

Grade 3 checklist

69 skills. Tick each one when you can do it. For grade 3 you need the skills for the grades below it too.

Energy

- ☐ **Define a system** A system is an object or a group of objects that you choose to study, e.g. a ball and the Earth. (Energy stores and systems)
- ☐ **Name the main energy stores** Kinetic, gravitational potential, elastic potential, thermal (internal), chemical, magnetic, electrostatic and nuclear. (Energy stores and systems)
- ☐ **Recall the kinetic and gravitational energy equations** $E_k = \frac{1}{2} m v^2$ and $E_p = m g h$: the specification says you must be able to recall both. (Changes in energy)
- ☐ **Name what affects the energy needed to heat** The energy needed depends on the mass, the material and the temperature rise. (Energy changes in systems)
- ☐ **State the unit of power** Power is measured in watts (W); 1 W is 1 joule transferred per second. (Power)
- ☐ **State the law of conservation of energy** Energy can be transferred usefully, stored or dissipated, but cannot be created or destroyed. (Energy transfers in a system)
- ☐ **Identify useful and wasted energy transfers** E.g. for a lamp, light is the useful output and heating the surroundings is wasted. (Efficiency)
- ☐ **List the main energy resources** Fossil fuels (coal, oil, gas), nuclear fuel, bio-fuel, wind, hydro-electricity, geothermal, the tides, the Sun and water waves. (National and global energy resources)
- ☐ **Define a renewable energy resource** A resource that is being (or can be) replenished as it is used. (National and global energy resources)

Electricity

- ☐ **Name common components from their symbols** Recognise the cell, battery, switch, lamp, resistor, ammeter and voltmeter symbols. (Standard circuit diagram symbols)
- ☐ **State that current is a flow of charge** Electric current is a flow of electrical charge around a closed circuit. (Electrical charge and current)
- ☐ **Give the units of charge, current, time** Charge in coulombs (C), current in amperes (A) and time in seconds (s). (Electrical charge and current)
- ☐ **State the unit of resistance** Resistance is measured in ohms (Ω). (Current, resistance and potential difference)
- ☐ **Recall that an LDR's resistance falls in light** The resistance of an LDR decreases as light intensity increases. (Resistors)
- ☐ **Tell series and parallel circuits apart** Series: one loop, one path. Parallel: two or more branches connected across the same two points. (Series and parallel circuits)
- ☐ **State that mains electricity is ac** The mains supply is an alternating current (ac) supply. (Direct and alternating potential difference)

- ☐ **Recall the UK mains frequency and pd** The UK domestic supply has a frequency of 50 Hz and is about 230 V. (Direct and alternating potential difference)
- ☐ **Recall the colours of the three wires** Live is brown, neutral is blue, earth is green and yellow stripes. (Mains electricity)
- ☐ **State the unit of power** Power is measured in watts (W); 1 W is 1 joule per second. (Power)
- ☐ **Describe energy transfers in simple appliances** e.g. a kettle transfers energy electrically from the mains to the thermal energy store of the water. (Energy transfers in everyday appliances)
- ☐ **Describe what the National Grid is** A system of cables and transformers linking power stations to consumers. (The National Grid)
- ☐ **State how like and unlike charges interact** The same type of charge repels; different types of charge attract. (Static charge)

Particle model of matter

- ☐ **Draw particle diagrams for the three states** Solid: particles touching in regular rows; liquid: particles touching but jumbled; gas: particles far apart and random. (Density of materials)
- ☐ **Name the changes of state** Melting, freezing, boiling, evaporating, condensing and sublimating. (Changes of state)
- ☐ **State that heating increases the particles' energy** Heating a system transfers energy to its particles, so the energy they store increases. (Internal energy)
- ☐ **Describe the motion of gas molecules** They are in constant random motion, moving in all directions. (Particle motion in gases)

Atomic structure

- ☐ **Name the three particles in an atom** Protons and neutrons are in the nucleus; electrons are arranged around the nucleus. (The structure of an atom)
- ☐ **State what atomic number means** The atomic number is the number of protons in the nucleus. (Mass number, atomic number and isotopes)
- ☐ **Put the models of the atom in order** Tiny spheres, plum pudding, nuclear model, Bohr's energy levels, then protons and neutrons. (Development of the model of the atom)
- ☐ **Name the types of nuclear radiation** Alpha particles (α), beta particles (β), gamma rays (γ) and neutrons (n). (Radioactive decay and nuclear radiation)
- ☐ **Give precautions for handling radioactive sources** Use tongs, wear gloves, keep the source in a lead-lined box and spend as little time near it as possible. (Radioactive contamination)
- ☐ **Define background radiation** Radiation that is around us all the time, from natural and man-made sources. (Background radiation)

Forces

- ☐ **Define scalar and vector quantities** A scalar has magnitude only; a vector has magnitude and an associated direction. (Scalar and vector quantities)

- ☐ **Define a force as a push or pull** A force acts on an object because of its interaction with another object, and is measured in newtons (N). (Contact and non-contact forces)

- ☐ **Name examples of contact forces** Friction, air resistance, tension and normal contact force act when objects are touching. (Contact and non-contact forces)

- ☐ **Define weight as the force due to gravity** Weight is measured in newtons (N); mass is measured in kilograms (kg). (Gravity)

- ☐ **Define resultant force** A single force that has the same effect as all the original forces acting together. (Resultant forces)

- ☐ **State that work done is energy transferred** When a force moves an object through a distance, energy is transferred and work is done. (Work done and energy transfer)

- ☐ **Explain why more than one force is needed** To stretch, bend or compress an object, forces must act on it in different directions. (Forces and elasticity)

- ☐ **Give examples of turning effects of forces** Opening a door, turning a spanner and a see-saw all involve forces that cause rotation. (Moments, levers and gears)

- ☐ **State that fluids are liquids or gases** Both liquids and gases are fluids and both exert pressure. (Pressure in a fluid ($p = F/A$))

- ☐ **State that distance is a scalar** Distance is how far an object moves; it does not involve direction. (Distance and displacement)

- ☐ **State that speed is a scalar** Speed is the distance travelled per unit time and has no direction. (Speed)

- ☐ **Define velocity** The velocity of an object is its speed in a given direction. (Velocity)

- ☐ **Describe motion from a distance–time graph** A horizontal line means stationary; a straight sloping line means constant speed. (Distance–time graphs)

- ☐ **Recognise balanced forces on a diagram** Equal-sized arrows in opposite directions mean the resultant force is zero. (Newton's First Law)

- ☐ **Define stopping distance as thinking plus braking** Thinking distance is covered during the reaction time; braking distance is covered while the brakes act. (Stopping distance)

- ☐ **Recall typical reaction times** Typical reaction times range from 0.2 s to 0.9 s. (Reaction time)

- ☐ **Name factors that increase braking distance** Higher speed, wet or icy roads, worn brakes and worn tyres. (Factors affecting braking distance)

Waves

- ☐ **Give examples of transverse and longitudinal waves** Transverse: ripples on water and all electromagnetic waves, such as light. Longitudinal: sound waves in air. (Transverse and longitudinal waves)

- ☐ **Label amplitude and wavelength on a diagram** Amplitude: from the undisturbed position to a crest (or trough). Wavelength: one complete wave, e.g. crest to crest. (Properties of waves)

- ☐ **State what can happen at a boundary** A wave can be reflected, absorbed or transmitted when it meets a boundary between two different materials. (Reflection of waves)

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- ☐ **Name the parts of the EM spectrum in order** Radio waves, microwaves, infrared, visible light, ultraviolet, X-rays, gamma rays. (Types of electromagnetic waves)
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- ☐ **State that EM waves are transverse** EM waves are transverse waves that transfer energy from a source to an absorber. (Types of electromagnetic waves)
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- ☐ **Name what substances can do to EM waves** A substance can absorb, transmit, refract or reflect EM waves. (EM waves: refraction and absorption)
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- ☐ **Name the EM waves that harm body tissue** Ultraviolet, X-rays and gamma rays can have hazardous effects on human body tissue. (EM waves: production and hazards)
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- ☐ **Match each EM wave to a use** E.g. radio waves: television and radio; X-rays: medical imaging. (Uses and applications of EM waves)
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- ☐ **Recognise the convex and concave lens symbols** Convex: a line with outward-pointing arrowheads. Concave: a line with inward-pointing arrowheads. (Lenses)
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- ☐ **Order the colours of the visible spectrum** Red, orange, yellow, green, blue, indigo, violet; red has the longest wavelength. (Visible light)
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- ☐ **State that all objects emit and absorb infrared** All bodies, whatever their temperature, emit and absorb infrared radiation. (Emission and absorption of infrared radiation)
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- ☐ **State that all bodies emit radiation** Every object emits radiation; how much, and at which wavelengths, depends on its temperature. (Perfect black bodies and radiation)
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Magnetism and electromagnetism

- ☐ **State where a magnet's forces are strongest** The magnetic forces are strongest at the poles: the north (seeking) pole and the south (seeking) pole. (Poles of a magnet)
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- ☐ **Predict attraction or repulsion between two poles** Like poles (N and N, or S and S) repel; unlike poles (N and S) attract. (Poles of a magnet)
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- ☐ **Name the four magnetic materials** Iron, steel, cobalt and nickel are always attracted by a magnet. (Magnetic fields)
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- ☐ **State that a current produces a magnetic field** When a current flows through a wire, a magnetic field is produced around the wire. (Electromagnetism)
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Space physics

- ☐ **List the objects in our solar system** One star (the Sun), eight planets, dwarf planets such as Pluto, and moons that orbit planets. (Our solar system)
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- ☐ **Name the galaxy our solar system is in** Our solar system is a small part of the Milky Way galaxy. (Our solar system)
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- ☐ **Order the first stages of a star's life** Every star starts as a nebula, then becomes a protostar, then a main sequence star. (The life cycle of a star)
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- ☐ **State the force that keeps objects in orbit** Gravity provides the force that keeps planets, moons and artificial satellites in their orbits. (Orbital motion and satellites)
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