

Grade 5 checklist

133 skills. Tick each one when you can do it. For grade 5 you need the skills for the grades below it too.

Cell biology

- ☐ **Compare prokaryotic and eukaryotic cells** Say what both have (cell membrane, cytoplasm, ribosomes) and how they differ, above all whether the DNA is enclosed in a nucleus. (Eukaryotes and prokaryotes)
- ☐ **Convert between mm, μm and nm** Multiply by 1000 for each step down ($\text{mm} \rightarrow \mu\text{m} \rightarrow \text{nm}$) and divide by 1000 for each step up. (Eukaryotes and prokaryotes)
- ☐ **Explain why some plant cells lack chloroplasts** Cells that receive no light, such as root cells, cannot photosynthesise, so they have no chloroplasts. (Animal and plant cells)
- ☐ **Describe the adaptations of each specialised cell** e.g. a sperm cell has a tail, many mitochondria and enzymes in its head. (Cell specialisation)
- ☐ **State what cell division does in adults** In mature animals, cell division is mainly for repair and replacement. (Cell differentiation)
- ☐ **Use magnification = image size $\div$ real size** Rearrange the equation to find the magnification, the image size or the real size. (Microscopy)
- ☐ **Prepare a slide and focus a microscope** Thin sample, stain, coverslip; start on the lowest power and focus with the coarse, then the fine, focus. (Microscopy)
- ☐ **Describe aseptic technique for preparing a culture** Sterilise the dishes, media and inoculating loop, tape the lid, store the dish upside down and incubate at 25 °C. (Culturing microorganisms)
- ☐ **Put cell, nucleus, chromosome and gene in order** Largest to smallest: cell, nucleus, chromosome, gene. (Chromosomes)
- ☐ **Describe what happens in each stage** The cell grows, copies its sub-cellular structures and DNA, divides its nucleus, then splits in two. (Mitosis and the cell cycle)
- ☐ **State why mitosis is important** For the growth and development of multicellular organisms, and to repair and replace cells. (Mitosis and the cell cycle)
- ☐ **Recognise where mitosis is happening** e.g. a root tip growing, a cut healing, an embryo developing. (Mitosis and the cell cycle)
- ☐ **Compare embryonic and adult stem cells** Embryonic stem cells can become most types of human cell; adult bone marrow stem cells form fewer types, including blood cells. (Stem cells)
- ☐ **Describe uses of meristem cloning** Making clones quickly and cheaply, saving rare species, and producing crops with useful features. (Stem cells)
- ☐ **Explain the factors that affect the rate** A bigger concentration gradient, a higher temperature and a larger surface area all increase the rate of diffusion. (Diffusion)
- ☐ **Describe the osmosis required practical** Weigh pieces of plant tissue, leave them in a range of concentrations, then reweigh them. (Osmosis)

- ☐ **Calculate percentage change in mass** $\text{Change in mass} \div \text{starting mass} \times 100$; a loss in mass gives a negative answer. (Osmosis)
- ☐ **Describe two examples of active transport** Mineral ions from the soil into root hair cells; sugar from the gut into the blood. (Active transport)

Organisation

- ☐ **Classify a structure by its level** For example, a red blood cell is a cell, blood is a tissue, the heart is an organ and the circulatory system is an organ system. (Principles of organisation)
- ☐ **Recall where each digestive enzyme is made** Amylase in the salivary glands, pancreas and small intestine; proteases in the stomach, pancreas and small intestine; lipases in the pancreas and small intestine. (The human digestive system)
- ☐ **Describe the double circulatory system** The right ventricle pumps blood to the lungs and the left ventricle pumps blood around the rest of the body. (The heart and blood vessels)
- ☐ **Describe the role of the pacemaker** A group of cells in the right atrium controls the natural resting heart rate; an artificial pacemaker is an electrical device that corrects an irregular heart rate. (The heart and blood vessels)
- ☐ **Identify blood cells in a photo or diagram** Red blood cells are biconcave discs with no nucleus, white blood cells are larger with a nucleus, and platelets are tiny fragments. (Blood)
- ☐ **List substances transported by the plasma** Carbon dioxide, urea, soluble products of digestion such as glucose and amino acids, hormones and antibodies. (Blood)
- ☐ **Describe how stents and statins treat CHD** A stent holds the coronary artery open; statins lower blood cholesterol, which slows the build-up of fatty material. (Coronary heart disease)
- ☐ **Describe treatments for faulty valves and heart failure** Faulty valves are replaced with biological or mechanical valves; heart failure can be treated with a donor heart (or heart and lungs) or, occasionally, an artificial heart. (Coronary heart disease)
- ☐ **Give factors other than disease affecting health** Diet, stress and life situations can have a big effect on both physical and mental health. (Health issues)
- ☐ **Describe effects of smoking and alcohol in pregnancy** Both can harm the unborn baby, e.g. smoking can cause low birth weight and alcohol can damage the baby's brain development. (Lifestyle and non-communicable diseases)
- ☐ **Describe malignant tumours and secondary tumours** Malignant tumour cells are cancers: they invade neighbouring tissues and spread in the blood to form secondary tumours. (Cancer)
- ☐ **Give lifestyle risk factors for cancer** For example smoking (lung cancer), obesity (e.g. bowel cancer), too much UV light (skin cancer) and some viral infections (e.g. cervical cancer). (Cancer)
- ☐ **State the function of each leaf tissue** Epidermis covers the leaf, palisade does most photosynthesis, spongy mesophyll lets gases diffuse, xylem carries water and phloem carries sugars. (Plant tissues)
- ☐ **Describe how root hair cells absorb substances** They take up water by osmosis and mineral ions by active transport, helped by their large surface area. (Plant organ system)
- ☐ **Compare the structure of xylem and phloem** Xylem is hollow tubes strengthened by lignin; phloem is tubes of elongated cells with pores in the end walls. (Plant organ system)

Infection and response

- ☐ **Explain how bacteria and viruses make you ill** Both reproduce rapidly in the body; bacteria release toxins that damage tissues, and viruses reproduce inside cells and damage them. (Communicable (infectious) diseases)

- ☐ **Describe ways to reduce the spread of disease** Hygiene, isolating infected individuals, destroying or controlling vectors, and vaccination. (Communicable (infectious) diseases)

- ☐ **Describe how measles and HIV are controlled** Measles: vaccinating young children; HIV: condoms, not sharing needles and antiretroviral drugs. (Viral diseases)

- ☐ **Describe how each disease is spread** *Salmonella*: bacteria swallowed in food or on food prepared in unhygienic conditions; gonorrhoea: sexual contact. (Bacterial diseases)

- ☐ **Describe how the spread of each is controlled** Vaccinating poultry and hygienic food preparation for *Salmonella*; antibiotics and condoms for gonorrhoea. (Bacterial diseases)

- ☐ **Describe how rose black spot is treated** Use fungicides and/or remove and destroy the affected leaves. (Fungal diseases)

- ☐ **Describe how the spread of malaria is controlled** Stop mosquitoes breeding, and use mosquito nets to avoid being bitten. (Protist diseases)

- ☐ **Describe phagocytosis** A white blood cell engulfs a pathogen and digests it. (Human defence systems)

- ☐ **Explain how vaccination prevents illness** If the live pathogen enters later, white blood cells quickly make the correct antibodies and destroy it before it causes illness. (Vaccination)

- ☐ **Explain why specific antibiotics are needed** Different antibiotics kill different bacteria, so the antibiotic must match the bacterium causing the disease. (Antibiotics and painkillers)

- ☐ **Describe preclinical testing** The drug is tested in a laboratory on cells, tissues and live animals before any people take it. (Discovery and development of drugs)

- ☐ **Describe the stages of clinical trials** Very low doses are given first to check safety; further trials on patients find the optimum dose. (Discovery and development of drugs)

- ☐ **Define monoclonal antibodies** Identical antibodies produced from a single clone of cells, specific to one binding site on one protein antigen. (Producing monoclonal antibodies)

- ☐ **Name the cells that make a hybridoma** A mouse lymphocyte (which makes the antibody) combined with a tumour cell (which divides rapidly). (Producing monoclonal antibodies)

- ☐ **List four uses of monoclonal antibodies** Diagnosis (e.g. pregnancy tests), laboratory tests on blood, locating molecules in research, and treating diseases such as cancer. (Uses of monoclonal antibodies)

- ☐ **Describe ways to identify a plant disease** Use a gardening manual or website, take the plant to a laboratory, or use a testing kit containing monoclonal antibodies. (Detection and identification of plant diseases)

- ☐ **Give examples of plant pathogens and pests** Tobacco mosaic virus (a virus), rose black spot (a fungus) and aphids (insects). (Detection and identification of plant diseases)

- ☐ **Explain how physical barriers stop pathogens** They are barriers that pathogens cannot easily get through, and dead cells take pathogens with them when they fall off. (Plant defence responses)

Bioenergetics

- ☐ **Explain why photosynthesis is endothermic** Energy is transferred from the environment to the chloroplasts by light, so the reaction takes in energy. (Photosynthetic reaction)

- ☐ **State where the reactants come from** Carbon dioxide diffuses into the leaf from the air through the stomata; water is absorbed by the roots and carried up in the xylem. (Photosynthetic reaction)

- ☐ **Explain the effect of temperature** The rate rises up to an optimum temperature, then falls quickly because the enzymes that control photosynthesis denature. (Rate of photosynthesis)

- ☐ **Explain a one-factor rate graph** Where the line rises the factor on the x-axis is limiting; where it levels off another factor has become limiting. (Rate of photosynthesis)

- ☐ **Describe how glucose reaches storage organs** Sugars made in the leaves are carried in solution in the phloem to where they are used or stored. (Uses of glucose from photosynthesis)

- ☐ **Describe respiration as a continuous exothermic reaction** It happens all the time in living cells and transfers energy to the surroundings, supplying the energy for living processes. (Aerobic and anaerobic respiration)

- ☐ **Describe fermentation and its uses** Anaerobic respiration in yeast makes ethanol and carbon dioxide, which are used to make alcoholic drinks and bread. (Aerobic and anaerobic respiration)

- ☐ **Explain when muscles respire anaerobically** When oxygen cannot be supplied fast enough for aerobic respiration alone, as in vigorous exercise. (Response to exercise)

- ☐ **Calculate changes from exercise data** Work out increases, percentage changes and recovery times from tables and graphs of heart rate or breathing rate. (Response to exercise)

- ☐ **Name the building blocks of large molecules** Carbohydrates are made from sugars, proteins from amino acids, and lipids from glycerol and fatty acids. (Metabolism)

- ☐ **State how a lipid molecule forms** One molecule of glycerol joins with three molecules of fatty acids. (Metabolism)

Homeostasis and response

- ☐ **Explain why homeostasis is important** It keeps conditions at the optimum for enzyme action and all cell functions. (Homeostasis)

- ☐ **Describe the job of each part** Receptors detect stimuli, coordination centres process the information, and effectors (muscles or glands) bring about a response. (Homeostasis)

- ☐ **Explain why reflex actions are fast** They are automatic and do not involve the conscious part of the brain. (Structure and function)

- ☐ **Describe the ruler-drop reaction time practical** Catch a dropped ruler, record the distance it fell and convert it to a reaction time. (Structure and function)

- ☐ **Describe how brain regions have been mapped** Studying patients with brain damage, electrically stimulating the brain, and MRI scanning. (The brain)

- ☐ **Describe how the pupil changes with light** The pupil widens in dim light to let more light in and narrows in bright light. (The eye)

- ☐ **List the responses to being too cold** Vasoconstriction, sweating stops, and skeletal muscles contract (shivering). (Control of body temperature)

- ☐ **Compare hormonal and nervous control** Hormones travel in the blood and are slower but longer-lasting; nerve impulses are fast and short-lived. (Human endocrine system)

- ☐ **Compare the causes of Type 1 and 2** Type 1: the pancreas does not make enough insulin. Type 2: body cells stop responding to insulin. (Control of blood glucose concentration)

- ☐ **Describe treatments for each type of diabetes** Type 1: insulin injections. Type 2: a carbohydrate-controlled diet and an exercise regime. (Control of blood glucose concentration)

- ☐ **Explain why cell water content must be controlled** If cells gain or lose too much water by osmosis, they do not function efficiently. (Maintaining water and nitrogen balance)

- ☐ **Describe the basic principles of dialysis** Blood flows past a partially permeable membrane; urea and excess ions diffuse into the dialysis fluid. (Maintaining water and nitrogen balance)

- ☐ **State the roles of the four cycle hormones** FSH matures an egg, LH triggers its release, and oestrogen and progesterone maintain the uterus lining. (Hormones in human reproduction)

- ☐ **Explain how hormonal methods work** The pill inhibits FSH so no eggs mature; progesterone implants stop eggs maturing and being released. (Contraception)

- ☐ **Describe how IUDs and spermicides work** IUDs prevent an embryo implanting or release a hormone; spermicides kill or disable sperm. (Contraception)

- ☐ **Name the hormones in fertility drugs** FSH and LH. (Hormones to treat infertility)

- ☐ **Describe how a fertility drug works** FSH and LH make eggs mature and be released, so the woman may become pregnant in the normal way. (Hormones to treat infertility)

- ☐ **State the effects of adrenaline** It increases heart rate and boosts delivery of oxygen and glucose to the brain and muscles. (Negative feedback)

- ☐ **State the role of thyroxine** It stimulates the basal metabolic rate and is important in growth and development. (Negative feedback)

- ☐ **Describe the seedling growth practical** Grow seedlings with light from one side, or on their side, and record both lengths and direction of growth. (Control and coordination)

- ☐ **Give uses of auxins** As weed killers, as rooting powders, and for promoting growth in tissue culture. (Use of plant hormones)

- ☐ **Describe how ethene is used for fruit** It controls the ripening of fruit during storage and transport. (Use of plant hormones)

Inheritance, variation and evolution

- ☐ **Name the cell division each type uses** Gametes are made by meiosis; asexual reproduction involves only mitosis. (Sexual and asexual reproduction)

- ☐ **Describe what happens in meiosis** The genetic information is copied, then the cell divides twice to give four genetically different gametes, each with a single set of chromosomes. (Meiosis)

- ☐ **Give chromosome numbers in body cells and gametes** A human body cell has 46 chromosomes (23 pairs) and a human gamete has 23. (Meiosis)

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- ☐ **Explain why variation helps a species survive** If the environment changes, some individuals are likely to have characteristics that help them survive, by natural selection. (Pros and cons of sexual and asexual reproduction)
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- ☐ **Define gene and genome** A gene is a small section of DNA on a chromosome; the genome is all of an organism's genetic material. (DNA and the genome)
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- ☐ **Describe the structure of a nucleotide** A common sugar and a phosphate group, with one of four bases attached to the sugar. (DNA structure)
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- ☐ **Describe DNA as a polymer of nucleotides** Long strands of alternating sugar and phosphate sections, with a base attached to each sugar. (DNA structure)
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- ☐ **Complete a Punnett square** Put each parent's gametes on the outside and combine one allele from each in every box. (Genetic inheritance)
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- ☐ **Give cross outcomes as ratios or probabilities** For example 3 : 1, or a probability of 0.25, 25%, $\frac{1}{4}$ or 1 in 4. (Genetic inheritance)
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- ☐ **Explain what a carrier is** A heterozygous person with one recessive allele who does not have the disorder but can pass it on. (Inherited disorders)
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- ☐ **State what the other 22 pairs do** 22 pairs control characteristics only; one pair carries the genes that determine sex. (Sex determination)
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- ☐ **Draw a genetic cross for sex** $XX \times XY$ in a Punnett square gives XX, XX, XY, XY . (Sex determination)
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- ☐ **Give examples of each cause** Blood group is genetic, a scar is environmental, and body mass depends on both. (Variation)
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- ☐ **State that populations show genetic variation** There is usually extensive genetic variation within a population of a species. (Variation)
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- ☐ **List the steps of natural selection** Variation, competition, the best suited survive and reproduce, alleles passed on, alleles become more common. (Evolution)
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- ☐ **Describe the steps of selective breeding** Choose parents with the characteristic, breed them, select the best offspring, and repeat over many generations. (Selective breeding)
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- ☐ **State what GM crops are** Crops whose genes have been modified by genetic engineering; they generally give increased yields. (Genetic engineering)
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- ☐ **Describe tissue culture and its uses** Small groups of cells from part of a plant are grown into identical plants, to preserve rare species or for nurseries. (Cloning)
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- ☐ **Describe Darwin's theory** Variation exists; the individuals most suited to the environment are more likely to survive to breed and pass on their characteristics. (Theory of evolution)
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- ☐ **Describe how Wallace influenced Darwin** Their joint writings in 1858 prompted Darwin to publish *On the Origin of Species* in 1859. (Speciation)
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- ☐ **Define a species** A group of organisms that can interbreed to produce fertile offspring. (Speciation)
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- ☐ **Put the development of gene theory in order** Mendel's units, chromosomes seen in cell division, units linked to chromosomes, then the structure of DNA. (The understanding of genetics)
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- ☐ **Explain why genes support Darwin's theory** It has been shown that characteristics are passed on to offspring in genes, which explains how they are inherited. (Evidence for evolution)
- ☐ **Explain why some remains do not decay** One or more of the conditions needed for decay (such as oxygen, warmth or moisture) are absent. (Fossils)
- ☐ **Give examples of catastrophic events** Massive volcanic eruptions or collisions with asteroids. (Extinction)
- ☐ **Explain why bacteria evolve rapidly** They reproduce at a fast rate, so there are many generations in a short time. (Resistant bacteria)
- ☐ **Describe how Linnaeus classified organisms** Into groups depending on their structure and characteristics. (Classification of living organisms)
- ☐ **Name the three domains** Archaea, bacteria and eukaryota. (Classification of living organisms)

Ecology

- ☐ **Explain what interdependence means** Each species depends on others for food, shelter, pollination or seed dispersal, so removing one species can affect the whole community. (Communities)
- ☐ **Describe a trend in abiotic data** State how one variable changes as the other changes, quoting values from the table or graph. (Abiotic factors)
- ☐ **Explain the effect of food availability** More food means more organisms survive and breed, so the population grows; less food has the opposite effect. (Biotic factors)
- ☐ **Define an extremophile and give an example** An organism that lives in extreme conditions of temperature, pressure or salt concentration, e.g. bacteria in deep sea vents. (Adaptations)
- ☐ **Describe using quadrats to estimate population size** Place quadrats randomly, count the organisms, find the mean per quadrat, then scale up to the whole area. (Levels of organisation)
- ☐ **Name processes that add or remove carbon dioxide** Photosynthesis removes carbon dioxide from the air; respiration and combustion release it. (How materials are cycled)
- ☐ **Describe how compost and biogas are produced** Waste decays in warm, moist, well-aerated heaps to make compost; anaerobic decay in a biogas generator makes methane. (Decomposition)
- ☐ **Name environmental changes that affect distribution** Temperature, availability of water and the composition of atmospheric gases. (Impact of environmental change)
- ☐ **Explain why biodiversity matters to humans** The future of humans relies on it, e.g. for food, materials, medicines and stable ecosystems. (Biodiversity)
- ☐ **Explain how pollution reduces biodiversity** Pollution kills plants and animals, so fewer species survive in the area. (Waste management)
- ☐ **State why peat bogs are destroyed** Peat is dug up to produce garden compost. (Land use)
- ☐ **Explain how deforestation reduces biodiversity** Forest habitats are destroyed and replaced by grazing land or one crop, so many species are lost. (Deforestation)
- ☐ **Describe biological consequences of global warming** Habitat loss as sea levels rise, changes in distribution and migration, and loss of biodiversity. (Global warming)

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- ☐ **Explain how each programme helps biodiversity** Say what the programme does and which species or habitats it protects. (Maintaining biodiversity)
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- ☐ **Define an apex predator** A carnivore with no predators. (Trophic levels)
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- ☐ **Describe the shape of a pyramid of biomass** Each bar is smaller than the one below, because biomass decreases at each trophic level. (Pyramids of biomass)
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- ☐ **Describe how biomass is lost between levels** Parts not eaten, egestion in faeces, carbon dioxide and water from respiration, and urea and water in urine. (Transfer of biomass)
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- ☐ **Explain how pests and pathogens threaten food supplies** They destroy crops or kill farm animals, so less food is produced. (Factors affecting food security)
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- ☐ **Explain why high-protein food increases growth** Protein is digested into amino acids, which animals use to make the proteins needed for growth. (Farming techniques)
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- ☐ **Explain why fish stocks must be maintained** If too few fish are left to breed, the species may disappear altogether in some areas. (Sustainable fisheries)
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- ☐ **Describe how GM bacteria produce insulin** Bacteria given the human insulin gene are grown in large numbers, and the insulin is harvested and purified. (Role of biotechnology)
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