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GCSE Physics

Common Mistakes - and How to Avoid Them

AQA Physics (8463) | GCSE | 17 mistakes fixed

The mistakes that lose the most marks in **GCSE Physics (AQA)** - the ones examiners report year after year. For each: what students do wrong, the correct method step by step, and the one habit that stops you making it again. Read the fix, not just the error.

MISTAKE 1 Rearranging equations the wrong way

WHAT STUDENTS DO	Students plug numbers into an equation like E = m c (delta)theta but then divide or multiply on the wrong side, e.g. computing m x (delta)theta instead of E / (c x (delta)theta) when finding mass.
DO THIS INSTEAD	**1.** Write the equation in symbols first, e.g. E = m c (delta)theta. **2.** Decide which symbol you want, then rearrange algebraically BEFORE inserting numbers: m = E / (c (delta)theta). **3.** Substitute the numbers with their units written next to them. **4.** Calculate, then check the answer is a sensible size.
HOW TO AVOID IT	› Always rearrange the symbols first, substitute numbers second - never the other way round.

MISTAKE 2 Missing or wrong units

WHAT STUDENTS DO	Students write a bare number like '4500' with no unit, or attach the wrong unit (J instead of W, or kJ instead of J), and lose the unit mark.
DO THIS INSTEAD	**1.** Identify the quantity: energy is J, power is W, force is N, charge is C. **2.** Carry units through the calculation, not just at the end. **3.** Write the unit immediately after the numerical answer. **4.** Check the unit matches the quantity the question asked for.
HOW TO AVOID IT	› Treat the unit as part of the answer - a number without a unit is incomplete in physics.

MISTAKE 3 Forgetting to convert to SI units before substituting

WHAT STUDENTS DO	Students put kilometres, grams, minutes or kilowatts straight into an equation, so a mass of 250 g goes in as 250 instead of 0.25 kg.
DO THIS INSTEAD	**1.** Underline every quantity in the question and note its unit. **2.** Convert each to base SI: g to kg (divide by 1000), km to m (x1000), minutes to s (x60), kW to W (x1000). **3.** Substitute the converted values. **4.** Only convert the final answer to a friendlier unit if the question asks.
HOW TO AVOID IT	› Convert everything to kg, m, s, A before you touch the equation.

MISTAKE 4 Rounding too early

WHAT STUDENTS DO	Students round an intermediate value (such as a resistance or velocity) to 2 significant figures, then use that rounded number in the next step, so the final answer is wrong in the last digit.
DO THIS INSTEAD	**1.** Keep full calculator precision for every intermediate value. **2.** Only round the FINAL answer. **3.** Round to the significant figures the question asks for, or match the data (usually 2 or 3 s.f.). **4.** State the rounded value clearly.
HOW TO AVOID IT	› Carry the full number through; round once, right at the end.

MISTAKE 5 Confusing series and parallel circuit rules

WHAT STUDENTS DO	Students add resistances in parallel as if in series, or assume current is the same everywhere in a parallel circuit and voltage the same in a series circuit.
DO THIS INSTEAD	**1.** Series: current is the same everywhere; voltages add up; resistances add up. **2.** Parallel: voltage is the same across each branch; currents add to give the total; total resistance is LESS than the smallest branch. **3.** Decide which arrangement you have before applying any rule. **4.** Use $V = I R$ on each component once the layout is clear.
HOW TO AVOID IT	› First ask 'series or parallel?', then quote the right rule for current, voltage and resistance.

MISTAKE 6 Mixing up speed-time and distance-time graphs

WHAT STUDENTS DO	Students read the gradient of a distance-time graph as acceleration, or take the area under a distance-time graph as distance.
DO THIS INSTEAD	**1.** Distance-time graph: gradient = speed; a flat line means stationary. **2.** Speed-time (velocity-time) graph: gradient = acceleration; AREA under the line = distance travelled. **3.** Check the y-axis label before reading anything off. **4.** For area, split into triangles and rectangles and add them.
HOW TO AVOID IT	› Read the y-axis label first - it tells you whether gradient means speed or acceleration.

MISTAKE 7 Forgetting work done against gravity uses g = 9.8

WHAT STUDENTS DO	Students use $g = 10$ when the AQA data sheet gives 9.8 N/kg, or forget to use the gravitational field strength entirely when finding weight or GPE.
DO THIS INSTEAD	**1.** Use the AQA value $g = 9.8$ N/kg unless the question states otherwise. **2.** Weight $W = m g$; gravitational PE $= m g h$. **3.** Substitute mass in kg and height in m. **4.** Give weight in newtons and energy in joules.
HOW TO AVOID IT	› Check the data sheet value of g (9.8 for AQA) and never confuse mass (kg) with weight (N).

MISTAKE 8 Sign errors with energy and forces

WHAT STUDENTS DO	Students ignore direction, so a deceleration is written as a positive acceleration, or energy transferred away is added instead of subtracted.
DO THIS INSTEAD	**1.** Choose a positive direction and state it. **2.** A force or acceleration opposite to that direction is negative. **3.** For energy, decide whether the store is gaining or losing energy. **4.** Keep the sign consistent through the whole calculation.
HOW TO AVOID IT	› Pick a positive direction at the start and stick to it for every quantity.

MISTAKE 9 Wrong equation for kinetic vs gravitational energy

WHAT STUDENTS DO	Students use Ek = m g h or mix the half into the GPE equation, blurring kinetic energy (1/2 m v squared) with gravitational PE (m g h).
DO THIS INSTEAD	**1.** Kinetic energy Ek = 1/2 m v squared - it has the half and v squared. **2.** Gravitational PE Ep = m g h - no half, uses height. **3.** Read whether the object is moving (use Ek) or raised (use Ep). **4.** Square the speed before multiplying by half the mass.
HOW TO AVOID IT	› Remember: kinetic has the 'half and v squared'; GPE has 'g and h'.

MISTAKE 10 Not squaring or square-rooting fully

WHAT STUDENTS DO	In Ek = 1/2 m v squared students forget to square v, or when finding v they forget to square root after dividing.
DO THIS INSTEAD	**1.** Write the equation with the square shown: Ek = 1/2 m v squared. **2.** To find v, rearrange: v squared = 2 Ek / m, then v = sqrt(2 Ek / m). **3.** Do the squaring or rooting as a separate calculator step. **4.** Check v is positive and a sensible speed.
HOW TO AVOID IT	› Treat the square and square root as their own step so they are never skipped.

MISTAKE 11 Confusing renewable and non-renewable energy resources

WHAT STUDENTS DO	Students call nuclear 'renewable' or list biofuel as non-renewable, and confuse reliability with environmental impact in 6-mark answers.
DO THIS INSTEAD	**1.** Non-renewable: coal, oil, gas, nuclear (fuel runs out). **2.** Renewable: solar, wind, hydro, tidal, wave, geothermal, biofuel. **3.** Separate the ideas of reliability, cost, and CO2 / pollution in your answer. **4.** Back each claim with a reason, not just a label.
HOW TO AVOID IT	› Learn the two lists, and judge reliability and environmental impact separately.

MISTAKE 12 Particle model: mixing mass, weight and density

WHAT STUDENTS DO	Students use weight instead of mass in density = mass / volume, or forget to convert cm cubed to m cubed.
DO THIS INSTEAD	**1.** Density rho = m / V, with m in kg and V in m cubed. **2.** Convert cm cubed to m cubed by dividing by 1 000 000. **3.** Substitute mass (kg), not weight (N). **4.** Give density in kg/m cubed.
HOW TO AVOID IT	› Density uses mass in kg and volume in m cubed - check both units before dividing.

MISTAKE 13 Specific latent heat vs specific heat capacity

WHAT STUDENTS DO	Students use E = m c (delta)theta during melting or boiling, when temperature is not changing and latent heat E = m L should be used.
DO THIS INSTEAD	**1.** If temperature is changing, use E = m c (delta)theta. **2.** If the substance is changing state at constant temperature, use E = m L. **3.** Pick L of fusion for melting/freezing, L of vaporisation for boiling/condensing. **4.** Keep mass in kg and energy in J.
HOW TO AVOID IT	› Temperature changing means c; state changing at constant temperature means L.

MISTAKE 14 Atomic structure: confusing mass number and atomic number

WHAT STUDENTS DO	Students swap the top and bottom numbers, or calculate neutrons by adding instead of subtracting (neutrons = mass number - atomic number).
DO THIS INSTEAD	**1.** Atomic (proton) number = bottom number = number of protons. **2.** Mass number = top number = protons + neutrons. **3.** Neutrons = mass number - atomic number. **4.** In a neutral atom, electrons = protons.
HOW TO AVOID IT	› Bottom number = protons; neutrons = top minus bottom.

MISTAKE 15 Radioactive decay: half-life mistakes

WHAT STUDENTS DO	Students halve the activity the wrong number of times, or multiply half-life by the number of halvings instead of counting them.
DO THIS INSTEAD	**1.** Count how many half-lives have passed: time / half-life. **2.** Halve the starting activity once for each half-life. **3.** For 3 half-lives, the activity becomes (1/2) x (1/2) x (1/2) = 1/8 of the start. **4.** Read the question for whether it wants the remaining or the decayed amount.
HOW TO AVOID IT	› Count the number of half-lives first, then halve that many times.

MISTAKE 16 Magnetism: confusing motor effect and generator effect

WHAT STUDENTS DO	Students use Fleming's left-hand rule for a generator and the right-hand for a motor, swapping the two effects.
DO THIS INSTEAD	**1.** Motor effect: current in a field produces a force - use Fleming's LEFT-hand rule. **2.** Generator effect: moving a wire in a field induces a potential difference - use the right-hand rule. **3.** Set thumb = force/motion, first finger = field, second finger = current. **4.** Make sure your fingers are at right angles.
HOW TO AVOID IT	› Left hand for motors (force from current), right hand for generators (induced p.d.).

MISTAKE 17 Waves: confusing frequency, wavelength and period

WHAT STUDENTS DO	Students mix up period and frequency, or use the wrong rearrangement of v = f (lambda), and forget frequency is in hertz.
DO THIS INSTEAD	**1.** Wave speed v = f (lambda), with v in m/s, f in Hz, (lambda) in m. **2.** Period T = 1 / f; frequency f = 1 / T. **3.** Rearrange for the unknown before substituting. **4.** Check frequency is in Hz and wavelength in m.
HOW TO AVOID IT	› Keep v = f(lambda) and T = 1/f straight, and watch the units of each term.