GCSE ONLINE TUTORING

IN PARTNERSHIP WITH RS REMOTE TUTORING

AQA GCSE (9-1) PHYSICS 8463

SEPARATE SCIENCE / TRIPLE SCIENCE

COMMON MISTAKES & DIAGNOSTIC REPAIR HANDBOOK

Foundation + Higher | evidence-labelled misconceptions

Examiner-report evidence where public | specification-derived risks otherwise | repair + retest routines

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Evidence policy

This handbook does not invent frequency statistics. Entries labelled ER are supported by public AQA examiner-report commentary. Entries labelled SPEC are independently authored diagnostic risks derived from the specification and common mathematical/physical demands. Some 2024 observations are included only where a publicly accessible copy reproduces an AQA-origin examiner report; these are explicitly labelled rather than presented as an AQA-hosted source.

Primary evidence used: ER22; ER23P1; ER23P2; SPEC. AQA-origin 2024 observations are supplementary and clearly identified.

01. Unit conversion before equation use

Area: Energy

Typical failure: Students substitute kW, cm or g directly when SI units are required.

Repair routine: Convert prefixes first; write the converted quantity beside the data before selecting the equation.

Rapid retest: Complete one unseen question on the same skill. Require correct physics terminology, units and reasoning before marking the issue repaired.

Evidence label: ER22; SPEC

02. Energy-store language

Area: Energy

Typical failure: Students describe "heat energy" or say energy is used up instead of identifying stores/transfers.

Repair routine: Name the initial store, pathway, final store and dissipated transfer explicitly.

Rapid retest: Complete one unseen question on the same skill. Require correct physics terminology, units and reasoning before marking the issue repaired.

Evidence label: SPEC

03. Squared terms

Area: Energy

Typical failure: Kinetic and elastic-energy calculations omit the square or square the wrong quantity.

Repair routine: Box the exponent before substituting; calculate the squared quantity separately.

Rapid retest: Complete one unseen question on the same skill. Require correct physics terminology, units and reasoning before marking the issue repaired.

Evidence label: SPEC

04. Current is used up

Area: Electricity

Typical failure: Students think current decreases through a series component.

Repair routine: Use conservation of charge: same current at all points in a simple series circuit.

Rapid retest: Complete one unseen question on the same skill. Require correct physics terminology, units and reasoning before marking the issue repaired.

Evidence label: SPEC

05. Meter placement

Area: Electricity

Typical failure: Ammeter/voltmeter positions are reversed.

Repair routine: Ammeter measures flow through: series. Voltmeter compares energy per charge across: parallel.

Rapid retest: Complete one unseen question on the same skill. Require correct physics terminology, units and reasoning before marking the issue repaired.

Evidence label: SPEC

06. Wire colour without role

Area: Electricity

Typical failure: Students memorise colours but cannot explain live/neutral/earth danger and function.

Repair routine: Revise potential and fault paths, not colours alone.

Rapid retest: Complete one unseen question on the same skill. Require correct physics terminology, units and reasoning before marking the issue repaired.

Evidence label: SPEC

07. Power-energy confusion

Area: Electricity

Typical failure: Students interchange W, J, kW and kWh.

Repair routine: Write quantity and unit pairs: power-W/kW; energy-J/kWh; time-s/h.

Rapid retest: Complete one unseen question on the same skill. Require correct physics terminology, units and reasoning before marking the issue repaired.

Evidence label: ER23P1; SPEC

08. Mean instead of difference for displacement

Area: Particle model

Typical failure: When using water displacement, students average the two cylinder readings instead of subtracting.

Repair routine: Final volume reading - initial volume reading = object volume.

Rapid retest: Complete one unseen question on the same skill. Require correct physics terminology, units and reasoning before marking the issue repaired.

Evidence label: 2024 AQA-origin report evidence; SPEC

09. Particles expand

Area: Particle model

Typical failure: Students say particles themselves become larger when heated.

Repair routine: State that average kinetic energy/spacing changes; particle size does not.

Rapid retest: Complete one unseen question on the same skill. Require correct physics terminology, units and reasoning before marking the issue repaired.

Evidence label: SPEC

10. State-change temperature

Area: Thermal physics

Typical failure: Students expect temperature to rise during melting/boiling.

Repair routine: During state change, transferred energy changes potential energy/arrangement rather than mean kinetic energy.

Rapid retest: Complete one unseen question on the same skill. Require correct physics terminology, units and reasoning before marking the issue repaired.

Evidence label: SPEC

11. Isotope vs ion

Area: Atomic

Typical failure: Students mix neutron-number changes with electron-number changes.

Repair routine: Isotope: same protons, different neutrons. Ion: electron number differs from neutral atom.

Rapid retest: Complete one unseen question on the same skill. Require correct physics terminology, units and reasoning before marking the issue repaired.

Evidence label: SPEC

12. Half-life linear decay

Area: Atomic

Typical failure: Students subtract a fixed amount each half-life.

Repair routine: Repeatedly halve activity/number; use exponential reasoning.

Rapid retest: Complete one unseen question on the same skill. Require correct physics terminology, units and reasoning before marking the issue repaired.

Evidence label: SPEC

13. Contamination vs irradiation

Area: Atomic

Typical failure: Students use the terms interchangeably and choose generic PPE.

Repair routine: Contamination = unwanted radioactive material on/in object; irradiation = exposure to radiation. Match control to route.

Rapid retest: Complete one unseen question on the same skill. Require correct physics terminology, units and reasoning before marking the issue repaired.

Evidence label: ER23P1; SPEC

14. Zero resultant means stationary

Area: Forces

Typical failure: Students say an object with zero resultant force must be at rest.

Repair routine: Zero resultant means zero acceleration: velocity is constant, which may be zero or non-zero.

Rapid retest: Complete one unseen question on the same skill. Require correct physics terminology, units and reasoning before marking the issue repaired.

Evidence label: ER23P2

15. Contact force classification

Area: Forces

Typical failure: Gravity is sometimes labelled contact force.

Repair routine: Ask: does the interaction require physical contact? Gravity/magnetic/electrostatic are non-contact.

Rapid retest: Complete one unseen question on the same skill. Require correct physics terminology, units and reasoning before marking the issue repaired.

Evidence label: ER23P2

16. Distance vs displacement

Area: Forces

Typical failure: Students measure path length when displacement is required.

Repair routine: Displacement is straight-line change from start to finish plus direction.

Rapid retest: Complete one unseen question on the same skill. Require correct physics terminology, units and reasoning before marking the issue repaired.

Evidence label: ER23P2

17. Area under velocity-time graph

Area: Motion graphs

Typical failure: Students use s=vt across changing velocity instead of area.

Repair routine: Split graph into simple shapes and sum signed areas; use s=vt only for constant velocity segments.

Rapid retest: Complete one unseen question on the same skill. Require correct physics terminology, units and reasoning before marking the issue repaired.

Evidence label: ER23P2

18. Reaction-time wording

Area: Stopping distance

Typical failure: Students write that reaction time is "slower" or mix thinking and braking distance.

Repair routine: Use longer reaction time -> greater thinking distance; braking distance depends on speed, brakes, tyres, road etc.

Rapid retest: Complete one unseen question on the same skill. Require correct physics terminology, units and reasoning before marking the issue repaired.

Evidence label: ER23P2

19. Friction explanation too vague

Area: Work/energy

Typical failure: Students mention friction but not the work/energy transfer.

Repair routine: State that work is done by friction, transferring kinetic energy to thermal stores of brakes/road/surroundings.

Rapid retest: Complete one unseen question on the same skill. Require correct physics terminology, units and reasoning before marking the issue repaired.

Evidence label: ER23P2

20. Wrong lever distance

Area: Moments

Typical failure: Students use lever length or distance to pivot without specifying perpendicular distance from force line.

Repair routine: Draw the pivot, force line and shortest perpendicular distance before using M=Fd.

Rapid retest: Complete one unseen question on the same skill. Require correct physics terminology, units and reasoning before marking the issue repaired.

Evidence label: ER23P2; SPEC

21. Airbag misconception

Area: Momentum

Typical failure: Students say airbags reduce momentum change.

Repair routine: For similar initial/final momentum, increasing collision time reduces average force.

Rapid retest: Complete one unseen question on the same skill. Require correct physics terminology, units and reasoning before marking the issue repaired.

Evidence label: SPEC

22. Frequency-speed confusion

Area: Waves

Typical failure: Students assume frequency changes when a wave enters a different material.

Repair routine: Source fixes frequency; speed and wavelength change together at a boundary.

Rapid retest: Complete one unseen question on the same skill. Require correct physics terminology, units and reasoning before marking the issue repaired.

Evidence label: SPEC

23. Ray diagrams

Area: Waves

Typical failure: Normals are omitted or angles are measured from the surface.

Repair routine: Draw the normal first; measure incidence/refraction angles from it.

Rapid retest: Complete one unseen question on the same skill. Require correct physics terminology, units and reasoning before marking the issue repaired.

Evidence label: SPEC

24. Ionising vs non-ionising

Area: EM spectrum

Typical failure: Students call all EM radiation ionising.

Repair routine: At GCSE, ultraviolet, X-rays and gamma are the main ionising hazard context; justify by energy/frequency.

Rapid retest: Complete one unseen question on the same skill. Require correct physics terminology, units and reasoning before marking the issue repaired.

Evidence label: SPEC

25. Real vs virtual images

Area: Lenses

Typical failure: Image descriptions are memorised but ray construction is inconsistent.

Repair routine: Use two principal rays and locate their actual intersection or backward extensions before naming image properties.

Rapid retest: Complete one unseen question on the same skill. Require correct physics terminology, units and reasoning before marking the issue repaired.

Evidence label: SPEC

26. Motor vs generator effect

Area: Magnetism

Typical failure: Students mix current-causes-force with motion/change-causes-induced-pd.

Repair routine: Motor: current + field -> force. Generator: changing flux -> induced pd/current.

Rapid retest: Complete one unseen question on the same skill. Require correct physics terminology, units and reasoning before marking the issue repaired.

Evidence label: SPEC

27. Turns ratio inverted

Area: Transformers

Typical failure: Primary/secondary quantities are swapped.

Repair routine: Write Vp/Vs=np/ns exactly first, then substitute labelled quantities.

Rapid retest: Complete one unseen question on the same skill. Require correct physics terminology, units and reasoning before marking the issue repaired.

Evidence label: SPEC

28. Measure resistance without method

Area: Practical skills

Typical failure: Students say "measure resistance" without specifying ammeter/voltmeter readings or resistance meter method.

Repair routine: State the measurable quantities and calculation: R=V/I, or name/use an ohmmeter where appropriate.

Rapid retest: Complete one unseen question on the same skill. Require correct physics terminology, units and reasoning before marking the issue repaired.

Evidence label: 2024 AQA-origin report evidence; SPEC

29. Precision vs accuracy

Area: Practical skills

Typical failure: Students treat the terms as synonyms.

Repair routine: Precision = spread/resolution; accuracy = closeness to true value. Link improvements to the actual error source.

Rapid retest: Complete one unseen question on the same skill. Require correct physics terminology, units and reasoning before marking the issue repaired.

Evidence label: SPEC

30. Repeatability/reproducibility

Area: Practical skills

Typical failure: Students say repeated similar results mean accurate.

Repair routine: Repeatability = same method/person/equipment gives similar results; reproducibility changes person/equipment/method.

Rapid retest: Complete one unseen question on the same skill. Require correct physics terminology, units and reasoning before marking the issue repaired.

Evidence label: 2024 AQA-origin report evidence; SPEC

31. Rearrangement failure

Area: Calculations

Typical failure: Correct equation selected but algebra/rearrangement fails.

Repair routine: Rearrange symbolically before numbers; perform inverse operations one step at a time.

Rapid retest: Complete one unseen question on the same skill. Require correct physics terminology, units and reasoning before marking the issue repaired.

Evidence label: ER23P2; SPEC

32. Scale reading

Area: Graphs

Typical failure: Students misread non-unit graph scales.

Repair routine: Annotate one minor division value before extracting coordinates.

Rapid retest: Complete one unseen question on the same skill. Require correct physics terminology, units and reasoning before marking the issue repaired.

Evidence label: ER23P2

33. Orbit force misconception

Area: Space

Typical failure: Students describe gravity as pushing a planet forward.

Repair routine: Velocity is tangential; gravity provides inward centripetal acceleration, continuously changing direction.

Rapid retest: Complete one unseen question on the same skill. Require correct physics terminology, units and reasoning before marking the issue repaired.

Evidence label: SPEC

34. Stellar life-cycle mixing

Area: Space

Typical failure: Low- and high-mass star endpoints are blended.

Repair routine: Branch the sequence after main sequence: red giant -> white dwarf; red supergiant -> supernova -> neutron star/black hole.

Rapid retest: Complete one unseen question on the same skill. Require correct physics terminology, units and reasoning before marking the issue repaired.

Evidence label: SPEC

Diagnostic log

Issue	First seen	Repair completed	Retest score	Secure?
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Source register

Source keys are used throughout the handbook so that curriculum, data and examiner-evidence statements can be audited. URLs are provided for verification; this publication paraphrases rather than reproduces protected assessment material.

Key	Source	URL
SPEC	AQA GCSE Physics 8463 specification (current web specification; first teaching 2016).	https://www.aqa.org.uk/subjects/physics/gcse/physics-8463/specification
GLANCE	AQA GCSE Physics 8463 specification at a glance: paper structure and topic split.	https://www.aqa.org.uk/subjects/physics/gcse/physics-8463/specification/specification-at-a-glance
PRACT	AQA GCSE Physics 8463 practical assessment: apparatus/techniques and 10 required practicals.	https://www.aqa.org.uk/subjects/physics/gcse/physics-8463/specification/practical-assessment
EQ	AQA GCSE Physics 8463 Appendix A: Physics equations.	https://www.aqa.org.uk/subjects/physics/gcse/physics-8463/specification/appendix-a-physics-equations
EQPOL	AQA, GCSE Maths and GCSE Sciences formulae and equation sheets for 2027 and 2028 onwards, published 1 Sep 2026.	https://www.aqa.org.uk/news/gcse-maths-sciences-formulae-equation-sheets-2027-28
GB	AQA grade-boundary publications, June 2022-2026.	https://www.aqa.org.uk/exams-administration/results-days/grade-boundaries
RS	AQA results-statistics publications, June 2022-2026.	https://www.aqa.org.uk/exams-administration/results-days/results-statistics
ER22	AQA GCSE Physics 8463 examiner reports, June 2022 (Paper 1 Higher and related reports).	https://filestore.aqa.org.uk/sample-papers-and-mark-schemes/2022/june/AQA-84631H-WRE-JUN22.PDF
ER23P1	AQA GCSE Physics 8463 examiner report, June 2023 Paper 1 Higher.	https://filestore.aqa.org.uk/sample-papers-and-mark-schemes/2023/june/AQA-84631H-WRE-JUN23.PDF
ER23P2	AQA GCSE Physics 8463 examiner report, June 2023 Paper 2 Higher.	https://filestore.aqa.org.uk/sample-papers-and-mark-schemes/2023/june/AQA-84632H-WRE-JUN23.PDF
RPG	AQA GCSE Physics required practical activities teacher/student practical resource.	https://filestore.aqa.org.uk/resources/physics/AQA-8463-PRACTICALS.PDF