# Biology Paper 1 — Rote Learning

### Cell Biology

| | |
|---|---|
| **Define diffusion** | Net movement of particles from high to low concentration down a concentration gradient |
| **Define osmosis** | Net movement of water across a partially permeable membrane from high to low water concentration |
| **Define active transport** | Movement against a concentration gradient using energy from respiration |
| **Mitosis** | Produces two genetically identical daughter cells |
| **Magnification** | Image size ÷ real size |
| **Eukaryotic cell** | Has nucleus and membrane-bound organelles |
| **Prokaryotic cell** | No nucleus, DNA free in cytoplasm |
| **Animal cell** | Nucleus, cytoplasm, membrane, mitochondria, ribosomes |
| **Plant cell** | Nucleus, cytoplasm, membrane, mitochondria, ribosomes, cell wall, chloroplasts, permanent vacuole |

### Organisation

| | |
|---|---|
| **Levels of organisation** | Cells → tissues → organs → organ systems → organism |
| **Enzyme** | Biological catalyst |
| **Active site** | Region where substrate binds |
| **Denature** | Change shape so substrate no longer fits |
| **Amylase** | Starch → sugars |
| **Protease** | Proteins → amino acids |
| **Lipase** | Lipids → fatty acids + glycerol |
| **Arteries** | Carry blood away from heart |
| **Veins** | Carry blood to heart |
| **RBC** | Carry oxygen (haemoglobin) |
| **WBC** | Defend against pathogens |
| **Platelets** | Blood clotting |

### Infection & Response

| | |
|---|---|
| **Pathogen** | Microorganism that causes disease |
| **Virus reproduction** | Inside host cells |
| **Phagocytes** | Engulf pathogens |
| **Lymphocytes** | Produce antibodies |
| **Antitoxins** | Neutralise toxins |
| **Vaccination** | Dead/inactive pathogen stimulates immunity |
| **Antibiotics** | Kill bacteria only |

### Bioenergetics

| | |
|---|---|
| **Photosynthesis (word)** | Carbon dioxide + water → glucose + oxygen |
| **Limiting factors** | Light, carbon dioxide, temperature |
| **Aerobic respiration** | Glucose + oxygen → carbon dioxide + water |
| **Anaerobic (animals)** | Glucose → lactic acid |
| **Anaerobic (yeast)** | Glucose → ethanol + carbon dioxide |

# Biology Paper 2 — Rote Learning

**Homeostasis & Response**

| | |
|---|---|
| **Homeostasis** | Regulation of internal conditions (e.g. body temperature) |
| **Receptor** | Detects stimulus (e.g. light receptors in eye) |
| **Coordinator** | Processes information (e.g. brain) |
| **Effector** | Carries out response (e.g. muscle contracts) |
| **Reflex action** | Automatic response (e.g. hand pulled away) |
| **Reflex pathway** | Receptor → sensory → relay → motor → effector |
| **Synapse** | Junction between neurones |
| **Across synapse** | Chemical signal crosses |
| **Hormone** | Chemical messenger (e.g. insulin) |
| **Insulin** | Lowers blood glucose |

**Reproduction**

| | |
|---|---|
| **Sexual reproduction** | Fusion of gametes (e.g. sperm + egg) |
| **Asexual reproduction** | One parent, identical offspring (e.g. bacteria) |
| **Gametes** | Sperm and egg |
| **Fertilisation** | Fusion of nuclei |
| **Embryo** | Early stage (e.g. fertilised egg) |
| **Menstrual cycle** | 28 days |
| **Ovulation** | Day 14, caused by LH |
| **Oestrogen** | Builds uterus lining |
| **Progesterone** | Maintains lining |

**Ecology**

| | |
|---|---|
| **Ecosystem** | Community and environment (e.g. pond) |
| **Habitat** | Where organism lives (e.g. forest) |
| **Population** | Same species (e.g. rabbits) |
| **Community** | All species (e.g. plants + animals) |
| **Abiotic factors** | Non-living (e.g. temperature, light, water) |
| **Biotic factors** | Living (e.g. predators, competition, disease) |
| **Producer** | Makes food (e.g. plant) |
| **Consumer** | Eats organisms (e.g. fox) |
| **Prey** | Organism eaten (e.g. rabbit) |
| **Carnivore** | Eats animals (e.g. fox) |
| **Herbivore** | Eats plants (e.g. cow) |
| **Omnivore** | Eats both (e.g. human) |
| **Herbicide** | Kills plants (e.g. weed killer) |
| **Pesticide** | Kills pests (e.g. insect spray) |
| **Biodiversity** | Variety of species (e.g. rainforest) |

**Inheritance & Evolution**

| | |
|---|---|
| **Gene** | Section of DNA (e.g. eye colour) |
| **Allele** | Different version (e.g. blue/brown) |
| **Homozygous** | TT or tt |
| **Heterozygous** | Tt |
| **Genotype** | Genetic makeup (e.g. Tt) |
| **Phenotype** | Physical trait (e.g. tall) |
| **Variation** | Differences in same species (e.g. height) |
| **Natural selection** | Variation → best survive → reproduce → pass on genes |

# Chemistry Paper 1 — Rote Learning

### Atomic Structure

| | |
|---|---|
| **Charge of proton** | +1 |
| **Charge of neutron** | 0 |
| **Charge of electron** | -1 |
| **Relative mass of proton** | 1 |
| **Relative mass of neutron** | 1 |
| **Relative mass of electron** | 1/1836 |
| **Atomic number** | Number of protons |
| **Mass number** | Protons + neutrons |
| **Neutrons** | Mass number − atomic number |
| **Isotope** | Same element with same number of protons but different neutrons |
| **Group** | Column (same outer electrons) |
| **Period** | Row (same number of shells) |
| **Group 1 trend** | Reactivity increases down the group |
| **Group 7 trend** | Reactivity decreases down the group |
| **State symbols** | (s), (l), (g), (aq) |

### Key Calculations

| | |
|---|---|
| **Relative formula mass (RFM)** | Sum of atomic masses |
| **Concentration (g/dm³)** | Mass ÷ volume |
| **1 dm³ in cm³** | 1000 cm³ |

### Bonding & Structure

| | |
|---|---|
| **Ionic bonding** | Transfer of electrons (metal + non-metal) |
| **Covalent bonding** | Sharing of electrons (non-metal + non-metal) |
| **Metallic bonding** | Positive ions in sea of delocalised electrons |
| **Ionic structure** | Giant ionic lattice |
| **Simple covalent** | Molecules with weak intermolecular forces |
| **Giant covalent** | Strong bonds throughout structure |
| **Diamond** | Each carbon forms 4 bonds |
| **Graphite** | Each carbon forms 3 bonds, layers, free electrons |
| **Fullerene examples** | C60, carbon nanotubes |
| **Why ionic conduct** | Ions free to move when molten or dissolved |
| **Why metals conduct** | Delocalised electrons |

### Chemical Changes & Energy

| | |
|---|---|
| **Acid + metal** | Acid + metal → salt + hydrogen |
| **Acid + base** | Acid + base → salt + water |
| **Group 1 reaction** | Metal + water → metal hydroxide + hydrogen |
| **Group 7 reaction** | Halogen + metal → salt |
| **pH scale** | 0–14 (7 neutral) |
| **Electrolysis** | Breaking compounds using electricity |
| **Cathode** | Negative electrode |
| **Anode** | Positive electrode |
| **Exothermic** | Releases energy |
| **Endothermic** | Takes in energy |

# Chemistry Paper 2 — Rote Learning

### Rates of Reaction

| | |
|---|---|
| **Rate of reaction** | Speed at which reactants form products |
| **Collision theory** | Particles must collide with enough energy |
| **Activation energy** | Minimum energy needed |
| **Increase temperature** | Particles move faster → more collisions |
| **Increase concentration** | More particles → more collisions |
| **Increase surface area** | More exposed particles (e.g. powder) |
| **Catalyst** | Speeds up reaction, not used up (e.g. enzymes) |
| **Reversible reaction** | Reaction can go both directions |
| **Equilibrium** | Forward rate = backward rate |

### Organic Chemistry

| | |
|---|---|
| **Crude oil** | Mixture of hydrocarbons |
| **Hydrocarbon** | Contains hydrogen and carbon only |
| **Fractional distillation** | Separates crude oil into fractions by boiling point |
| **Alkane** | Saturated (single bonds) e.g. methane |
| **Alkene** | Unsaturated (double bond) e.g. ethene |
| **Complete combustion** | Produces carbon dioxide + water |
| **Incomplete combustion** | Produces carbon monoxide or carbon (soot) |
| **Cracking** | Breaks long hydrocarbons into shorter ones |
| **Polymer** | Large molecule made from small units |

### Chemical Analysis

| | |
|---|---|
| **Pure substance** | Single element or compound |
| **Formulation** | Mixture designed as a useful product (e.g. paint) |
| **Chromatography** | Separates mixtures |
| **Rf value** | Distance substance ÷ distance solvent |
| **Test for hydrogen** | Squeaky pop |
| **Test for oxygen** | Relights glowing splint |
| **Test for carbon dioxide** | Limewater turns cloudy |
| **Test for chlorine** | Bleaches damp litmus paper |

### Atmosphere & Resources

| | |
|---|---|
| **Atmosphere composition** | 78% nitrogen, 21% oxygen, small $CO_2$ |
| **Greenhouse gases** | Carbon dioxide, methane |
| **Global warming** | Increase in Earth's temperature |
| **Pollutants** | Carbon monoxide, sulfur dioxide, particulates |
| **Finite resource** | Limited supply (e.g. fossil fuels) |
| **Renewable resource** | Replaced naturally (e.g. water) |
| **Potable water** | Safe to drink |
| **Waste water treatment** | Removes solids and microbes |
| **Life cycle assessment** | Environmental impact of product |
| **Reduce reuse recycle** | Ways to conserve resources |

# Physics Paper 1 — Rote Learning

### Energy

| | |
|---|---|
| **State the energy stores** | Thermal (internal), kinetic, gravitational potential, elastic potential, chemical, nuclear, magnetic, electrostatic |
| **What is chemical energy?** | Energy stored in chemical bonds |
| **Give 3 examples of chemical energy** | Fuel, food, batteries |
| **What is efficiency?** | How much useful energy is transferred |
| **Energy cannot be** | Created or destroyed |
| **Renewable energy** | Will not run out |
| **Non-renewable energy** | Will run out |

### Electricity

| | |
|---|---|
| **Symbol and unit of current** | I, amperes (A) |
| **Symbol and unit of potential difference** | V, volts (V) |
| **Current** | Flow of charge |
| **Potential difference** | Energy transferred per unit charge |
| **Resistance** | Opposition to current flow |
| **Series circuit** | Same current everywhere |
| **Parallel circuit** | Same voltage across components |
| **Mains electricity** | 230 V, AC, 50 Hz |
| **Live wire colour** | Brown |
| **Neutral wire colour** | Blue |
| **Earth wire colour** | Green and yellow |

### Particle Model

| | |
|---|---|
| **States of matter** | Solid, liquid, gas |
| **Solid particles** | Close together, vibrate in fixed positions |
| **Liquid particles** | Close together, move past each other |
| **Gas particles** | Far apart, move randomly |
| **Density** | Mass per unit volume |
| **Internal energy** | Total kinetic + potential energy of particles |
| **Temperature increase means** | Particles gain kinetic energy |
| **Change of state on graph** | Horizontal line (temperature constant) |

### Atomic Structure

| | |
|---|---|
| **Alpha radiation stopped by** | Paper or skin |
| **Beta radiation stopped by** | Thin aluminium |
| **Gamma radiation stopped by** | Thick lead or concrete |
| **Penetration order** | Alpha (low), beta (medium), gamma (high) |
| **Ionising power** | Alpha (high), beta (medium), gamma (low) |
| **Half-life** | Time for half the nuclei to decay |
| **Background radiation** | Radiation always present |
| **Example of background radiation** | Radon gas from rocks |
| **Uses of radiation** | Medical tracers, radiotherapy |

# Physics Paper 2 — Rote Learning

| Forces | |
|---|---|
| **Force** | Push or pull on an object |
| **Contact force** | Objects touching (e.g. friction) |
| **Non-contact force** | No contact (e.g. gravity) |
| **Weight** | Force due to gravity (e.g. object falling) |
| **Resultant force** | Overall force on object |
| **Balanced forces** | No change in motion |
| **Unbalanced forces** | Cause acceleration |
| **Stopping distance** | Thinking + braking distance |
| **Terminal velocity** | Constant speed when forces balance |

| Magnetism | |
|---|---|
| **Magnet** | Produces magnetic field |
| **Poles** | North and south |
| **Like poles** | Repel |
| **Opposite poles** | Attract |
| **Magnetic field** | Region where force acts |
| **Field lines** | Show direction of field |
| **Electromagnet** | Magnet made by current (e.g. crane) |
| **Increase electromagnet strength** | More current, more coils, iron core |

| Waves | |
|---|---|
| **Wave** | Transfer of energy without transfer of matter |
| **Transverse wave** | Oscillations perpendicular (e.g. light) |
| **Longitudinal wave** | Oscillations parallel (e.g. sound) |
| **Amplitude** | Height of wave (e.g. loudness) |
| **Wavelength** | Distance between peaks |
| **Frequency** | Number of waves per second |
| **Electromagnetic waves** | Travel at speed of light |
| **Order (highest → lowest frequency)** | Gamma → X-ray → ultraviolet → visible → infrared → microwave → radio |
| **Order (longest → shortest wavelength)** | Radio → microwave → infrared → visible → ultraviolet → X-ray → gamma |
| **Radio** | TV and radio signals |
| **Microwaves** | Cooking and satellites |
| **Infrared** | Heaters and thermal imaging |
| **Visible light** | Seeing |
| **Ultraviolet** | Sterilising and tanning |
| **X-rays** | Medical imaging |
| **Gamma rays** | Cancer treatment |

| Electromagnetism | |
|---|---|
| **Motor effect** | Force on current in magnetic field |
| **Fleming's left hand rule** | Thumb = force, First finger = field, Second = current |
| | |
| **Step-up transformer** | Increases voltage |
| **Step-down transformer** | Decreases voltage |
| **National Grid** | Uses cables, pylons and transformers to transfer electricity |
| **Why high voltage used** | Improves efficiency so less energy lost as heat |