Physics

HSC · 2017 SYLLABUS · STUDENT GUIDE

Where the marks are: HSC Physics 2027

What the eight HSC Physics papers from 2019 to 2026 show, and how to use it in your revision

42% of all marks came from just **12 dot points**. They are Priority 1 and 2 in this guide.	**35** marks in an average paper **need a calculation**. Working earns marks too.	**2** long questions worth **7–9 marks** in every paper, usually Explain or Analyse.	**67%** of marks are on questions with a **graph, table or diagram**. Practise reading them.

How to use this guide

1. **Start with Priority 1 and 2.** Tick a box only when you can do a past HSC question on that dot point, from a 2019–2025 paper, and it matches the marking guideline.
2. **Then Priority 3** and the two big topic areas on page 2.
3. **Then page 3:** content that has never or hardly been examined. 2027 is the last paper on this syllabus, so it could still come up. There are few past questions for these, so tick a box when you can explain the idea to someone else.
4. **Do calculations in full every time.** Write the formula, substitute, then give the answer with units, and a direction if it is a vector.

Priority 1: examined in every paper

These three dot points have been the main focus of a question in all eight papers.

Dot point	You should be able to	Papers
☐ **Faraday's and Lenz's Laws** M6.IQ3.DP2	Explain what happens when a magnet moves near a coil or a metal plate: the flux changes, an emf is induced, and in a complete circuit a current flows that opposes the change. Say where the energy goes, and calculate the emf.	**8/8**
☐ **Time dilation and length contraction** M7.IQ4.DP2	Explain time dilation and length contraction with a thought experiment, calculate both, say whose frame each measurement is in, and describe evidence such as muons.	**8/8**
☐ **Charges in uniform electric fields** M6.IQ1.DP1	Find the field, force, acceleration and work done on a charge between charged plates, and use energy to find its speed.	**8/8**

Why induction comes first

Faraday's and Lenz's Laws have earned more marks than any other dot point: 58 in eight papers, including a 7–9 mark question in 2020, 2021 and 2024. Those long questions were about a magnet falling through a copper cylinder, two coils on carts, and a magnet swinging over an aluminium can. In the two magnet questions, the best answers followed the energy. In the carts question, they explained the induced current, the equal and opposite forces, and why the lighter cart moved off faster.

Priority 2: examined in 7 of 8 papers

Each missed being the main focus of a question only once.

Dot point	You should be able to	Papers
☐ **Gravitational energy** M5.IQ3.DP5	Calculate escape velocity and satellite energy; explain energy changes between orbits.	**7/8**
☐ **The DC motor** M6.IQ4.DP1	Explain the parts of a DC motor, how torque is produced, and back emf.	**7/8**
☐ **Interference of light** M7.IQ2.DP2	Use $d \sin \theta = m\lambda$; predict changes with wavelength or slit spacing.	**7/8**
☐ **Photoelectric effect** M7.IQ3.DP3	Use $K_{max} = hf - \varphi$; graph data and use the gradient or intercept.	**7/8**
☐ **Black body radiation** M7.IQ3.DP1	Use Wien's Law, sketch black-body curves, and explain Planck's contribution.	**7/8**
☐ **Projectile variables** M5.IQ1.DP2	Calculate launch angle, maximum height, time of flight and range.	**7/8**
☐ **Half-life and decay** M8.IQ4.DP2	Find half-life and decay constant from a decay curve; calculate what remains.	**7/8**
☐ **Parallel wires** M6.IQ2.DP3	Find the direction and size of the force between two wires; apply the third law.	**7/8**
☐ **The Standard Model** M8.IQ5.DP2	Give the quarks in protons, neutrons and pions; know what is fundamental.	**7/8**

Priority 3: the rest of the top 20

Main focus in 5 or 6 of the 8 papers.

Dot point	You should be able to	Papers
☐ **Orbital motion** M5.IQ3.DP2	Relate orbital speed, radius and period, with gravity as the centripetal force.	**6/8**
☐ **Hydrogen line spectra** M8.IQ3.DP3	Calculate hydrogen wavelengths; explain line spectra with Bohr's energy levels.	**6/8**
☐ **Nuclear energy** M8.IQ4.DP6	Calculate the energy released from mass defect or binding energy.	**5/8**
☐ **Circular motion** M5.IQ2.DP3	Calculate speed, acceleration and net force for an object moving in a circle.	**5/8**
☐ **Projectile components** M5.IQ1.DP1	Split the motion into horizontal and vertical parts and describe the path.	**6/8**
☐ **Spectra of stars** M7.IQ1.DP6	Explain how a spectrum shows temperature, motion, density and composition.	**6/8**
☐ **Equations of motion** M5.IQ1.DP4	Solve problems with the equations of motion, including charges between plates.	**5/8**
☐ **Moving charges** M6.IQ1.DP3	Use $F = qvB \sin \theta$; calculate a circular path and describe a helical one.	**6/8**
☐ **Force on a conductor** M6.IQ2.DP1	Find the size and direction of the force on a current-carrying wire.	**6/8**

Two topic areas are bigger than any one row

Electromagnetic induction (Module 6: flux, Faraday, Lenz, transformers) carried **8–16 marks in every paper**. **Gravity and orbits** (Module 5) carried **12–14 marks in each of the last four**.

Skills that come up every year

- **Calculating** (24–48 marks in every paper) and **reading a graph, table or diagram**.
- **Graphing** (5 of 8 papers): plot data and rule a line of best fit, or sketch a curve.

Don't get caught out

watch this space

These are in the syllabus but have never or hardly been examined. We checked every question from 2019 to 2026 and every marking guideline published so far. Most need one clear idea and a few sentences.

Never examined	What to know
☐ **The definition of the ampere** M6.IQ2.DP3	Two parallel wires push or pull each other with equal and opposite forces. The ampere used to be defined from that force: 2×10^{-7} N per metre between wires 1 m apart carrying 1 A.
☐ **The speed of light and how we measure distance** M7.IQ1.DP3	The speed of light is now a fixed number, so a metre is defined as how far light travels in a vacuum in 1/299 792 458 of a second.
☐ **A projectile practical** M5.IQ1.DP3	Be able to describe an experiment, such as range against launch angle: what you change, measure and graph, and how air resistance affects it.
☐ **What different orbits are used for** M5.IQ3.DP3	Geostationary satellites stay above one place (communications); low Earth orbit is close to the surface (imaging).
Hardly examined	
☐ **Classifying stars from their spectra** M8.IQ1.DP5	The classes O B A F G K M run from hot blue stars to cool red ones. The pattern of absorption lines shows the class.
☐ **Nuclear fission and chain reactions** M8.IQ4.DP3	How a neutron splits U-235, controlled and uncontrolled chain reactions, and where the energy comes from.
☐ **AC induction motors** M6.IQ4.DP2	A rotating magnetic field induces currents in the rotor, which then follows the field. No brushes.
☐ **Energy and work in circular motion** M5.IQ2.DP4	In uniform circular motion the net force is at right angles to the motion, so it does no work and the speed stays the same. In a vertical circle gravity does work, so the speed changes (2025).
☐ **Radiation into matter after the Big Bang** M8.IQ1.DP1	How particle collisions recreate early-universe conditions, and the order: energy, quarks and leptons, protons and neutrons, nuclei, atoms.
☐ **Fundamental forces** M8.IQ5.DP2	Strong, weak and electromagnetic forces and the particles that carry them: gluons, W and Z bosons, photons.

What markers reward

- **Full working.** Formula, substitution, answer. Markers mention it more than anything else we counted.
- **Answering the question in front of you.** Use the set-up and numbers given, not a similar question you have seen.
- **Cause and effect.** Each step should follow from a law or principle.
- **Directions.** "Into the page" or "to the left", not just "down".
- **Units.** Convert where needed (cm to m, nm to m), and give the unit the question asks for.

Don't mix these up

Markers have flagged each of these. Can you explain the difference?

- 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 word of caution

These are patterns from past papers, not knowledge of the 2027 paper. When we built this list from earlier papers only and checked it against the next paper (2022–26), its top 15 dot points covered 42 of the 100 marks on average, so more than half of every paper came from elsewhere. Don't bank on a topic being "due": one missing from the last paper came back less often (57%) than one that appeared (73%). Use this guide to decide what to do first, not what to skip.

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