Year 10 Triple Science Biology Paper 1 Checklist

Cell Biology

Cells are individual units.
The nucleus controls the cell and contains DNA to create all the proteins.
The cytoplasm suspends all other organelles and where chemical reactions happen.
The cell membrane controls entry and exit in/out of the cell.
The mitochondria releases energy by aerobic respiration.
The ribosomes synthesis proteins.
The cell wall is made of cellulose and gives support to the cell.
The permanent vacuole fills with cell sap to keep the cell rigid.
The chloroplasts contain chlorophyll and carry out photosynthesis.
Algae, are protists not plants, even though they carry out photosynthesis.
Eukaryotic cells have genetic material enclosed in a nucleus.
Eukaryotes include: animals, plants, fungi, and Protista.
Prokaryote cells do not contain genetic material in a nucleus, can have additional pieces of DNA and are single celled.
Prokaryote cells are 1-2 orders of magnitude smaller than eukaryotes.
A plasmid is a small ring of DNA.
The cell wall of a prokaryote is not made of cellulose.
Some prokaryotes have a slime capsule, for additional protection.
A tail like structure is sometimes present on a prokaryote cell, called a flagellum/flagella.
Microscopes are used to magnify an object to allow it to be observed.
Microscopes use a range of methods to magnify, including light and electron beams.
Magnification is the process of making something bigger than it.
Magnify means to make something appear lager than it is.
Total magnification is calculated by multiplying the eyepiece lens magnification with the objective lens magnification.
Use the equation Magnification = Image size ÷ Real size
Resolution is the ability to distinguish between two separate points.
Resolving power refers to how much detail a magnifier can show.
Specialised cells have a specific shape and structures/organelles which enable them to carry out a specific function.
Differentiation is the process by which a cell becomes specialised.
Sperm cells are specialised for sexual reproduction.
Muscle cells are specialised for contraction and relaxation.
Nerve cells are specialised to carry electrical impulses.
Root hair cells are specialised to absorb water and mineral ions.
Phloem cells are specialised to transport sugars around the plant.
Xylem cells are specialised to transport water and mineral ions up the plant.
Diffusion is the spreading of particles of gas, or of any substance in solution, from a region of high concentration to a region of lower concentration.
The rate of diffusion is affected by: temperature of the particles, concentration of the particles, size of the particles.
Active transport is the movement of substances against the concentration gradient, from a lower concentration to a higher concentration.
A partially permeable membrane allows some substances through but not all substances.
A dilute solution contains a high concentration of water.
A concentrated solution contains a low concentration of water.
Osmosis is the movement of water particles from a dilute solution to a concentrated solution, across a partially permeable membrane.
An isotonic solution the concentration of solutes is the same inside and outside the cell.
In a hypertonic solution, the concentration of solutes is higher outside the cell than inside.
In a hypotonic solution, the concentration of solutes is lower outside the cell than inside.
Animal cells can be damaged if the concentration of water dramatically changes outside the cell.
Turgor pressure exists in cells with a cell wall, it makes a cell hard and rigid.
Plasmolysis occurs when water is lost from a plant cell causing the vacuole and cytoplasm to shrink, pulling the cell membrane away from the cell wall.
Surface area to volume ratio shows the size of the organisms surface compared to the volume of cells it contains.
The SA:Vol ratio falls as the object gets larger, meaning simple diffusion is not sufficient enough for adequate collection and removal of substances.

Several adaptations allow for more efficient exchange: large surface area, thin membranes, blood supply (where applicable), and steep concentration gradients.
Chromosomes carry the genes that contain the instructions for making new cells.
A gene is a section of DNA that contains the instructions to make one protein.
A human contains 46 chromosomes as 23 pairs. 23 from the mother and 23 from the father.
Mitosis is the process of cell division, which produces two identical cells, mainly for growth and repair of cells/tissues/organs.
The cell cycle varies in length from less than 24hours to more than several years.
The cell cycle has 3 stages, the first stage is the longest and where DNA and organelles are replicated, stage 2 is mitosis and stage 3 is the final division of the cell into 2 identical daughter cells.
Differentiation (already encountered)
Stem cells are unspecialised cells, able to become any type of cell.
Plants have specific locations of stem cell dense areas called the meristem, which remains undifferentiated for the plant's entire life.
Asexual reproduction involves the parent plant producing offspring using mitosis.
When identical offspring are produced from a single parent, this is called cloning.
A zygote is a single new cell produced from the fusion of an egg and sperm nucleus.
Embryonic stem cells are the inner cells within the embryo just after it has started dividing.
Adult stem cells are partially differentiated cells, able to become any type of cell within the tissue they are located.
Stem cells can be cloned and made to differentiate into many different cell types.
Plant meristems allow for plants to be quickly cloned for research, horticultural, and agricultural uses.
Stem cell treatments are being developed to help conditions like diabetes.
Progress with using stem cells has been extremely slow and expensive.
Therapeutic cloning involves using cells from an adult to create an early embryo of themselves as a source of perfectly matched cells, reducing rejection.
Stem cell use has risks as well as ethical and religious implications.

Organisation

Cells are the basic building blocks of all living organisms.
A tissue is a group of cells with a similar structure and function.
Organs are collections of tissues performing specific functions.
Organs are organised into organ systems, which work together to form organisms.
Both animals and plants have organ systems which each perform a role within the organism.
An example of an organ system would be the nervous system, which consists of the brain, spinal cord, nerves, receptors and effectors.
The digestive system is another example of an organ system in which several organs work together to digest and absorb food.
Digestive enzymes convert food into small soluble molecules that can be absorbed into the bloodstream.
The small intestine is adapted for efficient absorption of digestive products by being lined with small projections called villi, which are in turn lined with cells called microvilli.
Villi and microvilli increase the surface area of the small intestine allowing for fast absorption of the products of digestion.
Carbohydrates, lipids, and proteins are the main compounds that make up the structure of a cell. They are large molecules made up by smaller molecules joined together as part of cell metabolism.
Carbohydrates are made of long chains of sugars, such as glucose.
Proteins are made of chains of amino acids folded into 3D shapes.
Lipids are made of 3 fatty acid chains attached to one glycerol molecule.
Qualitative reagents are used to test for a range of carbohydrates, lipids and proteins.
Benedict's test is to identify if simple sugars are present in the food. A positive test is a change from blue to brick-red.
Iodine test is to identify if starch is present in the food. A positive test is a change from yellow/brown to blue/black.
Biuret reagent is to identify if protein is present in the food. A positive test is a change from blue to lilac/purple.
The emulsion test identifies lipids by turning the solution cloudy.
Enzymes control metabolism (the chemical reactions that occur daily in our body), this includes building molecules as well as breaking some down.
Enzymes are proteins.

Enzymes catalyse specific reactions in living organisms due to the shape of their active site.
The model of enzyme action we use is called the “lock and key” hypothesis.
Enzymes are chemicals, if their active site shape changes the enzyme cannot work and it is said to be “denatured”.
Enzymes speed up reactions, as they are biological catalysts.
Their rate of reaction is influenced by temperature and pH changes.
Rate of reaction can be calculated using the formula: rate = 1÷time.
Know how to investigate the effect of pH on the rate of reaction of amylase enzyme.
A continuous sampling technique is used to determine the time taken to completely digest a starch solution at a range of pH values. Iodine reagent is used to test for starch.
Temperature is able to be controlled by the use of a water bath or electric heater.
Amylase is produced by the salivary glands and the pancreas.
Proteases are produced by the lining of the stomach and in the pancreas.
Lipases are produced by the pancreas.
Carbohydrase’s break down carbohydrates into simple sugars. Amylase is a carbohydrase which breaks down starch.
Proteases break down proteins to amino acids.
Lipases break down lipids (fats) to glycerol and fatty acids.
The products of digestion are used to build new carbohydrates, lipids and proteins. Some glucose is used in respiration.
Bile is made in the liver and stored in the gall bladder.
Bile is alkaline to neutralise hydrochloric acid from the stomach. Bile also emulsifies lipids to form small droplets which increases the surface area allowing enzymes to work faster to digest lipids.
Mid-topic test
The heart is an organ that pumps blood around the body in a double circulatory system.
The right ventricle pumps deoxygenated blood via the pulmonary artery to the lungs where gas exchange takes place.
The left ventricle pumps oxygenated blood to the rest of the body via the aorta.
The vena cava brings deoxygenated blood back from the body to the right side of the heart.
The pulmonary vein brings oxygenated blood back to the left side of the heart.
The coronary arteries supply the heart with the oxygen and glucose it needs for respiration.
The natural resting heart rate is controlled by a group of cells located in the right atrium that act as a pacemaker.
Artificial pacemakers are electrical devices used to correct irregularities in the heart rate.
The body contains three different types of blood vessel: • arteries • veins • capillaries.
Arteries carry blood away from the heart at high pressure and speed. They have thick muscular and elastic layers with narrow lumens.
Veins bring blood back to the heart under low pressure and speed. They have less muscles and elastic tissue with large lumens.
Capillaries are where diffusion of nutrients and wate products in and out of the blood occurs. They are one cell thick to allow for efficient diffusion.
Blood is a tissue consisting of plasma, in which red blood cells, white blood cells and platelets are suspended.
Plasma is the liquid portion of the blood which carries dissolved nutrients and waste substances, as well as larger proteins such as hormones.
Red blood cells transport oxygen and contain a chemical called haemoglobin which converts to oxyhaemoglobin when oxygen is present.
White blood cells are part of the immune system which fights pathogens.
Platelets allow for the blood to clot when needed, preventing blood loss out of exposed vessels.
The lungs are large organs which allow for gas exchange to occur.
Breathing is a mechanical process, also called ventilation.
Gas exchange is the movement of oxygen from the air into the blood stream and carbon dioxide from the blood stream into the air.
The trachea is a large tube that has rings of cartilage around it in a C shape to prevent the trachea from closing.

The trachea divides into two, called the bronchi.
The bronchi divide further eventually leading to billions of tiny air sacs called alveoli.
Alveoli are one cell thick and surrounded by capillaries to allow for efficient gas exchange.
The roots, stem and leaves form a plant organ system for transport of substances around the plant.
Epidermal tissue covering the leaf provides a protective covering and is transparent to allow light to pass through. Sometimes it is also covered in a waxy waterproof layer.
The palisade mesophyll contains the palisade cells which are specialised to photosynthesise.
The spongy mesophyll contains air spaces to allow for gas exchange to occur within the plant.
The xylem and phloem are transport vessels, carrying water and minerals and sugars.
The meristem tissue found at the growing tips of shoots and roots is a site of undifferentiated cells.
Guard cells surround an opening called the stomata, which allows for gases to enter and exit as well as water vapour.
Root hair cells create a large surface area for increased osmosis of water and active transport of minerals into the root.
Transpiration is the movement of water through the xylem vessels which then evaporates out of the stomata in the leaf.
Factors affecting the rate of transpiration include: temperature, humidity, air movement and light intensity.
Xylem tissue transports water and mineral ions from the roots to the stems and leaves. It is composed of hollow tubes strengthened by lignin adapted for the transport of water in the transpiration stream.
Phloem tissue transports dissolved sugars from the leaves to the rest of the plant for immediate use or storage.
The movement of food molecules through phloem tissue is called translocation.
Phloem is composed of tubes of elongated cells. Cell sap can move from one phloem cell to the next through pores in the end walls.
Diseases, both communicable and non-communicable, are major causes of ill health.
Many other factors including diet, stress and life situations may have a profound effect on both physical and mental health. These are called “risk factors”.
Correlation does not necessarily mean causation. Many risk factors increase the risk of disease but may not directly cause a disease.
Describe the relationship between health and disease and the interactions between different types of disease.
Evaluate the human and financial cost of disease.
Different types of disease may interact. •• Defects in the immune system mean that an individual is more likely to suffer from infectious diseases. •• Viruses living in cells can be the trigger for cancers. •• Immune reactions initially caused by a pathogen can trigger allergies such as skin rashes and asthma. •• Severe physical ill health can lead to depression and other mental illness.
Translate disease incidence information between graphical and numerical forms and discuss the use of sampling in data.
A causal mechanism has been proven for some risk factors, but not in others. •• The effects of diet, smoking and exercise on cardiovascular disease. •• Obesity as a risk factor for Type 2 diabetes. •• The effect of alcohol on the liver and brain function. •• The effect of smoking on lung disease and lung cancer. •• The effects of smoking and alcohol on unborn babies. •• Carcinogens, including ionising radiation, as risk factors in cancer.
Many diseases are caused by the interaction of a number of factors.
Evaluate the advantages and disadvantages of treating cardiovascular diseases by drugs, mechanical devices or transplant.
In coronary heart disease layers of fatty material build up inside the coronary arteries, narrowing them. This reduces the flow of blood through the coronary arteries, resulting in a lack of oxygen for the heart muscle.
Stents are used to keep the coronary arteries open.
Statins are widely used to reduce blood cholesterol levels which slows down the rate of fatty material deposit.

In some people heart valves may become faulty, preventing the valve from opening fully, or the heart valve might develop a leak.
Faulty heart valves can be replaced using biological or mechanical valves.
In the case of heart failure a donor heart, or heart and lungs can be transplanted.
Artificial hearts are occasionally used to keep patients alive whilst waiting for a heart transplant, or to allow the heart to rest as an aid to recovery.
Cancer is the result of changes in cells that lead to uncontrolled growth and division.
Benign tumours are growths of abnormal cells which are contained in one area, usually within a membrane. They do not invade other parts of the body.
Malignant tumour cells are cancers. They invade neighbouring tissues and spread to different parts of the body in the blood where they form secondary tumours.
Scientists have identified both lifestyle and genetic risk factors for various types of cancer.

Bioenergetics

Photosynthesis is an endothermic chemical reaction.
Photosynthesis needs light energy to catalyse the reaction of carbon dioxide with water.
The reaction produces oxygen and glucose.
The word equation is: water + carbon dioxide ---light energy---> oxygen + glucose.
The symbol equation is: $6H_2O + 6CO_2$ ----light energy---> $6O_2 + C_6H_{12}O_6$
Leaves are adapted for photosynthesis by: • Containing palisade cells: elongated cells packed with chloroplasts (where green chlorophyll is present and absorbs light energy so that photosynthesis can take place). • Large surface area: leaves are wide or long and in abundance (e.g. millions of leaves on 1 tree). • Thin diffusion pathway: leaves are thin so gases can diffuse quickly. • Large vascular network: xylem transporting water to the leaf and phloem transporting sugar away from the leaf. • Waxy layer: reduces evaporation of water during transpiration.
The leaf is composed of many tissues: • Epithelium – transparent cells lining the leaf surface. • Palisade mesophyll – site of photosynthesis • Spongy mesophyll – site of gas exchange • Guard cells + stomata – controls entry and exit of gases and transpiration of water.
How fast a plant is photosynthesising is called “the rate of photosynthesis”.
The rate of photosynthesis can be measured by collecting oxygen over a unit of time, or by measuring the distance an air bubble moves over a unit of time.
Limiting factors are factors that limit the rate of photosynthesis.
The rate of photosynthesis is limited by: • low temperature • shortage of CO_2 • shortage of light • shortage of chlorophyll.
(HT) Limiting factors interact with each other, so any one of them could be limiting photosynthesis.
(HT) Light intensity is spread out equally over an area, as the distance away from the light source increases, the light intensity weakens. The Inverse Square Law shows us that the intensity of the light is inversely proportional the to the square of the distance.
A method details step by step what should be done to investigate a factor affecting the rate of photosynthesis.
Variables are factors that can influence the outcome of the practical work done to investigate the rate of photosynthesis.
Independent variable is the factor changed during the practical work to investigate its effect on the rate of photosynthesis.
Dependent variable is the factor we have chosen to measure to allow us to calculate the rate of photosynthesis.
Control variables are all the factors that may cause the results to become altered when we repeat the practical work. These variables must be kept the same as much as possible.

Graphs look at the rate of photosynthesis over time when plants are exposed to certain conditions. This allows us to make quick conclusions over the effectiveness of each limiting factor we are investigating.

Plants store excess glucose as starch, which can easily be tested using iodine.

Iodine turns blue-black in the presence of starch.

If plants are photosynthesising they convert the glucose they make into starch, if they are not photosynthesising they convert starch into glucose for use in respiration.

Other ways plants use glucose are:

- converted into starch for storage
- used to produce fats and oils for storage or cellulose to strengthen cell walls
- used to produce amino acids for protein synthesis.

To produce proteins plants also use nitrate ions from the soil

Leaves must have the chlorophyll removed before they can be tested for starch otherwise the colour change is not visible.

Oxygen is a waste product of photosynthesis and is released by the leaf into the atmosphere.

The test for oxygen is a glowing splint: if it relights then oxygen is present.

(HT) Limiting factors can be used to identify how to increase the productivity of plant species to produce more food for humans.

(HT) Greenhouses are used to prevent limiting factors reducing growth.

(HT) If it is cost effective adding heat, light or carbon dioxide to greenhouses can optimise growth.

(HT) Understand there are both advantages and disadvantages to manipulating the environment within a greenhouse or polytunnel.

(HT) Hydroponics is a way of utilising the needs of plant growth against the space needed to house and grow plants.

Respiration is an exothermic chemical reaction that occurs in all living cells to release energy.

Mitochondria are the site of aerobic respiration.

There are two types of respiration in cells: aerobic (with oxygen) and anaerobic (without oxygen).

The energy released is called ATP.

The word equation for aerobic respiration is: glucose + oxygen -----> carbon dioxide + water (+energy)

The symbol equation for aerobic respiration is: $C_6H_{12}O_6 + 6O_2$ -----> $6CO_2 + 6H_2O$

Organisms need energy for chemical reactions, movement (including transport of substances within the organism) and to maintain a constant internal temperature.

The products of respiration can be tested for:

- The test for carbon dioxide is to bubble the gas through limewater, which then turns cloudy.
- The test for water is to use cobalt chloride paper, it turns from blue to pink if water is present.

During exercise the heart and breathing rates increase and breath volume increases to supply oxygen to muscle cells faster.

Graphs can be used to interpret the effects of exercise on the body.

Can you design an investigation to look at the effects of exercise on the body?

Anaerobic respiration is the incomplete breakdown of glucose, so much less energy is released compared with aerobic respiration.

The word equation for anaerobic respiration is: Glucose ----> Lactic acid

When anaerobic respiration occurs during exercise, it creates an “oxygen debt” and the creation of lactic acid causes muscle fatigue due to the inefficient contraction of muscle cells.

The oxygen debt is the amount of oxygen needed to react with lactic acid and remove it from cells.

The oxygen debt is repaid by the continuation of deep breathing after exercise has finished.

(HT) Lactic acid is transported to the liver where it is converted back into glucose.

Anaerobic respiration in yeast cells is called fermentation

The word equation for fermentation is: glucose ---> ethanol + carbon dioxide

Fermentation is an economically important chemical reaction in the manufacture of bread and alcoholic drinks.

Metabolism means all the chemical reactions happening in a living organism.

Metabolism includes:

- the conversion of glucose to starch, glycogen or cellulose (long chain natural polymers).
- the formation of lipids (glycerol bonding to three chains of fatty acids).
- the formation of amino acids and proteins (glucose is joined with nitrate ions to form amino acids. Long chains of amino acids form a protein).
- Respiration.
- the breakdown of excess proteins to form urea for excretion.

Ecology

	RAG
An ecosystem is the interaction of a community of living organisms (biotic) with the non-living (abiotic) parts of their environment.	
Organisms do not live in isolation, even if they are solitary individuals.	
Organisms require materials from their surroundings and other living organisms to survive and reproduce.	
A community is made up of the populations of different species of animals, plants, Protista, fungi, bacteria and archaea that are all interdependent in a habitat.	
Within a community, each species depends on the other species for food, shelter, pollination, seed dispersal and more.	
If one species is removed from the community it can affect all of the species, this is called interdependence.	
A stable community is one where all the species and environment are in balance so that population sizes remain fairly constant.	
Abiotic (non-living) factors which can affect a community are: • light intensity • temperature • moisture levels • soil pH and mineral content • wind intensity and direction • carbon dioxide levels for plants • oxygen levels for aquatic animals.	
Biotic (living) factors which can affect a community are: • availability of food • new predators arriving • new pathogens • one species outcompeting another so the numbers are no longer sufficient to breed.	
The abundance and distribution of organisms in an ecosystem can depend on living and non-living factors.	
A quadrat is a simple device used to estimate the number of organisms in a habitat.	
When counting a population, sample size is important to consider as well as random sampling methods, such as random number generation to produce a set of coordinates at which to place the quadrat on the ground.	
Quantitative sampling means you take multiple readings at different locations within the defined sample area and then calculate a mean.	
Quantitative sampling is useful for comparing the same organism in different locations. A transect is a linear line across a habitat.	
Transects are not random and are used to look at how a changing habitat affects the distribution of organisms within it.	
The best-adapted individuals are most likely to win the competition for resources.	
These organisms are more likely to survive and reproduce.	
Competition exists between members of the same species and members of different species.	
Animals compete with each other for food, territories, and mates.	
Plants compete with each other for light, space, water, and mineral ions from the soil.	
All organisms, including microorganisms, have features (adaptations) that enable them to survive in the conditions in which they normally live.	
These adaptations could be structural, behavioural or functional.	
Plant adaptations involve: • ways in which they spread their seeds • size and position of their leaves • methods of pollination • collection and retention of water	
Animal adaptations involve: • Size and type of teeth • Bodily functions such as special salt glands to remove excess sea salt • Chemicals in their bodies which prevent freezing. • Changing their fur/coat to cope with varying temperatures • Camouflage techniques • Water retention	
An extremophile is an organism that can survive in the most difficult conditions on the planet.	
Most extremophiles are in the archaea domain, some are bacteria, plants or animals with special adaptations to certain environments.	

Photosynthetic organisms are the producers of biomass for life on Earth.	
Feeding relationships within a community can be represented by food chains.	
All food chains begin with a producer which synthesises new molecules.	
Producers are eaten by primary consumers, which in turn may be eaten by secondary consumers and then tertiary consumers.	
Consumers that eat other animals are often predators and those that are eaten are prey.	
In a stable community the numbers of predators and prey rise and fall in cycles.	
Trophic levels can be represented by numbers, starting at level 1 with plants and algae.	
Further trophic levels are numbered subsequently according to how far the organism is along the food chain.	
Level 1: Plants and algae make their own food and are called producers. Level 2: Herbivores eat plants/algae and are called primary consumers. Level 3: Carnivores that eat herbivores are called secondary consumers. Level 4: Carnivores that eat other carnivores are called tertiary consumers.	
Apex predators are carnivores with no predators.	
Decomposers break down dead plant and animal matter by secreting enzymes into the environment. Small soluble food molecules then diffuse into the microorganism.	
Pyramids of biomass can be constructed to represent the relative amount of biomass in each level of a food chain.	
Trophic level 1 is at the bottom of the pyramid.	
Producers are mostly plants and algae which transfer about 1 % of the incident energy from light for photosynthesis.	
Only approximately 10 % of the biomass from each trophic level is transferred to the level above it.	
Losses of biomass are due to: • not all the ingested material is absorbed, some is egested as faeces • some absorbed material is lost as waste, such as carbon dioxide and water in respiration and water and urea in urine.	
Large amounts of glucose are used in respiration.	
Efficiency of biomass transfer is calculated using the efficiency equation: Efficiency = useful energy transferred ÷ Total energy available	
Efficiency of biomass transfer explains why the energy available at each trophic level decreases.	
All materials in the living world are recycled to provide the building blocks for future organisms.	
The carbon cycle returns carbon from organisms to the atmosphere as carbon dioxide to be used by plants in photosynthesis.	
The water cycle provides fresh water for plants and animals on land before draining into the seas. Water is continuously evaporated and precipitated.	
Microorganisms are essential to the recycling of materials through an ecosystem by returning carbon to the atmosphere as carbon dioxide and mineral ions to the soil.	
Factors that affect the rate of decay of organic matter are: • temperature • oxygen availability • moisture levels	
Gardeners and farmer try to provide optimum conditions for the rapid decay of waste organic matter.	
Compost is used as a natural fertiliser.	
Anaerobic decay produces methane gas. Biogas generators can be used to produce methane gas as a fuel.	
Plan an effective investigation into the effect of temperature on the rate of decay of fresh milk.	
Plot a graph to show temperature against pH change.	
Analyse the results to explain the effect of temperature on the decay rate of fresh milk.	
Biodiversity is the variety of all the different species of organisms on Earth, or within an ecosystem.	
Biodiversity ensures the stability of ecosystems by reducing the dependence of one species on another for food, shelter and the maintenance of the physical environment.	
The future of the human species on Earth relies on us maintaining a good level of biodiversity. Many human activities are reducing biodiversity and only recently have measures been taken to try to stop this reduction.	
Rapid growth in the human population and an increase in the standard of living mean that increasingly more resources are used and more waste is produced.	
Humans reduce the amount of land available for other animals and plants by building, quarrying, farming and dumping waste.	
Pollution can occur: • in water, from sewage, fertiliser or toxic chemicals • on land, from landfill and from toxic chemicals.	
Pollution kills plants and animals which can reduce biodiversity.	

Pollution levels in water can be measured by oxygen and pH content. Pollution can also be measured by looking at bioindicators – these are a range of organisms found in different levels of polluted water.	
Pollution can occur in the air from smoke and acidic gases.	
Acidic gases are produced from the burning of fossil fuels: • Carbon reacts with oxygen to make carbon dioxide • Sulfur impurities reacts with oxygen to form sulfur dioxide • Nitrogen in the atmosphere reacts with oxygen inside the hot engine to form nitric acid	
Acidic gases dissolve in rain water to form acid rain.	
Acid rain causes damage to buildings, trees, lakes and soil.	
Smoke pollution refers to small unburnt carbon particles called "particulates". These cause cooling and reduced light levels.	
Smog is caused by a mixture of all these gases and particulates. It causes a brownish haze above a city. Smog is very dangerous to organisms, especially those with respiratory illnesses.	
Large scale deforestation in tropical areas has occurred to provide land for cattle and for rice fields and to grow crops for biofuels.	
The destruction of peat bogs and other areas of peat to produce garden compost reduces the area of this habitat and thus the biodiversity associated with it.	
"Peat free" composts reduce carbon emissions and conserve peat bogs and peatlands as habitats for biodiversity.	
The decay or burning of peat releases carbon dioxide into the atmosphere further fuelling global warming.	
Levels of carbon dioxide and methane in the atmosphere are increasing and contribute to global warming.	
The greenhouse effect is the warming of the Earth when solar radiation is absorbed by gases in the atmosphere, such as carbon dioxide and methane, keeping the Earth at an average temperature suitable for life on Earth to thrive.	
Global warming happens due to excessive levels of carbon dioxide and methane entering the atmosphere, increasing the amount of solar radiation that is absorbed and heating the Earth up more than it needs.	
Climate change is a consequence of global warming and it means the climate will become unpredictable.	
Consequences of global warming include: • Loss of low-lying habitats due to flooding • Changes in the distribution patterns of species • Changes to the migration patterns of animals	
These consequences will lead to unstable communities.	
Environmental changes affect the distribution of species in an ecosystem. These changes include: • temperature • availability of water • composition of atmospheric gases.	
These changes may be seasonal, geographic or caused by human interaction.	
Scientists and concerned citizens have put in place programmes to reduce the negative effects of humans on ecosystems and biodiversity.	
These include: • breeding programmes for endangered species • protection and regeneration of rare habitats • reintroduction of field margins and hedgerows in agricultural areas where farmers grow only one type of crop • reduction of deforestation and carbon dioxide emissions by some governments • recycling resources rather than dumping waste in landfill.	
Food security is having enough food to feed a population.	
Biological factors which are threatening food security include: • the increasing birth rate has threatened food security in some countries • changing diets in developed countries means scarce food resources are transported around the world • new pests and pathogens that affect farming • environmental changes that affect food production, such as widespread famine occurring in some countries if rains fail • the cost of agricultural inputs • conflicts that have arisen in some parts of the world which affect the availability of water or food.	
Sustainable methods must be found to feed all people on Earth, such as keeping soil quality high each year, looking at more efficient ways to produce food and taking care of fish stocks so they don't run out.	
The efficiency of food production can be improved by restricting energy transfer from food animals to the environment. This can be done by limiting their movement and by controlling the temperature of their surroundings. This is called intensive farming.	
There are ethical objections to this type of farming technique. Improving animal welfare has been shown to also improve how much mass the animals gain.	

Reducing the number of levels in the food chain also increases the amount of biomass available, and thus increases the amount of energy able to be transferred.	
Some animals are fed high protein foods to increase growth.	
Fish stocks in the oceans are declining. It is important to maintain fish stocks at a level where breeding continues or certain species may disappear altogether in some areas.	
Control of net size and the introduction of fishing quotas play important roles in conservation of fish stocks at a sustainable level.	
Modern biotechnology techniques enable large quantities of microorganisms to be cultured for food.	
The fungus Fusarium is useful for producing mycoprotein, a protein-rich food suitable for vegetarians.	
This fungus is grown on glucose syrup, in aerobic conditions, and the biomass is harvested and purified.	
A genetically modified bacterium produces human insulin. When harvested and purified this is used to treat people with diabetes.	
GM crops could provide more food or food with an improved nutritional value such as golden rice.	