IGCSE Combined Science revision sheet

Biology and chemistry definitions, the tests to learn and the physics equations in the 0653 syllabus. Mark schemes reward the key words, so learn them exactly.

Biology definitions

Diffusion	The net movement of particles from a region of their higher concentration to a region of their lower concentration (down a concentration gradient), as a result of their random movement.
Osmosis	The net movement of water molecules from a region of higher water potential (dilute solution) to a region of lower water potential (concentrated solution), through a partially permeable membrane.
Active transport	The movement of particles through a cell membrane from a region of lower concentration to a region of higher concentration (against a concentration gradient), using energy from respiration.
Photosynthesis	The process by which plants synthesise carbohydrates from raw materials using energy from light.
Physical / chemical digestion	The breakdown of food into smaller pieces without chemical change to the food molecules / the breakdown of large insoluble molecules into small soluble molecules.
Transpiration	The loss of water vapour from leaves.
Pathogen	A disease-causing organism.
Transmissible disease	A disease in which the pathogen can be passed from one host to another.
Aerobic respiration	The chemical reactions in cells that use oxygen to break down nutrient molecules to release energy.
Pollination / fertilisation	The transfer of pollen grains from an anther to a stigma / the fusion of the nuclei of gametes.
Herbivore / carnivore	An animal that gets its energy by eating plants / by eating other animals.
Decomposer	An organism that gets its energy from dead or waste organic material.
Ecosystem	A unit containing the community of organisms and their environment, interacting together.
Biodiversity	The number of different species that live in an area.

Chemistry definitions

Molecular formula	The number and type of different atoms in one molecule.
Electrolysis	The decomposition of an ionic compound, when molten or in aqueous solution, by the passage of an electric current.
Activation energy (E_a)	The minimum energy that colliding particles must have to react.
Exothermic / endothermic	A reaction that transfers thermal energy to the surroundings (temperature rises) / takes in thermal energy from the surroundings (temperature falls).
Oxidation / reduction	Gain of oxygen / loss of oxygen.
Moles	Number of moles = mass (g) ÷ M_r. Concentration (mol/dm³) = moles ÷ volume (dm³).

Tests to learn

Hydrogen	A lighted splint gives a squeaky pop.
Oxygen	Relights a glowing splint.
Carbon dioxide	Turns limewater milky.
Chlorine	Bleaches damp litmus paper.
Ammonia	Turns damp red litmus paper blue.
Water	Turns anhydrous copper(II) sulfate from white to blue (or anhydrous cobalt(II) chloride from blue to pink).
Starch / reducing sugar	Iodine solution turns from orange-brown to blue-black / Benedict's solution, heated, turns from blue to green, yellow or brick red.
Protein / fats	Biuret solution turns from blue to purple / the ethanol emulsion test gives a cloudy white emulsion.

Physics equations in 0653 (with units)

Speed and acceleration	speed = distance ÷ time (m/s) · acceleration $a = \Delta v \div \Delta t$ (m/s²)
Force, weight, density	$F = ma$ (N) · weight $W = mg$ ($g = 9.8$ N/kg) · density $\rho = m \div V$ (kg/m³ or g/cm³)
Pressure, work, energy	$p = F \div A$ (Pa) · work done $W = Fd$ (J) · $E_k = \frac{1}{2}mv^2$ · $\Delta E_p = mg\Delta h$ (J)
Power and efficiency	$P = \Delta E \div t$ (W) · efficiency = useful energy output ÷ total energy input × 100%
Waves	$v = f\lambda$ (wave speed m/s, frequency Hz, wavelength m)
Electricity	$I = Q \div t$ (A) · $V = IR$ (V) · $P = IV$ (W) · $E = IVt$ (J) · energy in kW h = power (kW) × time (h)
Resistors	Series: $R = R_1 + R_2$ · Parallel: the combined resistance is less than the smallest resistor
Space	Orbital speed $v = 2\pi r \div T$

Equations to know

Photosynthesis: $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$ (light energy, chlorophyll)
Aerobic respiration: $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$
Neutralisation: acid + base → salt + water · **Metal + acid:** → salt + hydrogen · **Carbonate + acid:** → salt + water + carbon dioxide

Self-test (answers at the bottom)

1. Define osmosis.
2. Calculate the number of moles in 8.0 g of methane, CH_4 (M_r 16).
3. A wave has a frequency of 50 Hz and a wavelength of 4.0 m. What is its speed?
4. A 1.5 kW kettle is used for 2 hours in a week. How many kW h does it use?
5. Give the test and result for carbon dioxide.
6. A 1200 kg car accelerates at 2.0 m/s². What is the resultant force on it?

Answers: 1. See the definition above (water potential, partially permeable membrane). 2. 8.0 ÷ 16 = 0.50 mol. 3. $v = f\lambda = 50 \times 4.0 = 200$ m/s. 4. 1.5 × 2 = 3.0 kW h. 5. Bubble it through limewater: it turns milky. 6. $F = ma = 1200 \times 2.0 = 2400$ N.