Physics

HSC · 2017 SYLLABUS · TEACHER BRIEF

What eight HSC papers tell us about 2027

All 349 question parts from 2019–2026, read against the syllabus, NESA's marking guidelines and marker feedback (2019–25) · Prepared November 2026 for teachers · 2027 is the last paper on this syllabus

42% *start here, page 3*
of all marks sat on **12 dot points**, each the main focus of a question in 7 or 8 of the 8 papers

35
marks per paper, on average, **need a calculation** (24–48 across the eight papers)

67%
of marks come with a **graph, table or diagram** (44–88% per paper)

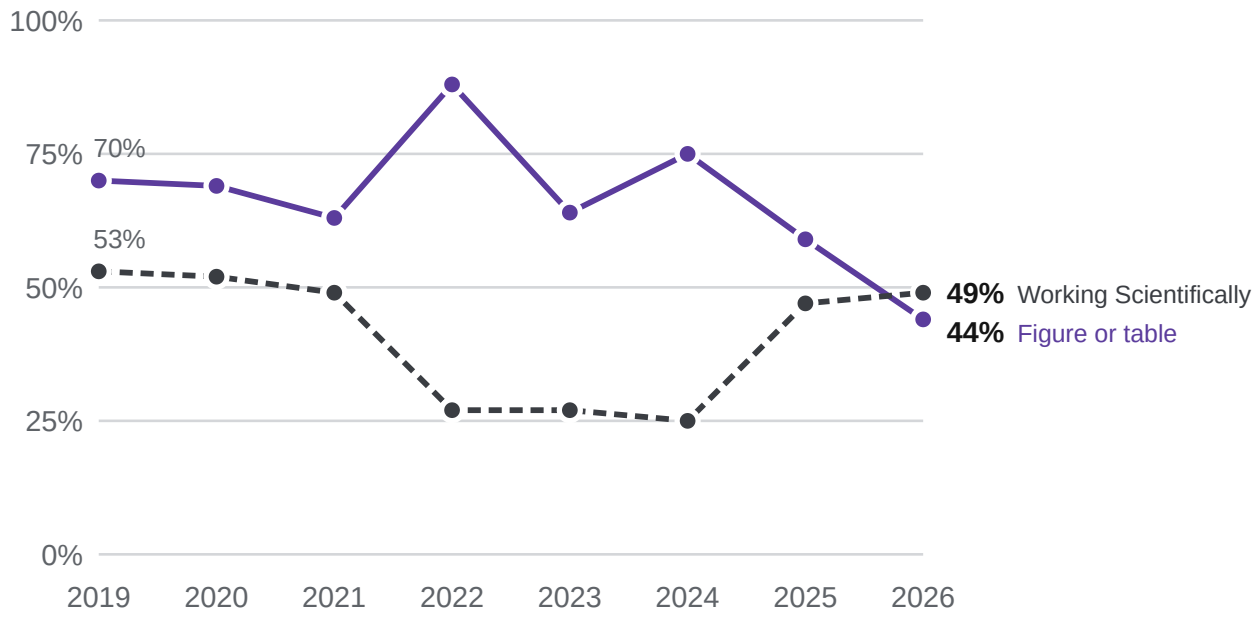
42
marks per 2022–26 paper, on average, on a **top-15 watch-list** made from earlier papers

Five things to act on

1. **Put induction first.** Faraday's and Lenz's Laws carried 58 marks, more than any other dot point, with a 7–9 mark question in 2020, 2021 and 2024: a magnet falling through a copper cylinder, two solenoids on carts, a magnet swinging over a can. The magnets were about energy; the carts about induced current and equal, opposite forces.
2. **Train the two long responses.** Every paper has had exactly two parts worth 7–9 marks. Twelve of the 16 asked students to explain or analyse, and nine asked for calculations or formulae inside the response. Students must write and do physics in one answer.
3. **Make full working a habit.** Parts needing a calculation carry 35 marks per paper, and working, formulas and substitution are what NESA's feedback mentions most (74 of 314 comments).
4. **Give gravity and orbits their full share of time.** Questions mainly on motion in gravitational fields (M5.IQ3) carried 3–8 marks in 2019–2022 and 12–14 per paper since, including 8-mark questions in 2025 and 2026.
5. **Close the gaps on page 5.** Four required pieces of content have never been examined, and 2027 is NESA's last chance to set them.

Most marks sit on a figure or table; 2026 had the lowest share

% of each paper's marks on parts with a graph, table or diagram, and the share of marks NESA maps to Working Scientifically outcomes*

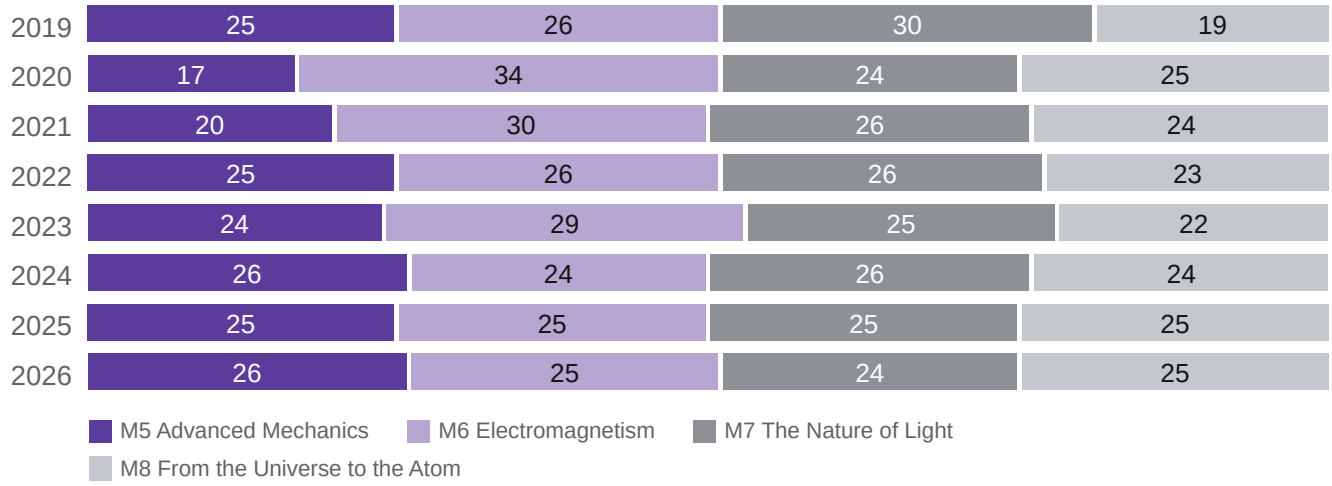


* Adding parts with only a written scenario, 80–98% of marks carry a stimulus. Working Scientifically share: each part's marks split equally across the outcomes in NESA's mapping grid (41% on average); counted as any part mapped to a Working Scientifically outcome it is 80%. In 2022–24 NESA mapped 43–50 marks per paper to content outcomes only (0–9 otherwise), so the line dips; the 2026 point is our estimate (grid not yet published). School tests set their own Working Scientifically/content split per assessment task.

How the paper is built

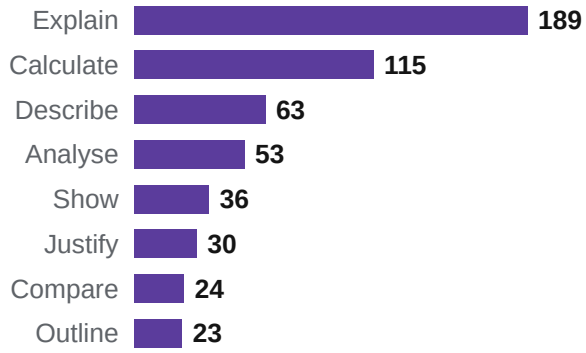
Each module gets about a quarter of the paper, and exactly 25 marks in 2025

Marks per paper by the module of each part's main dot point. Over eight papers: Module 5, 188 marks; Module 6, 219; Module 7, 206; Module 8, 187.



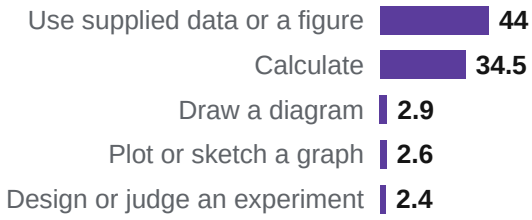
Explain and Calculate dominate Section II

Section II marks by the kind of task set: the eight largest groups, 2019–26 (532 of 640; two-verb parts split)



What students have to do

Average marks per paper, judged part by part from the question and its marking guideline. A part can count in more than one row.



The two long responses in each paper

Year	Parts worth 7–9 marks
2019	Q34 (9) Describe the Sun's energy output · Q36 (7) Calculate an alpha particle's kinetic energy
2020	Q32 (7) Explain what limits a motor pulling a mass · Q33 (9) Analyse a magnet falling through a copper cylinder
2021	Q31 (7) Explain two solenoids on carts · Q33 (9) Two experiments, two models of light
2022	Q31 (9) How Bohr's model fits the evidence · Q34 (7) Explain three paths in a magnetic field
2023	Q32 (7) Calculate where a launched ball lands · Q33 (9) Justify a statement on particles and fields
2024	Q32 (8) Analyse evidence from three experiments · Q33 (7) Analyse a magnet swinging over a can
2025	Q32 (8) Analyse consequences of special relativity · Q36 (8) Analyse a satellite exploding in orbit
2026	Q32 (8) Assess "no gravity in space" · Q34 (8) Explain why a result contradicts Newton

What the long responses demand

- **Physics and numbers together.** Nine of the 16 asked for calculations or formulae inside the answer.
- **An unfamiliar set-up:** carts, a magnet over a can, an exploding satellite, each needing conservation of energy or momentum.
- **Evidence for models** of light, the atom or matter in five (2021, 2022, 2023, 2024, 2026).
- **Two modules at once** in four (2019, both in 2020, 2024).
- **Graphs to draw elsewhere:** 3–6 marks in five papers.

The core: twelve dot points that return almost every year

Each of these was the main focus of a question in **7 or 8 of the 8 papers**. Together they carried **336 of the 800 marks (42%)**.

Dot point	Papers	Share of all marks	How it is examined, and what top answers do
Faraday's and Lenz's Laws *induced emf, eddy currents, energy* M6.IQ3.DP2	**8/8**	**7.2%**	Magnets and coils, eddy-current braking, emf from changing flux. Top answers name the changing flux and the induced emf (a current needs a complete circuit), then say where the energy goes.
Time dilation and length contraction *thought experiments, evidence* M7.IQ4.DP2	**8/8**	**4.9%**	Light-clock thought experiments, calculations, and evidence such as muons. Top answers say which frame each measurement is made in (2024 Q26).
Charges in uniform electric fields *plates, force, work done* M6.IQ1.DP1	**8/8**	**3.0%**	A charge between plates: force, acceleration, work and energy, in 2–3 mark written parts. Top answers keep V (voltage) and v (velocity) apart.
Gravitational energy *escape velocity, energy in orbit* M5.IQ3.DP5	**7/8**	**4.6%**	Escape velocity, satellite energy, moving between orbits; 10 marks in 2023 and 2025. Top answers apply conservation of energy step by step.
The DC motor *parts, torque, back emf* M6.IQ4.DP1	**7/8**	**3.9%**	Torque, the commutator and back emf; 10 marks in 2020, one MCQ in 2025 and 2026. Top answers link speed to back emf to current.
Interference of light *double slits and gratings* M7.IQ2.DP2	**7/8**	**3.4%**	d sin θ = mλ for slits and gratings; 9 marks in 2021, electrons in 2025. Top answers tie bright and dark bands to constructive and destructive interference.
Photoelectric effect *photon model, Kmax = hf − φ* M7.IQ3.DP3	**7/8**	**3.4%**	Kmax = hf − φ and graphs of data (2019, 2021, 2025); not examined in 2026. Top answers rule a line of best fit and use its gradient or intercept.
Black body radiation *Wien's Law, Planck* M7.IQ3.DP1	**7/8**	**3.2%**	Wien's Law and black-body curves; 10 and 8 marks in 2019–20, three or fewer since. Top answers sketch a cooler curve wholly under the hotter one.
Projectile variables *angle, height, time, range* M5.IQ1.DP2	**7/8**	**2.5%**	Angle, height, time of flight and range. Top answers resolve components first and notice when the path is not symmetrical (2022 Q33b).
Half-life and decay *decay constant, activity* M8.IQ4.DP2	**7/8**	**2.4%**	Half-life from a decay curve, λ and N = N_0e^(−λt); 8 marks in 2026 on Mo-99, with a curve to draw. Top answers label each step.
Parallel wires *force between currents* M6.IQ2.DP3	**7/8**	**2.0%**	Force between two wires: an MCQ each year 2020–23, written in 2024 and 2026 (2019: electrons beside a wire). Top answers separate equal forces from unequal motion.
The Standard Model *quarks, leptons, forces* M8.IQ5.DP2	**7/8**	**1.5%**	Quarks in protons, neutrons and pions, and which particles are fundamental. Six MCQs and two written parts.

What every paper so far has had

- Two parts worth **7–9 marks**; nine of the 16 needed calculations or formulae.
- A question whose main focus is **induction**, one on **time dilation or length contraction**, and one on a **charge in an electric field**: all eight papers had each.
- **Projectile motion** (M5.IQ1) as a main focus: 2–10 marks in every paper.
- **Calculation:** 24–48 marks per paper, with marks for working as well as the answer.

The 2027 watch-list

How it is ranked: each dot point's average marks per paper, plus a bonus for appearing in more papers. Built from earlier papers only, the top 15 held **42 of the 100 marks** in each 2022–26 paper, on average (how we tested it: page 6).

	Dot point	19	20	21	22	23	24	25	26	Papers	Marks per paper
1	**Faraday's and Lenz's Laws** M6.IQ3.DP2	1	14	10	6	8	9	6	4	8/8	7.2
2	**Time dilation and length contraction** M7.IQ4.DP2	6	1	3	7	4	5	8	5	8/8	4.9
3	**Gravitational energy** M5.IQ3.DP5	·	1	3	5	10	5	10	3	7/8	4.6
4	**The DC motor** M6.IQ4.DP1	4	10	5	·	5	5	1	1	7/8	3.9
5	**Interference of light** M7.IQ2.DP2	1	4	9	5	1	·	2	5	7/8	3.4
6	**Photoelectric effect** M7.IQ3.DP3	4	1	6	5	3	2	6	·	7/8	3.4
7	**Black body radiation** M7.IQ3.DP1	10	8	1	1	3	2	·	1	7/8	3.2
8	**Charges in uniform electric fields** M6.IQ1.DP1	3	3	6	4	1	2	2	3	8/8	3.0
9	**Orbital motion** M5.IQ3.DP2	1	3	·	2	·	7	3	8	6/8	3.0
10	**Hydrogen line spectra** M8.IQ3.DP3	·	5	1	9	·	6	1	1	6/8	2.9
11	**Projectile variables** M5.IQ1.DP2	1	5	4	4	1	·	1	4	7/8	2.5
12	**Nuclear energy** M8.IQ4.DP6	8	·	3	4	4	·	·	4	5/8	2.9
13	**Half-life and decay** M8.IQ4.DP2	·	1	3	4	1	1	1	8	7/8	2.4
14	**Circular motion** M5.IQ2.DP3	·	·	4	7	7	·	1	2	5/8	2.6
15	**Projectile components** M5.IQ1.DP1	·	1	5	5	1	1	·	5	6/8	2.2

Marks per paper: 0 1–2 3–4 5–7 8+

Next on the list (16–20)

- Spectra of stars M7.IQ1.DP6 · 6/8 papers, 2.2 marks per paper
- Parallel wires M6.IQ2.DP3 · 7/8 papers, 2.0 marks per paper
- Equations of motion M5.IQ1.DP4 · 5/8 papers, 2.4 marks per paper
- Moving charges M6.IQ1.DP3 · 6/8 papers, 2.1 marks per paper
- Force on a conductor M6.IQ2.DP1 · 6/8 papers, 2.1 marks per paper

What the ranking does not show

Two topic areas are bigger than any one row. Electromagnetic induction (M6.IQ3: flux, Faraday and Lenz, transformers) carried 8–16 marks in every paper and 90 marks in all, the most of any inquiry question. Motion in gravitational fields (M5.IQ3) carried 79, with 12–14 in each of the last four papers. **The Standard Model is core but small:** it has appeared in 7 of 8 papers, usually as a single MCQ, so it ranks 25th. **Two rows are in the top 15 on weight, not regularity:** nuclear energy and circular motion calculations each appeared in only 5 of 8 papers, but carried 7–8 marks in their heavy years.

The final paper: required content never examined

watch this space

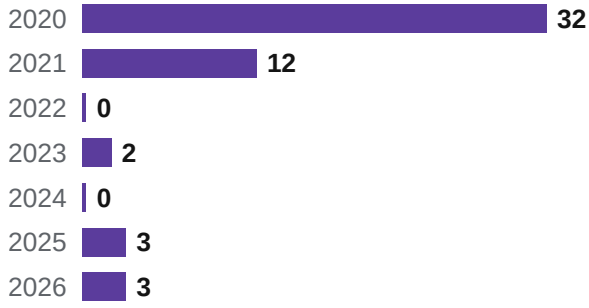
At least four pieces of **required** content have never been examined in eight papers, and six more only lightly. Each was checked against the full text of every question, marking guideline and feedback note (for 2026, the questions only). 2027 is the last paper on this syllabus, so revise each one.

Required content never examined	Syllabus wording	Examined so far	One thing to prepare
The SI definition of the ampere, and its link to Newton's third law M6.IQ2.DP3	Plain wording	never	Forces between wires are asked most years (the third-law pair in 2024 Q29b), the ampere never. Until 2019 it was defined from this force: 1 A in each of two wires 1 m apart gives 2×10^{-7} N per metre.
The speed of light and how time and distance are now measured M7.IQ1.DP3	Plain wording	never	Methods of measuring c were asked in 2020, 2022 and 2025; this half never. c is fixed, so the metre is the distance light travels in a vacuum in 1/299 792 458 s.
A practical with primary data to validate the projectile relationships M5.IQ1.DP3	Whole dot point	never	Projectile calculations appear every year, the practical never. E.g. range against launch angle at a fixed speed, compared with the sin 2θ prediction; air resistance as a limit of the model.
Relating low-Earth and geostationary orbits to their uses M5.IQ3.DP3	Plain wording	never	Orbit properties were asked in 2019, 2021 and 2026, uses never. Geostationary: fixed above one longitude, so suits communications. Low Earth orbit: close and fast, so suits imaging.
Examined only lightly			
Assigning a spectral class to a star from its spectrum M8.IQ1.DP5	Whole dot point	H–R axis only	Spectral class is the axis of the H–R diagrams of 2019, 2022 and 2025, but no question has asked students to classify. O B A F G K M: hot blue to cool red.
Nuclear fission, and controlled and uncontrolled chain reactions M8.IQ4.DP3	Whole dot point	1 MCQ (2020)	The only fission question is a 2020 MCQ on control rods. Neutron-induced fission of U-235, the chain reaction, moderator and control rods, energy from mass defect.
AC induction motors M6.IQ4.DP2	Plain wording	1 MCQ (2020)	A rotating stator field induces currents in the rotor (no brushes), and by Lenz's Law the rotor follows the field.
Total energy and work done in uniform circular motion M5.IQ2.DP4	Whole dot point	3 marks (2025)	Asked once, for a vertical circle, where speed changes. In uniform circular motion the net force is at 90° to the velocity, so it does no work.
Radiation turning into matter after the Big Bang M8.IQ1.DP1	Whole dot point	3 marks (2026)	2026 Q35c asked how accelerator collisions help us understand the early universe. Link collisions to those high-energy conditions; a short timeline is background.
Fundamental forces in the Standard Model M8.IQ5.DP2.c	"including"	within answers	Credited inside 2020 Q25 and 2025 Q33, never asked on its own. Strong, weak and electromagnetic interactions and their bosons: gluons, W and Z, photons.

Outcomes: PH12-3 (conducting investigations) has never appeared in NESA's Physics mapping grids (2019–2025), and PH12-1 and PH12-2 on only three parts each. 2026 Q31 asked for two improvements to a supplied method.

New dot points still arrive, a few marks at a time

Marks on parts with a dot point not seen in an earlier paper



Not required: "for example" content

The syllabus lists these as examples, so the named case need not be memorised, but students must apply the physics to any example set.

- Objects on banked tracks (M5.IQ2.DP2): never set. Flat bends and a mass on a string have been.
- Hafele–Keating atomic clocks (M7.IQ4.DP2): muons are the usual evidence. Airborne clocks were accepted in 2019; a clock MCQ was set in 2024.
- Combustion of fuel as a mass–energy example (M7.IQ4.DP4): never set (closest: 2025 Q19, magnesium and oxygen).

Also on the radar

Rarely the main focus, but examined inside other questions

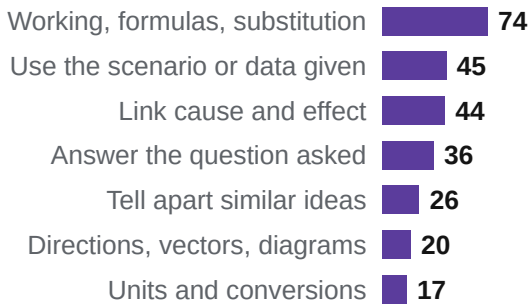
The first number is marks as a question's main focus over eight papers; the second adds parts where it was one of several dot points examined. Long responses such as 2024 Q32 let NESA reach several of these at once.

- Evidence that protons and neutrons are not fundamental M8.IQ5.DP1 · 0 main, 8 in all
- Energy release in fusion M8.IQ4.DP5 · 0 main, 9 in all
- Photoelectric evidence against the wave model M7.IQ3.DP2 · 1 main, 9 in all
- The Balmer series M8.IQ3.DP2 · 1 main, 9 in all
- Emission and absorption spectra M8.IQ1.DP4 · 1 main, 7 in all
- Uses of transformers M6.IQ3.DP5 · 1 main, 5 in all
- Maxwell's contribution M7.IQ1.DP1 · 2 main, 6 in all
- Schrödinger's contribution M8.IQ3.DP5 · 3 main, 8 in all
- How magnetic flux changes M6.IQ3.DP1 · 2 main, 2 in all
- Mass–energy equivalence ($E = mc^2$) M7.IQ4.DP4 · 4 main, 4 in all

What markers reward

What NESA's markers ask students to improve

Of 314 "areas to improve" comments, 2019–2025, the number that mention each theme (a comment can mention more than one)



- **Show the working.** Formula from the data sheet, substitution, answer: asked for in every year's feedback, 2019–2025.
- **Stay with the scenario.** 2022 Q33b: students solved a symmetrical projectile when the hammer landed lower than it was launched.
- **Explain with cause and effect**, each step following from a law or principle.
- **Say which way.** "Down the page" or "into the page", not just "down" (2019 Q28).
- **Units.** SI units, prefixes (micro, nano) and conversions such as cm to m; give the unit the question asks for.

Pairs that markers say students confuse

- Faraday's Law vs Lenz's Law
- force vs torque
- voltage (V) vs velocity (v)
- emission vs absorption spectrum
- luminosity vs brightness
- angular vs linear velocity
- Rutherford's vs Bohr's model
- de Broglie's vs Bohr's work
- a star's rotation vs its revolution

Method and limits

- **Data:** all 349 parts of the 2019–2026 papers, each given a main dot point within the topic NESA's mapping grid names (2026: from the question itself). A dot point's marks are those of parts where it is the main focus unless stated.
- **What each part asks students to do** was judged twice, independently, from the question and its marking guideline; every disagreement was settled against the guideline.
- **2026:** marking guidelines, mapping grid and feedback are not yet published, so 2026 is judged from the questions. **These are patterns in past papers.** NESA can examine any dot point.
- **Watch-list test:** each year's list (2022–26) was built from earlier papers only; questions mainly on its top 15 were worth 44, 41, 37, 44 and 42 of that paper's 100 marks (42 on average). **Topics are not "due":** a Physics dot point absent from one paper returned in the next 57% of the time (73% if it had appeared); a "due" bonus made the list worse.

References

1. NESA. *HSC exam papers: Physics*, 2019–2026 (papers, marking guidelines, mapping grids, marker feedback), nsw.gov.au/education-and-training/nesa/curriculum/hsc-exam-papers/physics; and *Physics Stage 6 Syllabus* (2017).

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