

Key Terms		Key Terms	
What was the Cold War?		12. Cominform	Organisation encouraging cooperation between communist countries
1. Capitalism	an economic and political system in which a country's trade and industry are controlled by private owners for profit, rather than by the state.	13. Blockade	Preventing access to a location or region
2. Communism	a theory or system of social organization in which all property is owned by the community and each person contributes and receives according to their ability and needs.	14. Bizonia	The merging of the German regions controlled by the US and Britain
3. USSR	A group of countries led by Russia, AKA the Soviet Union	15. Airlift	Bringing needed goods into a region by air
The Conferences		16. NATO	Military alliance of America and its allies
		17. Warsaw Pact	Military alliance of the USSR and its allies
		The Arms Race	
		18. Arms race	Competitive military spending between countries
		19. ICBM	Missiles that can be fired huge distances – across continents
4. Grand Alliance	Wartime alliance between USA, Britain and USSR	20. H-Bomb	Hydrogen bomb – a very powerful and destructive weapon
5. Sphere of Influence	The region over which a country has influence/control	21. B-52	The type of bomber aircraft used by the USA
6. Demilitarisation	The removal of army and other military from a region	22. Sputnik	A Soviet satellite, the first man made satellite in space
Soviet Expansion		Hungarian Uprising	
7. Satellite states	Countries controlled by a larger, more powerful nation	23. Destalinisation	Khrushchev's policy of moving away from Stalin's methods
8. Containment	The US plan to prevent the spread of Communism	24. Secret Police	Organisations that enforce the law but are not accountable or public
9. Iron Curtain	The name given to the 'border' of Western/Eastern Europe	25. Guerrilla	A type of fighting that relies on ambushes or unconventional warfare
US Actions – The Truman Doctrine and Marshall Plan			
10. Doctrine	A key message that you are committed to enforcing		
Soviet Actions – The Berlin Blockade			
11. Comecon	Organisation to increase Soviet economic control in Europe		

Timeline of the arms race 1945-1962		Capitalism	Communism
1945	The USA tests its first atomic bomb. It is used twice, against Japan. Joseph Stalin demands the USSR develop its own nuclear capability, and triples the pay of scientists working on the project.	Politics: Favours democracy – people choose their leaders from several different parties.	Politics: Only one party allowed, the Communist Party, which represents the people. There are no elections and you cannot change your government.
1949	The USSR carries out its first successful nuclear test. In the US, Truman massively increases defence spending and work commences on a new, more powerful 'hydrogen bomb' (H-bomb)	Economy: Businesses are privately owned, and there are opportunities to become very wealthy for some people. If you work hard and are good at your job, you will be promoted and earn more money – this gives people an incentive to work.	Businesses are all owned publicly – by the government. All profits and products are shared amongst the people. Nobody becomes hugely wealthy, but nobody is much poorer than anyone else.
1953	The US and USSR both conduct their first successful H-Bomb tests. Both sides are now in possession of powerful nuclear weapons.	Beliefs: Freedom is good and is necessary for a successful society. Some people will be wealthier than others but mostly this should reflect their ability, ingenuity and hard work. It would be unfair for every one to be equal if some work harder than others. Capitalism should be the system used by the rest of the world because it encourages prosperity and development.	Beliefs: Freedoms such as a free media and freedom to hold different political views is harmful to the unity and success of the country. Everyone should be equal, and it is the government's job to ensure that this happens, as capitalism will exploit the poor and the workers to benefit the elite. Communism should be the system used by the rest of the world, and the USSR should encourage revolutions in other countries to ensure this happens.
1954	The US explodes its largest ever H-Bomb – the equivalent of 15 million tons of TNT, and capable of wiping out Moscow. The USSR had similar capability to wipe out American cities.		
1957	The Soviet Union launches the first satellite into space. The US fears that this could eventually lead to a military threat, and diverts resources to its own space program.		
1962	The Cuban Missile Crisis – the US discovers Soviet nuclear missiles in Cuba, 90 miles off the coast of Florida. The USA has 63 inter-continental missiles, 21 nuclear submarines, 24 aircraft carriers and 96 missiles capable of being launched from submarines. The USSR had more than 50 inter-continental missiles, and no aircraft carriers, no sub-launched missiles and only 2 nuclear submarines. The USA had started to pull ahead in the arms race, but both sides possessed enough nuclear weapons to wipe the other side out many times over.	Problems: Capitalism leads to inequality – some people become very rich, but others become very poor. Power is concentrated in the hands of a minority of rich and powerful individuals, whilst the poor are vulnerable to being exploited.	Problems: Communism leads to a lack of productivity – why work hard with no opportunity for financial reward? It also stifles creativity – people are less likely to have the freedom and incentive to develop ideas if they won't personally benefit from them. Lack of democracy leads to the suppression of other basic rights.

GCSE History Paper 2: Superpower Relations KT2: Cold War Crises

Key Terms			
The Berlin Crisis, 1961		11. Hawks and Doves	People who favoured aggressive or diplomatic US response
1. Defection	Leaving one country to go to its enemy	12. Brinkmanship	Going right to the edge to get what you want
2. Refugee	A person fleeing crisis in their home country	Consequences of the Cuban Missile Crisis	
3. Ultimatum	A final choice with two serious options	13. Hotline	A telephone connection to allow instant communication
The Construction of the Berlin Wall		14. Treaty	An agreement between countries
4. Checkpoint	A guarded border post on the Berlin Wall	15. Detente	The thaw in relations that led to progress between US/USSR
The Cuban Revolution		The Prague Spring	
5. Dictator	A leader with total power over the country	16. Reforms	Changes to the way the country is run
6. Diplomat	A representative from one country in another	17. Censorship	Limiting the information that people have access to
7. Exile	A person forced to leave a country to live in another	The Soviet Invasion of Czechoslovakia	
8. CIA	The Central Intelligence Agency – US spy network	18. Resistance	Refusal to cooperate
9. Bay of Pigs	A bay in Cuba that was the focus of a failed invasion	19. Propaganda	Materials which are designed to push a particular message
The Cuban Missile Crisis		20. Brezhnev Doctrine	USSR plan to invade countries which threatened E. Europe
10. U-2	US spy plane which captured images of the missiles	21. Vietnam War	A disastrous conflict the US was involved in in the 1960s/70s

Two crises in Berlin – not the same thing!	
Berlin Crisis of 1948	Berlin Crisis of 1961
The Berlin crisis of 1948 was caused by Stalin, who was resentful of the US and Britain having free access through East Germany to get to their sectors of Berlin. He thought they were spying on the Communist country and were spreading pro-capitalist messages. He closed off all the roads and railways, and attempted to force the US and Britain to give up their claim to West Berlin. Instead, the US organised airlifts of food and fuel to defeat the blockade and save the people of West Berlin. Stalin eventually had to back down. This crisis was significant in the wider Cold War because it showed that the USA was prepared to back up its words in the Truman Doctrine with actions. It was also significant because it led to the creation of NATO.	The Berlin Crisis of 1961 was caused by Khrushchev, who was resentful of highly qualified professionals leaving East Berlin and East Germany. There was no border between the East and West zones, meaning that people frequently travelled to the West and then on to capitalist countries that they otherwise were not allowed to go to. Highly qualified people knew they could earn lots more money in the capitalist West, so the 'brain drain' was a big concern for Khrushchev. He attempted to force the US to prevent this migration, but the US refused, so Khrushchev authorised the East Germans to build a wall around the entirety of West Berlin. This meant no East Germans could enter or they would be shot. Migration stopped, but the city was cut in two. The wall stood for 28 years.

Three Cold War Crises			
The Berlin Crisis 1961	Cuban Missile Crisis 1962	Czechoslovakia 1968	
Key individuals: - Eisenhower and Kennedy (USA) - Khrushchev (USSR) Causes: 'Brain drain' refugee crisis - hundreds of thousands of highly qualified workers leaving East Germany for the West Key events: - Berlin ultimatum 1958 - Vienna Summit 1961 - Construction of the Berlin Wall 1961 Outcomes: - West Berlin isolated and migration ended - Heightened tensions between USA and USSR	Key individuals: - Kennedy (USA) - Khrushchev (USSR) - Castro (Cuba) Causes: - USSR placed missiles on Cuba in response to US Jupiter missiles in Turkey. Key events: - Communist revolution led by Castro 1959 - Bay of Pigs invasion 1961 - Missiles discovered by USA - Kennedy ordered removal + blockaded Cuba Outcomes: - Increased rivalry between USA and USSR - Hotline installed for instant communication - Various treaties between 1963 and 1968	Key individuals: - Brezhnev (USSR) - Dubcek (Czechoslovakia) - Johnson (USA) Causes: - Czechs demanded greater freedoms and economic reform. Dubcek appointed leader Key events: - Dubcek announced Prague Spring reforms - Opposition to Communism increase - USSR invades and arrests Dubcek, reversing reforms Outcomes: - Brezhnev Doctrine - Other communist countries condemned USSR - US condemnation but no intervention	

GCSE History Paper 2: Superpower Relations KT3: End of the Cold War

Key Terms			
Reasons for Détente		15. Carter Doctrine	A US vow to go to war if their interests in Middle East threatened
1. Détente	An period of improved relations between US and USSR	16. Boycott	A refusal to use certain services or to attend an event
2. Linkage	Nixon's plan to 'link' benefits to positive Soviet actions	Reagan and the Second Cold War	
3. Bilateral	Agreements that involve cooperation between two parties	17. Second Cold War	Reagan's escalation of the Cold War after the failure of détente
Détente		18. NUTS	Targeting nuclear weapons at USSR warheads, not cities
4. SALT I	A plan to limit production of new nuclear weapons	19. START	Talks focused on reducing total nuclear weapons on both sides
5. ABM	Anti-Ballistic Missiles – reduced by the SALT Treaty	20. SDI	'Star Wars' – high tech laser guided missile protection system
6. MIRV	Weapons that contained several targetable warheads	Gorbachev's 'New Thinking'	
7. Disarmament	Reducing or completely destroying supplies of weapons	21. New Thinking	A series of reforms proposed by Gorbachev to modernise USSR
8. Apollo-Soyuz	A US-Soviet meeting in space to show their cooperation	22. Perestroika	'Restructuring' – economic changes to the USSR and communism
9. Helsinki Agreements	Agreements over issues like security and human rights	23. Glasnost	'Openness' – greater freedoms within the USSR and E Europe
10. Human Rights	Basic freedoms that are not respected in some countries	24. Dissidents	Political opponents to a regime that often experience persecution
Afghanistan and End of Détente		25. Uskoreniye	Acceleration – a Soviet plan to boost and modernise the economy
11. Mujahideen	An Afghan resistance force that was armed by the US	26. INF Treaty	First successful agreement to reduce nuclear weapons
12. Jihad	A Muslim 'holy war' that was declared against the USSR	27. Sinatra Doctrine	Nickname of plan for E European countries to do things 'their way'
13. Fundamentalism	An extreme and dangerous version of a religion	The Fall of the Berlin Wall and the End of the Cold War	
14. Embassy	A building that represents one country's people in another.	28. Reunification	Germany being reunited into a single country after being divided

Ronald Reagan	Mikhail Gorbachev
Ronald Reagan was a former Hollywood actor who was elected US President in 1980. He took a tougher line with the USSR, and his SDI 'Star Wars' initiative led to massive military spending. His description of the USSR as the 'Evil Empire' in 1982 deteriorated relations, but his policies forced the USSR to accept that they couldn't keep up with US progress and that reform was necessary.	Mikhail Gorbachev came to power in 1985 with the USSR in crisis. He was their fourth leader in the last three years and their political and economic situation looked bleak. Gorbachev announced a series of reforms called 'New Thinking' including 'glasnost' and 'perestroika'. His willingness to reform the USSR and improve relations with the West made him incredibly popular in the USA. His reforms brought about the end of the Soviet Union.

	Nixon 1969-1974	1970 1971 1972 1973 War 1974 1975 1976 1977 1978 1979 Afghanistan Olympics 1981 1982 1983 1984 new leader 1985 Gorbachev meet 1986 1987 1988 1989 1990 1991 ends
	Ford 1974-77	Nixon visits Moscow for second time Apollo-Soyuz link up / Helsinki agreements
	Carter 1977-1981	Communist revolution in Afghanistan SALT II discussions end / Soviets invade US boycott of Moscow Olympics Death of Brezhnev / Andropov new leader SDI announced 'Star Wars'
	Reagan 1981-1989	Soviets boycott LA Olympics / Chernenko Gorbachev new leader / Reagan + Reykjavik Summit collapses INF Treaty
	Bush Sr. 1989-1993	Iron Curtain ends / Berlin Wall pulled down Collapse of Soviet Union / Germany reunited START I / Gorbachev resigns / Warsaw Pact ends

Key places	
East Germany	Oct-Nov 1989: Millions protest on the streets of major cities Nov 1989: Berlin Wall is opened Oct 1990: German reunification
Poland	1988: Mass strikes across country 1989: Solidarity party wins elections and first non-Communist leader in E Europe is elected.
Hungary	1988: Becomes multi-party state 1989: Border opens with democratic Austria 1990: anti-Communist alliance wins elections
Czechoslovakia	Nov 1989: Mass protests against Communism lead to resignation of government Dec 1989: Non-communist president appointed 1990: Elections won by non-Communist alliance
Romania	25 Dec 1989: Communist dictator Ceausescu executed 1990: Democratic elections held, won by party dominated by ex-communists
Bulgaria	1990: Democratic elections held, won by renamed Communist Party

Half term 1 – Communication and the world around us. Theme 3. The environment and where people live.

Quiz 1.1 – Describe where you live – Types of houses and location

J'habite dans une maison jumelée à la campagne.	I live in a semi-detached house in the countryside.
Tu vis dans un appartement moderne en ville.	You live in a modern flat in town.
Il habite dans une ferme isolée près de la montagne.	He lives in a remote farmhouse near the mountains.
Elle vit dans un pavillon confortable en banlieue.	She lives in a comfortable bungalow in the suburbs.
Nous habitons dans un immeuble ancien au centre-ville.	We live in an old building in the town centre.
Ils vivent dans une grande villa au bord de la mer.	They live in a big villa by the sea.

Quiz 1.2 Recent activities at home

J'ai regardé la télé dans le salon hier soir.	I watched TV in the living room last night.
Tu as aidé à faire la cuisine samedi matin.	You helped with the cooking on Saturday morning.
Il a rangé sa chambre après l'école.	He tidied his room after school.
Elle a mis la table pour le dîner.	She set the table for dinner.
Nous avons fait la vaisselle ensemble.	We did the washing up together.
Ils ont joué à des jeux vidéo dans leur chambre.	They played video games in their bedroom.

Quiz 1.3 Places in town and modal verbs

Je peux aller à la piscine le week-end.	I can go to the swimming pool at the weekend.
Tu sais où se trouve la bibliothèque ?	Do you know where the library is?
Il peut acheter du pain à la boulangerie.	He can buy bread at the bakery.
Elle sait comment aller au musée.	She knows how to get to the museum.
Nous pouvons prendre le bus jusqu'au centre commercial.	We can take the bus to the shopping centre.
Ils savent qu'il y a une gare près d'ici.	They know there is a train station nearby.

Quiz 1.4 Ma ville idéale

Dans ma ville idéale, il y aurait un grand parc et une piscine moderne.	In my ideal town, there would be a big park and a modern swimming pool.
Tu aimerais une ville où il y aurait beaucoup d'activités pour les jeunes ?	Would you like a town where there would be lots of activities for young people?
Je pense qu'il y aurait moins de pollution si on avait plus d'espaces verts.	I think that there would be less pollution if we had more green spaces.
Elle dit que ça serait calme et agréable de vivre au bord de la mer.	She says it would be calm and pleasant to live by the sea.
Nous voudrions une ville où il y aurait un marché tous les jours.	We would like a town where there would be a market every day.
Elles pensent que ça serait mieux sans voitures dans le centre-ville.	They think it would be better without cars in the town centre.

Quiz 1.5 More modal verbs

Je peux sortir après avoir fini mes devoirs.	I can go out after finishing my homework.
Tu dois ranger ta chambre tous les jours.	You must tidy your room every day.
Il veut aller au cinéma ce soir.	He wants to go to the cinema this evening.
Elle sait parler espagnol.	She knows how to speak Spanish.
Nous devons aider à la maison le week-end.	We have to help at home on the weekend.
Il faut arriver à l'heure à l'école.	It is necessary to arrive on time at school.

Model answers / Parallel texts

90 word writing task You write an email to attract tourists to your town. Describe *where you live *what you have done at home recently *what your ideal town would be like	J'habite dans une maison jumelée à la campagne. C'est calme mais un peu ennuyeux. Le week-end dernier, j'ai rangé ma chambre et j'ai aidé ma mère à faire la cuisine. J'ai regardé aussi la télé dans le salon et j'ai joué à des jeux vidéo. Dans ma ville, il y a une bibliothèque et un petit supermarché, mais il n'y a pas de cinéma. Je peux aller au parc avec mes amis et nous voulons aller à la piscine bientôt. Dans ma ville idéale, il y aurait un centre sportif et un grand centre commercial. Ça serait animé et moderne. Il faudrait aussi plus de transports publics. I live in a semi-detached house in the countryside. It's quiet but a bit boring. Last weekend, I tidied my room and helped my mum with the cooking. I also watched TV in the living room and played video games. In my town, there is a library and a small supermarket, but there is no cinema. I can go to the park with my friends, and we want to go to the swimming pool soon. In my ideal town, there would be a sports centre and a big shopping centre. It would be lively and modern. There should also be more public transport.
150 word writing task You are writing to your French exchange partner who is coming to stay. Describe *your home and local area *what activities you did at home recently	Salut ! Je suis tout à fait ravi que tu viennes bientôt chez moi. J'habite dans une maison jumelée confortable, située à la campagne, à environ dix kilomètres d'une petite ville. À mon avis, mon village est calme et agréable, avec un petit supermarché, une boulangerie et un joli parc où j'aime me promener. Il me semble que c'est un endroit parfait pour se détendre. Quand j'y réfléchis, dans ma ville idéale, il y aurait beaucoup plus d'activités pour les jeunes, comme un cinéma, un centre sportif et un grand centre commercial. Ça serait vraiment animé et pratique, surtout le week-end. Pour moi, ce serait un vrai plaisir d'y vivre. La semaine dernière, j'ai aidé à faire la cuisine et j'ai rangé ma chambre, ce qui n'était pas très amusant – j'ai un peu le cafard ! Après avoir fait cela, j'ai regardé un film et joué à des jeux vidéo avec mon frère. Dimanche, nous avons fait un gâteau au chocolat – c'était délicieux ! Sans doute, j'ai hâte de te voir et de te faire découvrir tout ça. Bisous, Hi! I'm absolutely delighted that you're coming to stay soon. I live in a comfortable semi-detached house, located in the countryside, about ten kilometres from a small town. In my opinion, my village is calm and pleasant, with a small supermarket, a bakery, and a lovely park where I enjoy going for walks. It seems to me that it's a perfect place to relax. When I think about it, in my ideal town, there would be many more activities for young people, like a cinema, a sports centre, and a large shopping centre. It would be really lively and practical, especially at the weekend. For me, it would be a real pleasure to live there. Last week, I helped with the cooking and tidied my room, which wasn't very fun – I was a bit down! After having done that, I watched a film and played video games with my brother. On Sunday, we made a chocolate cake – it was delicious! Without a doubt, I can't wait to see you and show you everything. Kisses,

Half Term 2 – Communication and the world around us. Theme 3. The environment and where people live

Quiz 2.1 J'aide l'environnement

J'essaie de protéger la planète en recyclant.	I try to protect the planet by recycling.
J'évite de prendre un bain pour économiser de l'eau.	I avoid taking a bath to save water.
Je mange moins de viande pour réduire la pollution.	I eat less meat to reduce pollution.
Nous utilisons les transports en commun au lieu de la voiture	We use public transport instead of the car.
Je ne jette pas les déchets plastiques dans la poubelle normale.	I don't throw plastic waste in the normal bin.
Ma famille décide d'acheter des produits locaux	My family decides to buy local products.

Quiz 2.2 - Autres actions pour protéger l'environnement

Je ne gaspille jamais la nourriture à la maison.	I never waste food at home.
J'éteins toujours les lumières quand je quitte une pièce.	I always turn off the lights when I leave a room.
Je n'achète pas de vêtements de la fast fashion.	I don't buy fast fashion clothes.
Je participe à des campagnes pour protéger les animaux en danger.	I take part in campaigns to protect endangered animals.
J'utilise une gourde au lieu d'acheter des bouteilles en plastique.	I use a reusable water bottle instead of buying plastic bottles.
Je prends des douches courtes pour économiser de l'eau.	I take short showers to save water.

Quiz 2.3 J'ai fait beaucoup pour l'environnement !

Hier, j'ai recyclé les bouteilles en plastique chez moi	Yesterday, I recycled the plastic bottles at home.
Ma sœur a décidé de devenir végétarienne	My sister decided to become vegetarian.
Nous avons voyagé à pied au lieu de prendre la voiture.	We travelled on foot instead of taking the car.
Ils n'ont pas pris l'avion afin de réduire leur empreinte carbone.	They didn't take the plane in order to reduce their carbon footprint.
Quand j'étais plus jeune, je ne faisais pas attention à la pollution.	When I was younger, I didn't pay attention to pollution.
Le week-end dernier, on a planté des arbres dans le parc pour aider l'environnement.	Last weekend, we planted trees in the park to help the environment.

Quiz 2.4 – Les problèmes environnementaux

On coupe trop d'arbres, ce qui cause la déforestation.	Too many trees are being cut down, which causes deforestation.
La pollution plastique est un problème grave pour les océans.	Plastic pollution is a serious problem for the oceans.
On utilise trop de produits chimiques dans les produits ménagers.	Too many chemicals are used in household products.
Les énergies fossiles polluent l'air et contribuent au réchauffement climatique.	Fossil fuels pollute the air and contribute to global warming.
Il faut créer plus de forêts pour aider les générations futures.	We must create more forests to help future generations.
Je voudrais utiliser des énergies renouvelables comme le vent et le soleil.	I would like to use renewable energies like wind and solar power.

Quiz 2.5 – Ce que je ferai pour l'environnement à l'avenir

Je planterai des arbres pour aider la planète.	I will plant trees to help the planet.
Je réduirai ma consommation de plastique.	I will reduce my use of plastic.
J'utiliserai les transports en commun au lieu de prendre la voiture.	I will use public transport instead of taking the car.
Je recyclerai tous mes déchets correctement.	I will recycle all my waste properly.
Je n'achèterai que des produits locaux et de saison.	I will only buy local and seasonal products.
Je fabriquerai mon propre savon pour éviter les produits industriels.	I will make my own soap to avoid industrial products.

90-Word Model answer F/H

You are writing a blog post for your school website about the environment.

Write about 90 words in French.

Mention:

- what you do now to protect the environment
- what you did recently at home to help the planet
- what you will do in the future to be more eco-friendly
- your opinion on environmental problems and why

Pour protéger la planète, je recycle et j'évite de prendre des bains **parce que** c'est important d'économiser l'eau. **À mon avis**, je dirais que chaque petit geste compte. Ma famille achète des produits locaux **vu que** cela réduit la pollution.

Récemment, j'ai recyclé les bouteilles en plastique. **Après avoir fait cela**, nous avons voyagé à pied au lieu de la voiture. **Il me semble que** c'est essentiel pour l'avenir.

À l'avenir, je planterai des arbres et je réduirai ma consommation de plastique. **Sans doute**, je veux vraiment aider l'environnement.

Cependant, à mon avis, la pollution plastique et la déforestation sont très graves. Il faut agir vite pour protéger la planète.

To protect the planet, I recycle and avoid taking baths **because** it is important to save water. **In my opinion**, I would say that every small action counts. My family buys local products **since** it reduces pollution.

Recently, I recycled plastic bottles. **After doing this**, we traveled on foot instead of by car. **It seems to me that** this is essential for the future.

In the future, I will plant trees and reduce my plastic consumption. **Without a doubt**, I really want to help the environment.

However, in my opinion, plastic pollution and deforestation are very serious. We must act quickly to protect the planet.

150-Word Model answer F/H

You are writing a post for a French environmental website.

Describe

- the importance of protecting the environment
- how you will help the environment in the future

Protéger l'environnement **est essentiel parce que** la planète fait face à la pollution, la déforestation et au changement climatique. **À mon avis, je dirais qu' il faut** faire des efforts pour réduire ces problèmes. **Autant que je sache**, ma famille et moi, nous recyclons **toujours** nos déchets, nous évitons de gaspiller l'eau **en prenant** des douches courtes, et nous achetons des produits locaux **vu que** cela aide à réduire la pollution liée au transport. **Je pense que** ces actions sont simples, mais **en même temps** elles auront un grand impact.

D'abord, dans le futur, je planterai des arbres **car** ils produisent de l'oxygène **et en plus** aident à lutter contre le réchauffement climatique. **Ensuite**, je réduirai ma consommation de plastique **en utilisant** une gourde réutilisable. **Enfin**, j'utiliserai les transports en commun **au lieu de** la voiture, **ce qui est meilleur pour** l'environnement et réduit les gaz à effet de serre. **Je crois que** ces gestes sont essentiels **pour** protéger notre planète et **afin d'assurer** un meilleur avenir.

1.1.1.1 Architecture of the CPU

The purpose of the CPU:

- The fetch-execute cycle

- Data and instructions **FETCHED** from main memory.
- They are then **DECODED** and **EXECUTED**.
- This is carried out in a continuous cycle.

Common CPU components and their function:

- ALU [Arithmetic and Logic Unit]
- CU [Control Unit]
- Cache
- Registers

- ALU performs calculations and logic checks.
- It may take several F-E-Cycles for a calculation to be finished.
- Intermediate results are stored in the **Accumulator**.
- **Cache** is VERY FAST memory.
- Instructions that are carried out frequently are stored there so that they don't have to be **FETCHED** (saving time).
- **Registers** = small amounts of high speed memory contained within the CPU.
- Registers store data that is needed during the F-E-C.

Von Neumann

Architecture:

- MAR (Memory Address Register)
- MDR (Memory Data Register)
- Program Counter
- Accumulator

MAR – Holds the address of the current instruction that is to be fetched from the memory, or the address in the memory to which data is to be transferred.

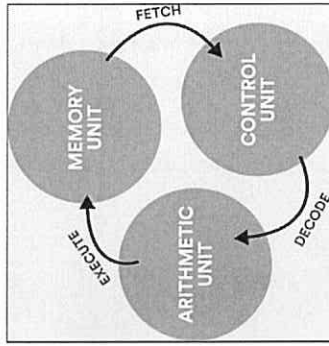
MDR – Holds the contents found at the address held in the MAR, or data which is to be transferred to primary memory.

John Von Neumann was a Hungarian mathematician who developed the idea that a computer could be used for many purposes and not just one.

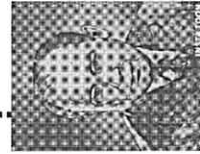
- This was called the **stored program concept**.

- A processor based on **Von Neumann's architecture** would use memory to store data and instructions and would use the **fetch execute cycle** to retrieve and process instructions.

REVISION NOTE:
You should learn what each register does and its role in the fetch execute cycle.



Accumulator
– Holds the data while it is being processed.

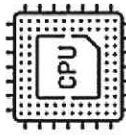


PC – Holds the memory address of the next instruction to be fetched from primary memory.

1.1.2 CPU Performance

How common characteristics of CPUs affect their performance:

- ☐ Clock speed
- ☐ Cache size
- ☐ Number of cores



- Each processing unit inside a CPU is called a **CORE**.
- **Each core can carry out the fetch execute cycle.**
- The more cores a CPU has, the more instructions it can process in a given time. (i.e. **Parallel Processing**)



- The **Clock** coordinates all the computer's components.
- It sends out a pulse that synchronises each component – the **FREQUENCY** of this is known as **CLOCK SPEED**.
- It is measured in **HERTZ**.
- The higher the frequency, the more instructions can be processed in a given time

single core CPU
= 1 instruction



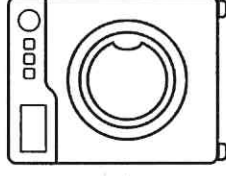
VS

dual core CPU
= 2 instructions



1.1.3 Embedded Systems

The purpose and characteristics of embedded systems Example of embedded systems:



- **Embedded Systems** are small computer systems built inside larger devices or pieces of equipment.
- they are designed to do one task (rather than a range of tasks).
- Embedded systems have a simple user interface.
- In addition, the software used to control or run the system is also basic.

Which of these is NOT an Embedded systems?



DOES ONE TASK



DOES ONE TASK



DOES MANY TASKS

As they are a dedicated to a single task, embedded systems are usually easier to design, cheaper to produce, and more efficient at doing their tasks than a general purpose computers.

Cache is very fast (and expensive) memory that can store frequently used data or instructions.

1.2.1 Primary Storage (Memory)

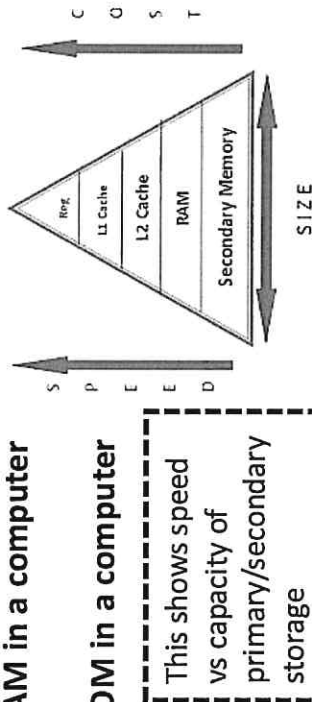
The need for primary storage

The difference between RAM and ROM

The purpose of RAM in a computer system

The purpose of ROM in a computer system

Virtual memory



Primary storage is used to store programs and data currently used by the computer. When a user needs to run a program, it is loaded from disk to primary storage.

Another term for primary storage is **RAM** or **Random Access Memory**. It is given this name because data can be stored anywhere within the available memory.

RAM is **Volatile** (i.e. any data stored in RAM is lost when the device is powered off).

ROM or **Read Only Memory** is **non-volatile** (i.e. any data stored in RAM is not lost when the device is powered off) – it is stored **permanently**.

ROM can be used to store the **BIOS** (i.e. the program that boots up and loads the **Operating System** when the computer turned on).

VIRTUAL MEMORY is used when the computer is short of RAM. This involves the hard disk being used as memory instead of RAM.

This is not ideal as the speed of hard disk is MUCH slower than RAM.

1.2.2 Secondary Storage

The need for secondary storage

Common types of storage:

- ☐ Optical
- ☐ Magnetic
- ☐ Solid state



OPTICAL STORAGE includes CD, DVD and Blu-ray. Data is written to optical storage media using laser.

The capacity of this type of media ranges from 640 megabytes (CD) to 50 gigabytes (Blu-ray). Since it involves the use of moving parts access/data transfer speeds are slower than for other types of media.

Examples – CD, DVD, Blu-ray



Examples – Hard Drive, Magnetic tape, external hard drive

Magnetic storage media include hard drive and tape and can have a huge capacity (100's of terabytes).

Magnetic storage media devices involve the use of moving parts. This means that they have comparatively slow data read and write speeds and can be prone to damage.

Criteria for choosing secondary storage

Criteria	Meaning
Cost	How much does it cost per GB of storage?
Capacity	How much is there to store files?
Speed	How fast can it read/write data?
Portability	Can it be carried easily or is it a device that is hard or impractical to carry/move?
Durability	How robust is it? Will it break or damage easily?
Reliability	How likely to fail is it? How long will it last?

Examples – Solid State, Flash drive, SD card

SOLID STATE media is also known as electrical or flash storage.

Solid state has the fastest transfer speed out of all the three types of media, since it features no moving parts.

This also makes it more robust than other forms of storage and addition they consume less power.

However this form of storage offers lower capacity than other forms of media and is still comparatively expensive

1.2.3 Units

The units of data storage:

- ☐ Bit
- ☐ Nibble (4 bits)
- ☐ Byte (8 bits)
- ☐ Kilobyte (1,000 bytes or 1KB)
- ☐ Megabyte (1,000 KB)
- ☐ Gigabyte (1,000 MB)
- ☐ Terabyte (1,000 GB)
- ☐ Petabyte (1,000 TB)

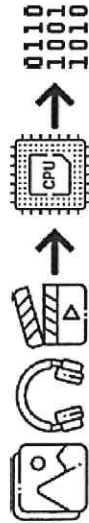
How data needs to be converted into a binary format to be processed by a computer

Data capacity and calculation of data capacity requirements

Computer are electrical devices; their components are made up of millions of circuits. Each circuit contains switches which can be Either 'on' or 'off'. These can be represented by values 1 and 0. **This is called BINARY.**



ALL data is stored and processed in binary form – this includes text, images, sound and video.



1.2.4 Data Storage

Numbers

- ☐ How to convert positive denary whole numbers to binary numbers (up to and including 8 bits) and vice -versa
- ☐ How to add two binary integers together (up to and including 8 bits) and explain overflow errors which may occur
- ☐ How to convert positive denary whole numbers into 2-digit hexadecimal numbers and vice versa
- ☐ How to convert binary integers to their hexadecimal equivalents and vice versa
- ☐ Binary shifts

To convert 25 to binary:

- ✓ Start with the column nearest 25 (i.e. 16 or 2⁴)
- ✓ Put a one in that column
- ✓ Check each remaining column, adding either a 1 or 0 onto the end of our number
- ✓ In this case 16 + 8 + 1 = 25 (2⁴ + 2³ + 2⁰)
- ✓ So... 25 in binary is 11001

To convert 101010 into decimal:

- ✓ Work which column the left digit is in (i.e. 32 or 2⁵)
- ✓ Work left to right – add up the column value each time there is a 1
- ✓ For example: 32 + 8 + 2 = 42

Converting to/from Hex

Hex	Dec
0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
A	10
B	11
C	12
D	13
E	14
F	15

To convert decimal to hex:

- ✓ First convert the number to binary:
i.e. 25 in binary = 00011001
- ✓ Then split the number into two groups of 4 bits:
i.e. 0001 1001
- ✓ Then convert each group of 4 bits to HEX:
i.e. 0001 = 1
1001 = 9
- Then join (don't add) both digits together:
i.e. 1 + 9 = 19

To convert hex to decimal, just work through this process backwards

Binary arithmetic

Use binary shift to:

- **Multiply**
00110111 x 2 =
01101110
[Left shift by 1]
- **Divide**
00110111 / 2 =
00011011
[Right shift by 1]

Rules for binary addition

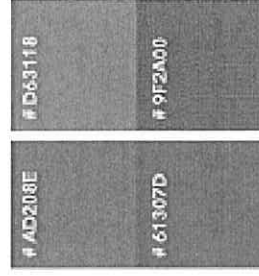
00 + 00 =	0	No remainder
00 + 01 =	1	No remainder
01 + 01 =	1 0	Carry 1
10 + 01 =	1 1	Carry 1

If there are insufficient bits to store the answer, this causes **OVERFLOW**

Hexadecimal numbers can be represented in fewer digits than in binary making them easier for humans to remember and more economical in terms of storage

Hexadecimal has many uses in computing:

- **assembly language**,
- to store a **MAC Address**
- representing colour codes



1.2.4 Data Storage

Characters

- ☐ The use of binary codes to represent characters
- ☐ The term 'character set'
- ☐ The relationship between the number of bits per character in a character set, and the number of characters which can be represented, e.g.:
 - ASCII
 - Unicode

METADATA = 'Data about data'
i.e. additional information stored when the image files are saved

Every character (letters, numbers, symbols) sent to the computer or typed in, is stored as a 7-bit binary code. For example, if the user types in the message below, H is represented by the number '072'. This character set is called

ASCII

Hello, world
>_

你好, 世界
>_

UNICODE uses 16 bits to allow for an even wider range of characters to be stored, including ones for foreign languages.

Sound

- ☐ How sound can be sampled and stored in binary form
- ☐ The effect of sample rate, duration and bit depth on;
 - The playback quality
 - The size of a sound file

Images

- ☐ How an image is represented as a series of pixels, is represented in binary
- ☐ Metadata
- ☐ The effect of colour depth and resolution on:
 - The quality of the image
 - The size of a image file



Bitmap images are made up of individual **pixels**. The more pixels stored in an image, the higher the detail (**resolution**) will be.

Each pixel will be represented in binary as a 1 (on) or a 0 (off).

These binary digits are combined into binary numbers that can be stored by a computer.

Colour images need additional binary code to store the colour. The more bits available to store the colour, the wider the possible colour range. This binary value is called **colour depth**.

1.2.5 Compression

The need for compression

- ☐ The need for compression
- ☐ Types of compression;
 - Lossy
 - Lossless

Compression can be applied to any file type and used to reduce the size of the file, this is useful when files need to be uploaded/downloaded to/from the internet or sent via email.



LOSSY

File size is reduced at the expense of quality

LOSSLESS

File size is reduced with no loss of quality

Sound waves are **ANALOGUE** and must be converted into **DIGITAL** (0's and 1's) in order to be stored/processed by computers.

- The height of a sound wave it's **Amplitude**.
- The **SAMPLE RATE** is the number of samples captured per second.
- **SAMPLE RESOLUTION** is the number of bits used to capture the sound



Working out the size of a sound file that needs to be stored on a computer system the following calculation is needed:

File size (in bits) = Sample rate (in Hz) x Bit depth x duration (in seconds)

1.6.1 Ethical, Legal, and Environmental Impact

Impacts of digital technology on wider society including:

- ☐ Ethical issues
- ☐ Legal issues
- ☐ Cultural issues
- ☐ Environmental issues
- ☐ Privacy issues

Legislation relevant to Computer Science:

- ☐ The Data Protection Act 2018
- ☐ Computer Misuse Act 1990
- ☐ Copyright Designs and Patents Act 1988
- ☐ Software licences (i.e. open source and proprietary)

REVISION NOTE

You need to be able to talk about each of these in detail, considering both advantages and disadvantages of each

ETHICS= Our principles, the things that influence our choices and behaviours
CULTURE = Our way of life, including customs and beliefs

THE COPYRIGHT DESIGNS AND PATENTS ACT 1988

An act of law designed to provide protection for creators of books, software music and video, against illegal copying, piracy and distribution.



COPYRIGHT – material cannot be used/distributed without permission

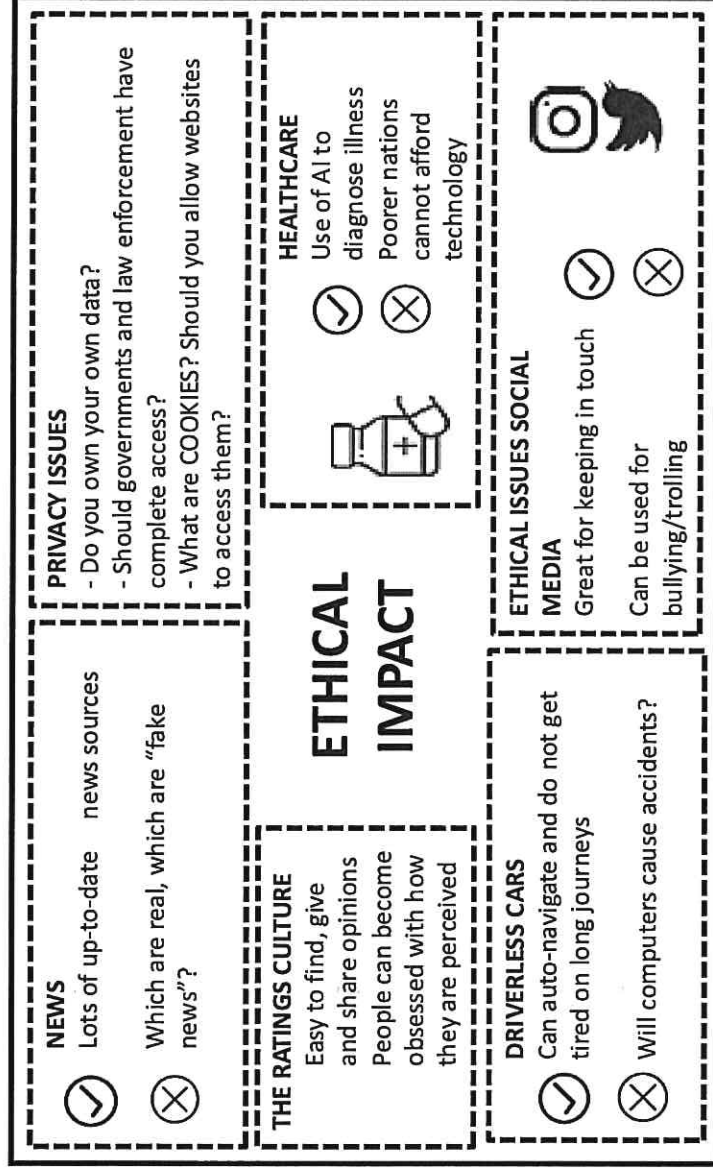
CREATIVE COMMONS – material can be used without permission (though credit may need to be given)



COMPUTER MISUSE ACT 1990

There are three main principles of the Computer Misuse Act. It is an offence to:

1. access computer material without permission, e.g. looking at someone else's files
2. access computer material without permission and with intent to commit criminal offences, e.g. hacking into your bank's computer and increasing the money in your own account
3. alter computer data without permission, e.g. writing a virus to destroy someone else's data



THE 8 PRINCIPLES OF THE DATA PROTECTION ACT 2018

- ✓ Fair, lawful & transparent processing
- ✓ Purpose limitation
- ✓ Data minimisation
- ✓ Accuracy
- ✓ Data retention periods
- ✓ Data security
- ✓ Accountability

SOFTWARE LICENSES

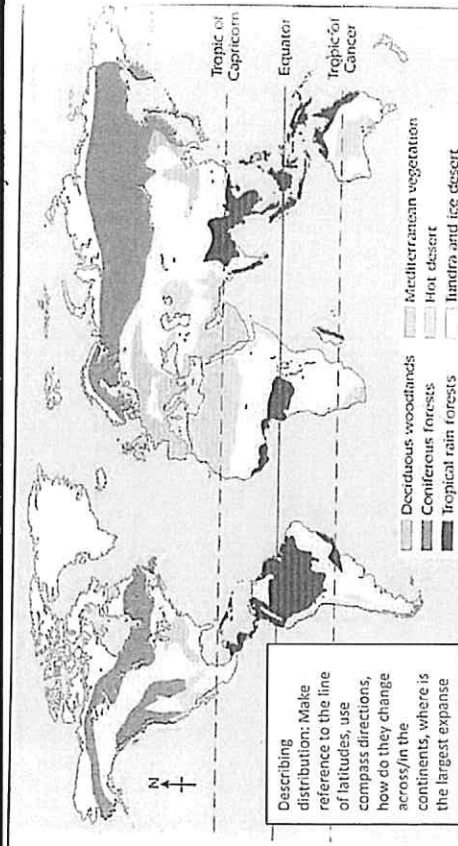
	Open Source	Proprietary	Freeware
Is licensed	✓	✓	✓
Can be edited by users	✓	✗	✗
License is free	✓	✗	✓
Users can make and sell their own version	✓	✗	✗

Geography - Ecosystems

Keywords

1. Producers	Convert energy from the environment into sugars – plants that convert energy from the Sun by photosynthesis
2. Consumers	Consumers get energy from the sugars produced by the producers e.g. animals that eat plants
3. Decomposers	Decomposers break down plant and animal material and return the nutrients to the soil e.g. fungi
4. Food chain	A food chain shows direct links between producers and consumers
5. Food Web	A food web shows all the complex connections between producers and consumers
6. Nutrient Cycling	When plants and animals die, decomposers help to recycle the nutrients, making them available once again for the growth of plants or animals.
7. Abiotic	Non-living environmental factors
8. Biotic	Living features of an ecosystem
9. Biomes	Large-scale ecosystems/ global ecosystems
10. Biodiversity	The variety of life in the world or a particular ecosystem
11. Deforestation	The cutting down or removal of forest
12. Selective Logging	Only carefully selected trees are cut down
13. Soil Erosion	Removal of topsoil faster than it can be replaced
14. Indigenous	Originating or occurring naturally in a particular place; native.
15. Ecotourism	Nature tourism usually involving small groups with minimal impact on the environment
16. Natural threats	Climate change, droughts and floods can cause changes to ecosystems like the sea ice melting in the Arctic and coasts flooding in the Bahamas
17. Human threats	People can damage ecosystems through deforestation, mining, urbanisation, overgrazing and irrigation.

- Describe the pattern of biomes globally.
- Explain why different biomes form at different latitudes.
- Explain why biomes change within the tropics.
- What influence does climate have on biomes globally?
- What are trophic levels?
- Describe how the number of species changes throughout trophic pyramids.



Biomes

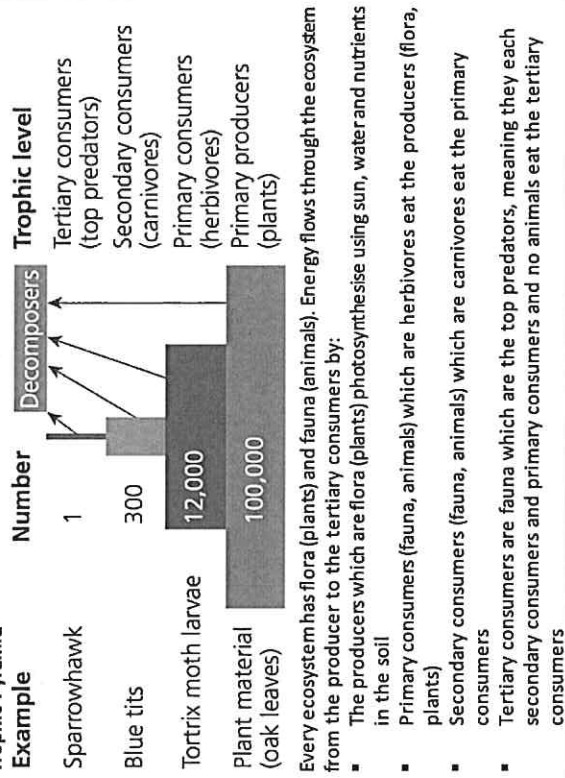
Tropical rainforest: hot all year round between 27-30. Wet all year, annual precipitation 2000, 3000mm.

Hot desert: very hot most of the year, above 30. Low annual rainfall, below 250mm.

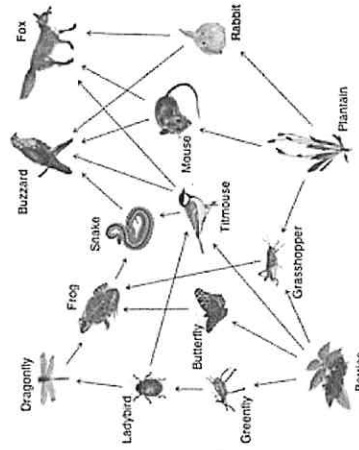
Deciduous woodland: Warm summers around 18. Mid/cool winters around 5. Precipitation all year around 1000mm.

Coniferous woodland: warm summers between 16-20. Very cold winters, well below freezing point. Precipitation mainly in summer, low annual total less than 500mm.

Trophic Pyramid



Food webs and chains



All flora and fauna in an ecosystem can be drawn onto a food web to show exactly which species are at which trophic level and which species they consumer. By showing what the fauna (animals), you can see how energy flows through the ecosystem. You can make food chains from food webs, where you follow one chain within the web for example:
Berries > greenfly > ladybird > dragonfly

Practice Exam Questions

- Explain how energy is transferred through an ecosystem.
- To what extent is photosynthesis vital for food webs?
- What is the difference between a food web and a food chain?
- What would happen to the food web if the tertiary predators became extinct?
- What would happen to the food web in the producers became extinct?
- How might climate change impact biomes globally?

Geography – Ecosystems – Monteverde Cloud Forest

1. Location	In western <u>Costa Rica</u> 100Km from the <u>Pacific coast</u> north of the <u>Tropic of Cancer</u> with 23.4% of the land protected
2. Climate	Hot temps all year – above <u>25°C</u> . High humidity, rain or cloud all year due to convection and orographic rainfall (relief) from the moist air blowing off the Pacific Ocean onto the mountains
3. Water	Rainfall is <u>high</u> . There is a lot of <u>interception</u> so it is stored and then <u>evaporated</u> off in the morning to form <u>new clouds</u> . Drip and stem flow take water down to the forest floor where it infiltrates into the soil. Tree roots take up vast amounts of water from the soil which travels up the tree and is then lost through <u>transpiration</u> .
4. Nutrients	High temps and humidity speed up chemical reactions and lead to <u>rapid nutrient cycling</u> . There is a lot of <u>biomass</u> (store) and leaves falling off the trees (flow), there is little leaf litter on the floor (store) because it rots down (decomposes) to humus quickly. The humus is then washed down into the <u>soil</u> (flow) by the rain and then the roots take up the nutrients from the <u>humus</u> (flow) to help them grow new leaves. Some nutrients enter soil from the bedrock.
5. Food web and adaptations	It is a <u>biodiversity hotspot</u> , plenty of water, sunshine and nutrients so that plants and animals can grow <u>all year long</u> , overhead <u>sunlight</u> means trees grow tall and straight, <u>emergent</u> trees can be <u>60m</u> , the canopy is up to 40m, the under canopy is 20m and the <u>shrub layer</u> is short and the area is dark. <u>Lianas</u> : have their roots in the ground but climb up other trees into the canopy to reach available sunlight. Many start growing in the canopy and send roots down to the forest floor. <u>Drip tips</u> : Leave have a waxy coating and grow into a point so rainwater flows off the leaf and onto the forest floor. This stops mould and algae growing on the leaf which would reduce photosynthesis. <u>Buttress roots</u> : Rainforest soils are very thin because of the rapid nutrient cycle so wide and tall roots grow above the soil to stabilise the tree, especially the emergent trees. <u>Howler monkey</u> : In the thick, dense canopy, communication is key so Howler Monkeys have adapted to be very loud, hence their name. The communicate about threats, food and mating. <u>Sloth</u> : Live in the canopy away from main predators and eat the leaves in the canopy. They rest during the day and are camouflaged by the green algae that grows on them and move very slowly at night so they are difficult for predators to spot. <u>Macaw</u> : Dense canopies are difficult to navigate so the macaw has streamlined bodies and tails and wings that do not flap deeply. They also use their wings as brakes to slow down and land on branches. Example of food chains include: Orchid > Macaw > Python. Coconut tree > Howler monkey > Jaguar. Banana tree > Insect > Vampire bats.
6. People	<u>Water Supply</u> : It provides a fresh water supply – interception and therefore there is more water evaporated for more rain the next day 27% is intercepted. The canopy prevents soil erosion as it stops the heavy rain-washing soil away as only drip and stem flow get to the forest floor. The canopy holds vast amounts of water as interception storage so this does not get into the rivers. The lack of soil erosion also means that little soil is washed into the rivers to choke them and cause floods. <u>Energy</u> : Wood can be used for building and the huge biodiversity of plants provides a range of medicines e.g. quinine for cramp and malaria <u>Food</u> : Plants and animals provide food e.g. honey, fruit and nuts
7. Threats	<u>Deforestation</u> has been widespread <u>Fragmentation</u> : larger clearings mean wildlife is restricted to isolated fragments of forest separated by farmland so animals are trapped in islands of forests <u>Extinction</u> : Animals hunted or isolated to extinction e.g. golden toad <u>Nutrient cycle broken</u> : if the canopy of trees is removed, no new leaf litter will reach the forest floor. Existing nutrients will be washed away by the rain and not replaced <u>Soil Erosion</u> : Protective canopy removed so gentle drip and stem flow is replaced with harsh, heavy rainfall which washes away the topsoil <u>Increased flooding</u> : soil erosion means soil is washed into the rivers, silting them up and choking them <u>Changes to the climate</u> : removal of canopy means no interception storage and less rain available for evaporation the next day. Fewer clouds form and climate becomes drier. Any rains run into the rivers and flows out of the drainage basin. In Monteverde, this means the Lake Arenal HEP project is not getting as much water
8. Management	<u>Ecotourism</u> : small scale tourist projects create money for conservation <u>Protected reserves</u> : 70% CR's tourists visit protected reserves. In 2000, CR earned \$1.25 billion from tourism, e.g. canopy walkway at Monteverde reserve, \$45 to climb up into the canopy and walk along a rope bridge <u>Visitor numbers limited</u> : rules to have not more than 160 people visiting Monteverde at one time <u>Guided trails</u> : these are set up in the forest to keep tourists away from fragile areas <u>Limited accommodation</u> : Lodges in Monteverde reserve are limited and are linked to educational conservation projects. Volunteers visit the lodge to help carry out conservation work <u>Wild Life corridors</u> : Monteverde is part of wildlife corridor the length of Central America. Strips of land are planted to connect remaining fragments of forest together (CBM – Mesoamerican Biological Corridor) <u>Debt-for-nature swap</u> : In 2007, CR spent \$26 million on conservation and the US government paid off \$26 million of CR's debt

Practice Exam Questions

1. Describe the location of an ecosystem you have studied.	9. Explain how people can benefit from an ecosystem.
2. Describe the climate of an ecosystem you have studied.	10. Explain how an ecosystem is naturally under threat.
3. Explain how an ecosystem can have surplus water supply.	11. Explain how an ecosystem is under threat due to human actions.
4. Using an example you have studied, explain how flora and fauna may be adapted to its ecosystem.	12. How can soil erosion cause issues for people?
5. Using an example you have studied, explain how energy can be transferred through a food chain.	13. Explain how an ecosystem may be managed by people.
6. Why do tropical rainforests have shallow soils?	14. How sustainable is the management at Monteverde cloud forest?
7. What role do decomposers play in tropical rainforests?	15. Why might some countries rely on international aid to protect an ecosystem?
8. How is the hydrological cycle influenced by tropical climates?	16. Why might the protection of ecosystems become more common and crucial in the future?
	17. What is ecotourism?
	18. Why might ecotourism not be a sustainable management strategy?

Geography – Ecosystems – Sahel Semi-Arid

1. Location	Semi-arid biomes are found 10°N and 10°S of the equator, between tropical rainforests and deserts. The Sahel lies in northern Africa south of the tropic of Cancer and North of the Equator. It is found in countries such as Mali and Chad and stretches from Senegal to Eritrea.
2. Climate	The climate of the Sahel is arid and hot, with strong seasonal variations in rainfall and temperature. The Sahel receives about 200-600mm of rainfall a year, which falls mostly in the May to September monsoon season. Average daily high temperature of 37 °C.
3. Water	Most rainfall falls between May and September, when the thermal equator moves towards the Tropic of Cancer. Non-profit organizations have worked in the region for more than fifty years and their strategy has been to dig wells and construct pumps, focusing on water supply. However, digging more wells or providing taps are not by themselves the answer because the groundwater in the Sahel may not sustain increasing demands. Soils become fertile during the wet season as soils are able to retain water and decompose fallen leaves and branches. Dry season cracks the soil and leads to soil erosion which loses minerals and dead materials decompose very slowly so nutrients are not returned to the soil.
5. Food web and adaptations	▪ <u>Baobab trees</u>: Wide and tall trunk stores lots of water, very long roots go deep into the soil and bedrock for water. ▪ <u>Acacia trees</u>: Very long roots go deep into the soil and bedrock for water, small leaves to reduce evapotranspiration losses. ▪ <u>Elephant grass</u>: Becomes straw like in the dry season to survive the lack of water. Roots have adapted to rapidly absorb water from the surface during the wet season. Sharp edges deter predators. ▪ <u>Giraffe</u>: Their tall necks mean they can reach the leaves at the top of trees that are left by other animals. Their spots/shapes on their fur also break up the shape of their outline, so it is hard to see against leaves on trees. ▪ <u>Lion</u>: Sleep and rest for the majority of the day to conserve energy as hunting requires chasing impala and zebra. Hunt in packs to increase success.
6. People	<u>Population</u>: The population is growing very quickly in the Sahel. There will be 100 million people in the region by 2020 and 200 million by 2050 – almost four times the current population. <u>GNI</u> (gross national income) of some countries: - Mali: 36.77 billion PPP dollars (2016) - Niger: 20.02 billion PPP dollars (2016) - Burkina Faso: 31.28 billion PPP dollars (2016) - Eritrea: 6.698 billion PPP dollars (2011) <u>Employment</u>: Main forms of employment and agriculture and informal work.
7. Threats	▪ <u>Overgrazing</u>: Ideally, farmers only let animals graze the top of the grass and then move them to another place, so they do not damage the grass. When there is less grass growing, farmers allow their cattle and goats to eat too much of the grass, even down to the roots. Goats will also climb trees and strip all the leaves. This will kill the plants and they will not re-grow. There are no roots to bind the soil together so when it is windy or rainy, the topsoil gets removed, leaving bare earth which is no good for plants. An increase in the number of people has led to overgrazing as there is less land for each person to use for their animals. ▪ <u>ITCZ</u>: The inter tropical convergence zone is the area of low pressure created by the zone of most intense heating by the sun. Low pressure causes rising air and if there is water there, this will evaporate and rise as well, causing clouds and the rainy season. The ITCZ moves N and S of the Equator during the year as the sun moves. In recent years the ITCZ has not moved as far N as usual due to a large area of high pressure over the Sahara Desert. This means the rains have not moved as far N either and some areas have turned into desert. ▪ <u>Deforestation</u>: Cutting trees down for more farmland or for firewood means there are no roots to bind the soil together as with overgrazing. There is also less shade or interception as there are no leaves. This means the soil is washed away by rain splash and no clouds form as there is no evapotranspiration.
8. Impacts of drought	▪ Low and erratic rainfall the area experienced in 2011 led to a poor harvest in 2011 and 2012 (the harvest season starts in October). ▪ Grain production in many areas of the Sahel region was 36 per cent down on the previous year and 20 per cent lower than the average for the past five years. In Senegal, the production of ground nuts, one of the area's main crops, was down 59 per cent on the previous year. ▪ In May, there were multiple outbreaks of locust swarms along the Libya/Algerian borders but due to the insecurity of the area, there simply wasn't anyone to deal with the infestations. As vegetation dried out, the swarms of locusts were left untreated to move south toward Chad, Niger and Mali. ▪ One theory is that due to climate change, the land is heating up more quickly than the part of the Atlantic Ocean where the Azores high pressure system is centred. This means the low-pressure areas have lower air pressure and the high-pressure areas are heavier and 2011-2012 saw large blocking anticyclones.
9. Management	▪ <u>Bunds</u>: Sometimes called magic stones. Lines of stones built up across a slope to catch any rain water an topsoil that washed down after a rainstorm. ▪ <u>Planting trees</u>: Tree roots bind the topsoil together to stop it being washed or blown away. The leaves will store water and evapotranspiration will occur, making the atmosphere more humid, possible causing clouds and rainfall. ▪ <u>The Great Green Wall</u>: An ambitious plan to plant trees across the 8,000km width of the Sahel and up to 15km at its widest point. This would retain water in the ecosystem and reduce the risk of drought, restoring the semi-arid ecosystem. The GGW would provide fertile farmland and food and sustainable rubber tapping so would also increase economic sustainability. ▪ <u>Terracing</u>: Cutting steps into a slope creates flat areas. This means that when there is a rainstorm, the water does not run down the slope, washing soil away with it – it sits on the flat steps of land like a puddle. This gives it time to infiltrate into the baked soil and then be available for crops. ▪ <u>OXFAM funding of girl's education</u>: Women collect all the firewood and do most of the farming. If girls are educated, they will know how to do this more sustainably. They might also get a job in a town, meaning there are fewer people needing land to produce food in the countryside. ▪ <u>Upesi stoves</u>: These stoves can be made easily out of clay and their design means far less firewood is needed so there is less deforestation near villages. They also produce far less smoke so cut pollution and chest and eye problems in homes.

Geography – Ecosystems – Ynyslas (small scale ecosystem)

1. Where is Ynyslas small scale ecosystem?	Ynyslas is an area of sand dunes 10km north of Aberystwyth on the west coast of Wales. The dunes are at the north end of the Borth spit. The dunes are 3km south of the Dyfi Estuary. Ynyslas Dunes are within Cardigan Bay. It is a small-scale ecosystem.
2. What species and adaptations are found at Ynyslas?	Marram grass: rolled leaf with waxy to protect from harsh winds and salt water. Stomata sunk into pits on inside of rolled leaf so photosynthesis can still take place. - Primary consumers: snails, Rabbits, Lizard, Butterfly - Secondary consumers: Hedgehog - Tertiary consumers: Fox, Buzzard, Gull, Dragonfly, Stonechat. Conservation began, Posts were sunk into the beach to prevent cars driving into the dunes. Wooden boardwalks were built across the dunes in 2 places to prevent further trampling and erosion.
3. How was Ynyslas developed in 1969?	Areas were fenced off to prevent trampling. Sand traps called brashings (branches and wire) were constructed and Marram Grass was planted to encourage layers of sand to be deposited – to help stabilise the dunes. Signs were put up around the reserve to inform the public of the management taking place.
4. How was Ynyslas developed in the 1980s?	Fences were removed as visitors were walking around them anyway. It was accepted that sand erosion was a natural process in the dunes. The blowing sand creates habitats for rare plants. Bins were installed.
5. How was Ynyslas developed in the 1990s?	Bins were removed as they were overflowing with rubbish. Areas were re-fenced off as rare birds such as linnet, stonechat and ring plovers were living and nesting amongst the dunes. Rabbits live in the dunes and they keep the grass short. The rabbit dung makes the soil more fertile which encourages plants to grow. The golf course isn't happy about the rabbits. A rabbit proof fence was built to prevent the rabbits entering. The fence is costly to maintain.
6. How was Ynyslas developed in the 2000s?	The visitor centre has been enlarged and improved. The boardwalks have also been improved. There is now wheelchair access.
7. How was Ynyslas developed in the 2005s?	The biggest problem is dog fouling. People are banned from walking their dogs in the summer months along Borth Beach to the south. Dog owners come to Ynyslas instead. The dog excrement doesn't decompose so it lies around for ages and it is a nuisance for other visitors.
9. What are the pressures at Ynyslas Dunes?	- Popular with tourists. - Tourists park their car close to the sand dunes. - Intensive trampling can damage the vegetation – leaving the dunes vulnerable to wind erosion and the formation of blowouts. - Litter – harms wildlife - Land is in demand who wish to develop the sand dunes for tourist developments such as caravan parks and golf courses. - Conservation groups such as the RSPB are keen to ensure that sand dunes are protected and conserved.
10. How were Ynyslas dunes formed?	Embryo Dunes: Formed when flotsam and jetsam are dropped at the strand line. Small dunes can form on this obstacle as it traps sand. Only halophytes can grow here Foredunes: Sand has become more stable and bigger dunes can form. Marram grass grows and binds the sand. Yellow dunes: Tall steep sided dunes form due to the colonisation of marram grass. These dunes are mobile due to the changing wind direction and build-up of sand. Grey Dunes/Fixed Dunes: The organic content of the dunes increases therefore the soil colour becomes darker. Increased biodiversity – gorse, brambles, butterflies, insects, birds such as the Ringed Plover, animals such as rabbits and stoats. Recreation, education, increased income from tourism, protects nearby homes from coastal flooding, increased biodiversity
11. What are the benefits for the local community?	Tourists, Local Residents, RSPB and conservation groups, Local council, Golf course owners
12. Who are stakeholders?	Halophytes: Salt tolerant plants such as sea rocket.
13. What do the following words mean?	Colonisation: A plant establishing itself in an area. Conservation: The action of protecting something. Biodiversity: The variety of living things in an area. Ecosystem: A community of plants and animals and the environment in which they live. Includes both the living and no living parts. Flotsam & Jetsam: Pile of discarded objects – driftwood, seaweed, plastic, rubbish, Stakeholders: A person with an interest or concern in something.

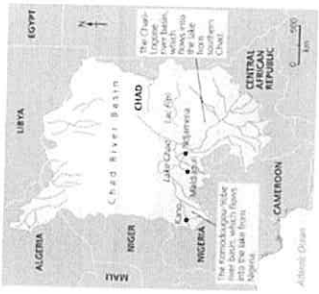
Practice Exam Questions

1. Compare the climate of a semi-arid biome with another biome you have studied.	8. Compare the impact of climate change on the semi-arid biome with another biome you have studied.
2. Compare the location of a semi-arid biome with another biome you have studied.	9. Describe the location of one small-scale ecosystem you have studied.
3. Compare the nutrient cycle of a semi-arid biome with another biome you have studied.	10. Why can it be difficult to manage small-scale ecosystems?
4. Compare the adaptations of a semi-arid biome with another biome you have studied.	11. How are sand dunes formed?
5. Compare the threats of a semi-arid biome with another biome you have studied.	12. Why are sand dunes beneficial for different stakeholders?
6. Compare the management of a semi-arid biome with another biome you have studied.	13. Explain how UK ecosystems may be under threat in the future.
7. Compare the stakeholders of a semi-arid biome with another biome you have studied.	

Geography – Water resources and management 1

Keywords	1. Water supply and demand		Water demand The demand for water is <u>increasing</u> globally, <u>by 2025</u> the world will require <u>5500 billion m3</u> of water, in the year 2000 this was around 4000 billion m3 and in 1990 just 600 billion m3. The demand for water is <u>not equal</u> everywhere this is due to: • <u>Population</u> – Larger population require more water, Asia currently uses the most water out of every continent due to having countries with extremely large populations. • <u>Consumerism</u> – HIC countries per capita use more water as their populations have become use to using water frequently. <u>NIC's</u> are the <u>fastest growing</u> in terms of their water consumption however as their <u>economy grows</u> increasing the number of <u>middle class</u> within their populations. Water Supply Just like water demand the supply of water globally is also <u>uneven</u>. <u>Environmental</u> factors that affect water supply: • <u>Climate</u> – some places experience more <u>precipitation</u> than others • <u>Climate change</u> – due to climate change some countries around the world are experiencing more <u>extreme weather events</u> like <u>drought</u> which reduces water supply • <u>Social</u> factors that affect water supply: <u>Economic</u> factors that affect water supply: • <u>Infrastructure</u> – it could be that your country has water but due to a lack of infrastructure and machinery you <u>can't</u> <u>extract, transport and clean</u> it for use. Economic factors often link with social factors as often in <u>LIC's</u> <u>women and children</u> will have to <u>walk for long periods of time</u> to access clean water for themselves and their families.
1. Water Supply	How much water an areas has		
2. Water Demand	How much water an area needs to support its people, economy and environment		
3. Water Footprint	The amount of water used per person both as direct and indirect water		
4. Direct water	Water that you can see		
5. Indirect water	Water you can't see but has been used in the manufacturing of a good.		
6. Water Security	When you have enough water to support your countries population, economy and environment.		
7. Water Insecurity	When you don't have enough water to support your countries population, economy and environment.		
8. Overabstraction	The process of taking too much water.		
9. Unsustainable Water Use	Not using water sustainably e.g. growing plants that require a large amount of water or using wasteful application methods.		
10. Water Transfer Scheme	Involves systems of dams, reservoirs, pipes or canals to transfer large amounts of water from a donor basin to a recipient basin.		
11. International	Between countries.		
Revision Questions			
1. Explain why the demand for water has increased (4 marks)			
2. Explain why the demand for water is higher in HIC's (4 marks)			
3. Define overabstraction and unsustainable water use (2 marks)			
4. Explain the SEE reasons why the supply of water in some areas is low (6 marks)			
5. Explain what could happen to a LIC if it is water insecure (6 marks)			
6. Explain what could happen to a HIC if it is water insecure (6 marks)			
7. Explain how transboundary water sources can result in tensions (6 marks)			
8. Explain the best way to manage water insecurity in a LIC (4 marks)			
9. Explain the best way to manage water insecurity in a HIC (4 marks)			
10. Explain the positives and negatives of dams (6 marks)			

2. Lake Chad, LIC Case Study	Lake Chad is a <u>freshwater</u> lake located in <u>west-central Africa</u> at the <u>conjunction of Chad, Cameroon, Nigeria, and Niger</u>. These are <u>LIC's</u>. Lake Chad has <u>shrunk by 90% since 1960</u>. There are <u>various causes</u> for Lake Chads reduction including: • <u>Over abstraction</u> – <u>agriculture</u> is the main source of income for Lake Chad therefore the <u>30 million people</u> the lake supports require water to make <u>money</u>. • <u>Unsustainable water use</u> – crops that are <u>water thirsty</u> (require large amounts of water) maybe <u>cheaper</u> to grow in the Sahel region, additionally water technology in the Sahel isn't modern therefore they lack the likes of <u>drip irrigation systems</u>. • <u>Dams</u> – <u>Nigeria</u> in particular have been building dams on the Yobe River which supports the Lake's water to keep up with their <u>population growth</u>. This however has reduced the Lakes water flow by <u>150 million cubic meters annually</u>. There are also <u>SEE impacts</u> of Lake Chads reduction including: • <u>Social</u> – People are forced to consume non-fresh water resources that could contain diseases like <u>cholera</u>. Additionally, <u>women and children</u> in particular are required to walk further distances in order to access clean water, this could mean they are <u>absent from school or work</u>. • <u>Economic</u> – The <u>agricultural industry</u> around the Lake Chad is <u>collapsing</u> as farmers <u>struggle</u> to water crops. Additionally, the Lake was once a <u>honeypot site</u> attracting many <u>tourists</u> however this has <u>significantly declined</u> since the <u>shrinking</u> of the lake. • <u>Environmental</u> – Fish stocks have <u>significantly reduced</u> in the lake as well as <u>livestock</u> on land. Additionally, <u>salinisation</u> has occurred on the soil, as people use non-fresh water <u>salt</u> from salty water is <u>left</u> on the soil once the water evaporates. The <u>Transaqua water project</u> has been proposed to <u>direct water</u> from the Congo River Basin to Lake Chad however the project is expected to <u>cost \$50 Billion</u> and therefore <u>other countries/bodies</u> would need to <u>fund</u> this for the Sahel region.
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3. The Murray Darling Basin, HIC Case Study

The Murray and Darling Rivers sit in the Murray Darling Basin to the South East of Australia. It spans over 1/7th of Australia in 4 states, New South Wales, Victoria, South Australia and Queensland. The basins water has decreased by 51% in the past 20 years.

There are various causes for The Murray Darling basins reduction including:

- **Population Growth** – Australia's population has increased every year since the 17th century. Population growth is particularly high in urban areas like Canberra, the capital of Australia which sees an increase of 2% in its population annually. Most of Australia's large cities are located close to the Murray Darling Basin.
- **Consumerism** – As Australia is a HIC its population have a large amount of disposable income to spend on water. For example swimming pools. Australia is the 10th highest country for water consumption globally.
- **Irrigation systems** – As Australia is a HIC it has irrigation systems installed which are used to grow crops for the growing population and culture of consumerism.

There are also SEE impacts of Murray Darlings reduction including:

- **Social** – The basin supports 2.3 million Australians without the water their health is impacted. The basin also has cultural influence for the First Nations People.
- **Economic** – Agriculture contributes \$22 billion to the USA's economy, without water this industry will be lost. The boating industry used to be popular on the basin but this is now being lost due to insufficient water.
- **Environmental** - Fish deaths become more likely. Less water means algal blooms and blackwater events are more likely. Less water also means the concentration of salt and toxic chemicals increases. Wetlands die without water.

The Snowy Highlands water project is a solution to the issues however. The \$820 Million scheme is Australia's largest engineering project which transfers water using tunnels totalling 145 km long from the Snowy Highlands on the coast of south east Australia (relief rainfall) into the Murray Darling basin. It is also a win-win project as it creates hydroelectric power through 16 dams.

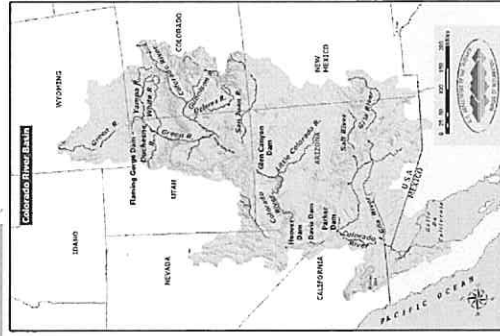
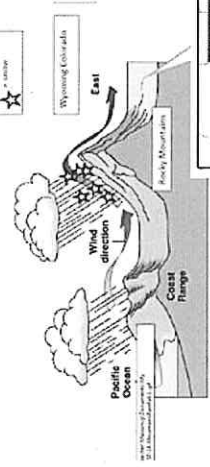
4. The Colorado River

The Colorado river is an international river that runs through 7 US states including Arizona, Nevada and California as well as Mexico. The river supports 40 million people.

Shares of the rivers water were established in 1920 however since the shares were established:

- **Climate change** – drought and other extreme weather events have become more common due to climate change since 1920 reducing the rivers water flow.
- **Population growth** – Some states and Mexico's population has increased since 1920. Phoenix in Arizona has the fastest population growth in the whole of the US. Population growth has increased the need for greater agriculture production.

Managing rivers across nations can be very difficult, resulting in issues. Each country will argue they need a high share of the water and countries can influence the rivers flow further downstream, for example by building dams.



5. Ways to manage water

Water transfer schemes

- + **Reservoirs and dams** can turn into tourist attractions for example Hoover Dam
- + **Hydro-Electric Power (HEP)** which is a renewable form of energy is made when dams are put on the transfer scheme.
- + **Work on a large scale** transferring huge volumes of water
- **Extremely expensive** and therefore not suitable for all countries
- **Can create tensions** if dams are built on the river as water flow further downstream is reduced.
- **Dams can alter marine ecosystems** as well as displacing land animals/humans when building as flooding occurs.

Rainwater harvesting/Fog Harvesting – collecting rainwater in butts/ a mesh sheet between 2 metal poles which condense fog into water.

- + **Cheap** and therefore suitable for all countries
- + **Simple** to construct
- **Requires rainfall/fog** which not all countries receive
- **Only works on a small-scale** providing water for a few individuals or a small community. **Aquifers** – water is stored in rock underground and pumping stations bring the water up onto the earth's surface.

- + **The quality and temperature** of the water when extracted is ideal for farming
- + **Aquifers can store large volumes** of water so this can work on a large scale
- **Requires precipitation** or salt water and porous rock
- **The pumping technology** can be expensive
- **Overabstraction** can occur and it takes a long amount of time to replenish the aquifer and surrounding ecosystems.

Desalination – removing salt from salty sea water making it useable.

- + Can work on a large scale as uses the oceans water
- **The cost of desalination** is extremely high and therefore it isn't suitable for all countries
- **The technology** requires the burning of fossil fuels
- **Some marine life** is killed in the process of extracting sea water

Persuade/force people to use less water – by writing laws/bans and enforcing them with fines or rewards. Councils can also refuse planning permissions on growth of thirsty industries to restrict the growth of them.

- + **Cheap option**
- + **Most people** will follow and therefore consumption will decrease
- + **Households** can save money
- + **Other non-thirsty industries** may get investment and therefore grow
- **Not all people** will follow which can result in community tensions
- It requires long term policing
- **Unemployment** and a reduction in tax occurs in the thirsty industries.



CIRCLES

Year 11 Higher Maths Absolute

A circle is a 2D shape where all of the points that form the circle are an equal distance from the centre.

π 'pi' is ratio of the circumference of every circle to its diameter $\pi = 3.1415926535897932...$

Key terms

Circumference
The distance around the outside of the circle.

Chord
A straight line that goes from one side of the circle to the other without passing through the centre.

Diameter
A straight line that goes from one side of the circle to the other and passes through the centre.

Radius
A straight line that goes from the centre to the circumference of the circle.

Tangent
A straight line that touches the circle at one point.

Arc
A part of the circle's circumference.

Sector
The area enclosed by two radii and an arc. It looks like a slice of pizza!

Segment
The area enclosed by a chord and an arc.

Circumference

$$C = \pi d \text{ or } C = 2\pi r$$

$$C = \pi \times 5$$

$$= 15.7 \text{ cm to 1 d.p.}$$

$$= 31.4 \text{ cm to 1 d.p.}$$

Area

$$A = \pi r^2$$

$$= \pi \times 10^2$$

$$= 100\pi$$

$$= 314.2 \text{ cm}^2 \text{ to 1 d.p.}$$

Volume of a cylinder

$$V = \pi r^2 h$$

$$= \pi \times 3^2 \times 9$$

$$= 81\pi$$

$$= 254.5 \text{ m}^3 \text{ to 1 d.p.}$$

Volume of a cone

$$V = \frac{1}{3} \pi r^2 h$$

$$= \frac{1}{3} \pi \times 4^2 \times 6$$

$$= 32\pi$$

$$= 100.5 \text{ cm}^3 \text{ to 1 d.p.}$$

Take care when working with semi circles or compound shapes involving circles.

Length of an arc

$$\text{Length of arc} = \frac{\theta}{360} \times \pi d$$

$$= \frac{120}{360} \times \pi \times 5$$

$$= 5.24 \text{ cm to 1 d.p.}$$

Area of a sector

$$\text{Area of sector} = \frac{\theta}{360} \times \pi r^2$$

$$= \frac{80}{360} \times \pi \times 10^2$$

$$= 69.8 \text{ cm}^2 \text{ to 1 d.p.}$$

Check that you:

- recognise 2D shapes and their properties
- understand the difference between perimeter, area and volume
- can substitute values into a formula
- can find missing angles on a straight line, at a point and in a triangle.

Volume of a Sphere

$$V = \frac{4}{3} \pi r^3$$

$$= \frac{4}{3} \pi \times 12^3$$

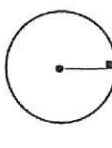
$$= 2304\pi$$

$$= 7238.2 \text{ cm}^3 \text{ to 1 d.p.}$$

Surface area of a sphere

$$SA = 4\pi r^2$$

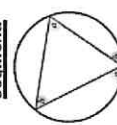
The tangent is perpendicular i.e. at 90° to the radius.



The lengths of two tangents from a point are always equal.



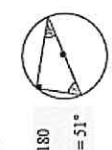
The angle between a tangent and a chord is equal to the angle in the alternate segment.



The angle at the centre is double the angle at the circumference.



The angle in a semicircle is a right-angle i.e. 90° .



Angles in the same segment are equal.



Circle Theorems



Angles in the same segment are equal.



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Vectors

Year 11 Higher Maths Absolute

A vector describes a movement of an object from one point to another.
A vector quantity has both magnitude and direction.

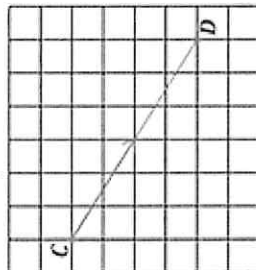
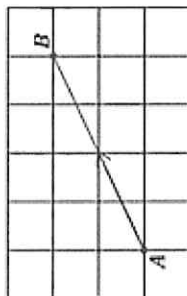
Vector representation

A vector between A and B can be described as $\overrightarrow{AB}$, $\mathbf{a}$ or $\underline{a}$.

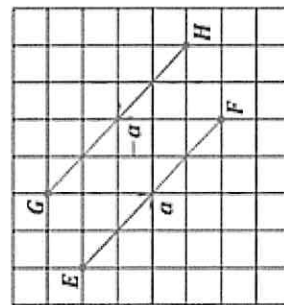
Vectors can be represented using the column vector $\begin{pmatrix} x \\ y \end{pmatrix}$. Where x is the number of moves in the positive horizontal direction, and y is number of moves in the positive vertical direction.

The below vector, $\overrightarrow{AB}$, can be written as $\begin{pmatrix} 4 \\ 2 \end{pmatrix}$.

The vector, $\overrightarrow{CD}$, can be written as $\begin{pmatrix} 6 \\ -4 \end{pmatrix}$.



Vectors, $\overrightarrow{EF}$ and $\overrightarrow{GH}$ are of equal magnitude but opposite direction.



$$\overrightarrow{EF} = -\overrightarrow{GH}$$

If $\overrightarrow{EF} = \mathbf{a}$,
then $\overrightarrow{GH} = -\mathbf{a}$

Check that you can:

- add, subtract and multiply negative numbers.

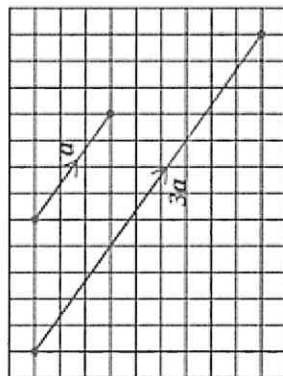
Multiplying vectors

When multiplying a vector by a scalar, multiply both x and y movements by the scalar.

Example 1

If $\mathbf{a} = \begin{pmatrix} 4 \\ -3 \end{pmatrix}$, calculate $3\mathbf{a}$.

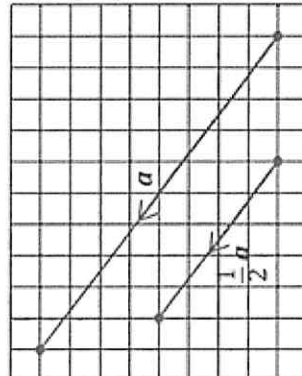
$$3\mathbf{a} = \begin{pmatrix} 3 \times 4 \\ 3 \times -3 \end{pmatrix} = \begin{pmatrix} 12 \\ -9 \end{pmatrix}$$



Example 2

If $\mathbf{a} = \begin{pmatrix} -10 \\ 8 \end{pmatrix}$, calculate $\frac{1}{2}\mathbf{a}$.

$$\frac{1}{2}\mathbf{a} = \begin{pmatrix} -10 \div 2 \\ 8 \div 2 \end{pmatrix} = \begin{pmatrix} -5 \\ 4 \end{pmatrix}$$



Adding and subtracting vectors

When adding or subtracting vectors either add the corresponding x components and y components or subtract them.

Example 1

If $\mathbf{a} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} -5 \\ 2 \end{pmatrix}$, then,

$$\mathbf{a} + \mathbf{b} = \begin{pmatrix} 3 \\ 2 \end{pmatrix} + \begin{pmatrix} -5 \\ 2 \end{pmatrix} = \begin{pmatrix} 3 + -5 \\ 2 + 2 \end{pmatrix} = \begin{pmatrix} -2 \\ 4 \end{pmatrix}$$

Example 2

If $\mathbf{a} = \begin{pmatrix} 4 \\ 2 \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} 2 \\ -3 \end{pmatrix}$, then,

$$\mathbf{a} - \mathbf{b} = \begin{pmatrix} 4 \\ 2 \end{pmatrix} - \begin{pmatrix} 2 \\ -3 \end{pmatrix} = \begin{pmatrix} 4 - 2 \\ 2 - -3 \end{pmatrix} = \begin{pmatrix} 2 \\ 5 \end{pmatrix}$$

REMEMBER!

Vectors have both magnitude and direction.

Scalars have magnitude only.

Negative vectors have the same magnitude but opposite direction.



Year 11 Higher Maths Absolute

+ - Trigonometric graphs

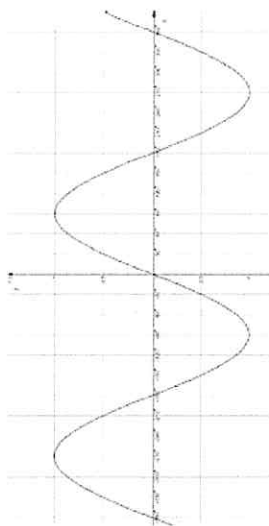
$\times \div$ Drawing, recognising and using the graphs of sin, cos and tan.

Check that you can:

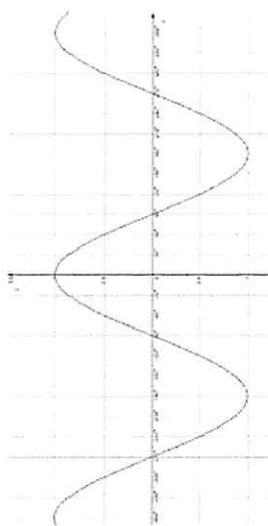
- ◆ solve equations to find the unknown variable
- ◆ use the trigonometric and inverse function buttons on your calculator.

Graph

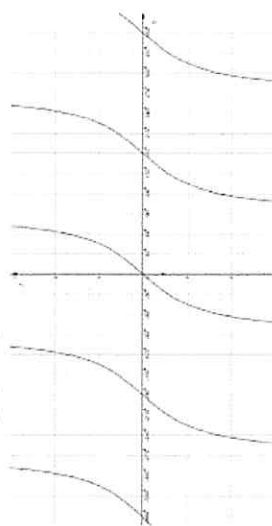
Here is the graph of $y = \sin x$ for the values $-360^\circ \leq x \leq 360^\circ$.



Here is the graph of $y = \cos x$ for the values $-360^\circ \leq x \leq 360^\circ$.



Here is the graph of $y = \tan x$ for the values $-360^\circ \leq x \leq 360^\circ$.



Key features

- ◆ The graph makes one complete 'wave' in 360° . This means that the graph repeats itself every 360° . This is referred to as the period of the graph.
- ◆ It goes through the origin $(0, 0)$.
- ◆ The maximum value is 1 and minimum is -1 so we can say that $-1 \leq \sin x \leq 1$.

- ◆ The graph makes one complete 'wave' in 360° . This means that the graph repeats itself every 360° . Therefore, the period of the graph is again 360° .
- ◆ It does not go through the origin $(0,0)$.
- ◆ It crosses the y axis at $(0,1)$.
- ◆ The maximum value is 1 and minimum is -1, so we can say that $-1 \leq \cos x \leq 1$.
- ◆ The shape is the same as $y = \sin x$ but it has been transformed (moved left 90°).
- ◆ The curve is symmetrical about the y-axis.

- ◆ The graph makes one complete 'wave' in 180° . This means that the graph repeats itself every 180° . Therefore, the period of the graph is 180° .
- ◆ It goes through the origin $(0,0)$.
- ◆ The shape is not similar to either the sin graph or the cos graph.
- ◆ There are some values that are undefined, i.e. values of $\tan x$ that will appear as an error on any calculator. There will be a break in the graph at these values, at $x = \pm 90^\circ, \pm 270^\circ, \dots$. The imaginary vertical lines at these values of x are called asymptotes – they are imaginary lines that the graph of $y = \tan x$ gets close to, but does not touch.
- ◆ There is no maximum or minimum value, so $-\infty \leq \tan x \leq \infty$.



FRACTION AND PERCENTAGE OF AN AMOUNT

A percentage is an amount 'out of 100'. A fraction is a way of describing parts of a whole amount. Percentages and fractions are common real-life applications of mathematics, therefore these methods will be useful for your studies and for the future too!

Check that you:

- know fraction, percentage and decimal equivalences
- can divide by 10 and 100
- can halve and double, multiply and divide
- can find a fraction of an amount
- can use a calculator efficiently.

Percentage of an amount (non-calculator)

E.g., 1) Find 15% of £65.

$$\begin{aligned} 10\% \text{ of } £65 &= 65 \div 10 = £6.50 \\ 5\% \text{ of } £65 &= 6.5 \div 2 = £3.25 \\ 15\% \text{ of } £65 &= 6.5 + 3.25 = £9.75 \end{aligned}$$

2) Find 32% of £41.

$$\begin{aligned} 10\% \text{ of } £41 &= 41 \div 10 = £4.10 \\ 30\% \text{ of } £41 &= 4.1 \times 3 = £12.30 \\ 1\% \text{ of } £41 &= 41 \div 100 = £0.41 \\ 2\% \text{ of } £41 &= 0.41 \times 2 = £0.82 \\ 32\% \text{ of } £41 &= 12.3 + 0.82 = £13.12 \end{aligned}$$

$$\begin{aligned} 50\% &\rightarrow \div 2 \\ 25\% &\rightarrow \div 4 \\ 10\% &\rightarrow \div 10 \\ 1\% &\rightarrow \div 100 \end{aligned}$$

Remember there is often more than one way to find a percentage of an amount.

Increase by a percentage

+

E.g., the population of a village of 1780 people

increases by 5%.

Find the new population.

$$\begin{aligned} 10\% \text{ of } 1780 &= 178 \quad 5\% \text{ of } 1780 = 178 \div 2 = 89 \\ \text{New population} &= \text{original} + \% \text{ increase} = 1780 + 89 = 1869 \end{aligned}$$

Decrease by a percentage

-

E.g., Lloyd receives a 20% discount on a laptop priced at £650.

How much does he pay?

$$\begin{aligned} 10\% \text{ of } £650 &= £65 \quad 20\% \text{ of } £650 = 65 \times 2 = £130 \\ \text{New price} &= \text{original} - \% \text{ decrease} = 650 - 130 = £520 \end{aligned}$$

Percentage change

$$\text{Percentage change} = \frac{\text{change}}{\text{original}} \times 100$$

E.g., 1) Dafydd received a pay increase following a promotion at work. His annual wage increased from £24000 to £29760.

What percentage increase is this?

$$\begin{aligned} \text{Percentage increase} &= \frac{29760 - 24000}{24000} \times 100 \\ &= \frac{5760}{24000} \times 100 \\ &= 24\% \end{aligned}$$

E.g., 2) Nia bought a summerhouse for the garden for £8500. She later sold it for £6000.

Find the percentage loss.

$$\begin{aligned} \text{Percentage loss} &= \frac{8500 - 6000}{8500} \times 100 \\ &= \frac{2500}{8500} \times 100 \\ &= 18.75\% \end{aligned}$$

Repeated percentage change

E.g., 1) Idris bought a brand new car for £18000. Each year the value of the car depreciates at a rate of 18%. Find the value of the car after 3 years.

$$\text{Value} = \text{Original value} \times \left(1 - \frac{\text{rate}}{100}\right)^{\text{number of years}}$$

$$\text{Value of the car after 3 years} = 18000 \times 0.82^3 = £9924.62$$

E.g., 2) Sera invests £3500 for 4 years at 2.5% per annum compound interest. Calculate the value of her investment at the end of the 4 years.

$$\text{Amount} = \text{Initial investment} \times \left(1 + \frac{\text{interest rate}}{100}\right)^{\text{number of years}}$$

$$\text{Amount} = 3500 \times \left(1 + \frac{2.5}{100}\right)^4$$

$$= 3500 \times (1.025)^4$$

$$= £3863.35$$

Reverse percentages

E.g., Gwennan buys a laptop and receives 30% student discount. Knowing that she pays £448 with her discount, find the original value of the laptop.

$$\text{Percentage of the original value} = 100 - 30 = 70\%$$

$$\begin{aligned} 70\% &= £448 \\ \div 70 & \quad \div 70 \\ 1\% &= £6.40 \\ \times 100 & \quad \times 100 \\ 100\% &= £640 \end{aligned}$$

The original value was £640.

Percentage of an amount (calculator)

E.g., 1) Find 90% of £328.

$$\frac{90}{100} \times 328 = £295.20 \quad \text{or} \quad 0.9 \times 328 = £295.20$$

2) Find 63% of £65.

$$\frac{63}{100} \times 65 = £40.95 \quad \text{or} \quad 0.63 \times 65 = £40.95$$

3) Find 7% of £41.

$$\frac{7}{100} \times 41 = £2.87 \quad \text{or} \quad 0.07 \times 41 = £2.87$$

Method 1 $\frac{\text{Percentage}}{100} \times \text{amount}$

Method 2 Equivalent decimal $\times$ amount

Writing a quantity as a percentage of another

E.g., 1) What percentage of 20 is 17?

$$\begin{aligned} \frac{17}{20} &= \frac{85}{100} = 85\% \\ \times 5 & \quad \div 5 \\ 17 \div 20 \times 100 &= 85\% \end{aligned}$$

2) Of the £75 Sara received for her birthday, she spent £39 of it. What percentage is this?

$$\begin{aligned} \frac{39}{75} &= \frac{52}{100} = 52\% \\ \div 3 & \quad \times 4 \\ 39 \div 75 \times 100 &= 52\% \end{aligned}$$

Remember finding an equivalent fraction with a denominator of 100 is easy when the original fraction has a denominator of 2, 4, 5, 10, 20, 25, 50 or even a multiple of 100. With any other denominator see if you can first find an equivalent fraction with one of these as a denominator.

Percentage change using multiplier

Increase £54 by 12%.

$$1.12 \times 54 = £60.48$$

Increase 3.5kg by 8%.

$$1.08 \times 3.5 = 3.78\text{kg}$$

Decrease 720 by 3%.

$$0.97 \times 720 = 698.4$$

Decrease 180 cm by 40%.

$$0.6 \times 180 = 108 \text{ cm}$$

PERCENTAGE INCREASE
100% + 5% = 105% multiplier 1.05
100% + 15% = 115% multiplier 1.15
100% + 20% = 120% multiplier 1.2

PERCENTAGE DECREASE
100% - 5% = 95% multiplier 0.95
100% - 15% = 85% multiplier 0.85
100% - 20% = 80% multiplier 0.8

Finding a fraction of a quantity

A unit fraction is a fraction which has a numerator of 1.

For example, $\frac{1}{2}, \frac{1}{5}, \frac{1}{8}$, etc.

To find the fraction of a quantity – where the fraction is a unit fraction – simply divide by the denominator. For example:

to find $\frac{1}{2}$ of an amount, we divide it by 2,

to find $\frac{1}{3}$ of an amount, we divide it by 3,

to find $\frac{1}{4}$ of an amount, we divide it by 4.

When the fraction is not a unit fraction

When finding a fraction of an amount, divide by the denominator and multiply by the numerator.

Example 1

Find $\frac{3}{4}$ of 240. Step 1: Find $\frac{1}{4}$ of 240 by dividing by the denominator.

$$\frac{1}{4} \text{ of } 240 = 240 \div 4 = 60.$$

Step 2: Then, to find $\frac{3}{4}$ of 240, multiply by the numerator. As $\frac{1}{4}$ of 240 = 60,

$$\frac{3}{4} \text{ of } 240 = 60 \times 3 = 180.$$

When using a calculator, combining the two calculations is easier and less likely to lead to errors.

$$\frac{3}{4} \text{ of } 240 = 240 \div 4 \times 3 = 180.$$

Angles

$+$ $-$
 $\times$ $\div$

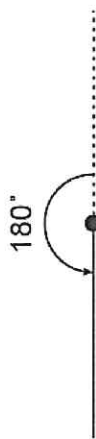
Angles are formed when two lines meet. The lines form the arms of the angle, and the angle measures the amount of rotation needed to move from one arm to the other.



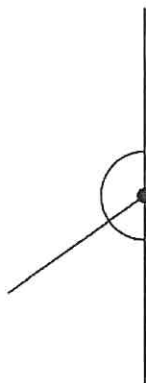
Year 11 Foundation Maths Absolute

Angles on a straight line

If a line is turned through half a complete turn, then it has turned through 180° .



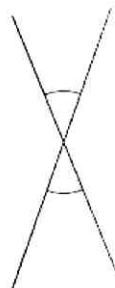
We can use this fact to help us calculate the angles that are formed when one or more lines come to meet at a point on another line. In this diagram, the two angles formed above the horizontal line. They combine to form the half turn angle of 180° .



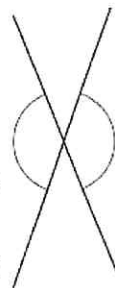
We refer to these angles as being 'angles on a straight line'. The rule for these angles is that angles on a straight line always add to 180° .

Vertically opposite angles

When two or more straight lines cross each other, vertically opposite angles are formed.



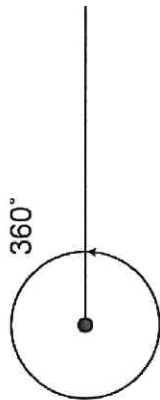
In the same diagram, we can identify another pair of vertically opposite angles.



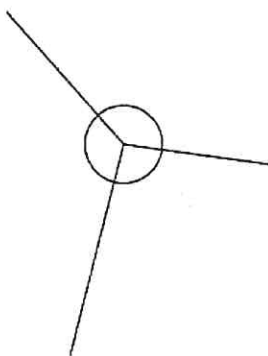
The rule for vertically opposite angles is that vertically opposite angles are equal to each other.

Angles around a point

If a line is turned through a full turn, then it has turned through 360° .



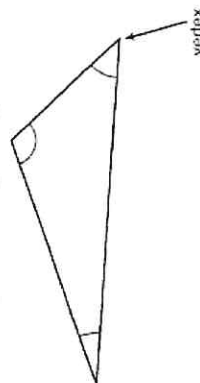
We can use this fact to help us calculate the angles that are formed when two or more lines meet at a point. In this diagram, the three angles that are formed combine to form the full turn angle of 360° .



We refer to these angles as 'angles around a point'. The rule for these angles is that angles around a point always add to 360° .

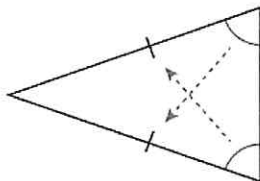
Angles in a triangle

Every triangle has three vertices and three interior angles. The rule for the angles in a triangle is that the angles in a triangle always add to 180° .



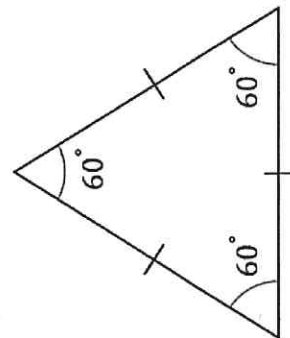
Isosceles triangles

In an isosceles triangle, two of the sides are of equal length, and two of the angles are equal. In this isosceles triangle, the two angles at the base (or bottom) of the triangle are equal. The two sides that are opposite these angles (follow the arrows) will then be equal. They are marked with a short line striking through each equal side.



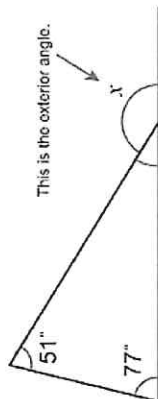
Equilateral triangles

All equilateral triangles have three equal sides and three equal angles. In equilateral triangles, every angle is 60° . For any equilateral triangle, the angles will always be the same size, 60° . However, although the lengths of the three sides will all be equal within a given equilateral triangle, they can be of any length, meaning we can have different sized equilateral triangles.



Exterior angles

Sometimes, one of the sides of the triangle is extended which then creates an exterior angle. As the name suggests, this angle will be outside the triangle.



We can start by calculating the third angle inside the triangle.

$$\begin{aligned}
 77 + 51 + (3^{\text{rd}} \text{ angle}) &= 180 \\
 (\text{Angles in a triangle add to } 180^\circ) \\
 128 + (3^{\text{rd}} \text{ angle}) &= 180 \\
 &= 180 - 128 \\
 &= 52^\circ
 \end{aligned}$$

Now we can calculate the size of angle x , by focusing on the angles on the right of the triangle.

$$\begin{aligned}
 \text{These two angles are angles on a straight line.} \\
 52 + x &= 180 \\
 x &= 180 - 52 \\
 x &= 128^\circ
 \end{aligned}$$



Check that you can:

- recognise the different types of angles, i.e. acute, right-angle, obtuse, straight and reflex
- remember the properties of the different types of triangle
- recognise parallel lines.



Four operations with fractions

Adding, subtracting, multiplying and dividing fractions.

Year 11 Foundation Maths Absolute

Check that you can:

- find the lowest common multiple (LCM) of two numbers
- simplify fractions
- turn an improper fraction into a mixed number fraction
- find the reciprocal of a number.

Adding and subtracting fractions with a common denominator

To add or subtract fractions that have a common denominator, we simply add or subtract the numerators (the denominator stays the same). We may need to simplify our fraction to get the final answer.

Example 1

$$\frac{1}{5} + \frac{2}{5} = \frac{3}{5}$$

Example 2

$$\frac{1}{8} + \frac{3}{8} = \frac{4}{8} = \frac{1}{2}$$

Example 3

$$\frac{5}{9} - \frac{2}{9} = \frac{(5-2)}{9}$$

$$= \frac{3}{9}$$

$$= \frac{1}{3}$$

Multiplying fractions

To multiply fractions together, we simply multiply the numerators and multiply the denominators. We may need to simplify our fraction to get the final answer.

Example 2

$$\frac{4}{5} \times \frac{3}{8} = \frac{4 \times 3}{5 \times 8}$$

$$= \frac{12}{40}$$

$$= \frac{3}{10}$$

Example 1

$$\frac{1}{5} \times \frac{2}{3} = \frac{1 \times 2}{5 \times 3}$$

$$= \frac{2}{15}$$

Example 2 can be solved by simplifying first. This can make the multiplication step easier because the numbers are smaller.

$$\frac{4}{5} \times \frac{3}{8} = \frac{4 \times 3}{5 \times 8}$$

$$= \frac{1 \times 3}{5 \times 2}$$

$$= \frac{3}{10}$$

Adding and subtracting fractions without a common denominator

When the denominators of the fractions that we want to add or subtract are different, we must first use our knowledge of equivalent fractions to write each fraction with the same, or common denominator.

Then, we simply add or subtract the numerators (the denominator stays the same).

Finally, we may need to simplify our fraction to get the final answer.

Example 1

$$\frac{2}{9} + \frac{5}{6}$$

The LCM of 9 and 6 is 18, so we use 18 as our common denominator.

$$\frac{2}{9} = \frac{4}{18} \text{ and } \frac{5}{6} = \frac{15}{18}$$

$$\frac{2}{9} + \frac{5}{6} = \frac{4}{18} + \frac{15}{18} = \frac{19}{18}$$

Here, as the answer is an improper fraction, it is usual to change the answer to a mixed number. $19 \div 18 = 1$ with a remainder of 1, and so the answer is:

$$= 1 \frac{1}{18}$$

Example 2

$$\frac{3}{4} - \frac{1}{10}$$

The LCM of 4 and 10 is 20, so we use 20 as our common denominator.

$$\frac{3}{4} = \frac{15}{20} \text{ and } \frac{1}{10} = \frac{2}{20}$$

$$\frac{3}{4} - \frac{1}{10} = \frac{15}{20} - \frac{2}{20} = \frac{13}{20}$$

REMEMBER!

To add and subtract fractions, we must ensure they have the same denominator.

Dividing fractions

To divide by a fraction, we simply multiply by its reciprocal. To find the reciprocal of a fraction, we just turn it upside down – in other words, we switch the numerator and denominator. For example:

- the reciprocal of $\frac{2}{5}$ is $\frac{5}{2}$

- the reciprocal of $\frac{1}{8}$ is $\frac{8}{1}$ (which is simply 8)

- the reciprocal of 5 is $\frac{1}{5}$ (because 5 is the same as $\frac{5}{1}$).

Example 1

$$\frac{3}{10} \div \frac{2}{5}$$

The first fraction, $\frac{3}{10}$, stays the same, and we multiply by the reciprocal of the second fraction, $\frac{5}{2}$.

$$\frac{3}{10} \div \frac{2}{5} = \frac{3}{10} \times \frac{5}{2}$$

$$= \frac{15}{20}$$

$$= \frac{3}{4}$$

Another way to do this is simplify first.

$$\frac{3}{10} \div \frac{2}{5} = \frac{3}{10} \times \frac{5}{2}$$

$$= \frac{3 \times 5}{10 \times 2}$$

$$= \frac{3 \times 1}{2 \times 2}$$

$$= \frac{3}{4}$$



FRACTION AND PERCENTAGE OF AN AMOUNT

A percentage is an amount 'out of 100'. A fraction is a way of describing parts of a whole amount. Percentages and fractions are common real-life applications of mathematics, therefore these methods will be useful for your studies and for the future too!

Check that you:

- know fraction, percentage and decimal equivalences
- can divide by 10 and 100
- can halve and double, multiply and divide
- can find a fraction of an amount
- can use a calculator efficiently.

Percentage of an amount (non-calculator)

E.g., 1) Find 15% of £65.

$$\begin{aligned} 10\% \text{ of } £65 &= 65 \div 10 = £6.50 \\ 5\% \text{ of } £65 &= 6.5 \div 2 = £3.25 \\ 15\% \text{ of } £65 &= 6.5 + 3.25 = £9.75 \end{aligned}$$

2) Find 32% of £41.

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$$\begin{aligned} 50\% &\rightarrow \div 2 \\ 25\% &\rightarrow \div 4 \\ 10\% &\rightarrow \div 10 \\ 1\% &\rightarrow \div 100 \end{aligned}$$

Remember there is often more than one way to find a percentage of an amount.

Increase by a percentage

E.g., the population of a village of 1780 people increases by 5%.

Find the new population.

$$\begin{aligned} 10\% \text{ of } 1780 &= 178 \quad 5\% \text{ of } 1780 = 178 \div 2 = 89 \\ \text{New population} &= \text{original} + \% \text{ increase} = 1780 + 89 = 1869 \end{aligned}$$

Decrease by a percentage

E.g., Lloyd receives a 20% discount on a laptop priced at £650.

How much does he pay?

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Percentage change

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E.g., 1) Dafydd received a pay increase following a promotion at work. His annual wage increased from £24000 to £29760.

What percentage increase is this?

$$\begin{aligned} \text{Percentage increase} &= \frac{29760 - 24000}{24000} \times 100 \\ &= \frac{5760}{24000} \times 100 \\ &= 24\% \end{aligned}$$

E.g., 2) Nia bought a summerhouse for the garden for £8500. She later sold it for £6000.

Find the percentage loss.

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Repeated percentage change

E.g., 1) Idris bought a brand new car for £18000. Each year the value of the car depreciates at a rate of 18%. Find the value of the car after 3 years.

$$\text{Value} = \text{Original value} \times \left(1 - \frac{\text{rate}}{100}\right)^{\text{number of years}}$$

$$\text{Value of the car after 3 years} = 18000 \times 0.82^3 = £9924.62$$

E.g., 2) Sera invests £3500 for 4 years at 2.5% per annum compound interest. Calculate the value of her investment at the end of the 4 years.

$$\text{Amount} = \text{Initial investment} \times \left(1 + \frac{\text{interest rate}}{100}\right)^{\text{number of years}}$$

$$\text{Amount} = 3500 \times \left(1 + \frac{2.5}{100}\right)^4$$

$$= 3500 \times (1.025)^4$$

$$= £3863.35$$

Reverse percentages

E.g., Gwennan buys a laptop and receives 30% student discount. Knowing that she pays £448 with her discount, find the original value of the laptop.

$$\text{Percentage of the original value} = 100 - 30 = 70\%$$

$$\begin{aligned} 70\% &= £448 \\ \div 70 & \quad \div 70 \\ 1\% &= £6.40 \\ \times 100 & \quad \times 100 \\ 100\% &= £640 \end{aligned}$$

The original value was £640.

Percentage of an amount (calculator)

$$\text{Method 1} \quad \frac{\text{Percentage}}{100} \times \text{amount}$$

$$\text{Method 2} \quad \text{Equivalent decimal} \times \text{amount}$$

E.g., 1) Find 90% of £328.

$$\frac{90}{100} \times 328 = £295.20 \quad \text{or} \quad 0.9 \times 328 = £295.20$$

2) Find 63% of £65.

$$\frac{63}{100} \times 65 = £40.95 \quad \text{or} \quad 0.63 \times 65 = £40.95$$

3) Find 7% of £41.

$$\frac{7}{100} \times 41 = £2.87 \quad \text{or} \quad 0.07 \times 41 = £2.87$$

Writing a quantity as a percentage of another

E.g., 1) What percentage of 20 is 17?

$$\begin{aligned} \frac{17}{20} &= \frac{85}{100} = 85\% \\ \times 5 & \quad \times 5 \\ 17 \div 20 \times 100 &= 85\% \end{aligned}$$

2) Of the £75 Sara received for her birthday, she spent £39 of it. What percentage is this?

$$\begin{aligned} \frac{39}{75} &= \frac{52}{100} = 52\% \\ \div 3 & \quad \div 3 \quad \times 4 \quad \times 4 \\ 39 \div 75 \times 100 &= 52\% \end{aligned}$$

Remember finding an equivalent fraction with a denominator of 100 is easy when the original fraction has a denominator of 2, 4, 5, 10, 20, 25, 50 or even a multiple of 100. With any other denominator see if you can first find an equivalent fraction with one of these as a denominator.

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Decrease 720 by 3%.

$$0.97 \times 720 = 698.4$$

Decrease 180 cm by 40%.

$$0.6 \times 180 = 108 \text{ cm}$$

PERCENTAGE INCREASE

$$\begin{aligned} 100\% + 5\% &= 105\% \text{ multiplier } 1.05 \\ 100\% + 15\% &= 115\% \text{ multiplier } 1.15 \\ 100\% + 20\% &= 120\% \text{ multiplier } 1.2 \end{aligned}$$

PERCENTAGE DECREASE

$$\begin{aligned} 100\% - 5\% &= 95\% \text{ multiplier } 0.95 \\ 100\% - 15\% &= 85\% \text{ multiplier } 0.85 \\ 100\% - 20\% &= 80\% \text{ multiplier } 0.8 \end{aligned}$$

Finding a fraction of a quantity

A unit fraction is a fraction which has a numerator of 1.

For example, $\frac{1}{2}, \frac{1}{5}, \frac{1}{9}$, etc.

To find the fraction of a quantity – where the fraction is a unit fraction – simply divide by the denominator. For example:

to find $\frac{1}{2}$ of an amount, we divide it by 2,

to find $\frac{1}{3}$ of an amount, we divide it by 3,

to find $\frac{1}{4}$ of an amount, we divide it by 4.

When the fraction is not a unit fraction

When finding a fraction of an amount, divide by the denominator and multiply by the numerator. Example 1

Find $\frac{3}{4}$ of 240. Step 1: Find $\frac{1}{4}$ of 240 by dividing by the denominator.

$$\frac{1}{4} \text{ of } 240 = 240 \div 4 = 60.$$

Step 2: Then, to find $\frac{3}{4}$ of 240, multiply by the numerator. As $\frac{1}{4}$ of 240 = 60,

$$\frac{3}{4} \text{ of } 240 = 60 \times 3 = 180.$$

When using a calculator, combining the two calculations is easier and less likely to lead to errors.

$$\frac{3}{4} \text{ of } 240 = 240 \div 4 \times 3 = 180.$$



Vectors

A vector describes a movement of an object from one point to another.
A vector quantity has both magnitude and direction.

Check that you can:

- add, subtract and multiply negative numbers.

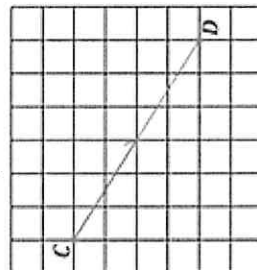
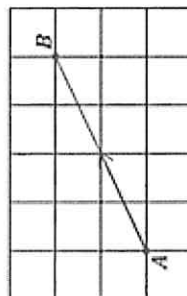
Vector representation

A vector between A and B can be described as $\overrightarrow{AB}$, $\overrightarrow{AB}$, $\mathbf{a}$ or $\underline{a}$.

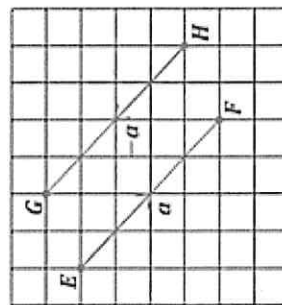
Vectors can be represented using the column vector $\begin{pmatrix} x \\ y \end{pmatrix}$. Where x is the number of moves in the positive horizontal direction, and y is number of moves in the positive vertical direction.

The below vector, $\overrightarrow{AB}$, can be written as $\begin{pmatrix} 4 \\ 2 \end{pmatrix}$.

The vector, $\overrightarrow{CD}$, can be written as $\begin{pmatrix} 6 \\ -4 \end{pmatrix}$.



Vectors, $\overrightarrow{EF}$ and $\overrightarrow{GH}$ are of equal magnitude but opposite direction.



$$\overrightarrow{EF} = -\overrightarrow{GH}$$

If $\overrightarrow{EF} = \mathbf{a}$,
then $\overrightarrow{GH} = -\mathbf{a}$

Adding and subtracting vectors

When adding or subtracting vectors either add the corresponding x components and y components or subtract them.

Example 1

If $\mathbf{a} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} -5 \\ 2 \end{pmatrix}$, then,

$$\mathbf{a} + \mathbf{b} = \begin{pmatrix} 3 \\ 2 \end{pmatrix} + \begin{pmatrix} -5 \\ 2 \end{pmatrix} = \begin{pmatrix} 3 + -5 \\ 2 + 2 \end{pmatrix} = \begin{pmatrix} -2 \\ 4 \end{pmatrix}$$

Example 2

If $\mathbf{a} = \begin{pmatrix} 4 \\ 2 \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} 2 \\ -3 \end{pmatrix}$, then,

$$\mathbf{a} - \mathbf{b} = \begin{pmatrix} 4 \\ 2 \end{pmatrix} - \begin{pmatrix} 2 \\ -3 \end{pmatrix} = \begin{pmatrix} 4 - 2 \\ 2 - -3 \end{pmatrix} = \begin{pmatrix} 2 \\ 5 \end{pmatrix}$$

REMEMBER!

Vectors have both magnitude and direction.

Scalars have magnitude only.

Negative vectors have the same magnitude but opposite direction.

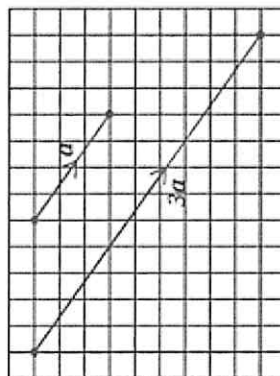
Multiplying vectors

When multiplying a vector by a scalar, multiply both x and y movements by the scalar.

Example 1

If $\mathbf{a} = \begin{pmatrix} 4 \\ -3 \end{pmatrix}$, calculate $3\mathbf{a}$.

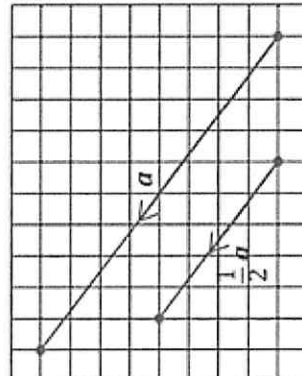
$$3\mathbf{a} = \begin{pmatrix} 3 \times 4 \\ 3 \times -3 \end{pmatrix} = \begin{pmatrix} 12 \\ -9 \end{pmatrix}$$



Example 2

If $\mathbf{a} = \begin{pmatrix} -10 \\ 8 \end{pmatrix}$, calculate $\frac{1}{2}\mathbf{a}$.

$$\frac{1}{2}\mathbf{a} = \begin{pmatrix} -10 \div 2 \\ 8 \div 2 \end{pmatrix} = \begin{pmatrix} -5 \\ 4 \end{pmatrix}$$



Religious Education - Applied Theology

Life and Death

Catholic beliefs about death, eternal life, and the value of human life

Key Beliefs

Catholics believe that death is a natural part of life, not the end.

In the words of the Funeral Liturgy, life is “changed, not ended.”

The soul lives on after the body dies, continuing its journey toward God.

The hope of eternal life means living forever with God in heaven.

It brings comfort and meaning to life and death.

It reminds Catholics that life has a purpose beyond this world.

This belief is rooted in the resurrection of Jesus.

Catholics believe that because Jesus rose from the dead, they too will rise.

His victory over death is the foundation of Christian hope.

These beliefs also reflect the deep value of every human life—from beginning to end. Life is sacred, and death is not the final word.

Dying Well (Catholic Teaching)

Dying well is part of living faithfully. Catholics are encouraged to prepare for death with peace and dignity.

This includes:

- Spending time with loved ones
- Making peace with others
- Receiving the Sacrament of the Sick
- Planning their funeral liturgy

These actions help the person face death with hope, comfort, and spiritual readiness.

The Church teaches that life is sacred and must be respected until natural death.

This means rejecting euthanasia and assisted suicide, which go against the belief in the dignity of every human life.

Dying well is not just about the end—it’s about trusting in God, loving others, and leaving this life in peace.

Palliative Care

Palliative care is fully supported by the Catholic Church.

It focuses on **relieving pain and suffering**, especially for those who are seriously ill or nearing the end of life.

This type of care is valued because it:

- **Respects the dignity** of the person
- **Allows for a natural and peaceful death**
- **Offers comfort**, not a cure, when healing is no longer possible

In his encyclical *Evangelium Vitae*, Pope John Paul II taught that **palliative care** is a moral and compassionate response to suffering.

The quote from Pope John Paul II's *Evangelium Vitae* that supports the Church's teaching on **palliative care** is:

"Even when death is thought imminent, patients must be given care and attention which helps them to live their last moments in comfort and dignity." (*Evangelium Vitae*, 65)

This quote affirms that **palliative care** is aligned with Catholic values. It emphasises the importance of **comfort, dignity, and respect** for life even in its final stages.

It reflects the Church's belief in the **sanctity of life** and the importance of **accompanying the dying with love and care**.

Sanctity of Life

Catholics believe in the **sanctity of life**—that every human life is **sacred from conception to natural death**.

Life is a **gift from God**, and only God has the right to give and take life.

Because of this belief, the Church teaches that euthanasia and **assisted suicide** are **morally wrong**.

They go against the Fifth Commandment:— **"Do not kill."**

Respecting the sanctity of life means **caring for the vulnerable**, supporting the dying with compassion, and trusting in God's plan for every stage of life.

Suffering and Purpose

Catholics believe that **suffering can have spiritual value**.

It is not meaningless—it can help people **grow in faith**, develop **compassion**, and **unite with the suffering of Christ**.

In moments of pain, believers are invited to trust in God and find deeper purpose.

The Church also teaches that **not everyone is called to suffer heroically**.

People should seek **comfort, healing, and support** when needed.

Suffering is not something to be glorified, but something to be faced with **faith, dignity, and hope**.

Resurrection and the Soul

Catholics believe in the **resurrection of both body and soul**. Death is not the end—**life continues** in a new and transformed way. **St Paul** taught that our **heavenly bodies will be transformed**—no longer weak or mortal, but **glorified and united with God**. This belief gives hope that we will be **fully restored** in eternal life. The **soul** is the **spiritual part of a person**. It lives on after death and is destined to be **reunited with the body** in the resurrection. This reflects the Catholic view that **every person is a unity of body and soul**, created for eternal life with God.

Judgement and the Afterlife

Catholics believe in both **Particular Judgement** and **Final Judgement**. At the moment of death, each person faces **Particular Judgement**—a personal encounter with God where their life is judged based on their **faith and actions**. At the end of time, there will be a **Final Judgement**, when **all people will be judged together**.

This is when God will fully reveal His justice and mercy to the whole world.

Jesus’ **parables**, like the **Sheep and the Goats** and **The Rich Man** and **Lazarus**, show that God rewards love, compassion, and justice, and **punishes selfishness and indifference**.

These stories remind us that how we treat others has eternal consequences.

Heaven, Hell, and Purgatory

Belief	Meaning
Heaven	Eternal life with God. A place of peace, joy, and union with God.
Hell	Eternal separation from God. Chosen by those who reject God’s love.
Purgatory	A process of purification before entering heaven. Not a place of punishment, but of hope.

Half term 1 – Communication and the world around us. Theme 3. The environment and where people live.

Quiz 1.1 – Mixed tenses revision

Ich esse gern Hähnchen	I like eating chicken
Wir treiben oft Sport	We often do sport
Ich habe Obst und Gemüse gegessen	I ate fruit and veg
Ich bin in die Stadt gegangen	I went into town
Ich werde vielleicht heiraten	Maybe I will get married
In der Zukunft will ich eine gute Karriere haben	In the future I want to have a good career
Wenn ich mehr Geld hätte, würde ich nochmal hingehen	If I were to have more money I would go there again

Quiz 1.2 Bei mir zu Hause (at home)

Ich wohne auf dem Land	I live in the country
Wir wohnen im Stadtzentrum	We live in the town centre
Ich wohne am Stadtrand	I live on the edge of town
Meine Familie und ich wohnen an der Küste	Me and my family live on the coast
Ich wohne in einem kleinen Dorf	I live in a little village
Wir haben ein schönes Haus in einer ruhigen Gegend	We have a nice house in a quiet area

Quiz 1.3 Beschreib dein Haus (describe your house)

Mein Haus hat drei Schlafzimmer und zwei Badezimmer	My house has three bedrooms and two bathrooms
Ich habe mein eigenes Schlafzimmer	I have my own bedroom
Wir haben einen schönen Garten	We have a nice garden
In meinem Zimmer gibt es ein bequemes Doppelbett	In my room there is a comfy double bed
Wir haben freundliche Nachbarn	We have friendly neighbours
Meine Familie wohnt in diesem Haus seit zehn Jahren (present tense with seit)	My family has lived in this house for ten years (translated as past tense in English)

Quiz 1.4 in meiner Gegend / in meiner Umgebung (in my area / surroundings)

Es gibt einen kleinen Supermarkt	There is a small supermarket
Wir haben viele Geschäfte in der Nähe	We have lots of shops nearby
In meiner Gegend gibt es viele Cafés	There are lots of cafés in my area
Es gibt interessante Dinge zu tun	There are interesting things to do
Ich würde lieber im Ausland wohnen	I would rather live abroad
Es gibt einen wunderbaren Blick auf die ganze Stadt	There is a wonderful view of the whole town

Quiz 1.5 in meiner Gegend / in meiner Umgebung (in my area / surroundings)

In meiner Stadt gibt es ein schönes Schloss	
Leider hat meine Stadt kein Kino	
Meine Gegend gefällt mir	
Es kann ein bisschen langweilig sein	
Ein Nachteil ist, dass es keine Geschäfte gibt	

Model answers

90 word writing task You write an email to attract Austrian tourists to your town. Describe <i>*what there is to do in your area</i> <i>*what place of interest you visited recently</i> <i>*a future event in your area</i>	In meiner Gegend gibt es viel für Touristen. Zum Beispiel haben wir viele Geschäfte in der Nähe, wo man Geschenke und Souvenirs kaufen kann. Ausserdem gibt es viele interessante Dinge zu tun daher kann man viel Spass haben. Normalerweise gehe ich mit meinen Freunden in die Stadtmitte, weil es interessant und empfehlenswert ist. Jedoch ist das Wetter manchmal schlecht. Neulich habe ich mit meiner Familie die Altstadt besucht, um uns zu entspannen. Wir haben Fotos gemacht, weil die alten Gebäude wirklich schön sind. Später haben wir in einem Restaurant gegessen, obwohl es teuer war. Es gefällt mir, hier zu wohnen. Nächste Woche gibt es ein Musikfest in meiner Gegend. Ich werde vielleicht Eintrittskarten kaufen, da ich Musik sehr toll finde. Es gibt viele Bands und Sänger und man kann dort tanzen und mitsingen. Meiner Meinung nach wäre das toll.
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150 word writing task You are writing to your German exchange partner who is coming to stay. Describe <i>*your home and local area</i> <i>*what activities you did at home recently</i>	Ich wohne mit meiner Familie in einem Einfamilienhaus im Stadtzentrum. Wir haben drei Schlafzimmer und zwei Badezimmer daher habe ich mein eigenes Schlafzimmer, wo es ein schönes Doppelbett gibt. Es gefällt mir, hier zu wohnen denn es gibt interessante Dinge zu tun. Zum Beispiel kann man gut einkaufen gehen, weil es viele Geschäfte in der Nähe gibt, obwohl es teuer ist! Ausserdem haben wir ein Kino und viele Cafés, wo man Freunde treffen kann, um sich zu entspannen. Ein Nachteil ist, dass wir kein Fitnesszentrum haben deswegen kann es ein bisschen langweilig sein, wenn man sportlich ist. Ehrlich gesagt habe ich neulich zu Hause nicht viel gemacht, da das Wetter wirklich schön war und ich bin oft mit meinen Freunden zum Park gegangen, um frische Luft zu schnappen. Der Park ist besonders eindrucksvoll im Sommer, weil es viele Bäume und Blumen gibt. Jedoch am Abend, als ich zu Hause war, habe ich ein bisschen ferngesehen und leider habe ich stundenlang auf meinem Handy mit Freunden gechattet. Meiner Ansicht nach ist das nicht gesund. Wenn ich mehr Geld hätte, würde ich vielleicht online einkaufen oder Aktivitäten mit Freunden planen. Das wäre bestimmt sehr schön! Morgen werde ich in der Küche einen Kuchen backen, weil meine Mutter Geburtstag hat.
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Half Term 2 – Communication and the world around us. Theme 3. The environment and where people live

Quiz 2.1 Mixed tense revision!

Ich wohne gern hier	I like living here
Ich wohne hier seit sechs Jahren	I have lived here for 6 years
Ich bin einkaufen gegangen	I went shopping
Ich habe meine Freunde im Park getroffen	I met my friends in the park
Vielleicht werde ich in die Stadt gehen	Perhaps I will go into town
Nächstes Wochenende werde ich mit meiner Familie einen Ausflug machen	Next weekend I will go on a trip / excursion with my family

Quiz 2.2 ich helfe der Umwelt

Ich trenne meinen Müll	I separate my rubbish
Ich recycle immer Glas und Paper	I always recycle glass and paper
Ich fahre lieber mit dem Zug / mit dem Fahrrad	I prefer to travel by train / by bike
Ich will die Umwelt schützen	I want to protect the environment
Wir müssen die Umwelt nicht verschmutzen	We must not pollute the environment
Wir müssen mit den öffentlichen Verkehrsmitteln fahren	We must travel on public transport

Quiz 2.3 – Umweltprobleme

Die Luftverschmutzung ist sehr schlecht	The air pollution is very bad
Sonnenenergie ist besser	Solar energy is better
Klimawandel ist ein ernstes Problem	Climate change is a serious problem
Es gibt zu viel Verschmutzung im Meer/in der Luft	There is too much pollution in the sea / in the air
Die Zukunft der Erde ist wichtig	The future of the planet is important
Müll verschmutzt die Landschaft	Rubbish is polluting the countryside

Quiz 2.4 – ich habe viel für die Umwelt gemacht!

Ich habe meinen Müll getrennt	I separated my rubbish
Ich habe Glas und Plastik recycelt	I recycled glass and plastic
Ich bin zu Fuß gegangen	I went by foot
Ich habe geduscht, um Wasser zu sparen	I showered in order to save water
Ich habe keine Spraydosen benutzt	I didn't use aerosols
Wenn ich mehr Zeit hätte, würde ich mehr für die Umwelt machen	If I had more time I would do more for the environment.

Quiz 2.5 - Social issues / problems

Es gibt viel Arbeitslosigkeit in meiner Gegend	There is a lot of unemployment in my area
Ich sehe Obdachlose jeden Tag	I see homeless people every day
Es gibt viele arme Leute in meiner Stadt	There are a lot of poor people in my town
Obdachlosigkeit ist das größte Problem	Homelessness is the biggest problem
Unsere Gesellschaft braucht Hilfe	Our society needs help!!!
Wir müssen ihr Leben verbessern	We must improve their life!

Don't forget your vocab book!! Environment and social issues vocab is quite tricky!

Model answers

90 word example Foundation / Higher

You write an email to your exchange partner about where you live.

Describe

*what problems there are in your area

*what you did recently at home

*where you would like to live in the future

In meiner Gegend gibt es viele Probleme. **Zum Beispiel** ist die Luftverschmutzung sehr schlecht, **weil** es zu viel Verkehr gibt. **Meiner Meinung nach** ist das nicht sehr gut **denn** wir müssen die Umwelt schützen. Ausserdem haben wir viele Obdachlose und sie wohnen jeden Tag auf der Strasse. Wir müssen ihr Leben verbessern

Neulich zu Hause habe ich viel gemacht, **weil** das Wetter sehr schlecht war. **Zuerst** habe ich in meinem Schlafzimmer gefaulenzt, **weil** ich ein schönes Doppelbett habe und ich habe mein eigenes Schlafzimmer, **wo** ich entspannen **kann**. Später habe ich mit meiner Familie ferngesehen, **obwohl** die Sendung nicht sehr eindrucksvoll war, **weil** die Handlung langweilig war.

In der Zukunft **würde** ich gern im Ausland wohnen, **wo** das Wetter immer warm und sonnig ist, **da** ich gern im Meer schwimme. **Meiner Meinung nach wäre** es unglaublich prima **dort**.

150 word example Higher

You are writing a post for a German environmental website.

Describe

*the importance of protecting the environment

*how you will help the environment in the future

Meiner Meinung nach ist es total wichtig, die Umwelt zu schützen denn es gibt viele Probleme. **Zum Beispiel** ist die Luftverschmutzung sehr schlecht **daher** müssen wir mit den öffentlichen Verkehrsmitteln fahren. **Wenn ich viel Zeit hätte, würde ich vielleicht mit dem Fahrrad fahren**, um die Umwelt zu schützen. **Kurz gesagt** ist es einfach und **deswegen ging ich** letzte Woche zu Fuss in die Schule, um die Umwelt nicht zu verschmutzen!

Außerdem ist Klimawandel ein Problem **daher** ist Sonnenenergie sehr wichtig für die Zukunft. Müll ist auch ein ernstes Problem und verschmutzt die Landschaft **deswegen** müssen wir unsere Glas und Plastik recyceln, um die Umwelt zu schützen, **damit** wir eine Zukunft haben. **Ehrlich gesagt** ist das **empfehlenswert** und nicht **besonders** schwierig!

In der Zukunft, **wenn ich älter bin**, werde ich viel machen, um die Umwelt zu schützen, **weil** es ganz einfach ist. **Erstens** werde ich immer meinen Müll zu Hause trennen **zum Beispiel** Zeitungen und Flaschen. **Zweitens** werde ich duschen denn es spart Wasser und Zeit. Gestern habe ich geduscht und es war nur 2 Minuten! **Schliesslich** will ich mit dem Bus oder Fahrrad fahren, **um fit zu bleiben** und man kann auch **frische Luft schnappen**! Das ist viel besser für die Umwelt und für meine Gesundheit!

Absolute BTEC PE- Component 3 LAA

1.Component	Explanation	Suitable Sport or PA
Aerobic Endurance	The ability to exercise at moderate intensity for extended periods of time.	Events/sports lasting more 30 minutes.
Muscular Endurance	The ability of a given muscle to exert force, consistently and repetitively, over a period of time	Events/sports lasting more 30 minutes.
Muscular Strength	The ability of a muscle to exert a maximal or near maximal force against an object.	Activities requiring force, e.g., throwing events
Flexibility	The ability of a joint or series of joints to move through an unrestricted, pain free range of motion.	Activities requiring a wide range of movement around a joint, e.g., gymnastics, martial arts.
Body Composition	The percentage of fat, bone, and muscle in your body.	Low body fat: gymnastics, long distance running. High muscle mass: sprinters, power activities.
Speed	The ability to move the body in one direction as fast as possible.	Activities requiring fast movement, e.g., sprinting

Absolute BTEC PE- Component 3 LAA

2.Component	Explanation	Suitable Sport or PA
Power	The product of force multiplied by distance, divided by time.	Activities requiring explosive movement e.g., gymnastics, basketball.
Agility	The ability to rapidly change body direction, accelerate, or decelerate.	Activities requiring quick changes of direction, e.g., dodging the opposition in a team game, freestyle skiing.
Co-ordination	The body's ability to perform smooth and efficient movements	Any activity requiring the movement of two or more body parts and can include the use of sporting equipment, e.g., hand, eyes, and tennis racquet to connect with the tennis ball.
Balance	The ability to retain the centre of mass above the base of support when stationary (static balance) or moving (dynamic balance).	An activity requiring the control of the distribution of weight or to remain upright and steady.
Reaction time	How fast an athlete can respond to stimulus.	Any activity where a quick decision or response to a stimulus is needed.

Principles of Training		
Frequency	The number of training sessions completed over a period of time, usually per week. How often.	e.g. Training muscular strength 2/3 sessions a week
Intensity	How hard an individual will train.	e.g. working at 90% HR therefore training anaerobically.
Time	How long an individual will train for.	60 minute session.
Type	The method of training or exercises to meet the requirements.	Weight training to improve strength
A2 Additional Principles of Training		
Progressive Overload	In order to progress, training needs to be demanding enough to cause the body to adapt, improving performance.	Extra stress is needed on the bodies system for adaptations to take place.
Specificity	Training should meet the needs of the sport, or physical/skill-related fitness goals to be developed.	To ensure that the correct component of fitness is being trained so that improvements take place.
Individual Differences	Training should meet the needs of an individual.	For example if they are older or overweight you will need more low impact exercises.
Adaptations	Changes to the body due to increased training loads.	e.g. increasing your strength through a weight training programme.
Reversibility	If training stops, or the intensity of training is lowered, fitness gains from training is lost.	Overtraining, when too much training takes place can cause injury. When you stop training muscle mass can be lost.
Variation	Altering types of training to avoid boredom and maintain motivation to train.	Keep motivation and enjoyment. Less likely to become bored. Provides challenges. Reduces injury through using the same muscles.
Rest and Recovery	To allow the body to recover and adapt.	To prevent injury, ensure training adaptations take place, recover before the next session.



A3 Measurements/ Calculations and Formulas

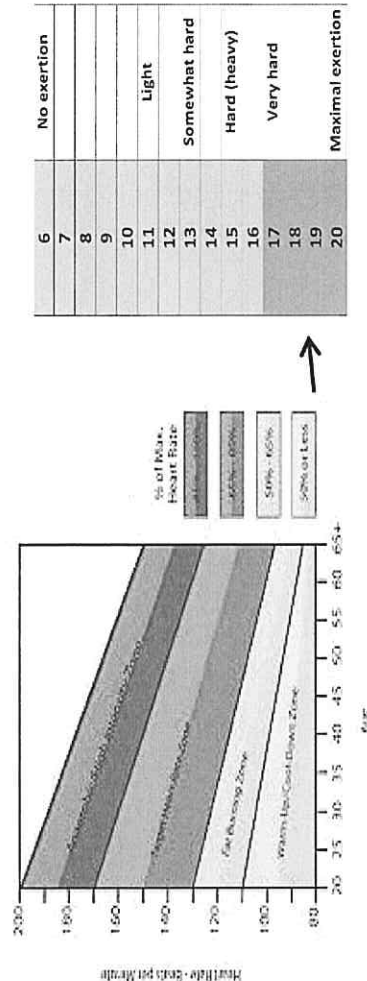
Intensity	
HR- How many times the heart beats within a minute, Beats Per Minute (BPM)	Count radial pulse with two fingers For 15 seconds x 4 = HR
Max HR- An average of what someone's maximum heart rate is depending on their age.	$220 - \text{Age} = \text{Max HR}$
Training Zones- The target ranges (of heart rate, pace or perceived exertion) that will be used to prescribe workout intensity	MAX HR Divided by 100 x the training zone % Example 16 year old – $204/100 \times 85 = 204/100 \times 65 =$
Strength and Endurance Calculation	
1RM (1 Repetition Max) Used to measure muscular strength	How much weight can be lifted in one repetition.
15RM (15 Repetition Max) Used to measure muscular endurance	How much weight can be lifted in fifteen repetitions.
Borg Scale- Rating of Perceived Exertion (RPE) Scale	
Borg Scale is a way of measuring physical activity intensity level. Perceived exertion is how hard you feel like your body is working.	Rate yourself on a scale of 6-20 depending on your perceived exertion. This value is then x10 for example 12 on the scale would equal 120BPM.

Used to:

Monitor Heart Rate- Record Calories- Energy usage- Identify Training Zones

A3 Target Zones

Anaerobic Training Zone 85%-100%	Used for improving speed, power, muscular strength
Aerobic Training Zone 65%- 85%	Used for improving aerobic endurance and muscular endurance



Technology to Measure Exercise Intensity

Heart Rate Monitors	
Smart Watches	
Apps	

B1 Absolute BTEC PE - Component 3 LAB



Investigate IMPORTANCE of fitness testing to determine fitness levels

B1 Reasons for Fitness Testing

1. Gives baseline data: If an athlete completes a test at the beginning and then at the end of their training programme, they can monitor their performance and see if they are improving.
2. Design training programmes: Athletes and coaches can use the results of fitness test and plan training programmes specifically to improve their weaknesses.
3. Determine if training programmes are working Tests can be used as a mid-point in training programmes.
4. Results can give a performer something to aim for: They can provide goal setting aims and give them motivation to improve.

B1 Pre-Test Procedures

1. Calibration of equipment: Equipment should be checked for wear and tear and damage; measuring must be completed with a tape measure and secured so the distance doesn't change throughout the test.
2. Complete informed consent: Informed consent is completed by the participant and allows them to understand what and how they will be tested and know they can remove themselves from the test at any time.
3. Complete physical activity readiness questionnaire (par-q): This is completed to ensure the participant is fit and healthy to take part in the test.
4. Participant pre fitness test check e.g. Prior exercise participation: This includes checking jewellery, clothing, trainers and completing a warmup.

B1 Validity of Results

1. Validity refers to whether a test measures what it aims to measure. If we are aiming to test flexibility however when we are performing the sit and reach and bending our legs the test becomes invalid.
2. Often in our tests to ensure it is valid we perform the test three times to see if we are getting similar results each time.
3. For example, the standing long jump can be completed three times and the highest score taken. However, this cannot happen with the copper run due to the length of the test and the impact it will have on the reliability of the test as the participant will be tired during the second and third time.

B1 Reliability of Test

B1 Factors affecting reliability:

1. Calibration of equipment: For example, if person administering the test has not measured out the 400m Cooper run correctly, when the athlete uses the nominal data their scores will be incorrect.
2. Motivation of the participant: If the participant is unwell or isn't trying their best, they will not receive accurate results.
3. Conditions of the testing environment (inside versus outside conditions) If the ground is wet when testing agility, it will be hard for the participant to change direction without falling over.
4. Experience of the person administering the test – compliance with standardised test procedure. If the administrator stops the stopwatch at the correct time the results will be incorrect.



B1 Practicality

1. Cost: Specialist equipment and facility hire can be expensive to carry out the tests.
2. Time taken to perform the test: Tests like the Cooper run and multistage fitness test can take a long time to perform.
3. Time taken to set up the test: Measuring for test such as the Cooper run, Sprint test and Illinois test can be difficult and time consuming.
4. Time taken to analyse data: Collecting and analysing large cohorts of data can be very time consuming and if you are conducting more than one type of test.
5. Number of participants: Some tests require specific equipment and if you have 30 participants to complete the test however on one piece of equipment this is not practical.

B1 Interpretation of Fitness Test Results

In your exam you will need the following skills

1. To be able to compare results to normative published data: normative data is results taken from people of similar ages and finding out what the average norm is for that age and sex. For Example normative data for the Cooper run, female and a range of ages. Not all tests have normative data is they aren't common/popular tests

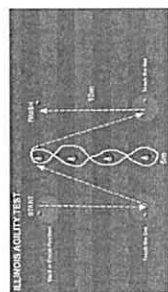
Age	Excellent	Above Average	Average	Below Average	Poor
13-14	>2000m	1900-2000m	1600-1899m	1500-1599m	<1500m
15-16	>2100m	2000-2100m	1700-1999m	1600-1699m	<1600m
17-20	>2300m	2100-2300m	1800-2099m	1700-1799m	<1700m
20-29	>2700m	2200-2700m	1800-2199m	1500-1799m	<1500m
30-39	>2500m	2000-2500m	1700-1999m	1400-1699m	<1400m
40-49	>2300m	1900-2300m	1500-1899m	1200-1499m	<1200m
>50	>2200m	1700-2200m	1400-1699m	1100-1399m	<1100m

2. Analyse and evaluate test results: Understanding where an athlete's success and weaknesses are based on the results of their tests.
3. Make recommendations for improvements to fitness performer based on test results: This could be a specific type of training which is linked to the



Fitness test methods for components of Skill-related fitness

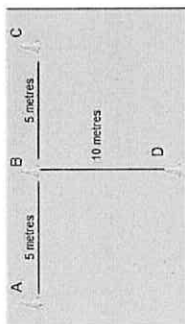
Agility



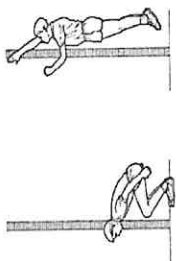
Illinois agility run test

The Illinois and T test are used to examine the participant's ability to change direction at speed and remain in an upright position.

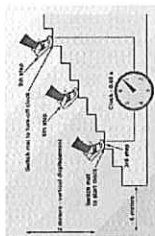
T Test



Power



Vertical Jump Test



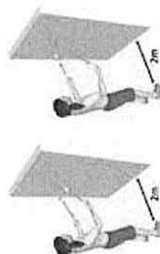
Margaria- Kalamen Test



Standing Long/Jump

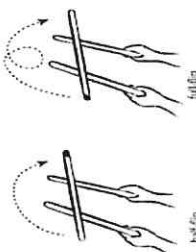
These tests are used to examine explosive movements of the legs.

Coordination



Alternate hand wall toss test.

30 seconds



Stick flip test

These tests are used to examine the participants ability to move two or more body parts at the same time smoothly and efficiently, to allow effective application of technique, such as catching the ball or stick.

Balance



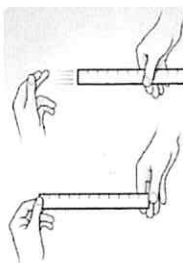
Y balance test



Stork Stand test

These tests are used to examine the participants ability to maintain centre of mass over the base of support, useful to maintain positions in performance sports (static balance) or when on the move in any other sporting examples (dynamic balance).

Reaction Time



Ruler drop test

Test Number	Reaction Time	The signal to watch	The button to click
1	0.246		
2	0.281		
3	0.240		
4	0.209		
5	0.203		
AVG	0.248		

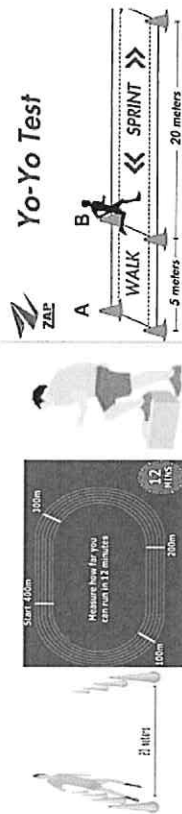
Online reaction time test

These tests are used to examine how quickly the athlete can respond to a stimulus. In one test the ruler is the stimulus and the quicker athlete catches the ruler. The stimulus on the online test are the lights and the computer examines the speed in which the athlete presses the button.

Fitness test methods for components of Physical fitness

Aerobic Endurance

Multistage Fitness test/ 12 min cooper run/ Harvard step/ Yo yo Test



These tests are used to examine the participants ability of the cardiovascular system to provide the muscles with nutrients and oxygen over a long period of time.

Flexibility

Calf muscle flexibility test



Shoulder flexibility test



Sit and reach test



Each of these tests are used to examine the range of movement at a joint, shoulder hip and ankle joint. There is a range of tests as different sports require flexibility in different joints in the body.

Muscular Endurance

Timed Plank



Sit up Test



Press up Test



Each test examines how many times the different muscles groups can contract in a length of time.

Muscular Strength

Hand Grip Dynamometer

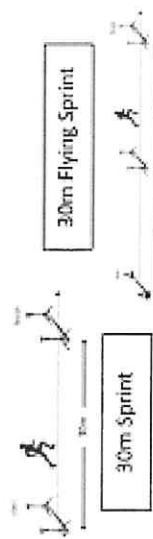


1 Rep Max



These tests are done to examine the amount of force that can be applied against a resistance. For example, the dynamometer tests for strength of grip lower arm and bicep muscle. 1RM test the maximum weight lifted in 1 repetition.

Speed



Two test which both examine distance divided by time to reduce the time taken to move the body or body parts. In this case the fast movements of the arms and legs.

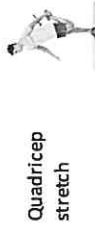
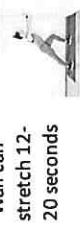
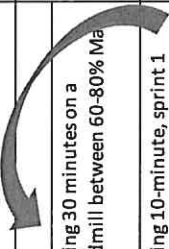
30m Sprint form standing start.

The flying sprint tests the athlete at full speed.

Body Composition

Fitness training methods for physical components of fitness

Appropriate physical fitness training methods that could be used for specific sports participants for different ages and different sporting abilities

Flexibility		Muscular Endurance				
Static Active	The performer applies internal force to stretch and lengthen the muscle		Free weights	High repetitions and low loads	e.g. Bicep curl 10 kg X 15 reps	
Static Passive	Requires the help of another person or an object, e.g. A wall to apply external force causing the muscle to stretch		Fixed resistance machines	High repetitions and low loads	e.g. Squat 20 kg X 20 reps	
Proprioceptive Neuromuscular Facilitation (PNF)	The technique involves the use of a partner or immovable object, isometric muscle contractions to inhibit the stretch reflex.		Circuit training	Using body resistance exercises or weights with low loads and high repetitions.	Series of different exercise stations can be made sport specific E.g. Press ups, sit ups , squats and lunges.	
Muscular Strength Training		Speed				
Free Weights	High loads and low repetitions	e.g. Bicep curl 15 kg X 6 reps	Acceleration Sprints	Pace is gradually increased from a standing or rolling start to jogging, then to striding, and then to a maximal sprint	Long jumper run up 	
Resistance Machines	High loads and low repetitions	e.g. leg press 60 kg X 6 reps	Interval Training	Work period followed by a rest or recovery period. For speed short, high intensity work periods, increasing the number of rest periods and increasing work intensity.	100m 	
Continuous Training	Aerobic Endurance					
Fartlek Training	Steady pace and moderate intensity for a minimum period of 30 minutes	Jogging 30 minutes on a treadmill between 60-80% Ma HR.	Resistance Drills	Hill runs, parachutes, sleds, bungee ropes, resistance bands	Rugby players 	
Interval training	The intensity of training is varied by running at different speeds and/or over different terrain	Jogging 10-minute, sprint 1 minute, run 2 min repeat for 30 minutes.	Aerobic Endurance			
	Work period followed by a rest or recovery period of aerobic endurance decrease the number/length of rest periods and decrease work intensity (compared to speed training)	Netball players walking back into position after a team has scored.	Circuit Training	Use of a number of stations/exercises completed in succession with minimal rest periods in between to develop aerobic endurance.	Step ups. Shuttle runs and skipping to develop aerobic endurance with minimal rest.	

Fitness training methods for skill related components of fitness

Agility		Power	
Speed Agility and Quickness training (SAQ)	drills used to develop physical ability and motor skills.	Plyometrics Training	Hopping/ bounding/ two footed jumps
Co-ordination		Reaction time	
Co-ordination Training	Use of specific training exercises using two or more body parts together.	Reaction Time Training	Sprinter responding quickly to the sound of a gun in a sprint start.

Balance		Reaction time	
Dynamic Balance Training	Use of specific training exercises that require balancing on a reduced size base of support.	Use of specific training exercises to practise quick responses to an external stimulus.	Sprinter responding quickly to the sound of a gun in a sprint start.
Static Balance Training	e.g. lunging, standing on one leg and kicking, single leg lunging.  e.g. Handstand, yoga, gymnastics, Pilates.		

<u>C5: Provision for taking part in fitness training methods</u>			
Type of provision	Explanation	Advantages	Disadvantages
Public sectors	include local authorities and school provision	-Funded by local council -Low cost -Accommodate large groups	-Lack of equipment -Poor facilities
Private sector	provided by organisations who aim to make a profit	-specialist services -latest training equipment	-expensive to join -members pay month or yearly -Aime at certain groups of people other than public
Voluntary sector	activities provided by volunteers who have a common interest in the participant.	-fitness or competitive sports -low cost -coaches usually have experience	-opportunities in only one sport -Basica facilities or equipment -Limited training times as they normally don't own the facility.

C4: Choosing training methods

- Demands of the sport: focus on area of sport or components of fitness involved.
- Cost of equipment: specialist equipment may be needed such as fixed resistance machines.
- Location of training: specific facilities may be needed such as swimming pool.
- Ease of set up: some methods involve setting up e.g. circuit training
- Number of participants: may be limited amounts of space to access



The effects of long-term fitness training on the body systems

How training methods affect the different body systems, which can lead to adaptations to improve specific components of fitness.

Aerobic Endurance Training:

- Adaptations to the cardiovascular and respiratory systems
- Cardiac hypertrophy
- Decreased resting heart rate
- Increased strength of respiratory muscles
- Capillarisation around alveoli.

Flexibility Training:

- Adaptations to the muscular and skeletal systems
- Increased range of movement permitted at a joint
- Increased flexibility of ligament and tendons
- Increased muscle length.

Muscular Endurance Training:

- Adaptations to the muscular system
- Capillarisation around muscle tissues increased muscle tone.

Muscular Strength and Power Training:

- Adaptations to the muscular and skeletal systems
- Muscle hypertrophy
- Increased tendon and ligament strength
- Increased bone density.

Speed Training:

- Adaptations to the muscular system
- Increased tolerance to lactic acid.

Requirements for Each of the Following Fitness Training Methods

To ensure a fitness training plan is carried out safely and effectively it must include the following.

- **Warm-Up:** prior to taking part in the fitness training method – pulse raiser- increase heart rate and body temperature, mobility- increase range of movement and stretch, reduce the risk of injury, prepare the body for exercise.
- **Cool Down:** after taking part in the fitness training method – gradually lower pulse and breathing rate to resting levels; remove lactic acid; stretch to help return muscles to pre-exercise length.
- **Fitness Training Method:** linked to the associated component of fitness.
- **Application of the basic (FITT) and additional principles of training:** to each fitness training method.
- **Application of appropriate training intensities:** to fitness training methods.

Additional requirements for each of the fitness training methods

Advantages and disadvantages

- To include number of people that can take part
- Cost of equipment
- Ease of set up, access to venue/location of training
- Risk of injury to the performer if performed incorrectly, effectiveness of training for given sports performer
- Specificity to component of fitness
- Replicating demands of the sport



D1 Personal Information to Aid Training Fitness

Programme Design

Aims – details of what they would like to achieve for the selected sport.

Objectives – how they intend to meet their aims using an appropriate component of fitness and method of training.

Lifestyle and physical activity history.

Attitudes, the mind and personal motivation for training.

D2 Use Personal Information to Aid Training

Programme Design

Selection of appropriate training method/activity for improving/maintaining the selected components of physical and/or skill-related fitness.

Application of the FITT principles and additional principles of training.

D3 Motivational Techniques for Fitness Programming

Motivation – the internal mechanisms and external stimuli that arouse and direct behaviour.

Two types of motivation:

Intrinsic- From within e.g. I want to go to the gym because its good for me.

Extrinsic – from the outside e.g. Rewards

Principles of setting goals to increase and direct motivation.

Personal goals – (SMARTER):

Specific: The goal must be specific to what you want to achieve, e.g. I want to improve upper body strength

Measurable: Goals must be stated in a way that is measurable, I want to increase my chest press 1RM to 100kg.

Achievable: The person has to have access to training and the time to take part in it in order to meet the goal.

Realistic: It must be possible to actually reach this goal and not expect improvements beyond what can be achieved in the time frames and current fitness or ability or ability level of the person setting the goals.

Time: Their must be a set time or deadline on the goal. This means you can review your success. It is best you put the date you wish to achieve the goal by.

Exciting: The goal must be something the person really wants to achieve and have an impact on their sports performance in order for them to be motivated to attend their regular training and work hard while training to achieve the goal.

Recorded: The results should be written down so the performer can see how close they are to achieving their goal and how long it takes to reach it

Goals:

Short-term goals (set over a short period of time, between one day and one month)

Long-term goals (what they want to achieve in the long term, and the best way of doing this).

- Influence of goal setting on motivation: Provide direction for behaviour, maintain focus on the task in hand
- Benefits of motivation on the sports performer: Increase participation
- Maintain training and intensity Increased fitness Improved performance.

1.Characteristic of skill movement

Skills are learned predetermined movement

Motor Skill – A coordinated pattern of movements using voluntary body movement

Characteristics of skilful performance	
	Pre-determined – A player will practice skills with an aim in mind e.g. Improving shooting skills in order to score more goals.
	Aesthetics – The skills look good. E.g. A high quality dance or gymnastics routine is pleasing to watch this will give them a higher score.
	Coordination – The skilful performer is in charge, controlling the rate and timing of the skill. E.g. serving in tennis, throwing the ball up and timing when to hit the ball.
	Efficiency – A skilled player is able to perform the task to the same high-level repeatedly without wasted energy. E.g. having a larger reach in swimming to not waste energy.
	Fluency - Performed in a smooth movement e.g. A gymnastic routine flowing.

2. Classification of skills

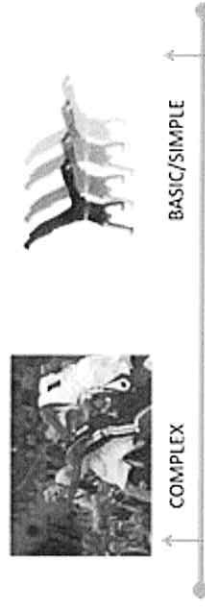
It is useful to classify skills because it makes it clearer about what is required to learn and perform a particular skill.

Every skill can be placed on a continua (scale). There are two continua:

Every skill can be placed on a continua (scale).

There are two continua:

Difficulty Continuum - Simple/Complex



Environmental Continuum - Open/Closed



Difficulty Continuum

Simple = Straightforward, with very few decisions to be made. Can be taught as a whole in a repetitive way. E.g. Sprint start in athletics, a goal kick/pass in football, swimming stroke.

Complex = Many decisions or judgements/ many linked sub routines. May have to be learned in stages. E.g. dribbling in Basketball, Somersault, Trampoline routine.

Environmental Continuum

Open = the skill is effected by the environment and requires the performer to make perceptual decisions. E.g. passing in football

Closed = the skill is not effected by the environment. E.g. Long Jump, golf swing.

Goal Setting

Why do we set goals?

1. For exercise/training adherence – goal setting can help people to stick to a training plan
2. To motivate performers – goal setting can inspire and drive performers to achieve their best
3. To improve and/or optimise performance – goal setting can often lead to higher levels of performance

Why do some athletes not reach their goals?

1. The goals were unrealistic
2. The athlete did not try hard enough
3. The athlete used poor technique

SMART Targets – Bobby is a 100m sprinter and has used the SMART principle to his targets to optimise his performance on the track.

Specific	Measurable	Achievable/ realistic	Recorded	Time-phased
Targets must be concise. <i>"To take a 0.5 second off my time personal best time"</i>	Must be measured and compared, performances should be measured after each training session. <i>"I will time my runs every training session for the next five weeks of training"</i>	Target must be challenging but yet reachable. <i>"My coach and I devised the training programme around improving leg power for my start"</i> <i>"We agreed that a 0.5 seconds off my personal best is realistic for my current ability and status"</i>	You must ensure you write down your results in response to your goal. <i>I will monitor my performance by writing down how many first serves are aces in Tennis, to see an improvement"</i>	Set for a particular time to be completed. <i>"We agreed to do the training programme four times per week for the next five weeks"</i>

1. Mental Preparation: Mental preparation helps athletes to achieve a focused, confident and trusting mind set to allow them to compete at their highest level.

There are 4 types of mental preparation:



1. **Imagery** - A technique involving a performer practising a skill in their head/mind before physically executing it. The imagery should have the athlete performing successfully and feeling satisfied. E.g. Owen Farrell imagining the set up for his kick.



2. **Mental Rehearsal** – Going over an event/ skills time and time again. This is similar to imagery but can be used to:

- Familiarise the athlete with the competitive environment
- Motivate the athlete by recalling images previous success
- Perfect skills or skill patterns by refining the skill
- Set the stage for the performance with a complete mental run through



3. **Selective Attention** – This is the process of focusing on a particular object in the environment for a certain period of time and blocking out the distractions. *e.g. free throw in basketball; whereby you focus on the basket and your performance and block out the crowd.*



4. **Positive Thinking** - This involves recognising that the athlete has started worrying about a performance and refocusing by using positive inner thoughts. E.g. A netball player tells herself "focus" or a footballer telling themselves that they can score a penalty kick.

2. Types of Guidance: Needed for learning new skills

Type of Guidance	Advantages	Disadvantages	Example
1. Visual Guidance: Showing a skills/ demonstration.	Provides a mental image. Draws attention to key points beginners to interpret new skills	Can demotivate and overload learner if it's a complex skill.	Providing a demonstration how to perform a Tennis serve/ watching a lay up on an I pad.
2. Verbal Guidance: Terminology and phrases used to make skills simple	Explain tactics and technical info Immediate feedback	Players can be confused easily Lose concentration	Explaining the correct technique for a Handball Jump Shot.
3. Manual Guidance: Physically moving a limb into place.	Builds confidence Eliminates danger Gives feel for whole skill	Learner becomes dependent on support	A coach supporting a shoulder when performing a handspring on a vault.
4. Mechanical Guidance: Involves the use of equipment	Promotes confidence Ensures safety	Learner becomes dependent on support	Using a float in Swimming to help stay a-float. Trampoline belt for somersaults.

4. Feedback: There are 6 Types of Feedback

Feedback	Description/ Evaluation	Application
Negative Feedback	Information about an unsuccessful performance/ weaknesses / what went wrong/ EBI +ve can result in a higher leveled performance -ve This might result in a lowering of confidence.	E.g. A coach telling a Badminton player that his last serve showed poor technique
Positive feedback	Information about successful performance/ What Went Well. +ve Good for beginners to help them gain confidence. -ve Does not correct errors in performance.	e.g. A Coach telling the diver that their handstand to back tuck was fluent,
Internal/ Intrinsic Feedback	This type of feedback happens within the performer. Information is received as a direct result of producing movement	After taking a corner in football, the player will know straight away if it is the desired ball intended to take.
External/ Extrinsic Feedback	This feedback comes from results of match analysis. Examples include watching a performance back from a video or listening to a coaches comments.	Watching a Hockey hit pass replay on an I pad to gain an understanding of what technical points need improving.
Knowledge of results	Feedback that relates to the outcome of the performance/ skill.	e.g, Looking at the Shot Put distance to gain an understanding of were they are at in their training.
Knowledge of performance	Feedback that relates to the quality of the performance/ skill/ technique.	e.g. A coach telling the high Jumper to drive their knee higher on their next jump.

1. Participation rates – The number of people taking part in physical activity.

There are 5 main factors affecting participation in physical activity and sport:

Groups- G.A.S.E.D= Gender, Age, Socio-economic, Ethnicity, Disability

1. Age – The reason why different age groups participate can vary based on access, cost, health problems, image problems, time available and the nature of the activity. As you get older trends suggest activity levels decrease. Some sports have age divisions to ensure safety. This can prevent people from taking part.



4. Gender – Men and women can participate for different reasons including image, cost, time and society. Increased media coverage has helped remove many stereotypes.

2. Ethnicity – The number of ethnic groups (black, asian & other minorities) playing sport are on the rise. Reasons for the difference include stereotypes, cost and cultural influences. Trends suggest there is still a gap with people of colour participating less than white individuals.



5. Disability – This can be a physical or mental impairment. Activities and rules are often adapted i.e. *Wheelchair tennis*. Other barriers include availability, cost and access.



3. Socio-economic group – This is determined by profession and available income. Factors include cost, availability and time. i.e. *golf is far more expensive to participate than athletics*.



Other reasons for non-participation:

6. Media Coverage – *lack of coverage of some sports*

7. Environment & Climate – *denotes which sports are more or less relevant for an area*

8. Time – *work commitments reduce activity*

9. Resources – *facilities & provision*

10. Role Models – *lack of direction & peers*

1. Current Trends (Participation Rates)

2. Priority/Target Groups: Groups of people who have been identified as either not, or in danger of, not participating in sport or physical activity as much as they should.

3. Gender: 15% more males take part in PA/Sport compared to women

4. Age: The 16-24 age group participate most in PA/Sport

5. SOCIO-ECONOMIC: Most adults playing sport are from professional/managerial workers (17% inactive) and lowest amongst manual workers/unemployed (38% inactive)

6. SPORTS PARTICIPATION FIGURES:

HIIIT: 518,000+

CYCLING: 93,000

SWIMMING: 283,000

Physical activity and sport in the UK

Current trends in participation in physical activity and sport. The data varies depending on:

- The source of the data
- Different social groups
- Different physical activities and sports.

Strategies for overcoming barriers and increasing participation:

1. Increase promotion e.g. *Promote sports and benefits on the TV.*

2. Increase provision e.g. *Provide mums and baby group sessions to increase PA*

3. Increase Access e.g. *Provide ramps for disabled people to get into the gym or set up new routes*

1. Barrier: AGE



Strategies

- Exercise classes ran by Age UK
- Adapting exercises

Sporting Examples

Yoga, golf, bowls and walking football are all enjoyed by an older population

2. Barrier: GENDER



Strategies

- National campaigns such as 'This Girl Can'
- Increase media coverage
- Increase clubs
- More promotion

Women's boxing, tennis, rugby, and football have all seen an increase in media coverage and therefore increased popularity. E.g. World cup 2019.

3. Barrier: ETHNICITY



Strategies

Consider religious clothing e.g. Modified Hijabs/ head scarfs to enable Muslim women to take part safely.

Sporting Examples

In 2016, the first woman competed in a hijab. This encouraged more Muslim women to participate in sport.

4. Barrier: DISABILITY



Strategies

- Increase sports included in Paralympics and Invictus Games

Sporting Examples

Paralympic cycling, badminton and snowboarding were only introduced after 2010.

5. SOCIO-ECONOMIC



Strategies

- Lottery Funded facilities and clubs
- Subsidised membership for people on benefits.

Sporting Examples

Sports facilities are free to use and sports clubs are awarded grants by Sport England.

Factor	Positive affects	Negative affects/ Barriers	Strategies to improve participation [PROMOTION/ PROVISION/ ACCESS]
Gender	Opportunities for female officials and management roles within teams have grown too and there are a great deal more female presenters on TV.	Male/female discrimination (e.g. females banned from golf clubs). Stereotypes: Some activities traditionally linked to males/females or females don't want to play male sport or males don't want to play female sport or examples of this e.g. males for boxing and females for danding.	National campaigns such as 'This Girl Can' Increase media coverage Increase clubs at all levels for a range of sports More promotion of a range of sports on the TV.
Age	Many NGBs have developed adaptations of their sport that are suitable for older people.g. Walking netball, walking basketball and walking football are examples.	Some sports have age restrictions e.g. minimum age is for Olympic snowboarding is 15 years; some fitness gyms have a minimum age restriction. Sport is often perceived as a 'young person's activity'. Some older people lack confidence to participate.	Exercise classes ran by Age UK – promote on local radio. Adapting exercises Adult only classes.
Race/Religion/Culture	Taking up a sport or activity may be influenced by ethnic background. i.e. Cricket is very popular among Asian countries Traditional sports are encouraged	In some countries certain ethnic minorities are prevented from joining clubs. E.g. Muslim women, not being able to take part in competitive swimming due to restrictions in their religion. Some sports/activities are banned Some cultures have dress codes such as hijabs and turbans which make participation more difficult. Some religions/cultures expect worship/prayer/festivals at specific times which can affect participation.	Consider religious clothing e.g. Modified Hijabs/ head scarfs to enable Muslim women to take part safely. Women only swimming sessions
Family	You are more likely to participate in sport if your parents do. Support with transport, membership fees.	You are less likely to participate if there is little interest shown by your family; They may place undue pressures on children; too much pressure.	Discounted bus to a local climbing wall Family fun run, for all the family at a local park. Top Tips for Top Mums -Encourages parents to share tips an ideas on how they get their children to eat more fruit and vegetables/ exercise regularly.
Friends/Peers	If your friends are sporty you are more likely to take part in sport.	If your peers tease you when you take part in sport you are more likely to avoid playing.	More education in school about the benefits of physical activity, this can change mind sets, and promote physical activity.
Disability	Activities and rules are often adapted to allow inclusion in sport. i.e. Wheelchair tennis	Limited clubs or access to clubs therefore reducing participation. E.g. Lack of Boccia clubs. E.g. No disabled changing rooms to allow changing. [availability and access]	Increase sports included in Paralympics and Invictus Games
Social Economic	If your parents have unlimited funds, then can pay for travel, equipment and coaching for sports such as Tennis, which can be expensive.	Limiting factors include cost, availability and time. i.e. golf is far more expensive to participate than athletics.	Lottery Funded facilities and clubs Subsidised membership for people on benefits.
Media coverage	Promotes and encourages sport and healthy living. Creates funds and sponsorship. Media coverage is huge for football, which can be accessed on multi platforms. This increases the chance of watching it. Can motivate through role models.	Some sports, such as Squash has limited media coverage, therefore less promotion, less participation. [minority sports]. Disability sports, womens' sports and vet sports are underrepresented.	Promote women in sport, through global campaigns e.g. this girl can, to encourage more people to take part. Promote more minority sports
Environment/climate	If you live in a rural area, near mountains you are more likely to do fell running or climbing.	If you do not live near the Ocean, you are less likely to take up water sports such as surfing.	Build a climbing wall in urban [city] areas to encourage for OAA activities.
Role models	If your role models are on the TV frequently, e.g. Jill Scott you may be inspired to take part. Good behaviour is copied, encourages participation, introduces others to new sports and promotes good sportsmanship.	If your role model does something wrong/ demonstrates poor sportsmanship it may cause you to not like a particular sport. Lack of role models.	Use social media platforms to promote positives of different role models from different cultures in a variety of sports.

1. **Health-** Health is a state of complete physical, mental and social wellbeing and not merely the absence of disease.
2. **Wellbeing** - this refers to a feeling or mental state of being contented, happy, prosperous and healthy
3. **Fitness** - A persons ability to carry out daily life activities without becoming overly tired. ability to meet physical demands placed on them by the environment
4. **Lifestyle-** Daily habits
5. **Obesity-** Very overweight and a body Mass index of 30 and above.

1. Effects of exercise on health

Physical Health	Emotional Health	Social Health
- Increased bone density - Lower cholesterol / reduced obesity - Reduce risk of type 2 diabetes - Increase posture - Development of components of fitness e.g. strength and CV endurance.	- To increase self esteem/confidence – increased endorphins released - Controlling anxiety / managing stress - Relieve stress and tension - Increase happiness - Better self image <i>e.g. Going to a gym will release endorphins which will help reduce stress levels.</i>	- To meet new people/friends - Reduce loneliness - Feeling of belonging to a group - May alienate other friends/ acquaintances - May result in rejection from other groups or jealousy - Might result in rejecting other who do not participate in sport <i>e.g. If I join a Netball team, I will make new friends and socialise more. This will make me happier.</i>

2. Sedentary lifestyle – a way of lifestyle with no/ little physical activity. This includes sitting, reading, watching television & playing video games, sitting at a desk.

Consequence- A lack of energy or feeling lethargic or lack of fitness; More likely to be obese/overweight or negative body image; Lack of interest / motivation/ more stressed; Less likely to benefit from social interaction.

Data

Data is used to gain national information about health, fitness and wellbeing. When studying graphs, look at the X and Y axis to know what the variable area and then comment on the general trend.

3. Health risks associated are:

- Heart disease
- Type 2 diabetes
- Obesity (result in stroke or CHD)**
- Osteoporosis
- Depression
- Muscular Atrophy
- Poor posture

4. Energy balance – This is where the energy in through food/ calories must match the energy expenditure through exercise/ daily activity. If you eat too many calories and do little exercise, you will slowly increase in body mass.



Diet

5. **Balanced Diet** – Taking in the right amount of energy/nutrient in the right proportions to maintain a healthy body weight.
6. **Eat well plate-** This must include 55% of Carbohydrates, 30% of fat and 15% Protein. Plenty of fruit and vegetables; Water is essential.

Macronutrients	Micronutrients
Carbohydrates – Main energy source. i.e. Complex starch (pasta, potatoes, cereals, breads) & simple sugars (glucose, chocolate, sweets, fruit)	Minerals – Maintains healthy bodily functioning. i.e. iron and calcium e.g. Protects against heart disease.
Fats – Secondary energy source & provides insulation. i.e. Saturated fats (butter) & unsaturated fats (vegetable oil)	Vitamins - 1. Prevents disease / illness / maintain health 2. (Helps) produce energy 3. Essential for metabolism or helps for growth/repair/development Maintains a healthy immune system. i.e. vitamin A, C, D
Proteins – Help growth and repair of muscles e.g. hamstrings, cardiac muscle. i.e. eggs, meat, fish, nuts and oats	Vitamins- e.g. Fruit, vegetables
Fibre – Aids digestion of food/large intestine function, helps reduce cholesterol, limit obesity/diabetes and limit certain cancers or help prevent disease. i.e. Fruit vegetables, wholemeal bread, beans, lentils, cereals , brown bread	
Water – Carries nutrients in the body, Helps with digestion/waste removal, Regulates body temperature, Avoid dehydration and help replaces lost fluid (from urine and sweat), To quench thirst, To offset fatigue or to prevent heat exhaustion	

e.g. After a hard training session, it is vital that Carbohydrates are consumed after to replenish the energy expired and aid the recovery process.

7. How do the nutritional requirements change for different athletes?

	- Long Distance Runner - Will need a high Carbohydrate Diet (Carbo-Loading) - Increase stores of glycogen / energy - Ability to work at a higher intensity for longer
	- Weight lifter - High Protein Diet - Aid in the repair and growth of muscles - Recover quicker leading to training more and becoming stronger.

Key terms:

1. Commercialisation – refers to the influence of buying and selling, trade or industry to make a profit.
2. Sponsorship- The giving of money or goods to performers in order to get good publicity and/or increase profit

Different types of sponsorship:

1. Facilities
2. Clothing and equipment
3. Financial

GOLDEN TRIANGLE

The links and relationship between sponsorship, sporting events and the media.

Different types of media:

1. Social e.g. TikTok, Instagram.
2. Internet e.g. google, BBC 1 player, YouTube.
3. TV/films e.g. Sky Sports News, ski Sunday.
4. Radio e.g. Radio 5 live
5. Newspapers/ magazines/ print media e.g. 442, Triathlon, women / men's health
6. Online gaming e.g. FIFA

1. Includes sport and sponsorship and media
2. All factors show interdependence / links / connections
3. Influence of the media in making sport more commercial by providing sponsorship opportunities or to make more money for commerce/industry
4. Influence of sponsorship and media provides more money for sport
5. Influence of sport and sponsorship provides more money for the media

For example, Nike sponsors women's Netball- which then gets more media coverage leading to increased popularity in the sport, in turn increasing the level of sponsorship.

NEGATIVE influences of media include

- Only main sports shown, so minority sports do not gain exposure. E.g. --Media shows few disability sports
- Media highlights only narrow range of sports
- Media focuses on more male sport. E.g. Sky Sports and BT sport show many more men's football matches than female football matches, however they are now beginning to show more female football matches.
- Media could give false information /fake news about sport
- More money to major sports and performers, so less funds to minority sports.
- Media may give sport a bad image due to poor behaviour/deviance. -Expose potential danger/ bad injury of some activities. E.g. If you hear or see an injury from a sport you may decide not to take part in that sport, for example a cricket batter being hit by the ball in the head and suffering from concussion.
- Role models behaviour is exposed, poor behaviour on and off the performance area is exposed, and quickly.
- The exposure/advertising of some sponsors may be unethical. Examples include alcohol, smoking products and gambling companies.
- Pay per view channels/events may make it difficult for low-income families to watch their favourite sports.
- Where games/events are shown live, spectators may choose to watch on television rather than go to the live game as it is cheaper and they get a better experience from replays, pundits etc.
- May hinder participation / produces couch potatoes or rather watch than participate E.g. With so much sporting content available to watch now people may choose to watch sport as opposed to playing the sport themselves.

Positive influences of media include

- More education/ through raising awareness/ interest/ exposure. E.g. BBC showing the women's football FA Cup final to increase awareness of the sport and give exposure to the players.
- Improving information / guidance e.g. -By entertaining or making sport exciting e.g. Fast 5 netball, football holograms
- Giving info on new / other sports
- Raises confidence in trying a sport as they see people succeed
- Positively associated with health and fitness E.g. People will see athletes who are healthy and will want to recreate their image and health status.
- May encourage those with disabilities to take up sport if seen on TV. E.g. Increased media coverage of disability sports such as the Paralympic games will increase awareness of the different opportunities available and provide role models to follow within those sports.
- Produce role models who inspire participation. E.g. People will aspire to emulate sporting stars they see through the media and will want to take part in sport to replicate what they have seen/heard the athlete perform.
- Highlight minority/new/female sports – which will increase popularity e.g. Womens' Euros
- Rules have been adapted to increase the speed of play and increase excitement. E.g you can now score on any play, not just your serve.

2. Advantages and disadvantages of commercialisation

PLAYER/PERFORMERS

Advantages	Disadvantages
• It provides money to train / compete/competitions fees or enables participant to train full-time • Can lead to additional roles post playing career within the sport. • It provides money for a place at University coaching/sports science support • Pays for equipment, or specialist clothing. • Makes the player more high profile/more famous which increases their marketability. Increased earnings due to sponsorship	• Sponsors can put pressure on performers which could lead to deviant behaviour/poor performance/mental health issues.. • Generally, favours male over female and able bodied over disabled. • Sponsorship might be short term or can be withdrawn. • Sponsorship if immoral/unethical /unhealthy / alcohol / fast food etc brand therefore can give bad image on the performer. • Athletes may be forced to wear kit/equipment even if they don't want to.

SPORT

Advantages	Disadvantages
• Raises the profile of the sport due to increased exposure. The media can educate/raise awareness/interest in sport. • Changes to sport format/rules to make audience friendly.	• Tends to only support the popular sports. • The influence of TV has caused an increase in adverts and changed TV timings (traditions lost) • Rules changes • 2016 netball rule changes to make game faster and more attractive to television companies & viewers • Adapted versions of sports e.g. Fast 5 netball • Event time changes- Live Football/ Rugby being shown on different days • Sponsors can be controlling/restrict other income (only one sponsor per event) • Sponsorship if immoral/unethical /unhealthy / alcohol / fast food etc brand therefore can give bad image on the sport.

SPECTATOR

Advantages	Disadvantages
• Offers a wider choice of sports available to watch. • Viewing experience has been enhanced due to technology	• Encourages spectating not participating. • Can become very expensive for fans/spectators. • Affects view experience - increased TV breaks.

SPONSOR

Advantages	Disadvantages
• Raise awareness of brand leading to increased sales • Displays goodwill • Free tickets for sponsors • Tax concessions • Their products get an attractive, fitness or health related image.	• Poor behaviour from athletes/clubs causes negative media attention. • Some sponsors are not suitable to be promoted within sport i.e. tobacco.

Key terms:

1. **Commercialisation** – refers to the influence of buying and selling, trade or industry to make a profit.
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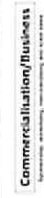
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Sponsorship or Media

Super Sunday
Football

- Sky Sports
- Ford



All England
Open 2018

- Yonex



National Football League (NFL)

A range of
sponsors:

- Nike, Pepsi
- Oakley



*The influence of the media on the commercialisation of physical activity in sport:

1. Event changes
2. Rule changes
3. Adapted versions of sports
4. Technological innovations e.g, Hawkeye in Tennis/ VAR in Football
5. Increase Sponsorship.

2. Advantages and disadvantages of commercialisation

PLAYER/PERFORMERS

Advantages

- It provides money to train / complete/competitions fees or enables participant to train full-time
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- Changes to sport format/rules to make audience friendly.

Disadvantages

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- The influence of TV has caused an increase in adverts and changed TV timings (traditions lost)
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Disadvantages

- Poor behaviour from athletes/clubs causes negative media attention.
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Ethics in Sport

1. **Sportsmanship** – the qualities of fairness and following the rules. *i.e. shaking hands after a football match (must use a named sport).*

Places or times in a game situations when sporting gestures are expected:



e.g. When an injury occurs in football the ball is kicked out of play.



e.g. After a match of rugby, both teams for a 'tunnel' and clap each other off the pitch.



e.g. When a team wins in any sport, players should be gracious and shake hands to offer commiseration.



e.g. At all times, players and referees are expected to control their behaviour, language and manner.

There has been a huge decline in sportsmanship in recent years due to: a large emphasis on winning, media hyping up events and rivalry, and increased wages

2. **Gamesmanship** – Bending the rules to gain an advantage *i.e. fainting injury to waste time*



e.g. Sledging is used in cricket to directly insult the opposing player in the hope to distract the player.



e.g. Grunting can be a technique used in tennis to distract the opposing player.



e.g. Grabbing in boxing is sometimes used to waste half time but can frustrate the opposing player.

Drugs in Sport

Drug	Reason for athlete taking this	Health risk	Sporting example who might use it
Beta Blockers	Slows heart rate, calms and steadies hands, reduces anxiety.	Lowers blood pressure and oxygen delivery to muscles	e.g. Snooker player that requires a steady hand Archery, shooting, darts, golf
Anabolic Steroids	Promote muscle growth and promotes a faster recovery time	High blood pressure, aggressive behaviour & develops male features	e.g. A Weightlifter that requires maximum strength
Stimulants	Increased alertness/ concentration and reduce tiredness	Heart rate irregularities & increased aggression.	e.g. A sprinter or football player that requires increased focus.

Reasons for taking an illegal performance drug

1. Improve physical fitness / function / strength / speed / power
2. To be able to train harder / longer / faster recovery
3. To build muscle mass
4. To lose weight
5. To reduce pain
6. To lower anxiety / steady nerves / lower arousal / lower HR
7. To increase motivation / determination / arousal / alertness
8. To increase aggression
9. Because they perceive / feel that others are taking them or otherwise they will feel at a disadvantage
10. They think they can get away with it / they will not get caught
11. Pressure from coaches / media

3. **Deviance in sport** – Deliberate and dangerous breaking of the rules. This type of behaviour causes negative role models. *i.e. drug taking, fighting in football or match fixing.*

Consequence of Deviant Behaviour

1. Punishment – red card / sin bin / bans
2. Loss of sponsors / contracts with clubs
3. Damaging own reputation or club / country

Player Violence: Controlled aggression is a fundamental part of any sports. Sometimes, however, this spills over into uncontrolled situations where serious injury is caused.

Reasons for Violent Behaviour

- Pressures of the media
- Frustration as a result of losing
- Sponsorships deals
- Pressure from spectators / opponents
- As a reaction to a challenge / tackle
- Annoyed by poor decisions by officials
- To gain an advantage / to hurt your opponent
- opponent controlled aggression may be required for effective play
- As a result of the influence of drugs

Case Study Example

In 2014, Luis Suarez (a professional football player) was found guilty of biting an opponent for the 3rd time in his career. He was suspended and fined



	Effect on the sport/players	Effect on the spectators
Sportsmanship	• Creates a good sporting environment • Players enjoy the game	• Produces positive role models • Positive image for sport.
Gamesmanship	• Irritates players and causes retaliation	• Produces bad role models

Aggression	Aggressive manner which is within the laws of the game.
Violence	The intent to harm others outside the rules of the game
Motor skill	An action or task that has a target or goal and that requires voluntary body/limb movement to achieve this goal.
Skill characteristics – Efficient	A skill is performed without wasting time or energy
Pre-determined	A skill has a clear objective or goal or is planned
Co-ordinated	The skill is performed with control, using limbs, sense and movement at the same time
Fluent	The skill is performed in one flowing movement
Aesthetic	The skill looks pleasing to the eye.
Open skill	Where the skill is largely affected by the environment, predominantly perceptual and externally paced. Effected by others, terrain/surface, weather and situation.
Closed skill	Where the skill is hardly affected by the environment and internally paced.
Simple skill	Where there are very few decisions to be made, limited information to be processed and the skill is made up of little subroutines.
Complex skills	Where there are numerous decisions to be made, lots of information to be processed and the skill is made up of many subroutines.
SMART targets – Specific	Your goals must be clear.
SMART targets – Measurable	Your goal must be something that can be measured.
SMART targets – Achievable	Your goal must be something that is possible for you to do.
SMART targets – Recorded	Your goal must be pre-determined and written down
SMART targets	Your goal must be pre-determined and written down

Key Vocabulary for Paper 2	
Key term	Meaning
National Governing Body (NGBs)	NGBs make and enforce the rules and laws of the game, promote their sport and participation, develop club and school links, support elite performers and improve promotion, provision and access in their sports.
Sport England	Helps communities, develop sporting habits, funds organisations and projects, help athletes pursue sport to the highest level, promote general physical activity.
Golden triangle	The relationship/independent links between sport, sponsorship and media.
Commercialisation	The use of sport to make a profit
Anabolic steroids	Enables athletes to train harder/for longer increasing strength and aggression.
Stimulants	Stimulants – work to stimulate the brain which increases alertness
Beta blockers	Beta blockers – help to control heart rate and keep the athletes calm.
WADA	World Anti-Doping Agency
Sportsmanship	Behaviour which shows fair play, respect for your opponents and gracious behaviour in a particular situation.
Etiquette	Customs we observe around the rules and regulations which is socially acceptable. An unwritten rule that is not enforceable but usually followed.
Gamesmanship	The use of unethical (not illegal or against the rules) to win or gain an advantage. (Bending the rules).
Deviance	This involves behaviour that is against society norms and values. Normally illegal.

Imagery	Imagining the movement be successful or emotional feeling such as winning.
Mental rehearsal	Imagining yourself doing the activity or skill, simulating the feeling of the skill in your mind.
Selective attention	Concentrating on what is relevant to the skill and ignores irrelevant information and distractions.
Positive thinking	Thinking about being confident, performing well and winning.
Visual guidance	Usual visual aids to build up the ideal picture of what is required successfully perform a new skill.
Verbal guidance	Describing or explaining how to perform the activity.
Manual guidance	Giving physical support to the athlete performing the skill.
Mechanical guidance	The use of equipment to support and guide the performer.
Health	State of complete physical mental, and social well-being without disease or infirmity.
Fitness	A person's ability to carry out daily life activities without becoming overly tired. Used as a measure of the body's ability to function effectively and efficiently.
Well being	The refers to a feeling or mental state of being happy/contented, prosperous and healthy and your overall quality of life and performing tasks in your daily life without becoming overly tired.
Sedentary lifestyle	Sedentary – Inactivity or lack of exercise Lifestyle – Way of life or how you live your life.
Balanced diet	A diet that contains the correct proportions of carbohydrates, proteins, fats, proteins, vitamins, minerals and water to maintain good health.
Carbohydrates	Source of energy and increases glycogen stores.
Protein	Growth and repair of muscles.
Fats	Source of energy and can be used for protection and warmth.

B6 – Inheritance, Variation and Evolution

1. DEFINITIONS

Gamete	Sex cells. In humans these are the sperm and egg. In plants they are pollen and egg cells.
Gene	A small section of DNA on a chromosome. Each gene codes for a particular sequence of amino acids, to make a specific protein.
DNA	DNA is a polymer made up of two strands forming a double helix.
Chromosome	Structure which contains DNA.
Allele	Alternative version of the same gene.
Dominant	Allele that is always expressed, even if only one copy is present.
Recessive	Allele that is only expressed if two copies are present.
Homozygous	If the two alleles present are the same.
Heterozygous	If the alleles are different.
Genotype	The alleles present in an organism. E.g. BB or Bb or bb
Phenotype	The physical appearance of an organism. E.g. black fur
Genome	The entire genetic material of that organism.
Variation	Differences in the characteristics of individuals in a population.
Evolution	Change in the inherited characteristics of a population over time through a process of natural selection which may result in the formation of a new species.
Species	A group of organisms that can breed together to produce fertile offspring.
Extinction	No remaining individuals of a species still alive.
Desired Characteristic	A feature that is wanted in an organism, often to increase yield

2. SEXUAL AND ASEXUAL REPRODUCTION

Sexual	Asexual
2 parents	1 parent
Mixing of genetic material	No mixing of genetic material
Offspring have variation, they are not clones	Offspring are clones of their parent
Meiosis	Mitosis
Joining (fusion) of male and female gametes:	No gametes involved

3. MEIOSIS

Cells in reproductive organs divide by meiosis to form gametes which contain half the number of chromosomes of a regular cell.

When a cell divides to form gametes:

- Copies of genetic information are made.
- The cell divides twice to form four gametes, each with a single set of chromosomes.
- All gametes are genetically different from each other.

During fertilisation:

- Gametes join to restore the normal number of chromosomes.

After fertilisation:

- The cell divides by mitosis, increasing the number of cells.
- The embryo develops and cells differentiate

4. COMPARING MITOSIS AND MEIOSIS

Mitosis (in all body cells)	Meiosis (in testes and ovaries)
2 daughter cells	4 daughter cells
Daughter cells are genetically identical	Daughter cells are not genetically identical
Cell divides once	Two divisions
Daughter cells have same number of chromosomes as original cell	Daughter cells have half the chromosomes as original cell
Used for growth and repair.	Produces gametes for sexual reproduction

1. CHROMOSOMES, GENES & ALLELES

The **chromosomes** are in the **nucleus** of cells. Humans have 46 chromosomes.

Chromosomes contain **genes**, which code for **proteins**. In body cells, chromosomes are in **pairs** – one from each parent.

In sex cells (gametes) they are not in pairs and there is half the number of chromosomes (e.g. 23 in humans).

Different forms of the same gene are called **alleles**.

There are two alleles for any one characteristic – one on the chromosome from mum and one from dad.

E.g. you have a gene for eye colour but different alleles for blue eyes or green eyes.

If the alleles are the same, the person is **homozygous**. If the alleles are different the person is **heterozygous**.

3. SEX DETERMINATION

Ordinary human body cells contain 23 pairs of chromosomes: 22 pairs control characteristics only. But one of the pairs carries the genes that determine sex.

- Female sex chromosomes = XX
- Male sex chromosomes = XY

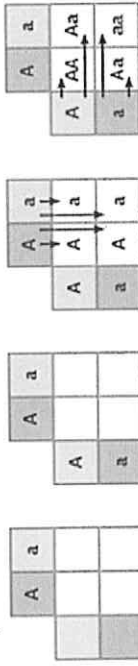
If a man (XY) and woman (XX) have a baby, there is a 50% chance that baby will be a boy. This is shown in the Punnett square diagram:

	X	Y
X	XX male	XY female
X	XX male	XY female

7. HOW TO COMPLETE A PUNNETT SQUARE

If A = blue eyes, a = green eyes
Note that the dominant allele is a capital letter and the recessive allele is the same letter but lower-case.

Calculate the probability of two heterozygous parents having a green eyed child



Step 1	Step 2	Step 3	Step 4
Put one parent's alleles into the boxes at the top	Put the other parent's alleles into the boxes down the side	Write the alleles from parent one in all boxes underneath	Put the alleles from the second parent into the boxes to the right

In each box write down their phenotype (physical appearance) e.g. eye-colour

	A	a
A	AA Blue eyes	Aa Blue eyes
a	Aa Blue eyes	aa Green eyes

The probability of green-eyed child (aa genotype) is $\frac{1}{4}$, 25% or 0.25.

8. INHERITED DISORDERS

Polydactyly – extra fingers & toes – caused by a dominant allele

Cystic Fibrosis – a cell membrane disorder – caused by a recessive allele

9. EMBRYO SCREENING

Parents that have inherited disorders may opt for embryo screening

- Multiple embryos are made in IVF
- One cell is removed from each embryo
- The cells are screened for faulty genes
- Only embryos without the genes for disorders are transferred to the womb of the mother.

Advantages

- Babies born free of that inherited disorder

Disadvantages

- No guarantee that a child will be free of other health issues
- Many embryos are destroyed, which are potential human lives

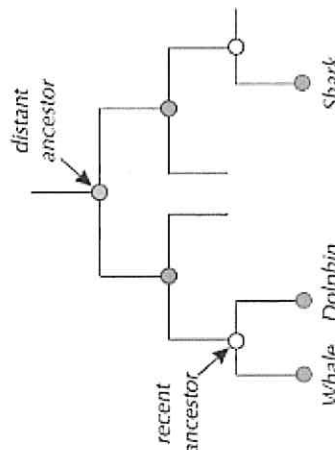
10. THE HUMAN GENOME

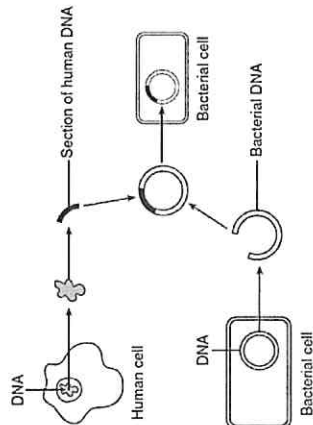
The entire human genome has been sequenced. The information can be used to:

- search for genes linked to different types of disease
- understand and treat inherited disorders
- trace human migration patterns from the past

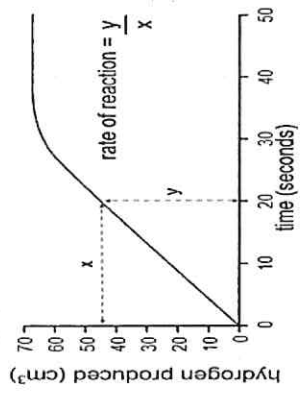
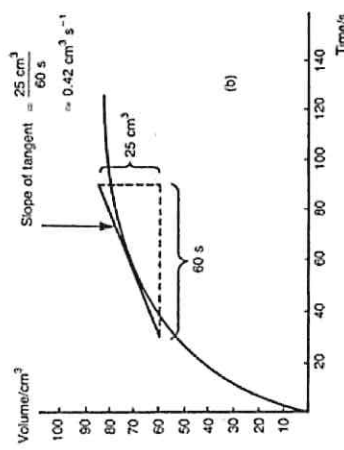
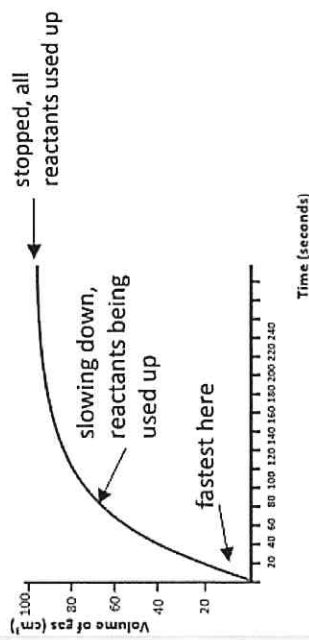
11. MUTATIONS

- Mutations are changes in DNA
- Mutations cause variation
- Mutations are random
- Very rarely a mutation leads to a change in phenotype
- If a mutation causes an advantageous change in phenotype, this can lead to a rapid change in the evolution of the species.

12. CLASSIFICATION Linnaeus classified things into: Kingdom, Phylum, Class, Order, Family, Genus and Species. Organisms are named by the binomial system (2 names). e.g. <i>Homo sapiens</i> (the first name is the genus and the second is the species) Due to evidence from chemical analysis and more detailed microscope images, there is now a 'three-domain system' by Carl Woese: The 3 domains are: • Bacteria • Archaea (primitive bacteria that usually live in extreme conditions – extremophiles) • Eukaryotes The 4 eukaryote kingdoms are: • Animals • Plants • Fungi • Protists	13. CAUSES OF VARIATION • Genetic factors (e.g. eye colour, blood type) • The environment (e.g. accent) • A combination of genes and the environment (e.g. height) Differences between genetically identical twins must be due to environmental differences. Similarities between genetically identical twins must be due to inherited factors.	14. SELECTIVE BREEDING (ARTIFICIAL SELECTION) Humans selectively breed plants and animals for particular genetic characteristics, such as: • Disease resistance in food crops • Animals which produce more meat or milk or wool • Domestic dogs with a gentle nature • Large or unusual flowers Steps in selective breeding: 1. Choose a male and a female with the desired characteristic 2. Breed together 3. The offspring with the desired characteristic are chosen and bred together 4. Continue over many generations, selecting the best offspring each time, until all offspring show desired characteristics. PROBLEM: Selective breeding can lead to inbreeding, leaving individuals prone to disease or inherited defects.
15. EVOLUTION AND NATURAL SELECTION The theory of evolution by natural selection states that all species of living things have evolved from simple life forms that first developed more than three billion years ago. • There is variation within the population, due to mutation • Some genes may give better adaptations • The best adapted will survive and reproduce • They will pass the advantageous genes on to their offspring • This will continue over many generations until the entire species show this characteristic If two populations of one species become so different in phenotype that they can no longer interbreed to produce fertile offspring, they have formed two new species.	16. EVOLUTIONARY TREES These show how species have evolved and are related to each other. Whales and dolphins have a recent common ancestor so are closely related. They are both more distantly related to sharks. 	

17. EVIDENCE FOR EVOLUTION - FOSSILS Fossils help us understand how much or little organisms have changed as life developed on Earth. Fossils are the remains of plants or animals from millions of years ago. They are formed in different ways: • Remains of an organism that has not fully decayed as one of the decay conditions was absent (e.g. too cold, not enough oxygen) • Mineralised forms of the harder parts of an organisms (such as bones) • Traces of organisms such as footprints or burrows or rootlet traces The fossil record is incomplete because: • Many early life forms were soft bodied so have left few traces behind, as they decayed so we cannot be sure how life started on Earth. • Many have been destroyed by Earth's rock cycle.	18. EXTINCTION If the environment of a species is changing rapidly a species may become extinct before it can evolve and become better adapted. Factors that cause extinction include: • Habitat loss • New diseases, predators or competitors • Human impact e.g. pollution, hunting, fishing, poaching, deforestation • Climate change • Rapid change in the environment e.g. meteor, volcanic eruption	19. EVIDENCE FOR EVOLUTION - ANTIBIOTIC RESISTANCE Bacteria evolve rapidly as they reproduce at a fast rate. MRSA is an example of a bacteria that is resistant to antibiotics. 1. Mutations occur, causing a strain of bacteria to become resistant (<u>not immune</u>) to the antibiotic 2. The resistant bacteria survive and reproduce 3. The resistant population increases 4. The resistant strain spreads as people are not immune to the resistant bacteria and there is no treatment <u>Reducing the development of resistance:</u> • Do not take antibiotics for a viral infection • Complete the full course of antibiotics • Only take antibiotics when necessary • Restrict the use of agricultural antibiotics Problem: The development of new antibiotics is costly and slow. It is unlikely to keep up with the emergence of new resistant strains.						
20. GENETIC ENGINEERING The genome of an organism is modified, by adding a gene from another organism, to give a desired characteristic. Genes from the chromosomes of humans and other organisms can be 'cut out' and transferred to cells of other organisms. Genetically Modified (GM) plant crops have been engineered to be resistant to diseases, insects or herbicides or to produce bigger better fruits or higher yields. Bacterial cells have been genetically engineered to produce useful substances such as human insulin to treat diabetes. <table><tr><th>Advantages</th><th>Disadvantages</th></tr><tr><td>Resistant to insect attack</td><td>Could affect populations of wildflowers and insects</td></tr><tr><td>Produce increased yields</td><td>Not sure of the long-term effects when eating GM crops</td></tr></table>	Advantages	Disadvantages	Resistant to insect attack	Could affect populations of wildflowers and insects	Produce increased yields	Not sure of the long-term effects when eating GM crops		21. GENETIC ENGINEERING (HIGHER ONLY): 1. Enzymes are used to isolate the required gene; this gene is inserted into a vector, usually a bacterial plasmid or a virus 2. The vector is used to insert the gene into the required cells 3. Genes are transferred to the cells of animals, plants or microorganisms at an early stage in their development so that they develop with desired characteristics 
Advantages	Disadvantages							
Resistant to insect attack	Could affect populations of wildflowers and insects							
Produce increased yields	Not sure of the long-term effects when eating GM crops							

C6 Rate of Reaction

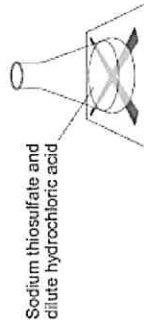
1. Definitions <table><tr><td>Collision theory</td><td>For a reaction to take place, reactant particles have to collide</td></tr><tr><td>Activation energy</td><td>minimum amount of energy needed to start a reaction</td></tr><tr><td>Catalyst</td><td>Speeds up reaction without being used up</td></tr><tr><td>Gradient</td><td>Calculated by <u>change in y</u> on a graph change in x</td></tr><tr><td>Reversible reaction</td><td>reactions in which the products can react to produce the original reactants</td></tr><tr><td>Tangent</td><td>A line that touches the curve on a graph at the point given in the question</td></tr><tr><td>Equilibrium</td><td>Rate of forward reaction = rate of reverse</td></tr><tr><td>Closed system</td><td>Reactants or products cannot escape the container</td></tr></table>	Collision theory	For a reaction to take place, reactant particles have to collide	Activation energy	minimum amount of energy needed to start a reaction	Catalyst	Speeds up reaction without being used up	Gradient	Calculated by <u>change in y</u> on a graph change in x	Reversible reaction	reactions in which the products can react to produce the original reactants	Tangent	A line that touches the curve on a graph at the point given in the question	Equilibrium	Rate of forward reaction = rate of reverse	Closed system	Reactants or products cannot escape the container	2. Calculating rate of reaction rate = $\frac{\text{quantity of reactant used}}{\text{time}}$ Units are either g/s or cm^3/s rate = $\frac{\text{quantity of product formed}}{\text{time}}$ Rate calculations can be done from tables of data or graphs: 	3. HT only – calculating rate using tangent 1. Draw a line along the point you're interested in. The line should touch the curve at the point given 2. Make a triangle. 3. Measure the change in volume (change in y) and change in time (change in x) 4. Calculate the gradient 5. Use units from the axes to determine the units for rate 
Collision theory	For a reaction to take place, reactant particles have to collide																	
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Closed system	Reactants or products cannot escape the container																	
4. Progress of a reaction A reaction is always fastest at the beginning and slows down over time as the reactants get used up and the frequency of collisions decreases. 	5. Factors that increase the rate of reaction <table><tr><td>Increasing temperature</td><td>This is because the particle have more kinetic energy and therefore move faster, so there are more frequent collisions, increasing the rate</td></tr><tr><td>Increasing surface area</td><td>Powder has the largest surface area so when solid is in powdered form there are more frequent collisions increasing the rate of reaction</td></tr><tr><td>Increasing concentration (usually of acid)</td><td>There are more (acid) particles in a given volume so there are more frequent collisions</td></tr><tr><td>Increasing pressure of a gas</td><td>There are more gas particles in a smaller volume so there are more frequent collisions</td></tr><tr><td>Adding a catalyst</td><td>Catalysts work by providing an alternative route of lower activation energy so increases the rate of reaction</td></tr></table>	Increasing temperature	This is because the particle have more kinetic energy and therefore move faster, so there are more frequent collisions, increasing the rate	Increasing surface area	Powder has the largest surface area so when solid is in powdered form there are more frequent collisions increasing the rate of reaction	Increasing concentration (usually of acid)	There are more (acid) particles in a given volume so there are more frequent collisions	Increasing pressure of a gas	There are more gas particles in a smaller volume so there are more frequent collisions	Adding a catalyst	Catalysts work by providing an alternative route of lower activation energy so increases the rate of reaction							
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6. Required Practical

Investigating the effect of changing the concentration of HCl on the rate of reaction



The sulphur being made is insoluble and is what makes the liquid go cloudy



Independent variable: concentration of HCl

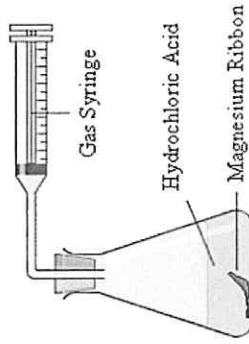
Dependent variable : Time taken for the cross to disappear

Control variables : volume of HCl, volume of sodium thiosulphate, temperature of both solutions, concentration of sodium thiosulphate

Method

1. Use a measuring cylinder to put 10 cm³ sodium thiosulfate solution into the conical flask.
2. Put the conical flask on the black cross.
3. Put 10 cm³ of 0.5M hydrochloric acid into the 10 cm³ measuring cylinder.
4. Put this acid into the flask. At the same time swirl the flask gently and start the stopwatch.
5. Look down through the top of the flask. Stop the stopwatch when you can no longer see the cross. Record the time.
6. Repeat steps 1-5 using different concentrations of HCl – 1M, 1.5M, 2M and 2.5M

Using volume of gas collected over time as a measure of the rate



Independent variable: concentration of HCl

Dependent variable : Volume of gas produced / min

Control variables : volume of HCl, mass of Mg, temperature of acid

Method

1. Measure 20cm³ 0.5M HCl into a conical flask.
2. Insert 2 x 2cm pieces of Mg and attach a gas syringe
3. Start a stopwatch and measure the volume of gas collected every 20 seconds until the reaction is over.
4. Repeat using different concentrations of HCl.

7. Reversible Reactions

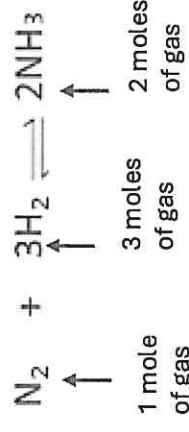
- These are reactions in which the products can react to produce the original reactants
 - They are represented by the symbol $\rightleftharpoons$
 - The direction of the reaction can be changed by changing the conditions
 - If a reaction is exothermic in one direction, it is endothermic in the opposite direction
- | | |
|---|--|
| hydrated
copper
sulfate
(blue) | $\xrightleftharpoons{\text{endothermic}} \text{anhydrous copper sulfate (white)} + \text{water}$ |
|---|--|
- When a reversible reaction takes place in sealed apparatus, then a point occurs when the forward and backward reactions occur at the same rate. This is equilibrium

8. The effect of changing conditions on equilibrium (HT only)

Le Chatelier's principle states:

if a system is at equilibrium and a change is made to any of the conditions, then the system responds to counteract the change

Condition	change	Which way position of equilibrium moves	Effect on yield of product
Concentration	Increase concentration of reactants	Right	Increase
	Increase concentration of products	Left	Decrease
Pressure	Increase pressure	Side with less moles of gas	
	Decrease pressure	Side with more moles of gas	
Temperature	Increase temperature and reaction is endothermic	Right	Increase
	Decrease temperature and reaction is endothermic	Left	Decrease
	Increase temperature and reaction is exothermic	Left	Decrease
	Decrease temperature and reaction is exothermic	Right	Increase
Catalyst	Add catalyst	No effect on position of equilibrium	None



If increase pressure, equilibrium would move to right as 4 moles of gas on the left and only 2 on the right

C8 chemical analysis

1. Definitions		2. Pure substances	3. Formulations
Pure substance	Single element or compound, not mixed with any other substance		
formulation	a mixture that is designed as a useful product.		
chromatography	Method for separating substances and can be used to check purity		
Stationary phase	In chromatography, the phase that does not move (paper)		
Mobile phase	In chromatography, the phase that moves (solvent)		

	Melting point of a pure substance
	Melting point of an impure substance

- Pure substances melt and boil at **specific** temperatures.
- E.g. Water has a boiling point of 100oC, if it is above or below this, it is not pure
- Heating graphs can be used to distinguish pure substances from impure.

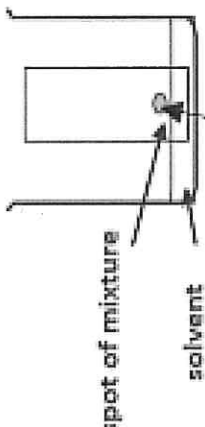
4. Chromatography

- Technique used to separate mixtures of soluble substances.
- How soluble a substance is determines how far it travels across paper.
- More soluble = travels further (higher up paper)

- Mobile phase** –
- Solvent is the mobile phase
- The substances dissolve in the solvent
- The solvent then moves through the stationary phase.
- Stationary phase**
- Does not move.
- The paper is the stationary phase.

The compounds in the mixture separate into different spots- depends on the solvent used.

Pure substances produce 1 spot whereas impure will produce multiple.



Important – start line on paper must be drawn in pencil as pencil is insoluble and will not run. The spot and start line must be above the solvent line so the colours won't just wash into the solvent in the beaker.

5. Rf values

- This is the ratio of the distance moved by a substance to the distance moved by the compound

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

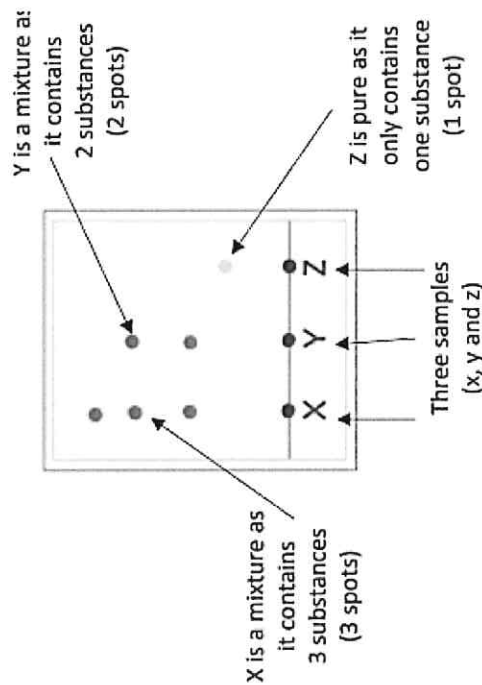
- Should always be between 0 and 1
- Each substance has a unique Rf value
- Can compare Rf values to a library of known substances
- Can identify unknown substances

5. Required Practical – chromatography

Method:

- 1) Using a ruler, measure 1cm from bottom of chromatography paper and draw a line across the paper with a pencil.
- 2) Using a pipette, drop small spots of each ink onto pencil line (leave a gap so do not merge).
- 3) Pour solvent into a beaker, do not fill solvent above the pencil line on the paper.
- 4) Place chromatograph paper into beaker and allow solvent to move up the paper.
- 5) Remove paper just before solvent reaches top of the paper and leave to dry.
- 6) Calculate Rf values of all the spots using the equation below:

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



6. Tests for gases

Gas	Test	Positive result
Hydrogen	<i>Burning splint</i>	'Pop' sound.
Oxygen	<i>Glowing splint</i>	Re-lights the splint.
Chlorine	<i>Litmus paper (damp)</i>	Bleaches the paper white.
Carbon dioxide	<i>Lime water</i>	Goes cloudy (as a solid calcium carbonate forms).