

Topic 1: Variation, inheritance and evolution

Variation - means indifference within the same species due to combination of genetic and environmental causes.

SEXUAL REPRODUCTION causes lots of variation. ASEXUAL REPRODUCTION leads to no variation (clones). New gene forms can be made by mutations which are caused by UV light, X-Rays, Radioactive substances and some chemicals.

Genetic information - which controls how we develop is carried on GENES found on CHROMOSOMES. Body cells have 23 pairs (46) chromosomes, gametes have 23 singular chromosomes.

Cloning - Clones are genetically identical individuals. In plants CUTTINGS can be used to make clones; all identical but therefore susceptible to the same disease. In animals a few cells can be cloned by TISSUE CULTURE.

Selective breeding is when we choose individuals with the 'best' characteristics together to produce better individuals. This has been used to improve farm animals and crops. It can reduce variation and lead to problems with genetic disease.

Genetic engineering Enzymes are used to cut open bacterial genes and implant useful genes. This has been used to make insulin, improve crop yields, disease resistance and increase shelf life of food stuffs.

Sex inheritance The 23rd chromosome pair of genes are either x or y. If an individual has 2 x chromosomes they are female, an x and a y male.

ALLELE is the different forms of a gene.

DOMINANT strongest allele always shows through

RECESSIVE weaker allele needs both to show through.

HOMOZYGOUS both alleles the same.

HETEROZYGOUS alleles are different.

Evolution is a slow change in organisms to make them better adapted to their environment. Some species couldn't change and due to increased competition, change in environment, new predators and died out, became EXTINCT.

Fossils are formed from hard parts of animals show decay, or when conditions for decay aren't present, or when soft parts become replaced by minerals. Fossils allow scientists to see how animals have changed over a long period of time.

Natural selection is when species compete all the time, better adapted individuals survive and pass on their genes.

Topic 2: The Working Plant

Plant Structure - Plants have four main parts: FLOWER contains the reproductive organs, STEM provides support and XYLEM tubes to carry water, PHLUEM tubes to carry glucose, LEAVES carry out photosynthesis, ROOTS anchor the plant and absorb water.

Photosynthesis

Word equation



Plants use glucose for energy via respiration. This is used to convert sugars into starch, convert sugars into cellulose for cell walls, convert sugars into nitrates and amino acids for proteins, converts sugars into liquids (fats or oils) for storage in seeds.

If you increase the temperature up to 40°C photosynthesis increases after than enzymes demature and it stops. Photosynthesis also increases when you increase the light and or CO₂ until another factor limits the rate.

Water Loss

Water is lost through the stomata. The waxy cuticle prevents water loss from upper surface, and stoma on bottom to reduce transpiration. Water is used in plants to keep leaves cool, transport minerals, keep cells firm and rigid. Water is evaporated through the stoma, water from the xylem vessels enters the leaf, water is pulled into the xylem from the roots, water goes into the root via osmosis.

Osmosis is the movement of water from a high concentration of water to a low one.

Support Plant cells keep rigid by containing water. When full of water plant stays erect. When they are short of water the plant wilts. Plants also need certain MINERALS. They need potassium, phosphates and nitrates for growth and magnesium to make chlorophyll for photosynthesis.

Topic 3: HEALTH IN THE BALANCE

INHALED AIR: Nitrogen 78%, Oxygen 21%, Carbon Dioxide 0.03%

EXHALED AIR: Nitrogen 78%, Oxygen 16%, Carbon Dioxide 4%

AEROBIC RESPIRATION: Glucose and Oxygen _ Carbon Dioxide and Water and lots of energy.

This process releases energy by using oxygen to break down glucose inside cells, pulse and breathing rates will increase during exercise to provide more oxygen and glucose for the cells.

AEROBIC RESPIRATION: Glucose _ Lactic Acid and a bit of energy when there isn't enough oxygen anaerobic respiration takes place to give an emergency energy supply.

HOMEOSTASIS is keeping body conditions (temperature, water, oxygen, glucose and CO₂). When we are too cold we shiver, keep our blood away from our skin (vasoconstriction) and sweat less. When we are too hot we keep our blood by our skin vasodilation, sweat more to evaporate water and cools skin. The kidney filters blood removing excess water and salt, and all urea.

BODY DEFENCE - To stop microbes entering our body has various barriers, the skin prevents entry, breathing system produces mucus to trap germs, stomach produces hydrochloric acid to kill bacteria. Inside respiratory system cells have cilia on them that brush the mucus which traps the bacteria out of the body. Once inside the body WHITE BLOOD CELLS either ingest microbes or produce antibodies to destroy microbes. Once we can make the specific antibody we keep the ability giving a natural immunity.

DRUGS

ALCOHOL is a depressant, slowing reactions, and can lead to a lack of self control. Excess can lead to coma, unconsciousness, or death. Long term effects include liver and brain damage.

TOBACO (smoking) can cause Emphysema (damage to alveoli), bronchitis (increased infection and mucus production), smokers cough (cilia damage so find it difficult to get mucus and tar from lungs), heart disease and cancers.

SOLVENTS are depressants leading to slow reactions and hallucinations, can change behaviour, or permanently damage the lungs, liver, brain or kidneys.

Topic 4: CARBON CHEMISTRY

HYDRECARBONS - These are made up of only carbon and hydrogen atoms.

ALKANES - hydrocarbons that only contain single bonds joining atoms.

ALKENES - hydrocarbons with one double bond between carbon atoms.

Alkenes make bromine water go colourless, alkanes have no effect.

FRACTIONAL DISTILLATION - is how crude oil is separated into its parts (FRACTIONS), crude oil contains refinery gases, petrol, naphtha, kerosene, diesel, lubricating oil, fuel oil and bitumen. As we need more of certain fractions than others we need to CRACK (convert large molecular fractions to smaller ones). To crack a fraction we use high temperature and a catalyst.

PLASTICS are made by joining small monomers together to form long chain polymers.

Polythene; light, flexible, used in plastic bags, moulded containers.

Polystyrene; light, poor conductor of heat, insulation and packaging (as

foam) Epoxy glue; very strong bond, adhesive to slide surfaces together.

DISPOSAL OF PLASTICS

LANDFILL SITES, most plastics are non-biodegradable, so putting in landfill sites builds up a waste. BURNING produces pollution such as CO₂ contributing to the greenhouse effect and toxic fumes. Some plastics can be recycled.

COVALENT BONDING - is when non-metal atoms share electrons.

E.g.

Water - 1 oxygen and 2 hydrogen atoms, it is a liquid with low melting point:

Carbon Dioxide - 1 carbon 2 oxygen atoms, is a gas with low melting point and doesn't conduct electricity.

Carbon exists in 3 forms (allotropes)

- 1) Diamond is very hard, doesn't conduct electricity, has high melting point due to strong bonds.
- 2) Graphite, soft conducts electricity, high melting point due to layers that can slide.
- 3) Buckminster fullerene a ball shape.

Topic 5: CHEMICAL ECONOMICS

FORMULAE - used to show different elements and number of atoms of each in a substance e.g. Calcium Nitrate $\text{Ca}(\text{NO}_3)_2$ - 1 calcium atom, 2 nitrogen atoms, 6 oxygen atoms.

WRITING EQUATIONS E.G. SODIUM + WATER = SODIUM HYDROXIDE + HYDROGEN
REACTANTS = PRODUCTS

RELATIVE ATOMIC MASS (AR) - this is a mass of a particular atom of an element compared to the mass of an atom of hydrogen. The mass number $^{16}_8\text{O}$ also doubles as the relative atomic mass.

RELATIVE FORMULA MASS Mr - this is the mass of all the atoms in a formula added together e.g. Mr of water H_2O Hydrogen weighs 1, Oxygen weighs 16. Water is H_2O so add 2 Hydrogens to 1 Oxygen $(2 \times 1) + (1 \times 16) = 18$.

PRODUCTION OF AMMONIA - Ammonia is made in the Haber Process. Nitrogen and hydrogen are passed over an iron catalyst at 450°C and a pressure of 200 atmospheres. Un-reacted nitrogen and hydrogen are re-cycled. This is a reversible reaction nitrogen + hydrogen \rightleftharpoons ammonia.

PERCENTAGE YIELD - This allows you to compare the amounts of products made against what you would project.

PERCENTAGE YIELD - $\frac{\text{ACTUAL YIELD}}{\text{PREDICTED YIELD}} \times 100$

ECONOMICS OF MAKING SUBSTANCES - We have to consider the cost of making materials to see if it's worth it. Costs come from energy needed, raw materials, workers wages, machinery, how quick it can be made.

ACIDS AND BASES - Acids have a pH less than 7. BASES are oxides and hydroxides of metals. Those that are soluble are called alkalines and have a pH of more than 7. Neutralisation is when an acid and an alkali react to make a neutral solution of water and salt.

Fertilizer can be made from reactions and they provide plants with nitrogen, phosphorous and potassium needed for growth.

Topic 6: THE PERIODIC TABLE

STRUCTURE OF ATOM - An atom consists of a nucleus containing protons (positive charge mass) and neutrons (no charge, 1 mass) and electrons (negative charge, 0 mass) in shells. An atom has the same number of protons and electrons so is always neutral, no charge. A substance with one type of atom is called an ELEMENT.

MASS NUMBER is the total number of neutrons and protons in an atom.

ATOMIC MASS is the number of protons in an atom.

ELEMENTS one element always has the same number of protons.

An ISOTOPE is when an element can have two or more forms with more neutrons.

PERIODIC TABLE

Elements in the same group have the same number of electrons in the outer shell. Elements in the same group have similar properties.

A row of elements is called a period, this number shows the number of electron shells.

An element cannot be broken down and contains one type of atom.

A compound is a substance with two or more elements chemically combined.

GROUP 1 METALS - called the ALKALI metals. These have distinctive flame colours LITHIUM - red, SODIUM - yellow, POTASSIUM - lilac. They react vigorously with water to make alkaline hydroxides and give off hydrogen gas.

GROUP 7 - the HALOGENS - all react with alkali metals to form metal halides. At room temperature chlorine is a green gas, bromine an orange liquid, iodine a grey solid. Chlorine is used to sterilize water and make pesticides and plastics. Halogens displace each other according to reactivity. Fluorine at the top of the group being the most reactive.

GROUP 8 - the NOBLE GASES have 8 outer electrons and are un-reactive. Helium is used in balloons, Argon, Neon and Krypton used in lighting.

TRANSITION METALS - these are in the central block of the periodic table. They are hard, have high density, high tensile strength, high melting and boiling points. Iron is made into steel for structural work. Copper is used in electrical wiring, and to make brass.

TOPIC 7: USING ELECTRICITY

CIRCUITS - A current (flow of electrons) will go through a component if there is a voltage (potential difference) across it. A voltmeter measures the p.d. by being connected in parallel across a component. Current is measured in amps by an ammeter connected in series with a component.

D.C. AND A.C. - Direct Current (D.C.) always flows in the same direction through a circuit. Alternating Current (A.C.) changes its direction continuously flowing back and forth through a circuit. $\text{POWER} = \text{CURRENT} \times \text{VOLTAGE}$. A current transfers energy from the battery to components in a circuit. The rate of this energy transfer is the POWER 1 WATT = 1 JOULE OF ENERGY PER SECOND.

RESISTANCE - is a measure of how hard it is to get a current through a component, it is measured in Ohms(Ω). A fixed resistor has a constant resistance. A variable resistor can have its resistance altered.

$$\text{RESISTANCE} = \frac{\text{POTENTIAL DIFFERENCE}}{\text{CURRENT}}$$

For a given resistor as you increase current, p.d. increases and vice versa. For a fixed p.d current decreases as resistance increases and vice versa.

STATIC ELECTRICITY - Electrons can be gained giving a negative charge or lost giving a positive charge. Materials with the same charge REPEL, opposite charges ATTRACT.

$$\text{DISCHARGE} = \frac{\text{When the charge leaves due to a connection to EARTH being made}}{\text{ }}$$

STATIC can be used in PAINT SPRAYING. Charge the surface and paint oppositely to get even application. PHOTOCOPIER the copying plate is electrically charged, the image is projected onto the plate leaving an 'electrostatic impression'. This impression attracts the ink which is then transferred from the plate to the paper. LASER PRINTER the cartridge contains a charged rotating drum, a laser then discharges part of the drum leaving an image. It then rotates attracting toner which is then transferred to the paper.

STATIC can be dangerous, as the fuel and pipe become oppositely charged, so to prevent discharges or sparks the plane is earthed or the tanker and plane are connected with a copper wire.

TOPIC 8: APPLICATIONS OF PHYSICS

WORK - When a force moves an object work is done transferring energy.

WORK (J) = FORCE (N) × DISTANCE MOVED IN DIRECTION OF FORCE (M)

POWER - Is work done per second. More power, more work, more energy transferred.

POWER (W or J/S) =	WORK DONE (J)
	TIME TAKEN (S)

KINETIC ENERGY = Movement energy. The amount of energy depends on 2 things. The mass of the object (kg), the speed of the object (m/s). KINETIC EN = $\frac{1}{2} \times \text{MASS} \times \text{SPEED}^2$.

GRAVITATIONAL POTENTIAL ENERGY - Is energy stored in an object when it is high up. When the object falls this converts to kinetic energy.

GRAVITATIONAL POTENTIAL ENERGY = MASS × GRAVITY × HEIGHT

THE MOTOR EFFECT - When a wire carrying an electric current is put in a permanent magnetic field, the field around the wire interacts with the field to cause the wire to feel a force making it move.

PRODUCTION OF ELECTRICITY - Fossil fuels are burnt to release heat which boils water producing steam, which turns turbines and then generators producing electricity. At each stage energy is wasted into the surroundings.

% EFFICIENCY =	USEFUL OUTPUT	X 100
	INPUT	

THE NATIONAL GRID distributes electricity made. Transformers change the voltage, it is stepped up to be transported then back down to go to houses. Electricity can also be made when a wire goes through a magnetic field.

ELECTROMAGNETIC WAVES - All these waves travel at the same speed (300,000,000 m/s) through the vacuum of space. Light, infrared, microwaves and radio waves can be reflected and refracted, and carry information for communication. LIGHT allows us to see. INFRARED - remote controls, optical fibres. MICROWAVES - in satellite communications, radar, RADIO - broadcasts and satellite communication. OPTICAL FIBRES more light or infrared by internal reflection along fibre.

ANALOGUE SIGNALS vary continually. DIGITAL signals are either on or off. Digital signals are clearer and can carry more information.

TOPIC 9: EARTH, SPACE AND NUCLEAR RADIATION.

SPEED AND VELOCITY - Speed measures how fast something is moving. VELOCITY is the speed in a given direction. ACCELERATION is the change in velocity over time.

ACCELERATION (m/s ²) =	CHANGE IN VELOCITY (m/s)
	TIME TAKEN (S)

When a skydiver falls they accelerate until forces balance then it falls at a constant (TERMINAL VELOCITY). If forces are imbalanced the object will accelerate or decelerate. When balanced object moves at a steady speed or stays stationary.

SOLAR SYSTEM - Comets are made of frozen gas and dust orbiting the sun in elliptical orbits. Meteors are bits of dust and rock which burn up in the Earth's atmosphere giving out light. Planets, moons, comets and satellites are kept in orbit by the sun's gravity. The UNIVERSE consists of Stars, Planets, Comets, Meteors, Galaxies and Black Holes. Our sun is a star, our galaxy (Milky Way) is one galaxy out of a billion. A LIGHT YEAR is distance travelled by light in one Earth year. Most people believe the universe began with a huge explosion 'THE BIG BANG'.

LIFE CYCLE OF A STAR - You need to revise this as a flowchart.

RADIATION - There are 3 types of radioactive particles 1) ALPHA which is made of a helium atom (2 protons & 2 neutrons). 2) BETA a fast moving electron. 3) GAMMA - high frequency electromagnetic waves.

BACKGROUND RADIATION occurs naturally all around us. With 4 alpha and 3 beta decay a new atom is formed, 8 GAMMA radiation has no effect on the nucleus structure.

Radiation can be used in many ways, alpha in smoke detectors, beta as traces or thickness gauges. Gamma radiation treating cancer and sterilising equipment. Radiation can also damage living cells. The amount of radiation decreases with time. The Half-life is the time taken for half the atoms to decay, so the amount of radiation to half.