

Specification

Focus Questions

Every line of the Edexcel International GCSE Physics specification, rewritten as a question with the answer directly underneath. This free sample shows seven real pages from the full pack.

What's in this sample

- Topic 1 Forces and motion — questions and answers straight from the specification
- Topic 1 — the equations of motion worked step by step
- Topic 3 Waves — refractive index and critical angle
- Topic 5 Solids, liquids and gases — density, pressure and the practicals
- Topic 7 Radioactivity — nuclear equations and half-life
- Topic 8 Astrophysics — red-shift calculations, tagged Paper 2 only
- A 6-mark practice question with its mark scheme

The full pack: 8 booklets, 73 pages

286 questions & answers · 67 worked examples · 32 exam tips

Every practical investigation · 24 six-mark questions with mark schemes

1.1-1.2 Units

Q1. Which units must you be able to use in this topic?

kilogram (kg), metre (m), metre/second (m/s), metre/second² (m/s²), newton (N), second (s) and newton/kilogram (N/kg).

Q2. Which two extra units are needed for the Paper 2 content? [Paper 2 only]

Newton metre (N m) for moments, and kilogram metre/second (kg m/s) for momentum.

1.3-1.5 Movement and position

Q3. What does a distance-time graph show, and what does its gradient give?

How the distance travelled changes with time. The gradient gives the speed.

Q4. On a distance-time graph, what do a horizontal line and a straight sloping line show?

Horizontal — the object is stationary. Straight sloping — constant speed; the steeper the line, the faster the object.

Q5. What does a curved distance-time graph show?

The speed is changing: getting steeper means speeding up, getting less steep means slowing down.

Q6. How do you find the speed at one moment from a curved distance-time graph?

Draw a tangent to the curve at that time and find the gradient of the tangent.

Q7. Write the relationship between average speed, distance moved and time taken.

average speed = distance moved ÷ time taken

Q8. Practical 1.5: how would you investigate the motion of a toy car or tennis ball?

Mark out a measured distance and use a stopwatch, or light gates and a data logger, to time the object over each section. Repeat and take means, then calculate the average speed for each section and plot distance against time.

Q9. Practical 1.5: how can the measurements be made more accurate?

Use light gates rather than a stopwatch to remove reaction time, measure over a longer distance, and repeat each run to find a mean.

Q14. What does the area between a velocity-time graph and the time axis give? □□□

The distance travelled.

Q15. How do you find the distance travelled when the velocity-time graph is curved? □□□

Count the squares under the line and multiply by the distance each square represents.

Q16. Write the relationship between final speed, initial speed, acceleration and distance moved. □□□

$(\text{final speed})^2 = (\text{initial speed})^2 + (2 \times \text{acceleration} \times \text{distance moved})$
 $v^2 = u^2 + (2 \times a \times s)$

WORKED EXAMPLE 4 • Acceleration

Question: A car speeds up from 8 m/s to 20 m/s in 6.0 s. Calculate the acceleration.

Step 1: Change in velocity = $20 - 8 = 12$ m/s

Step 2: $a = 12 \div 6.0$

Answer: 2.0 m/s²

WORKED EXAMPLE 5 • Distance from a velocity-time graph

Question: A train accelerates uniformly from rest to 30 m/s in 20 s, then travels at 30 m/s for 40 s. Find the total distance.

Step 1: Triangle: $\frac{1}{2} \times 20 \times 30 = 300$ m

Step 2: Rectangle: $40 \times 30 = 1200$ m

Step 3: Total = $300 + 1200$

Answer: 1500 m

WORKED EXAMPLE 6 • Using $v^2 = u^2 + 2as$

Question: A motorbike accelerates at 3.0 m/s² from 12 m/s over 50 m. Find its final speed.

Step 1: $v^2 = u^2 + 2as = 12^2 + (2 \times 3.0 \times 50)$

Step 2: $v^2 = 144 + 300 = 444$

Step 3: $v = \sqrt{444}$

Answer: 21 m/s (2 s.f.)

Q35. Explain the meaning of critical angle.

The angle of incidence inside the denser medium for which the angle of refraction is 90° .
Above this angle, all the light is totally internally reflected.

Q36. Write the relationship between critical angle and refractive index.

$\sin c = 1 \div n$

WORKED EXAMPLE 4 · Snell's law

Question: Light enters glass of refractive index 1.50 at an angle of incidence of 40° . Find the angle of refraction.

Step 1: $n = \sin i \div \sin r$, so $\sin r = \sin i \div n$

Step 2: $\sin r = \sin 40^\circ \div 1.50 = 0.6428 \div 1.50 = 0.4285$

Answer: $r = 25^\circ$

WORKED EXAMPLE 5 · Finding refractive index

Question: A ray enters a block at 50° and refracts to 30° . Find the refractive index.

Step 1: $n = \sin i \div \sin r$

Step 2: $n = \sin 50^\circ \div \sin 30^\circ = 0.766 \div 0.500$

Answer: $n = 1.53$

WORKED EXAMPLE 6 · Critical angle

Question: Find the critical angle for a material of refractive index 1.40.

Step 1: $\sin c = 1 \div n = 1 \div 1.40 = 0.714$

Answer: $c = 45.6^\circ$

EXAM TIP

$n = \sin i \div \sin r$, where i is the angle in air. Check your calculator is in degrees, and remember $\sin c = 1 \div n$ for the critical angle.

3.23-3.29 Sound

Q37. What type of wave is sound?

A longitudinal wave, which can be reflected and refracted.

Q38. What is the frequency range for human hearing? [Paper 2 only]

20 Hz to 20 000 Hz.

WORKED EXAMPLE 5 · Specific heat capacity [Paper 2 only]

Question: How much energy is needed to heat 0.80 kg of water from 15 °C to 100 °C? $c = 4200 \text{ J/kg } ^\circ\text{C}$.

Step 1: $\Delta T = 100 - 15 = 85 \text{ } ^\circ\text{C}$

Step 2: $\Delta Q = m \times c \times \Delta T = 0.80 \times 4200 \times 85$

Answer: 285 600 J (about 286 kJ)

WORKED EXAMPLE 6 · Finding c [Paper 2 only]

Question: A 2.0 kg block is given 36 000 J and rises by 20 °C. Find its specific heat capacity.

Step 1: $c = \Delta Q \div (m \times \Delta T)$

Step 2: $= 36\,000 \div (2.0 \times 20)$

Answer: 900 J/kg °C

EXAM TIP

During a change of state the temperature stays constant, because the energy breaks the forces between particles rather than increasing their kinetic energy.

5.15-5.22 Ideal gas molecules

Q23. Explain how a gas exerts a pressure.

Gas molecules are in constant random motion. They collide with the walls of the container, and each collision exerts a small force on the wall. The total force per unit area is the pressure.

Q24. Why is there an absolute zero of temperature?

As a gas is cooled its molecules move more slowly, so the pressure falls. Extrapolating a pressure-temperature graph to zero pressure gives $-273 \text{ } ^\circ\text{C}$, the lowest possible temperature, where molecules have minimum energy.

Q25. Describe the Kelvin scale and how to convert between the scales.

The Kelvin scale starts at absolute zero, so $0 \text{ K} = -273 \text{ } ^\circ\text{C}$. To convert: $\text{K} = ^\circ\text{C} + 273$, and $^\circ\text{C} = \text{K} - 273$.

Q26. Why does an increase in temperature increase the average speed of gas molecules?

Raising the temperature increases the average kinetic energy of the molecules, and since their mass is unchanged, their average speed increases.

Q27. How is the Kelvin temperature of a gas related to its molecules?

The Kelvin temperature is proportional to the average kinetic energy of the molecules.

WORKED EXAMPLE 3 · Counting particles

Question: How many protons and neutrons are in $^{235}_{92}\text{U}$?

Step 1: Protons = atomic number = 92

Step 2: Neutrons = 235 – 92

Answer: 92 protons and 143 neutrons

EXAM TIP

Balance both numbers in a nuclear equation: the mass numbers on top and the atomic numbers underneath. A beta particle is written $^0_{-1}\text{e}$, so the atomic number goes *up* by one.

7.10–7.16 Background radiation, half-life and safety

Q17. Explain the sources of background radiation from Earth and space. □ □ □

From Earth: radon gas from rocks and soil, especially granite; radioactive materials in building stone, food and water; and medical sources such as x-rays. From space: cosmic rays, which are more intense at high altitude.

Q18. Why must background radiation be measured? □ □ □

It is always present, so the background count rate must be measured and subtracted from every reading to give the corrected count rate due to the source.

Q19. What happens to the activity of a radioactive source over time, and how is it measured? □ □ □

It decreases over time, because fewer undecayed nuclei remain. Activity is measured in becquerels, where 1 Bq is one decay per second.

Q20. Define half-life. □ □ □

The time taken for the activity of a source, or the number of undecayed nuclei, to fall to half its original value. It is different for different isotopes.

Q21. How can half-life be found from a graph? □ □ □

Read the initial activity, find half that value on the activity axis, read across to the curve and down to the time axis. Repeat for several halvings and take a mean.

Q22. Describe uses of radioactivity in industry. □ □ □

Thickness monitoring of paper or foil using beta sources; detecting leaks in underground pipes with a gamma tracer; sterilising equipment with gamma rays; smoke alarms using alpha sources; and dating rocks.

Q23. Describe uses of radioactivity in medicine. □ □ □

Gamma tracers to image organs, radiotherapy to destroy cancer cells, and sterilising surgical instruments.

6-mark practice: extended response

These are marked on the quality of the whole answer, not separate points. Plan 3–4 linked ideas, use the correct technical words, and answer every part of the question.

Question 1. Describe the life cycle of a star like the Sun, and explain how it differs for a much more massive star. [6 marks]

MARK SCHEME — what a top-level answer includes

- A star forms when gravity pulls together a cloud of dust and gas called a nebula.
- As the material collapses the temperature and pressure rise until hydrogen nuclei fuse to form helium, and a main sequence star is formed.
- A main sequence star is stable because the outward pressure from fusion balances the inward pull of gravity.
- When the hydrogen in the core runs out, the outer layers expand and cool, and a star like the Sun becomes a red giant.
- It then sheds its outer layers, leaving a hot dense core — a white dwarf — which slowly cools.
- A star much more massive than the Sun becomes a red supergiant instead, and then explodes as a supernova.
- The remnant becomes a neutron star, or a black hole if the original star was massive enough.

Question 2. Explain how gravity governs the motion of objects in the solar system, and describe how the orbit of a comet differs from that of a planet. [6 marks]

MARK SCHEME — what a top-level answer includes

- Gravitational attraction acts between any two masses and gets weaker with distance.
- It causes moons to orbit planets, planets and comets to orbit the Sun, and artificial satellites to orbit the Earth.
- The gravitational force acts towards the centre of the orbit, at right angles to the motion, so it changes the direction of travel and keeps the object in orbit.
- Planets have nearly circular orbits, so their distance from the Sun and their speed stay roughly constant.
- A comet has a long, highly elliptical orbit with the Sun near one end.
- Close to the Sun the gravitational force is much stronger, so the comet travels very fast.
- Far from the Sun the force is weak, so the comet moves slowly and spends most of its orbital period far away.

6-mark practice: extended response

These are marked on the quality of the whole answer, not separate points. Plan 3–4 linked ideas, use the correct technical words, and answer every part of the question.

Question 1. Explain how fuses, earthing and double insulation protect the user of an electrical appliance. [6 marks]

MARK SCHEME — what a top-level answer includes

- Mains electricity is supplied through a live wire at a high voltage, a neutral wire and, in many appliances, an earth wire.
- Insulation around the wires stops the user touching a live conductor.
- A double insulated appliance has a plastic case and insulated wiring, so no part the user can touch can become live; it needs no earth wire.
- If a live wire touches the metal case of an earthed appliance, the case would otherwise become live and give a shock.
- The earth wire provides a low-resistance path to earth, so a very large current flows.
- This large current melts the fuse wire (or trips the circuit breaker), breaking the circuit and disconnecting the live wire.
- The fuse rating should be just above the normal operating current of the appliance, found using $I = P \div V$.

Question 2. Describe how you would investigate how the current through a filament lamp varies with the voltage across it, and explain the shape of the graph. [6 marks]

MARK SCHEME — what a top-level answer includes

- Connect the lamp in series with an ammeter and a variable power supply or variable resistor.
- Connect a voltmeter in parallel across the lamp.
- Increase the voltage in steps, recording the current at each voltage.
- Reverse the connections to the supply to obtain negative values, and repeat the readings to find means.
- Plot a graph of current against voltage.
- The graph is an S-shaped curve through the origin that becomes less steep as the voltage increases.
- This is because a larger current makes the filament hotter, the ions vibrate more, and the resistance of the filament increases.

Question 3. Explain how electrostatic charges are produced by friction, and describe one danger and one use of them. [6 marks]

MARK SCHEME — what a top-level answer includes

- Insulating materials can be charged by rubbing them together.
- Friction transfers electrons from one material to the other.
- The material that gains electrons becomes negatively charged; the one that loses electrons is left equally positively charged.
- Like charges repel and unlike charges attract, which is why a charged rod attracts small pieces of paper.
- Danger: when fuelling an aircraft or tanker, friction between the fuel and the pipe builds up charge, and a spark could ignite the fuel vapour — so the tanker is earthed by a bonding wire.
- Use: in a photocopier, a charged plate holds charge only in the dark areas of the image, and attracts oppositely charged toner powder.
- The toner is then transferred to paper and fused in place by heat.

Get the full pack

Eight booklets covering the whole of Edexcel International GCSE Physics (4PH1), in specification order, so nothing gets missed.

1 Forces and motion	47 questions · 19 worked examples
2 Electricity	40 questions · 7 worked examples
3 Waves	44 questions · 8 worked examples
4 Energy resources and energy transfers	33 questions · 9 worked examples
5 Solids, liquids and gases	31 questions · 9 worked examples
6 Magnetism and electromagnetism	31 questions · 4 worked examples
7 Radioactivity and particles	37 questions · 7 worked examples
8 Astrophysics	23 questions · 4 worked examples

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