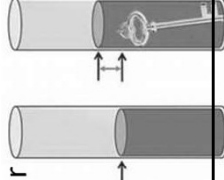
$$c = \frac{E}{m \theta}$$

20 questions retrieval practice

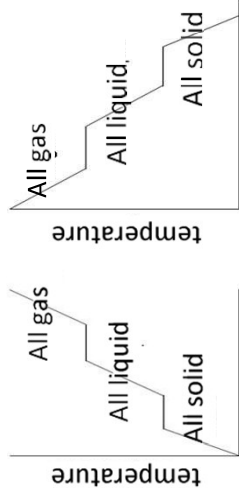


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Key points to learn

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 = $w \times d \times h$ 
	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.

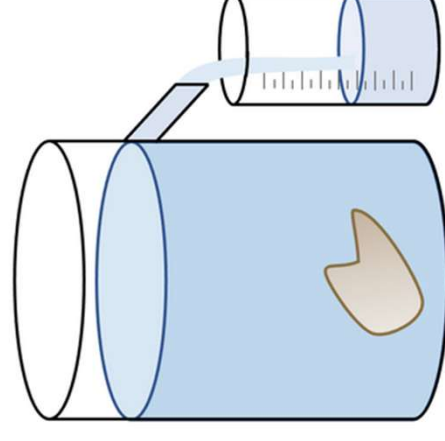
Key points to learn

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.
Condensation 13. 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	
	Caused by particles hitting surfaces. Increases when temperature increases
20. Gas pressure	

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/m³] ρ = $\frac{m}{V}$ $\frac{[kg]}{[m^3]}$

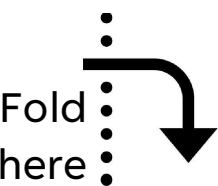
(You need to remember this.)

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

$E = m \times L$ (You are given this)

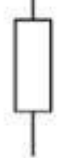
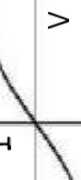
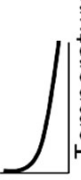
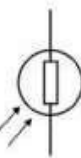
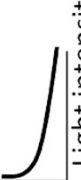
[J] [kg] [J/kg]

20 questions retrieval practice

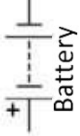
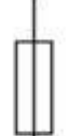


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Key points to learn

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.	

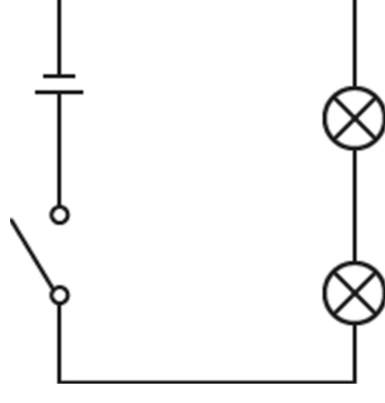
Key points to learn

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.	

Trilogy P4: Electric circuits

Collins revision guide: Electricity

Knowledge Organiser



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]

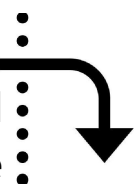
- $V = I \times R$

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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Key points to learn

1. Distance-time (d-t) graph	A graph showing how distance changes with time
2. Speed, v [m/s]	Gradient represents speed
3. Average speed [m/s]	Scalar. Distance travelled in one second Speed = $\frac{\text{distance travelled, } s \text{ [m]}}{\text{time taken, } t \text{ [s]}}$
4. Velocity, v [m/s]	Considers the total distance travelled and the total time taken
5. Displacement	Vector. Speed in a given direction. Uses the same formula as speed
6. Acceleration, a [m/s ²]	Vector. Distance travelled in a certain direction
7 Deceleration a [m/s ²]	Any change in velocity. Can be either speed or direction
10. Scalar	Change in velocity per second. eg 10m/s ² means velocity changes by 10m/s every second
11. Vector	Acceleration = $\frac{\text{change in velocity}}{\text{time taken for change}}$ $a = \frac{\Delta v}{t}$ [m/s] [m/s ²] t [s]
12. Velocity-time (v-t) graph	When acceleration is negative. Object slows down
	Magnitude only eg speed
	Magnitude and direction eg velocity
	A graph showing how velocity changes with time
	Gradient represents acceleration
	Area under a v-t graph line represents distance travelled

Key points to learn

13. Typical speeds	Walking ~1.5m/s Running ~1.5m/s Cycling ~6m/s Sound ~330m/s
14. Slopes of d-t graphs	Stationary  Constant low speed  Accelerating  Constant high speed 
15. Slopes of v-t graphs	Low constant velocity  Low constant acceleration  High constant acceleration  Low constant deceleration  Low constant acceleration. Big distance 
16 Gravitational acceleration	Acceleration due to gravity on Earth is ~9.8m/s ²
17. Equation of motion	You need to be able to use this equation. It is given in the exam $v^2 - u^2 = 2as$ v = final velocity in m/s u = start velocity in m/s a = acceleration in m/s ² s = distance travelled in m

Trilogy P8: Motion

Collins rev guide: Forces

Knowledge Organiser



Background

We all know about acceleration and speed, but how are they really related. The ideas on this page are essential in the use of vehicle design and tectonic movement. They can be used to describe any journey by any object.

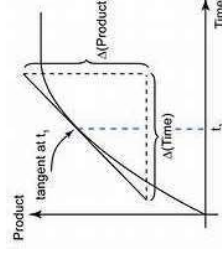
Graph skills:

- Finding the steepness (gradient) of a curved line at a point using a tangent.

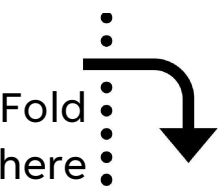
$$\text{Gradient} = \text{rise} \div \text{run}$$

- Find the area under a straight line graph. Using areas of triangles and rectangle

$$\text{Rearrange the speed equation } v = s \div t$$

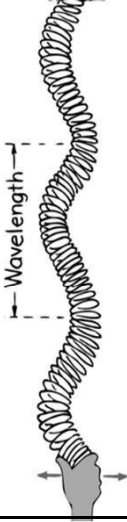
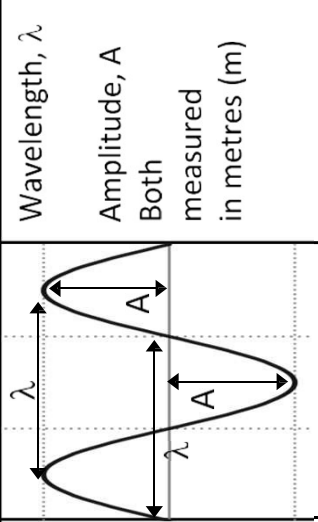


20 questions retrieval practice

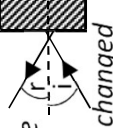


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Key points to learn

1 Oscillations	Vibrations of a wave
	Carry energy using oscillations
	Can reflect - bounce off a boundary
2. Waves	Can refract - change direction at a boundary as they change speed
	Two types: transverse and longitudinal
	Oscillate at right angles to direction that the wave transfers energy
3. Transverse waves	Eg Electromagnetic waves, such as light, radio, ripples on water
	
4. Longitudinal waves	Oscillate in same direction as the wave transfers energy eg sound
	
5. Drawing waves	
6 Mechanical waves	Need particles to move eg sound, water, Mexican
7. Vacuum	No particles. Space is a vacuum

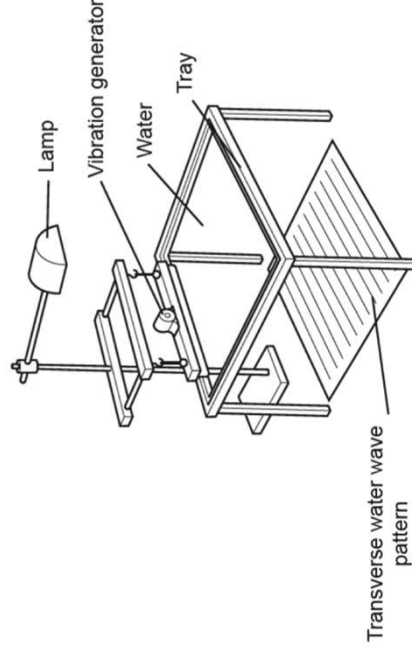
Key points to learn

8. Electromagnetic waves	Family of transverse waves.
	Travel through vacuum at speed of light (300 000 km/s)
	The waves in the EM family are: Radio, Infra Red, Visible light, Ultra Violet, X-ray and Gamma
	Rich Men In Vegas Use X-ray Glasses
9. Amplitude, A [cm]	Height/depth of the wave above/below the rest point
10. Wavelength, λ [m]	Length of one wave. Distance on a wave from one point to the next identical point
11. Frequency, f [Hz]	Number of waves in one second Measure in Hertz <i>given this in the exam)</i>
	Frequency = $1 \div \text{Period}$ [Hz] $f = \frac{1}{T}$ [s]
12. Period, T [s]	Time for one wave to pass
13. Wave equation	Speed of a wave = frequency x wavelength $v = f \times \lambda$ [m/s] [Hz] [m]
15. Sound waves	Longitudinal. Cannot travel through a vacuum. Reflections are called echoes
16. Observing waves	We can use these devices: 1. A ripple tank 2. A slinky spring 3. A signal generator
17. Law of reflection	 Angle of reflection is same as angle of incidence. Speed and wavelength not changed

Trilogy P10: Wave properties

Collins rev guide: Waves

Knowledge Organiser



Background

We are continuously hit with waves in many forms from sound to radio. They are so much more than just ripples on water we can surf on.

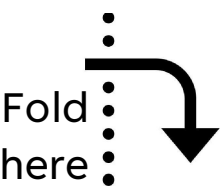
Maths skills

You need to be able to use the equation relating f and T (statement number 11). In it you have to divide 1 by a number.

Units of quantities are shown in square brackets [.]. The wavelength and frequencies of waves varies hugely. You will be expected to use standard form.

Prefix	Meaning	Standard form
Mega (M)	x 1000000	x 10 ⁶
kilo (k)	x 1 000	x 10 ³

20 questions retrieval practice



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Key points to learn

Key points to learn

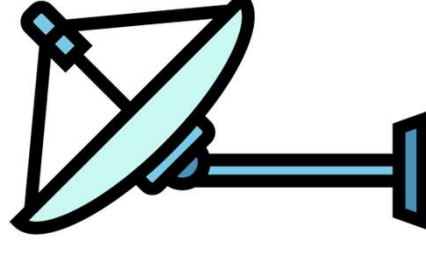
1. Electro-magnetic waves	Family of transverse waves. Travel through vacuum at speed of light. Long (1000 m) Very short ($1/1000000$)m Rich Men In Vegas Use X-ray Glasses Wavelength, λ Amplitude, A Both measured in metres (m)	Radio Microwave Infrared (IR) Visible Ultraviolet (UV) X-ray Gamma ray Low Frequency (Hz) High
2. Drawing waves		
3 Transverse wave	Oscillate at right angles to direction that the wave transfers energy	
4. Wave equation	Speed of a wave = frequency x wavelength $v = f \times \lambda$ [m/s] [Hz] [m] (You need to learn this)	
5. Energy of waves	Increases as frequency increases. Gamma have most, radio least	
6. Refraction	Light changing direction as it changes speed at a boundary 	
7. Ionising	Knocking electrons off atoms	
8 Absorbing waves	Waves carry energy so absorbing any wave generates some heat	

Trilogy P11: Electromagnetic waves

waves

Collins rev guide: Waves

Knowledge Organiser



Background

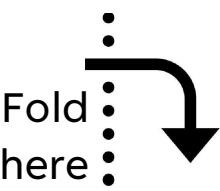
This family of waves is all around us, all the time. They travel at 300million metres a second through space and are some of the building blocks of the Universe. So what are they and how do we use them?

Maths skills

You need to remember and be able to rearrange the Wave Equation. A nice way to check is by finding the frequency of your microwave oven ~2450MHz (usually written on back of oven). Speed of light is 3×10^8 m/s. You should be able to calculate that a microwave in your oven is 0.12m long exactly.

9. Radio waves	No known dangers Can be made and absorbed by electrical circuits Used for television and radio Some can cause burning Used for satellite communications, and cooking food Can cause burning Emitted by hot objects. Matt black surfaces are best absorbers and emitters Smooth shiny surfaces reflect IR waves so are worst absorbers and emitters Used for electric heaters, cooking, infrared cameras
10. Microwaves	Very bright light can cause blindness We see. Used in fibre optics Ionising: can cause skin cancer Used in energy efficient lamps, sun tanning and sterilising
11. Infrared radiation	Ionising: can cause cancer Used in medical imaging and in radiotherapy treatment and sterilising <i>Used in communication. Different amplitudes mean different things</i>
12. Visible light	Number of waves in one second. Measure in Hertz
13. Ultraviolet	
14. X-rays and gamma rays	
15. Carrier waves	
16 Frequency, f [Hz]	

20 questions retrieval practice



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