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OCR GCSE (9-1) GATEWAY SCIENCE PHYSICS A J249

FOUNDATION + HIGHER

MASTER SPECIFICATION & PRACTICAL REFERENCE

Full J249 course map, Foundation/Higher distinctions, PAGs, maths and working scientifically

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Qualification architecture

OCR route used in this pack

OCR offers Physics A (Gateway Science) J249 and Physics B (Twenty First Century Science) J259. This publication is specifically J249. Do not use it as a substitute for J259.

Tier	Components	Marks	Duration	Content
Foundation	J249/01 + J249/02	90 + 90	1 h 45 each	Paper 1: P1-P4 + P9; Paper 2: P5-P8 + P9, assuming P1-P4
Higher	J249/03 + J249/04	90 + 90	1 h 45 each	Paper 3: P1-P4 + P9; Paper 4: P5-P8 + P9, assuming P1-P4

Foundation awards grades 1-5. Higher awards grades 4-9 with a grade-3 safety-net boundary. OCR states that at least 30% of Physics assessment targets mathematical skills and at least 15% targets practical skills.

Complete topic map

P1 - Matter

Paper	Official sub-topics
Paper 1 / 3	P1.1 The particle model; P1.2 Changes of state; P1.3 Pressure

What the course requires: Particle/subatomic model, density, internal energy, SHC/latent heat, gas and fluid pressure, separate-Physics pressure extensions.

High-risk diagnostic areas: Particle-type confusion; volume-unit conversions; SHC vs latent heat; gas-pressure reasoning.

Secure-performance test: Explain the core model in precise scientific language, complete at least one multi-step calculation with correct SI units, interpret one graph/data set, and answer one unfamiliar application without relying on memorised wording.

Tier check: All non-bold specification statements are common to Foundation and Higher; bold statements are Higher-only. Separate-Physics-only items are identified by OCR with the separate-science symbol in the specification.

P2 - Forces

Paper	Official sub-topics
Paper 1 / 3	P2.1 Motion; P2.2 Newton's laws; P2.3 Forces in action

What the course requires: Vectors/scalars, motion graphs, acceleration, Newton laws, momentum, work/power, springs, weight/GPE, pressure and moments.

High-risk diagnostic areas: Distance-time vs velocity-time graphs; sign of velocity; zero resultant force; extension vs length.

Secure-performance test: Explain the core model in precise scientific language, complete at least one multi-step calculation with correct SI units, interpret one graph/data set, and answer one unfamiliar application without relying on memorised wording.

Tier check: All non-bold specification statements are common to Foundation and Higher; bold statements are Higher-only. Separate-Physics-only items are identified by OCR with the separate-science symbol in the specification.

P3 - Electricity

Paper	Official sub-topics
Paper 1 / 3	P3.1 Static and charge; P3.2 Simple circuits

What the course requires: Charge transfer and fields, current, p.d., resistance, series/parallel circuits, power and energy, circuit characteristics.

High-risk diagnostic areas: Positive charge moving; current being used up; meter placement; unit conversion and rearrangement.

Secure-performance test: Explain the core model in precise scientific language, complete at least one multi-step calculation with correct SI units, interpret one graph/data set, and answer one unfamiliar application without relying on memorised wording.

Tier check: All non-bold specification statements are common to Foundation and Higher; bold statements are Higher-only. Separate-Physics-only items are identified by OCR with the separate-science symbol in the specification.

P4 - Magnetism and magnetic fields

Paper	Official sub-topics
Paper 1 / 3	P4.1 Magnets and magnetic fields; P4.2 Uses of magnetism

What the course requires: Field patterns, electromagnets, motor effect, Fleming rule, induction, transformers, microphones/loudspeakers.

High-risk diagnostic areas: Field-line direction/density; electron vs conventional current; steady vs changing magnetic field; transformer explanation.

Secure-performance test: Explain the core model in precise scientific language, complete at least one multi-step calculation with correct SI units, interpret one graph/data set, and answer one unfamiliar application without relying on memorised wording.

Tier check: All non-bold specification statements are common to Foundation and Higher; bold statements are Higher-only. Separate-Physics-only items are identified by OCR with the separate-science symbol in the specification.

P5 - Waves in matter

Paper	Official sub-topics
Paper 2 / 4	P5.1 Wave behaviour; P5.2 Electromagnetic spectrum; P5.3 Wave interaction

What the course requires: Wave quantities, transverse/longitudinal, reflection/refraction, ultrasound/sonar, EM spectrum, lenses/filters and wave interactions.

High-risk diagnostic areas: Wavelength measurement; graph axes; frequency/wavelength trends; sound-speed misconceptions; echo-time halving.

Secure-performance test: Explain the core model in precise scientific language, complete at least one multi-step calculation with correct SI units, interpret one graph/data set, and answer one unfamiliar application without relying on memorised wording.

Tier check: All non-bold specification statements are common to Foundation and Higher; bold statements are Higher-only. Separate-Physics-only items are identified by OCR with the separate-science symbol in the specification.

P6 - Radioactivity

Paper	Official sub-topics
Paper 2 / 4	P6.1 Radioactive emissions; P6.2 Uses and hazards

What the course requires: Atomic radiation, penetration/ionisation, half-life, background radiation, contamination/irradiation, fission and fusion.

High-risk diagnostic areas: Random decay; half-life; contamination vs irradiation; fission vs fusion; hazard/risk language.

Secure-performance test: Explain the core model in precise scientific language, complete at least one multi-step calculation with correct SI units, interpret one graph/data set, and answer one unfamiliar application without relying on memorised wording.

Tier check: All non-bold specification statements are common to Foundation and Higher; bold statements are Higher-only. Separate-Physics-only items are identified by OCR with the separate-science symbol in the specification.

P7 - Energy

Paper	Official sub-topics
Paper 2 / 4	P7.1 Work done; P7.2 Power and efficiency

What the course requires: Energy stores/transfers, work, power, conservation, dissipation and efficiency.

High-risk diagnostic areas: Energy “lost”; incorrect store terminology; efficiency denominator; power vs energy.

Secure-performance test: Explain the core model in precise scientific language, complete at least one multi-step calculation with correct SI units, interpret one graph/data set, and answer one unfamiliar application without relying on memorised wording.

Tier check: All non-bold specification statements are common to Foundation and Higher; bold statements are Higher-only. Separate-Physics-only items are identified by OCR with the separate-science symbol in the specification.

P8 - Global challenges

Paper	Official sub-topics
Paper 2 / 4	P8.1 Physics on the move; P8.2 Powering Earth; P8.3 Beyond Earth

What the course requires: Vehicle safety/stopping, energy resources and electricity distribution, transformers, planetary/orbital physics and cosmology.

High-risk diagnostic areas: Thinking vs braking distance; energy-resource evaluation; orbit misconceptions; red-shift/Universe reasoning.

Secure-performance test: Explain the core model in precise scientific language, complete at least one multi-step calculation with correct SI units, interpret one graph/data set, and answer one unfamiliar application without relying on memorised wording.

Tier check: All non-bold specification statements are common to Foundation and Higher; bold statements are Higher-only. Separate-Physics-only items are identified by OCR with the separate-science symbol in the specification.

Topic-by-topic audit checklist

P1 Matter

- ☐ I can explain: Particle/subatomic model, density, internal energy, SHC/latent heat, gas and fluid pressure, separate-Physics pressure extensions.
- ☐ I can avoid: Particle-type confusion; volume-unit conversions; SHC vs latent heat; gas-pressure reasoning.
- ☐ I can identify relevant equation(s) from the current equation sheet and still explain why they apply.
- ☐ I can link this topic to a practical method, graph or data-analysis skill.
- ☐ I can answer an unfamiliar-context question using a model rather than keyword recall.

P2 Forces

- ☐ I can explain: Vectors/scalars, motion graphs, acceleration, Newton laws, momentum, work/power, springs, weight/GPE, pressure and moments.
- ☐ I can avoid: Distance-time vs velocity-time graphs; sign of velocity; zero resultant force; extension vs length.
- ☐ I can identify relevant equation(s) from the current equation sheet and still explain why they apply.
- ☐ I can link this topic to a practical method, graph or data-analysis skill.
- ☐ I can answer an unfamiliar-context question using a model rather than keyword recall.

P3 Electricity

- ☐ I can explain: Charge transfer and fields, current, p.d., resistance, series/parallel circuits, power and energy, circuit characteristics.
- ☐ I can avoid: Positive charge moving; current being used up; meter placement; unit conversion and rearrangement.
- ☐ I can identify relevant equation(s) from the current equation sheet and still explain why they apply.
- ☐ I can link this topic to a practical method, graph or data-analysis skill.
- ☐ I can answer an unfamiliar-context question using a model rather than keyword recall.

P4 Magnetism and magnetic fields

- ☐ I can explain: Field patterns, electromagnets, motor effect, Fleming rule, induction, transformers, microphones/loudspeakers.
- ☐ I can avoid: Field-line direction/density; electron vs conventional current; steady vs changing magnetic field; transformer explanation.
- ☐ I can identify relevant equation(s) from the current equation sheet and still explain why they apply.
- ☐ I can link this topic to a practical method, graph or data-analysis skill.
- ☐ I can answer an unfamiliar-context question using a model rather than keyword recall.

P5 Waves in matter

- ☐ I can explain: Wave quantities, transverse/longitudinal, reflection/refraction, ultrasound/sonar, EM spectrum, lenses/filters and wave interactions.
- ☐ I can avoid: Wavelength measurement; graph axes; frequency/wavelength trends; sound-speed misconceptions; echo-time halving.
- ☐ I can identify relevant equation(s) from the current equation sheet and still explain why they apply.
- ☐ I can link this topic to a practical method, graph or data-analysis skill.

- ☐ I can answer an unfamiliar-context question using a model rather than keyword recall.

P6 Radioactivity

- ☐ I can explain: Atomic radiation, penetration/ionisation, half-life, background radiation, contamination/irradiation, fission and fusion.
- ☐ I can avoid: Random decay; half-life; contamination vs irradiation; fission vs fusion; hazard/risk language.
- ☐ I can identify relevant equation(s) from the current equation sheet and still explain why they apply.
- ☐ I can link this topic to a practical method, graph or data-analysis skill.
- ☐ I can answer an unfamiliar-context question using a model rather than keyword recall.

P7 Energy

- ☐ I can explain: Energy stores/transfers, work, power, conservation, dissipation and efficiency.
- ☐ I can avoid: Energy “lost”; incorrect store terminology; efficiency denominator; power vs energy.
- ☐ I can identify relevant equation(s) from the current equation sheet and still explain why they apply.
- ☐ I can link this topic to a practical method, graph or data-analysis skill.
- ☐ I can answer an unfamiliar-context question using a model rather than keyword recall.

P8 Global challenges

- ☐ I can explain: Vehicle safety/stopping, energy resources and electricity distribution, transformers, planetary/orbital physics and cosmology.
- ☐ I can avoid: Thinking vs braking distance; energy-resource evaluation; orbit misconceptions; red-shift/Universe reasoning.
- ☐ I can identify relevant equation(s) from the current equation sheet and still explain why they apply.
- ☐ I can link this topic to a practical method, graph or data-analysis skill.
- ☐ I can answer an unfamiliar-context question using a model rather than keyword recall.

P9 practical skills - eight PAGs

OCR practical requirement

OCR requires learners to complete at least eight practical activities covering all specified apparatus and techniques. The course organises these into eight Practical Activity Groups (PAGs). Practical skills are assessed in the written examinations; the specification states approximately 15% of questions assess practical skills.

PAG P1 - Materials

Typical focus: Density / properties of materials

Method and analysis control: Measure mass/volume appropriately; use displacement for irregular solids; calculate density; evaluate uncertainty.

- State independent, dependent and controlled variables.
- Explain why the chosen instrument/range/resolution is suitable.
- Describe repeats and how anomalous data would be handled.
- State what graph/calculation is used and what its gradient/area/intercept means where relevant.
- Distinguish random error, systematic error, precision, accuracy, repeatability and reproducibility.

PAG P2 - Forces

Typical focus: Force-extension / motion / force and acceleration

Method and analysis control: Control mass or force as appropriate; measure extension or motion; plot/interpret graphs; identify proportional and non-linear regions.

- State independent, dependent and controlled variables.
- Explain why the chosen instrument/range/resolution is suitable.
- Describe repeats and how anomalous data would be handled.
- State what graph/calculation is used and what its gradient/area/intercept means where relevant.
- Distinguish random error, systematic error, precision, accuracy, repeatability and reproducibility.

PAG P3 - Electric circuits

Typical focus: I-V characteristics / resistance

Method and analysis control: Correct ammeter/voltmeter placement; vary p.d.; collect paired V-I data; calculate resistance and interpret curves.

- State independent, dependent and controlled variables.
- Explain why the chosen instrument/range/resolution is suitable.
- Describe repeats and how anomalous data would be handled.
- State what graph/calculation is used and what its gradient/area/intercept means where relevant.
- Distinguish random error, systematic error, precision, accuracy, repeatability and reproducibility.

PAG P4 - Waves

Typical focus: Wave speed / reflection / refraction / filters

Method and analysis control: Measure wavelength/frequency or angles; use normal lines and repeat measurements; process graphical or calculated results.

- State independent, dependent and controlled variables.
- Explain why the chosen instrument/range/resolution is suitable.
- Describe repeats and how anomalous data would be handled.
- State what graph/calculation is used and what its gradient/area/intercept means where relevant.
- Distinguish random error, systematic error, precision, accuracy, repeatability and reproducibility.

PAG P5 - Radioactivity

Typical focus: Background/radiation handling

Method and analysis control: Measure count rate, correct for background where appropriate, control distance/time and apply safe handling principles.

- State independent, dependent and controlled variables.
- Explain why the chosen instrument/range/resolution is suitable.
- Describe repeats and how anomalous data would be handled.
- State what graph/calculation is used and what its gradient/area/intercept means where relevant.
- Distinguish random error, systematic error, precision, accuracy, repeatability and reproducibility.

PAG P6 - Energy

Typical focus: Thermal / energy transfer investigations

Method and analysis control: Measure temperature/energy/time; control insulation or material variables; analyse rates/efficiency and losses.

- State independent, dependent and controlled variables.
- Explain why the chosen instrument/range/resolution is suitable.
- Describe repeats and how anomalous data would be handled.
- State what graph/calculation is used and what its gradient/area/intercept means where relevant.
- Distinguish random error, systematic error, precision, accuracy, repeatability and reproducibility.

PAG P7 - Forces and pressure

Typical focus: Pressure / moments / fluids

Method and analysis control: Measure force/area/distance or pressure variables; use perpendicular distance and appropriate units.

- State independent, dependent and controlled variables.
- Explain why the chosen instrument/range/resolution is suitable.
- Describe repeats and how anomalous data would be handled.
- State what graph/calculation is used and what its gradient/area/intercept means where relevant.
- Distinguish random error, systematic error, precision, accuracy, repeatability and reproducibility.

PAG P8 - Global challenges

Typical focus: Applied physics investigation

Method and analysis control: Apply a suitable method to vehicle, energy or space-context data; evaluate evidence, risk and limitations.

- State independent, dependent and controlled variables.
- Explain why the chosen instrument/range/resolution is suitable.
- Describe repeats and how anomalous data would be handled.
- State what graph/calculation is used and what its gradient/area/intercept means where relevant.
- Distinguish random error, systematic error, precision, accuracy, repeatability and reproducibility.

Mathematics and working scientifically

OCR states that quantitative skills make up at least 30% of the Physics assessment. Higher-tier maths will not be below the demand of Foundation GCSE Mathematics. The specification also assesses Working Scientifically (WS1/WS2) across all papers.

Calculation discipline

Convert units first; identify the target quantity; select the relationship; rearrange symbolically; substitute; keep guard digits; round at the end; state the unit.

Graphs

Check axis quantity and unit; distinguish gradient from area; use a large triangle; identify linearity/proportionality correctly; interpolate only within justified range.

Evaluation

Name the actual limitation and mechanism before suggesting improvement. “Repeat and average” only treats random scatter; it does not fix a systematic bias.

Extended response

Answer every strand of the question. OCR examiner reports repeatedly reward concise scientific language, visible calculations and practical detail.

References and evidence base

Accessed 12 November 2026. Specification mappings, boundaries, results statistics, equation-sheet policy and examiner-evidence labels were checked against the sources below. The diagnostic handbook does not invent error-frequency percentages where OCR has not published them.

[SPEC] OCR GCSE (9-1) Gateway Science Physics A J249 Specification, Version 4.2 (February 2024)
https://www.ocr.org.uk/Images/234600-specification-accredited-gcse-gateway-science-suite-physics-a-j249.pdf

[ASSESS] OCR Physics A J249 assessment materials and examiner reports
https://www.ocr.org.uk/qualifications/gcse/gateway-science-suite-physics-a-j249-from-2016/assessment/

[EQ27] OCR formulae and equation sheets for assessments in 2027
https://www.ocr.org.uk/administration/support-and-tools/subject-updates/formulae-equation-sheets-763224/

[EQ28] OCR formulae and equation sheets confirmed for 2028 onwards
https://www.ocr.org.uk/administration/support-and-tools/subject-updates/maths-science-ofqual-update-758751/

[MATH26] OCR mathematical skills handbook update for GCSE sciences
https://www.ocr.org.uk/administration/support-and-tools/subject-updates/gcse-sciences-maths-handbook-750981/