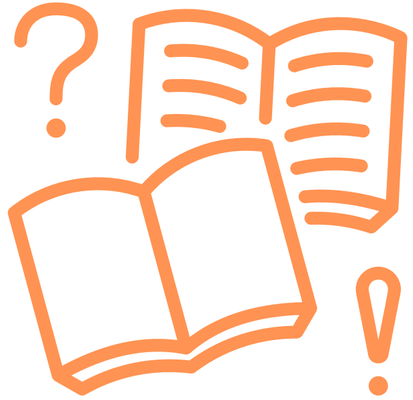
Classroom 42

Exam Success: AQA GCSE Physics Paper 2: Triple and Combined

- What to expect
- Triple & Combined students
- Key content, tips and strategies
- Exam questions for you to try!



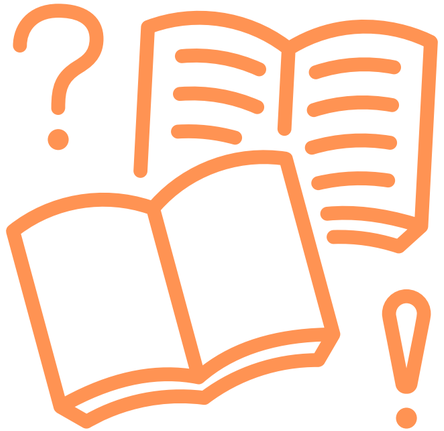
Exam Overview: Which Paper Are You Sitting?

	Triple Physics Paper 2 (Higher and Foundation)	Combined Science Trilogy Paper 2 (Higher and Foundation)
Duration	**1 hour 45 minutes**	**1 hour 15 minutes**
Marks	**100 marks**	**70 marks**
Weighting	**50% of GCSE**	**16.7% of GCSE**
Question Types	**Multiple choice, short answer, structured, open response**	

Paper 2: Exam Overview

Topics Covered

- P5 - Forces
- P6 - Waves
- P7 - Magnetism and Electromagnetism
- P8 - Space Physics (Physics only)



Paper 2: Exam Overview

Required Practicals

For Each Required Practical:

1. **Hypothesis**
2. **Variables**: independent, dependent, control
3. **Equipment** and their purposes
4. **Method**
5. **Data collection** methods
6. **Data visualization** (e.g., graph types)
7. **Evaluation**: errors, limitations, improvements for validity and reliability, conclusion.

Practical	Triple?	Combined?	What they might ask...
Forces and Extension	✅	✅	• Describe how to investigate the extension of a spring. • Identify control variables and suggest improvements to increase accuracy. • Plot a force-extension graph and identify linear/non-linear regions. • Calculate spring constant using F=kx
Acceleration	✅	✅	• Describe a method for investigating how mass or force affects acceleration using trolleys, ramps, and light gates. • Use a velocity-time graph to calculate acceleration. • Explain why a ticker timer/light gate improves measurement accuracy. • Identify independent, dependent and control variables.
Waves	✅	✅	• Describe how to measure the wavelength and frequency of waves in water. • Calculate wave speed using v=fλ • State how to improve accuracy or reduce errors (e.g. lighting, measuring from still images). • Interpret diagrams of wave traces.
Light	✅	❌	• Draw or label ray diagrams showing light entering glass blocks or reflecting off surfaces. • Measure angles of incidence/refraction and explain results using refraction principles. • Identify dependent and control variables. • Suggest how to reduce uncertainty in angle measurement.
Radiation and Absorption	✅	✅	• Describe a method for comparing how surfaces (e.g. black vs shiny) absorb radiation. • Identify variables and suggest improvements to control heat loss. • Explain findings using knowledge of infrared radiation. • Evaluate limitations in the experimental design.

Forces

P5 Questions Can Feel Tough:

- **Forces questions often combine maths, diagrams and tricky language**
- **Some questions mix multiple concepts (e.g. Newton's laws and graphs)**
- **High-tier content (like momentum or pressure in fluids) can feel unfamiliar**

1. Know Your Equations

Learn the formulas on the equation sheet: don't just memorise, understand what each variable means

2. Draw a Diagram

If a question doesn't give one, sketch forces, motion, or collisions (e.g. for resultant force and momentum questions)

3. Watch the Command Words

"State" = 1 mark fact.
"Explain" = link cause and effect.
"Evaluate" = discuss both sides.
Look at the number of marks to guide answer length

4. Break it down

For long questions, underline the key values and goals
Solve step-by-step as even partial working can get marks

5. Use your graph skills

Understand what the gradient and area show in both distance-time and velocity-time graphs
Use rulers for tangents and label units clearly

6. Practise Wordy Problems

P5 often includes real-life context (drivers, parachutes, cranes, collisions...)
Link your science back to forces, motion, or energy transfer

Forces

Key Concepts

• 1. Scalars and Vectors

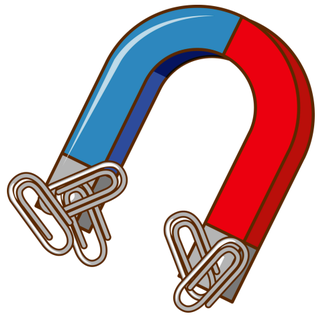
Command words: Identify, Define, Distinguish

- Scalars have magnitude only (e.g. speed, distance).
- Vectors have magnitude and direction (e.g. velocity, force).
- Vectors can be represented by arrows: length = magnitude, arrow = direction.

You may be asked to distinguish between scalar and vector quantities, or draw and interpret vector diagrams.

• 2. Contact and Non-Contact Forces

Command words: Describe, Compare, Identify



- Forces can be contact (e.g. friction, tension, air resistance) or non-contact (e.g. gravity, magnetism, electrostatic)
- A force is an interaction between two objects — can be physical or at a distance
- All forces are vector quantities

Expect to describe the interaction between objects, and classify the forces involved.

Forces

Key Concepts

- **3. Gravity and Weight**

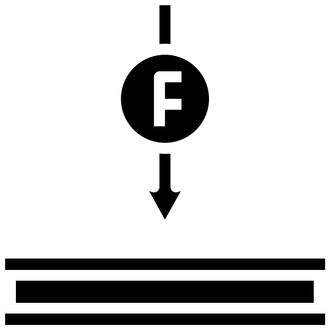
Command words: Calculate, Explain, Recall

- Weight (W) = mass (m) × gravitational field strength (g)
- Weight is a force (vector), measured in newtons and acts through the object's centre of mass
- Mass and weight are directly proportional
- Measured using a newtonmeter

You may be asked to calculate weight, explain the difference between mass and weight, or use the proportionality symbol (∝).

- **4. Resultant Forces**

Command words: Calculate, Use, Draw, Describe



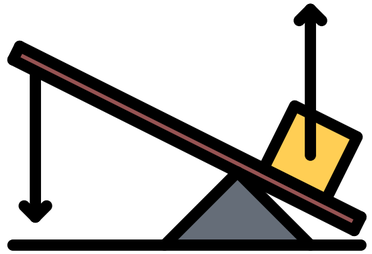
- A resultant force replaces multiple forces with a single force with the same effect
- Can be calculated when forces act in a straight line
- (HT only) Resolve forces into components at right angles
- (HT only) Use free body diagrams and vector diagrams for forces in equilibrium

Expect to calculate resultant forces, draw diagrams, or for HT, use vector diagrams in equilibrium questions.

Forces

Key Concepts

- **7. Moments, Levers and Gears (Physics only)**

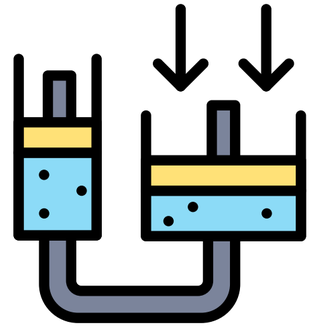


Command words: Calculate, Explain, Recall

- Moment:
- M=F×d
- Balanced object: total clockwise moment = total anticlockwise moment
- Levers and gears transmit rotational effects and can increase force or distance

You may be asked to calculate moments, recall the equation, or explain how gears and levers work.

- **8. Pressure in Fluids (Physics only)**



Command words: Calculate, Recall, Apply

- Fluids (liquids and gases) exert pressure at right angles to any surface
- Surface pressure can be calculated with: Pressure (p)=Force (F)Area (A)
- (HT only) In liquids: p = hpg (height × density × gravitational field strength)
- Pressure increases with depth and density
- Uneven fluid pressure causes upthrust, making objects float or sink

You may be asked to calculate pressure, or explain why pressure increases with depth in a liquid.

Forces

Key Concepts

- **9. Atmospheric Pressure**

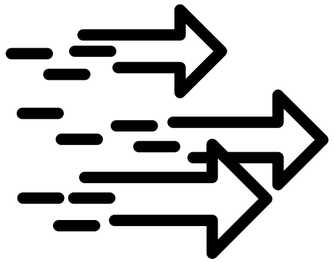
Command words: Describe, Explain

- Atmospheric pressure is caused by air molecules colliding with surfaces
- As height above Earth increases, atmospheric pressure decreases
- There are fewer air molecules above at higher altitudes, so less weight of air

Expect to explain why atmospheric pressure decreases with altitude using a particle model.

- **10. Distance, Speed and Velocity**

Command words: Define, Calculate, Compare



- Distance = how far an object moves (scalar)
- Displacement = distance in a straight line from start to finish (vector)
- Speed = distance ÷ time, $s = d\ t$
- Velocity = speed in a given direction (vector)

You may be asked to compare scalar and vector quantities, or calculate speed using distance and time.

- **11. Acceleration**

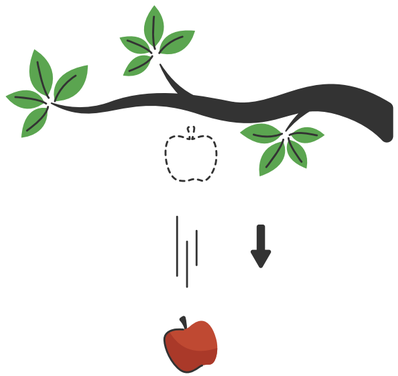
Command words: Calculate, Interpret, Use

- Acceleration = change in velocity ÷ time $a = \Delta vt$
- (HT only) $v2-u2=2as$
- Measured in m/s^2
- Deceleration = negative acceleration

Expect to calculate acceleration or interpret it from a velocity-time graph. (HT: Use area or gradient for motion analysis.)

Forces

Key Concepts



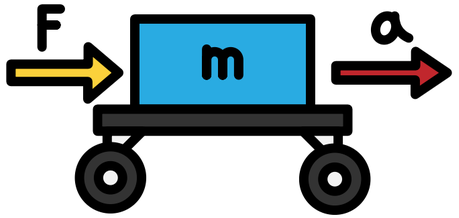
• 12. Newton's First Law

Command words: State, Apply, Explain

- If the resultant force on an object is zero:
  - A stationary object stays still
  - A moving object keeps moving at a constant velocity
- Objects resist changes in motion – this is called inertia (HT only)

Expect to explain whether an object will accelerate or remain in steady motion, based on whether forces are balanced.

• 13. Newton's Second Law



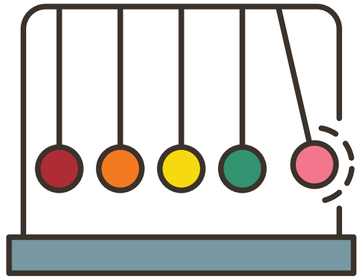
Command words: Recall, Use, Estimate

- A non-zero resultant force causes acceleration
- The acceleration is proportional to the force and inversely proportional to mass
- F= m a
- Force is measured in newtons (N)

You may be asked to calculate force, mass, or acceleration using the equation, or describe how they are related.

Forces

Key Concepts



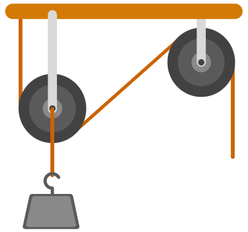
• 14. Newton's Third Law

Command words: Apply, Identify, Describe

- For every action, there is an equal and opposite reaction
- The two forces act on different objects
- Applies to all interactions, even in equilibrium

Expect to identify interaction pairs in a scenario and explain how they are equal and opposite.

• 15. Required Practical - Acceleration



Command words: Describe, Measure, Analyse

- Investigate how changing the force or mass affects acceleration
- Common setup uses trolleys, pulleys, and light gates
- Use graphs or calculations to find $a = \Delta v / t$

You may be asked to describe the method, control variables, or use your results to support Newton's Second Law.

• 16. Stopping Distance (Physics only)

Command words: Estimate, Analyse, Evaluate

- Stopping distance = thinking distance + braking distance
- Affected by speed, driver reaction time, road/weather conditions, and car condition
- Graphs often show how stopping distance increases with speed

Expect to estimate stopping distances or interpret stopping distance graphs using real-life scenarios.

Forces

Key Concepts

• 17. Braking and Energy Transfer (Physics only)

Command words: Explain, Evaluate, Calculate

- Braking force does work on a vehicle:
  - Transfers kinetic energy → heat
  - Increases brake temperature
- Greater speed = more braking force needed
- Large decelerations can cause overheating or skidding

Expect to link braking distance with kinetic energy or describe how stopping involves energy transfer.

• 18. Momentum (HT only)

Command words: Calculate, Apply, Define

- p=mv
- Momentum = mass × velocity (kg·m/s)
- In a closed system, momentum is conserved during collisions

You may be asked to calculate momentum before/after an event and apply the principle of conservation of momentum.

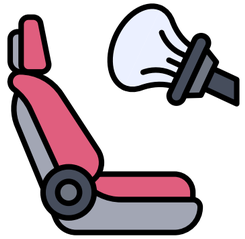
$$\vec{p} = m\vec{v}$$

• 19. Changes in Momentum (HT only)

Command words: Explain, Use, Justify

- $F=\Delta p/\Delta t$
- Force = rate of change of momentum
- Increasing time reduces force in a collision
- Safety features like seatbelts, airbags, and crumple zones work by increasing time

Expect to justify how safety features reduce injury using ideas about momentum and time.



Now it's your turn!

EITHER:

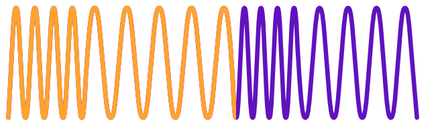
Complete the Revision Clocks for P5

OR

Have a go at a range P5 questions on Revision Hub

Waves

Key Concepts



- **1. Transverse and Longitudinal Waves**

Command words: Describe, Distinguish, Identify

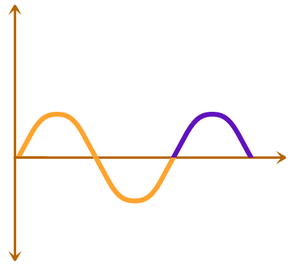
- Transverse waves: oscillations are perpendicular to the direction of energy transfer (e.g. water waves, EM waves)
- Longitudinal waves: oscillations are parallel to energy transfer (e.g. sound waves)
- Sound waves in air show compressions and rarefactions
- In both types, it's the wave that moves, not the particles

You may be asked to describe the difference between wave types or explain that waves transfer energy, not matter.

- **2. Properties of Waves**

Command words: Define, Identify, Calculate, Apply

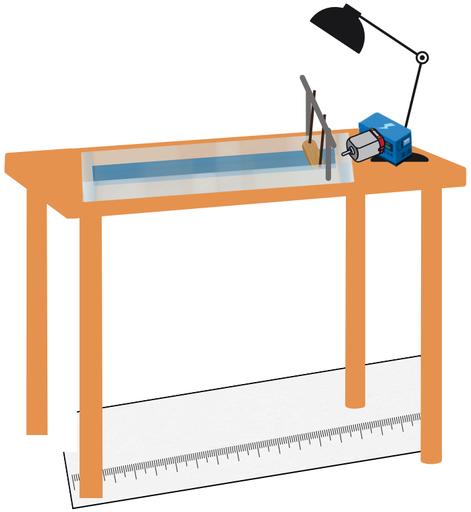
- Amplitude: maximum displacement from rest position
- Wavelength (λ): distance between matching points on adjacent waves
- Frequency (f): waves per second (measured in Hz)
- Period (T) = $T=1/f$
- Wave speed (v) = $v=f\lambda$
- (Physics only) In different media: velocity, frequency and wavelength are linked



You may be asked to calculate wave speed, identify amplitude/wavelength on diagrams, or use the period equation.

Waves

Key Concepts



- **3. Required Practical – Wave Speed**

Command words: Describe, Observe, Measure

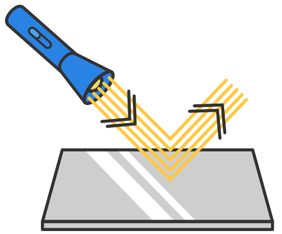
- Investigate speed of waves on:
  - a ripple tank (water surface)
  - a solid (e.g. using a vibration generator and string)
  - sound in air (e.g. two microphones and data logger)
- Measure wavelength, frequency and calculate speed using $v=f\lambda$

You may be asked to describe the method, identify suitable equipment, or evaluate accuracy in measurements.

- **4. Reflection, Transmission and Absorption (Physics only)**

Command words: Construct, Illustrate, Describe

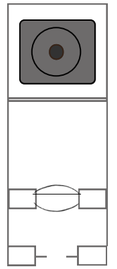
- Waves can be reflected, transmitted, or absorbed at boundaries
- Specular reflection = smooth surface; diffuse reflection = rough surface
- Ray diagrams show the path of light waves and reflection



Expect to draw ray diagrams or explain what happens when a wave meets a new material.

Waves

Key Concepts



- **5. Required Practical – Light (Physics only)**

Command words: Investigate, Record, Construct

- Investigate the reflection of light by different surfaces
- Investigate refraction of light through different substances
- Measure angles of incidence and reflection/refraction using ray boxes and protractors

You may be asked to explain refraction, evaluate results, or identify variables and controls.

- **6. Sound Waves (Physics only – HT only)**

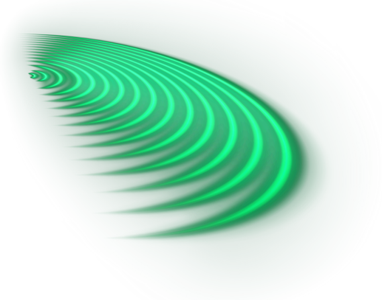
Command words: Describe, Explain

- Sound travels by vibrations through solids and air
- Vibrations in solids create movement in particles (e.g. ear drum)
- Hearing range: 20 Hz – 20,000 Hz (20 kHz)
- Converting between sound waves and vibrations works over a limited frequency range

Expect questions on how sound waves cause hearing or why some frequencies can't be heard.

Waves

Key Concepts



- **7. Waves for detection and exploration (physics only) (HT only)**

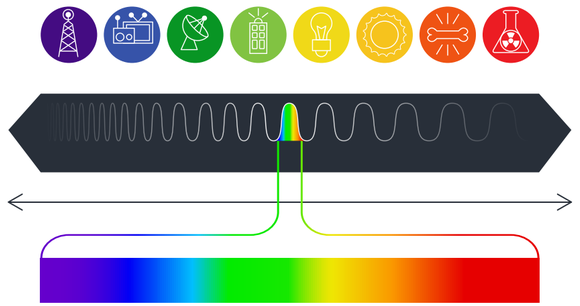
Command words: Explain, Use, Describe

- Ultrasound:
  - Frequency above 20 kHz
  - Used for medical imaging, echo sounding, and industrial scans
  - Reflects at boundaries → time delay used to calculate distances
- Seismic waves:
  - P-waves (longitudinal) travel through solids and liquids
  - S-waves (transverse) only through solids
  - Seismic wave data helps us understand Earth's internal structure

Expect questions on how sound waves cause hearing or why some frequencies can't be heard.

Waves

Key Concepts



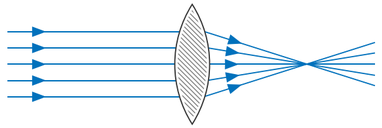
• 8. Electromagnetic Spectrum

Command words: Recall, Identify, Describe

- Electromagnetic (EM) waves are transverse and transfer energy from a source to an absorber
- All EM waves travel at the same speed in a vacuum (≈ 3×10^8 m/s)
- The EM spectrum is arranged by wavelength and frequency:
  - Radio → Microwave → Infrared → Visible → Ultraviolet → X-rays → Gamma rays
- Visible light is the only part detected by the human eye

Expect to name the spectrum in the correct order and describe how wavelength/frequency changes across it.

• 9. Refraction and Wave Behaviour (HT only)



Command words: Construct, Explain, Illustrate

- Different materials can absorb, transmit, reflect, or refract EM waves
- Refraction occurs due to a change in wave speed when entering a new medium
- Ray diagrams and wavefront diagrams can show how refraction works

You may be asked to draw or interpret ray diagrams and explain how speed affects the direction of waves.

Waves

Key Concepts

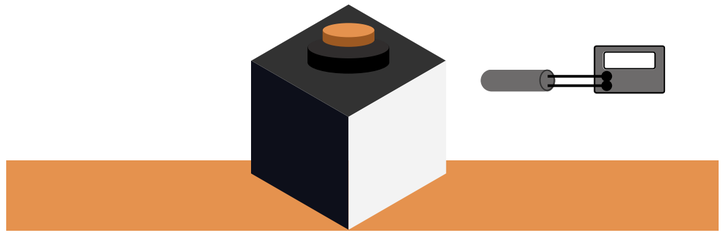
- **10. Required Practical – Infrared Radiation**

Command words: Investigate, Compare, Record

- Investigate how different surfaces absorb or emit infrared radiation
- Compare surfaces like shiny metal, matte black, or white paper
- Identify which is the best absorber/emitter

You may be asked to describe the practical, interpret results, or suggest reasons for differences between surfaces.

- **11. Wave Interactions with Atoms (HT only)**



Command words: Describe, Explain, Use

- Radio waves can be produced by oscillations in electrical circuits
- When absorbed, they can create an alternating current in a receiver
- Gamma rays come from changes in the nucleus
- EM waves can be emitted or absorbed during changes in atoms or nuclei

Expect to link EM wave production to electron or nuclear changes, and to circuits.

Waves

Key Concepts

- **12. Dangers of EM Radiation (HT only)**

Command words: Draw conclusions, Evaluate

- UV, X-rays, and Gamma rays can be hazardous
  - UV: premature skin aging, skin cancer
  - X-rays/Gamma: ionising → cause gene mutation or cancer
- Risk depends on type of radiation and dose
- Radiation dose measured in sieverts (Sv) (1000 mSv = 1 Sv)

You may be asked to evaluate risks using data or compare dangers of different types of EM radiation.

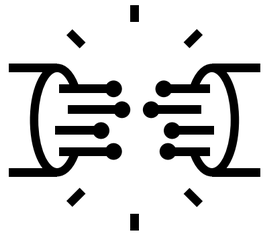
- **13. Uses of EM Waves (HT only)**

Command words: Give examples, Explain, Apply

Wave	Use
Radio	TV, radio signals
Microwaves	Satellite communication, cooking
Infrared	Heaters, night-vision, remote controls
Visible Light	Fibre optics, photography
Ultraviolet	Sunbeds, security pens, sterilisation
X-rays	Medical imaging
Gamma Rays	Cancer treatment, sterilising equipment

- (HT only) Know why each wave is suitable: e.g. microwaves penetrate the atmosphere; X-rays pass through soft tissue but not bone

Expect to match uses to waves or explain why a wave is suitable for a specific purpose.



Waves

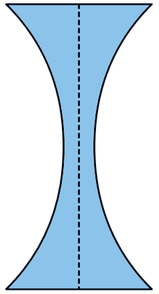
Key Concepts

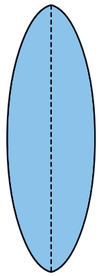
- **14. Lenses and Ray Diagrams**

Command words: Construct, Compare, Calculate**

- Convex lens: focuses light to a point (real or virtual image)
- Concave lens: spreads out light (always virtual)
- Ray diagrams show light paths and image position
- Magnification: Magnification = Image height / Object height

Expect to draw ray diagrams and calculate magnification (no units).



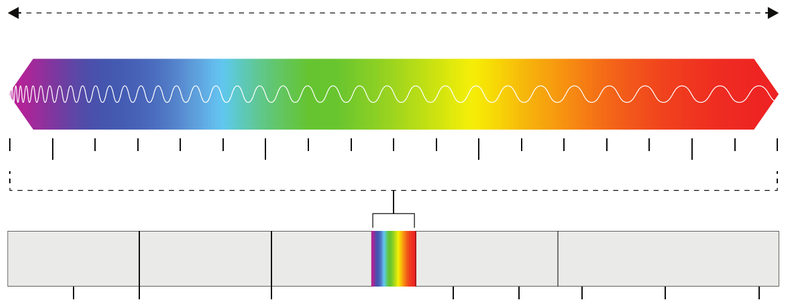


- **15. Visible Light and Colour (Physics only)**

Command words: Explain, Describe, Identify**

- Each colour = specific wavelength/frequency
- White objects reflect all wavelengths; black absorbs all
- Filters absorb some wavelengths and transmit others
- Transparent = transmits all light; translucent = scatters light

You may be asked to explain how an object's colour is seen or how filters affect light.



Waves

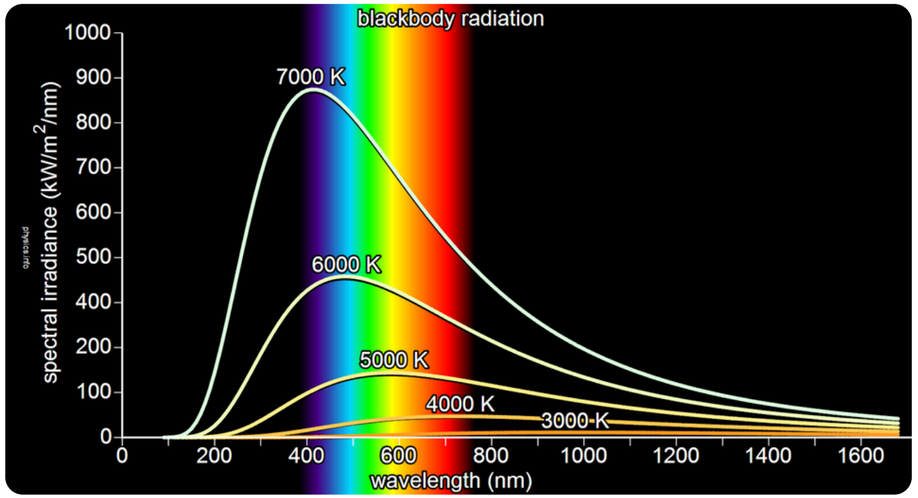
Key Concepts

- **16. Black Body Radiation (Physics only)**

Command words: Explain, Interpret, Use**

- All objects emit and absorb infrared radiation
- A perfect black body is the best absorber/emitter
- Hotter objects emit more radiation at shorter wavelengths
- At constant temperature: rate of emission = rate of absorption
- Earth's temperature is affected by absorption, emission, and reflection of radiation

Expect to explain temperature changes in terms of radiation balance, or interpret diagrams/data on radiation.



Now it's your turn!

EITHER:

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OR

Have a go at a range P6 questions on Revision Hub

Magnetism and Electromagnetism

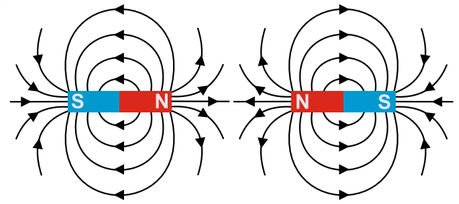
Key Concepts

- **1. Magnetic Poles and Magnetic Materials**

Command words: Describe, Distinguish, Identify

- The poles are where the magnetic force is strongest
- Like poles repel, unlike poles attract – these are non-contact forces
- Permanent magnets produce their own field
- Induced magnets become magnetic when in a field and lose magnetism when removed
- Induced magnets always attract

You may be asked to describe interactions between magnets or explain the difference between permanent and induced magnets.



- **2. Magnetic Fields and Compasses**

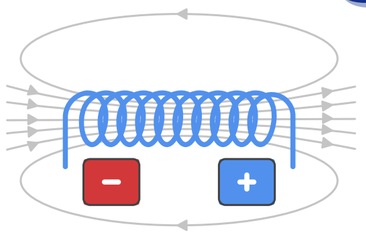
Command words: Draw, Explain, Use

- A magnetic field is the region where a force acts on a magnet or magnetic material (iron, steel, cobalt, nickel)
- Field lines point from north to south
- Field is strongest at the poles and weaker further away
- Use a compass to plot field lines
- The Earth has its own magnetic field — a compass aligns with it

Expect to draw a bar magnet field or explain how compass evidence suggests Earth's core is magnetic.

Magnetism and Electromagnetism

Key Concepts



- **3. Electromagnetism and Solenoids**

Command words: Describe, Draw, Explain

- A current-carrying wire produces a circular magnetic field around it
- Field strength increases with current and decreases with distance
- A solenoid (coiled wire) produces a strong, uniform field similar to a bar magnet
- Adding an iron core makes an electromagnet

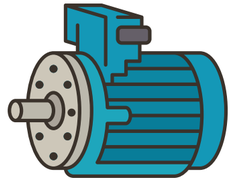
You may be asked to draw field patterns or explain how a solenoid creates a stronger magnetic effect.

- **4. The Motor Effect (HT only)**

Command words: Show, Use, Recall

- When a wire carrying a current is in a magnetic field, it experiences a force
- The force is at right angles to both current and magnetic field
- Fleming's Left-Hand Rule shows force (thumb), magnetic field (first finger), and current (second finger)
- Equation: F=BIL, (Force = magnetic flux density × current × length)

Expect to apply the rule or equation to questions involving direction or size of force.



- **5. Electric Motors (HT only)**

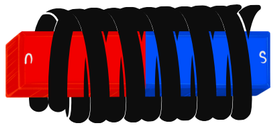
Command words: Explain, Describe**

- A current in a coil within a magnetic field produces a rotating force
- The motor continues to spin due to a split-ring commutator
- Used in devices like fans, drills, and hairdryers

You may be asked to explain how a current-carrying coil produces rotation in a magnetic field.

Magnetism and Electromagnetism

Key Concepts

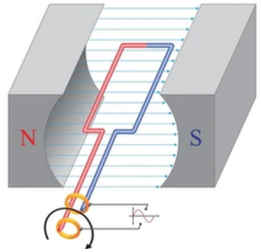


- **6. Loudspeakers (HT only)**

Command words: Explain, Describe

- Use the motor effect to convert electrical signals into sound waves
- A coil moves back and forth in a magnetic field when current varies
- This movement creates pressure variations in the air = sound

Expect to explain how the motor effect produces movement and how that relates to sound.



- **7. Induced Potential and the Generator Effect (HT only)**

Command words: Recall, Apply, Explain

- Moving a wire in a magnetic field induces a potential difference
- If in a complete circuit, a current is induced
- Called the generator effect
- An induced current creates a magnetic field that opposes the change (Lenz's Law)
- Affected by: speed of movement, strength of field, and length of wire

You may be asked to explain how induced current is created or how changing factors affects it.

Magnetism and Electromagnetism

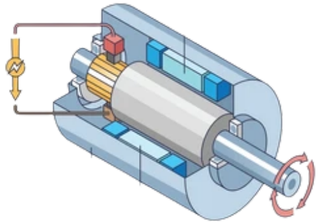
Key Concepts

- **8. Uses of the Generator Effect (HT only)**

Command words: Explain, Interpret, Draw

- Alternators: generate AC by rotating a coil in a magnetic field
- Dynamos: generate DC using a split-ring commutator
- Output can be shown as voltage vs time graphs

Expect to compare AC and DC generators or interpret graphs of induced potential.



- **9. Microphones (HT only)**

Command words: Explain, Describe

- Use the generator effect to convert sound wave pressure variations into electrical signals
- Vibrating diaphragm moves a coil in a magnetic field → induces a current

You may be asked to explain how induced current is created or how changing factors affects it.

Magnetism and Electromagnetism

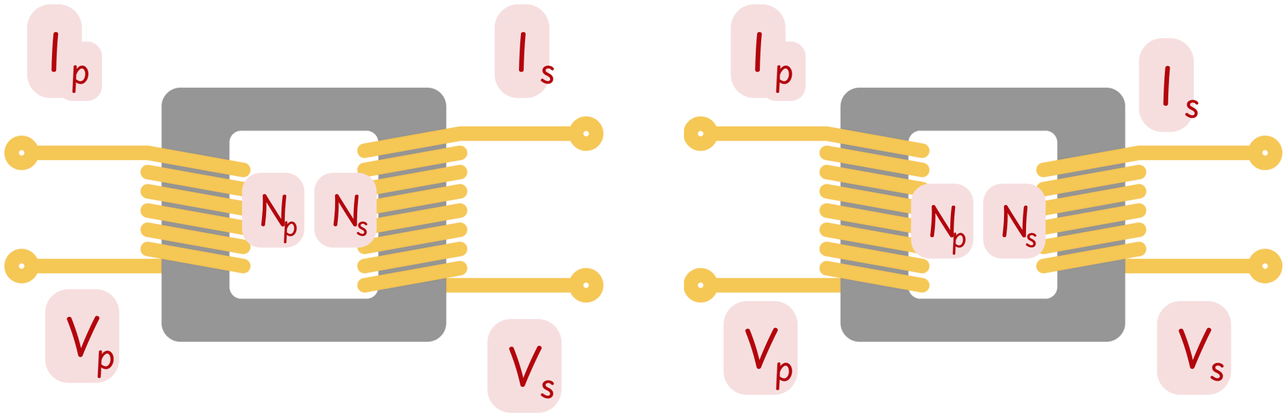
Key Concepts

- **11. The National Grid and Power Transfer (HT only)**

Command words: Justify, Evaluate, Explain

- Electricity is transferred efficiently by using high voltage and low current
- Step-up transformer: increases voltage for transmission
- Step-down transformer: reduces voltage for homes
- Reduces energy losses due to heating in wires

You may be asked to explain why high voltage is used or evaluate the efficiency of the system.



Now it's your turn!

EITHER:

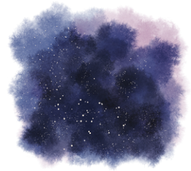
Complete the Revision Clocks for P7

OR

Have a go at a range P7 questions on Revision Hub

Space Physics

Key Concepts



Expect to explain how gravity caused the Sun to form and how fusion led to a stable star.

• 1. Our Solar System

Command words: Describe, Identify, Explain

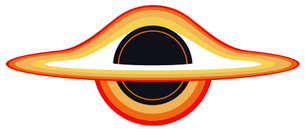
- The solar system consists of the Sun, eight planets, dwarf planets, and natural satellites (moons)
- The Sun formed from a nebula — a cloud of gas and dust pulled together by gravity
- Fusion began in the core → energy release balanced gravitational collapse
- Our solar system is a tiny part of the Milky Way galaxy

• 2. Life Cycle of a Star

Command words: Describe, Compare, Explain

- Life cycle stages of a star the size of the Sun:
  - Nebula → Protostar → Main sequence star → Red giant → White dwarf → Black dwarf
- For stars much more massive than the Sun:
  - Red supergiant → Supernova → Neutron star or black hole
- Fusion forms all naturally occurring elements
- Heavier elements (above iron) are formed during supernovae
- Supernovae scatter elements across the universe

You may be asked to describe each stage or explain how fusion produces new elements.



Space Physics

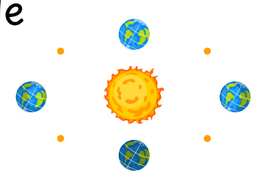
Key Concepts

Expect to compare natural vs artificial satellites or explain the link between orbital radius, speed, and stability.

- **3. Orbital Motion and Satellites**

Command words: Describe, Distinguish, Explain (HT only)

- Gravity keeps planets, moons, and satellites in circular orbit
- Artificial satellites orbit Earth for communication, weather, navigation, etc.
- (HT only) In circular motion, the object's speed is constant, but velocity changes because direction changes
- (HT only) If orbital speed changes, radius must change to remain stable



- **4. Red-Shift and the Expanding Universe**

Command words: Explain, Describe, Interpret

- Light from distant galaxies appears red-shifted → wavelengths are longer
- Greater red-shift = faster recession = further away
- This shows that the universe is expanding
- Supports the Big Bang theory: universe began from a hot, dense, small region
- Since 1998, evidence from supernovae suggests expansion is accelerating

You may be asked to explain red-shift, link it to galaxy motion, or describe how it supports the Big Bang theory.

Space Physics

Key Concepts

- **5. Unanswered Questions**

Command words: Discuss, Describe, Suggest

- Scientists use observations to build theories, but some phenomena remain unexplained
- Example:
  - Dark matter: adds gravity but doesn't emit radiation
  - Dark energy: may explain accelerated expansion

Expect to acknowledge that science is evolving, and not all aspects of the universe are fully understood.

Now it's your turn!

EITHER:

Complete the Revision Clocks for P8

OR

Have a go at a range P8 questions on Revision Hub