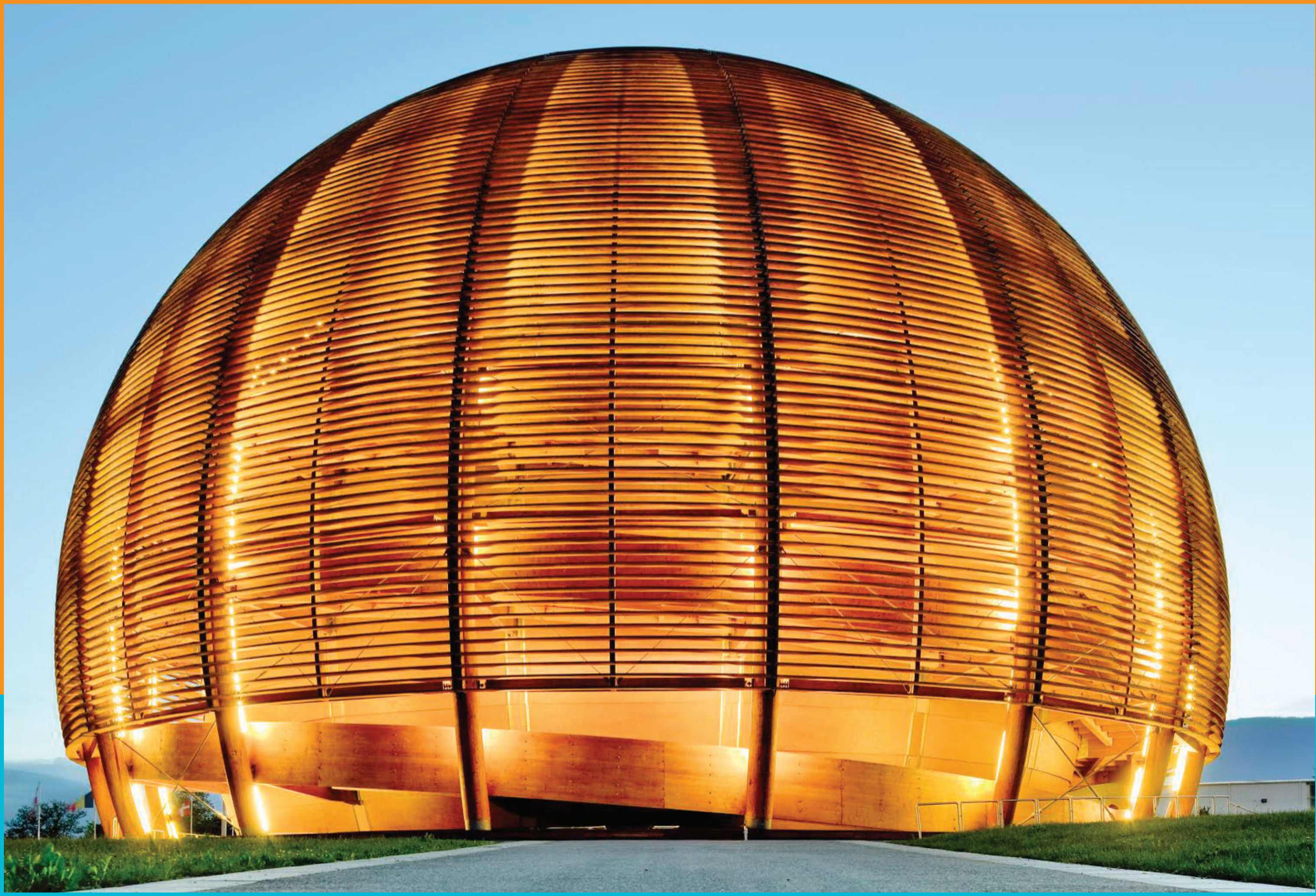


EDEXCEL INTERNATIONAL GCSE (9–1)

# PHYSICS

TEACHER RESOURCE PACK

## Chapter 10: Properties of Waves

**1** **a** Sketch a transverse wave and label the amplitude and wavelength.

**b** Describe the pattern of oscillations in a longitudinal wave.

**c** Give one example of a longitudinal wave.

**2** **a** State the equation that links frequency and time period.

**b** For the following examples, calculate the frequency of the wave.
For a wave with a time period:

**i** 2 s

**ii** 5 s

**iii** 10 s

**iv** 15 s

**c** For the following examples, calculate the time period of the wave.
For a wave with a frequency of:

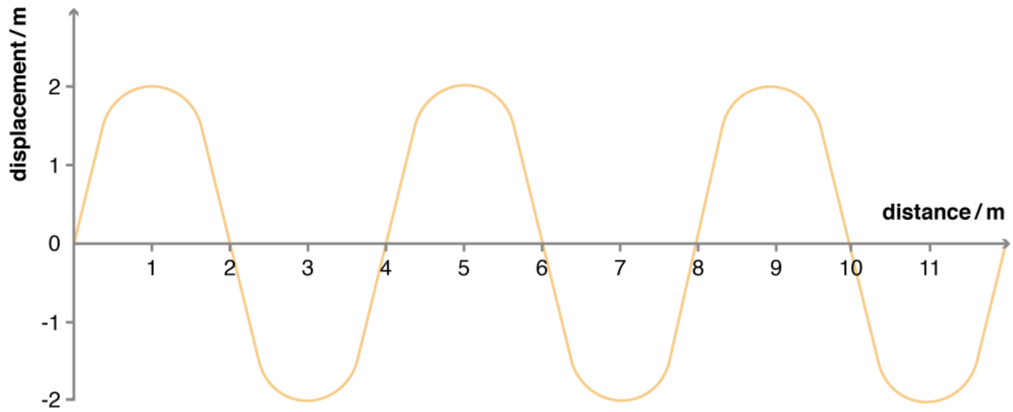
**i** 10 Hz

**ii** 50 Hz

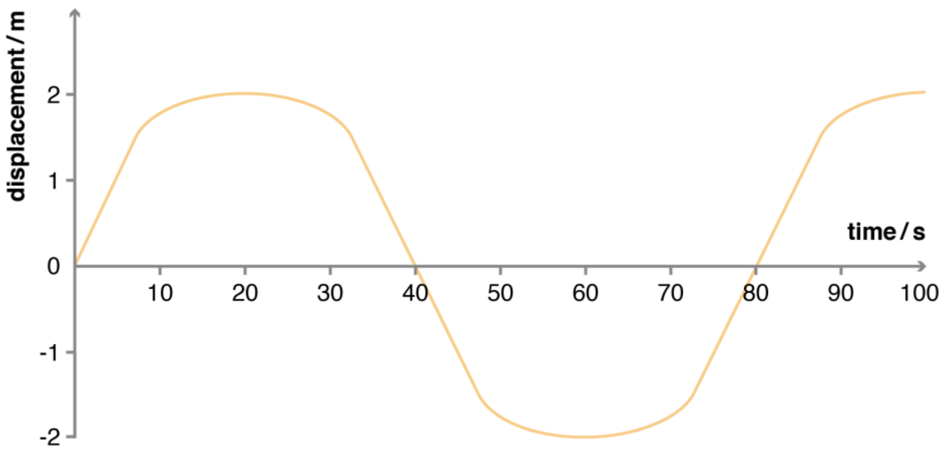
**iii** 250 Hz

**iv** 600 Hz

**3 a** Sketch a wave with twice the wavelength of the wave shown below.




**b** Draw a wave that will have twice the frequency of the wave form shown below.




**4 a** Write the equation that links, wave speed, frequency and wavelength.

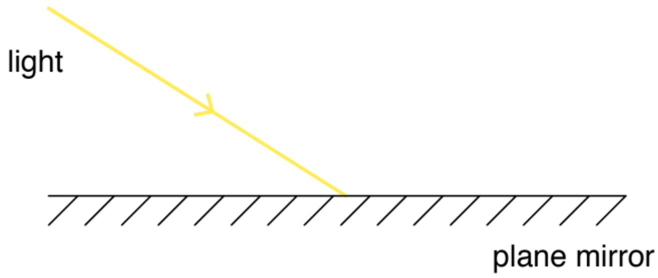
**b** A ripple tank uses an electric motor and wooden bar to produce waves in the water. The frequency of the wooden bar is 2 Hz and produces waves with a wavelength of 0.5 cm. Calculate the speed of the wave in water in m/s.

**c** Using your answer from part b, calculate the frequency of the wooden bar when the wavelength is reduced to 2.5 cm.

**5** Radio waves travel at the speed of light, 300 000 000 m/s. Radio One transmits at a frequency of 97.6 MHz. Calculate the wavelength of the radio wave.

**6** **a** State the Law of Reflection.

**b** A ray of light hits a plane mirror. Using the law of reflection, complete the ray diagram below to show the path of the reflected ray.




**7** An ambulance is sounding its siren. Explain why the sound of the siren appears to change as it passes.

## Chapter 1

**1** Which of the following quantities is a vector?

**A** distance

**B** speed

**C** acceleration

**D** time

**2** Identify the correct units for velocity.

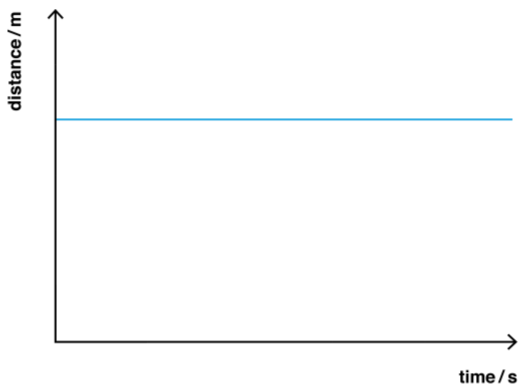
**A** m/s

**B** $m/s^2$

**C** s

**D** $m^2$

**3** The graph shows a car's motion. What is the car doing at this point?




**A** accelerating

**B** stationary

**C** decelerating

**D** travelling at a constant speed

**4** Which of the equations below shows the correct relationship between speed, distance and time?

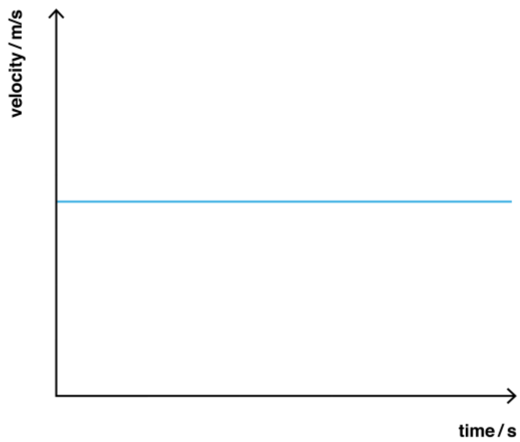
**A** $speed^2$= distance/time

**B** distance × speed = time

**C** speed × time = distance

**D** speed = distance × time

**5** The graph shows a car's motion. What is the car doing at this point?




**A** accelerating

**B** stationary

**C** decelerating

**D** travelling at a constant speed

**6** Which of the following statements is correct about displacement?

**A** displacement is measured in m/s

**B** displacement is a vector quantity

**C** displacement is a scalar quantity

**D** acceleration is a change in displacement

**7** A speed skater is travelling at 2 m/s and accelerates uniformly to 4 m/s in 5 seconds. What is her acceleration?

**A** 0.4 $m/s^2$

**B** 0.75 $m/s^2$

**C** 0.8 m/s

**D** 0.4 m/s

**8** A car travels 20 miles in 1 hour 15 minutes. What is its average speed?

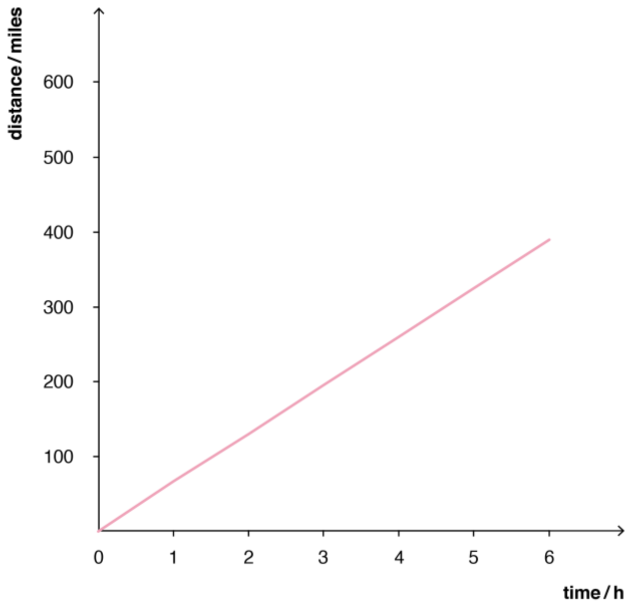
**A** 16 m/s

**B** 25 mph

**C** 16 mph

**D** 6.25 m/s

**9** The graph shows a car journey. What is the maximum speed of the car?




**A** 50 mph

**B** 50 m/s

**C** 65 mph

**D** 60 mph

**10** A cyclist is travelling at 12 m/s and decelerates uniformly to come to a stop in 4 seconds. What is his acceleration?

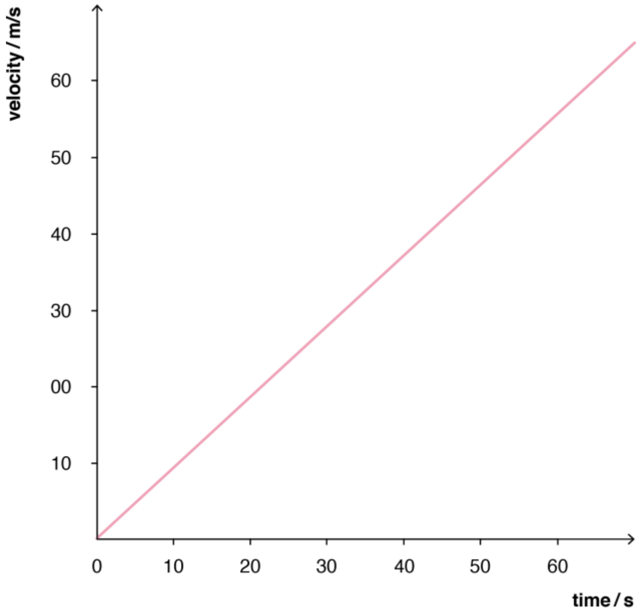
**A** 3 m/s$^2$

**B** −3 m/s$^2$

**C** 0.6 m/s

**D** he is decelerating not accelerating

**11** The graph shows the journey of a lorry. How could you calculate the distance the lorry has travelled from the graph?




**A** divide the maximum speed by the time

**B** multiply the maximum speed by the time

**C** the gradient of the line

**D** the area underneath the graph

**12** Which statement is true for velocity?

**A** velocity is a vector quantity

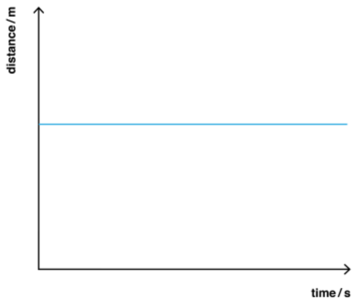
**B** velocity is measured in $m/s^2$

**C** velocity is a scalar quantity

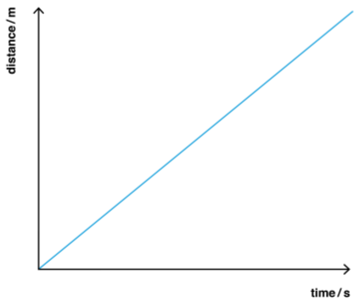
**D** $velocity^2 = 2 \times distance \times time$

**13** Which sketch shows a cyclist accelerating?

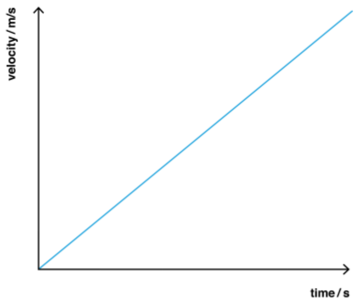
A



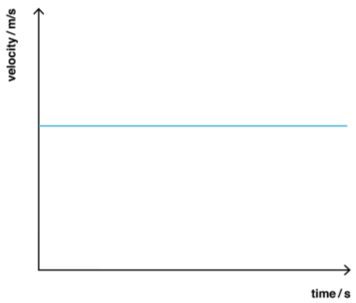

B




C




D




**14** A cyclist is travelling round a roundabout at constant speed. Which of the following statements is correct?

**A** the cyclist is accelerating

**B** the velocity of the bike is constantly changing

**C** the magnitude of velocity is constant

**D** all of the above

**15** A skier is heading for the finish line of the Olympic downhill. Her average speed down the course is 60 mph. What is her speed in m/s?

**A** 26.7 m/s

**B** $3.45 \times 10^6$ m/s

**C** 1600 m/s

**D** 0.44 m/s

**16** A student wants to reduce the errors in her results. Which of the suggestions would reduce the experimental error in her results?

**A** repeating each reading three times and averaging the results

**B** taking readings from eye level

**C** measuring from the same point each time

**D** all of the above

**17** In the equation $v^2 = u^2 + 2as$, what does the $u$ represent?

**A** initial velocity

**B** displacement

**C** final velocity

**D** acceleration

**18** A ball is released from rest and allowed to drop vertically downwards from a cliff edge. Gravity causes the ball to accelerate at 10 m/s$^2$. It reaches a maximum velocity of 25 m/s. What is the height of the cliff?

**A** 645 m

**B** 1.25 m

**C** 31.25 m

**D** 62.5 m

## Answers

**1** C – It has both a magnitude and a direction.
**2** A
**3** B – On the distance–time graph, it shows time increasing as the vehicle stays still.
**4** C
**5** D – As time goes on, the car is maintaining its velocity.
**6** B – It has both a direction and a magnitude.
**7** A – 2/5 gives 0.4 acceleration.
**8** C – Time in the same units gives 1.25 hours.
**9** C – The change in *y*/change in *x* gives a value of 65 = speed.
**10** B – Negative implies a deceleration.
**11** D – The area underneath the graph represents distance travelled.
**12** A
**13** C – Straight line represents a constant increase.
**14** D – The velocity is constantly changing because the direction is, so the cyclist must be accelerating.
**15** A – Average speed, so her top speed will be greater.
**16** A
**17** A
**18** C– If using up as positive, both the velocity and the acceleration will be negative as acting downwards.

# Chapter 11: The Electromagnetic Spectrum

**Alignment with Student Book: pages 106–112**

### Chapter overview

This chapter discusses the electromagnetic spectrum. The chapter approaches the whole spectrum, discussing the wavelength and frequency of each band and the uses and dangers of each of the parts of the electromagnetic spectrum.

### What to expect

3.10 know that light is part of a continuous electromagnetic spectrum that includes radio, microwave, infrared, visible, ultraviolet, x-ray and gamma ray radiations and that all these waves travel at the same speed in free space

3.11 know the order of the electromagnetic spectrum in terms of decreasing wavelength and increasing frequency, including the colours of the visible spectrum

3.12 explain some of the uses of electromagnetic radiations, including:

- radio waves: broadcasting and communications
- microwaves: cooking and satellite transmissions
- infrared: heaters and night vision equipment
- visible light: optical fibres and photography
- ultraviolet: fluorescent lamps
- x-rays: observing the internal structure of objects and materials, including for
- medical applications
- gamma rays: sterilising food and medical equipment.

3.13 explain the detrimental effects of excessive exposure of the human body to electromagnetic waves, including:

- microwaves: internal heating of body tissue
- infrared: skin burns
- ultraviolet: damage to surface cells and blindness
- gamma rays: cancer, mutation

    and describe simple protective measures against the risks

The content in this chapter will be new to students but will be easy to work through as a research project or as taught lessons. This is predominantly a theory-based topic with basic calculations in the wave equation included.

The magnitudes of numbers will be the most challenging part of this topic for students.

## Teaching notes

### Start activities

Guess what: Show the students images taken in different filters, i.e. UV, infrared, x-ray, radio wave etc. Ask students to identify first the image and second the filter used.

EM spectrum bingo: Provide students with an EM spectrum grid containing a combination of the parts of the EM spectrum and frequencies or wavelengths. Make statements about the uses of the EM spectrum and students mark off the correct answer on their grid.

Guess the injury: Provide students with images of broken bones. Students have to guess the bone or the injury.

Find the secret information: Provide students with a variety of items that will fluoresce under a UV light. Students need to write down the information they find using the light. Example materials could be banknotes or items that have been written on with UV pen.

### Main activities

EM spectrum song: Ask students to write their own version of the EM spectrum song. Students could use a similar tune or create a different tune. They should write their own lyrics about the EM spectrum uses and dangers. Students could perform this as a group to their class or record it using a tablet, phone or video recorder.

EM spectrum video: Group students into fours. Ask students to create a video teaching other students about the EM spectrum, its uses and dangers. They could do this using stop frame animation apps or recording in a group.

UV research task: Ask students to research how fluorescent materials are used in everyday life. Students should put together a short presentation about their findings.

Group teaching: Provide students with an information grid for the EM spectrum with columns for the order of magnitude for wavelength, frequency, the uses, the dangers, how the waves are produced. Group students in fours and provide each group with the task of teaching the class about a section of the EM spectrum. Students should create a 3-minute presentation that will allow students to fill their grids with the relevant information.

### Differentiation

Extension: Students should research how the EM spectrum is used in our search to learn about space. Students could select a space telescope and provide an information leaflet on the telescope, the type of camera it uses and why it has selected to use this type of camera, e.g. the Chandra X-ray Observatory, the James Webb Space Telescope, the Hubble Space Telescope.

**Homework**

Students could research either the uses, dangers or ways to protect against particular elements of the EM spectrum for homework.

Students could produce a revision leaflet which includes each of the elements of the EM spectrum, their order of magnitude, their uses and dangers.

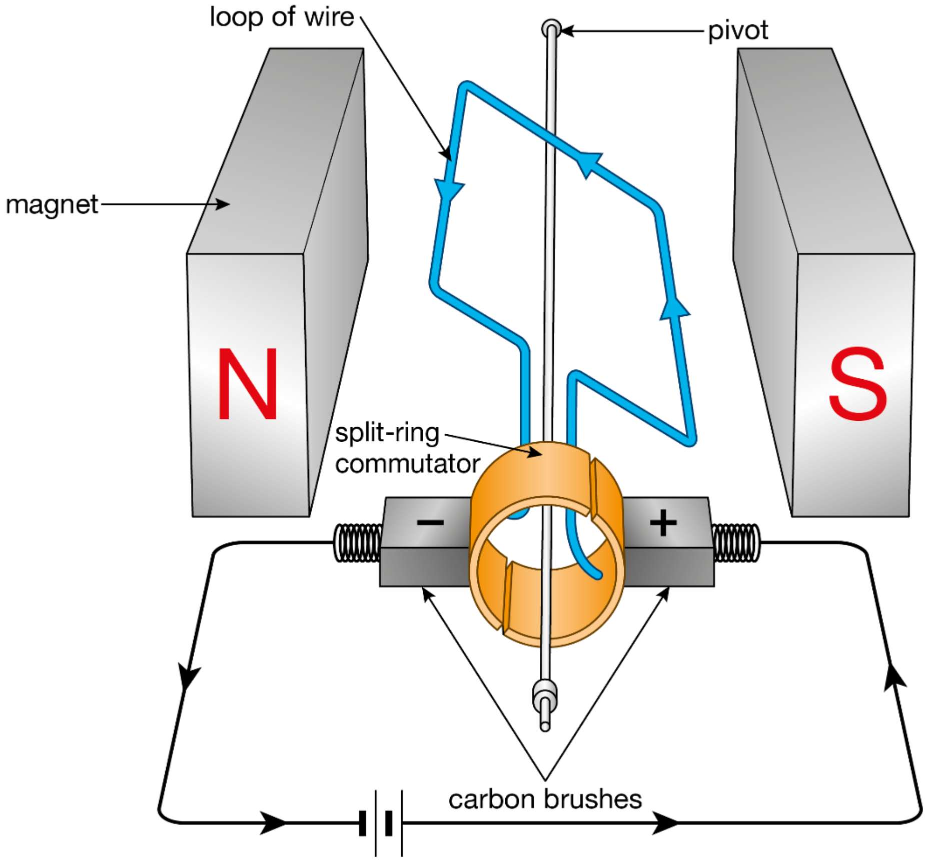
**Possible misunderstandings**

Students may find the magnitudes used difficult to handle. Discussing with students how to input standard form into their calculators will help. Manipulating the wave equation may also prove tricky for some. Use of the formula triangle will be of use to these students.

# Physics Paper 1 Exam Question – Electromagnetism

The diagram shows the set-up of a simple motor used in a motorised bicycle. Describe how the simple motor works to drive the bicycle up a hill.

**(5)**



# Student Response 1

When the switch is closed a current flows in the wire and it becomes an electromagnet. The motor then spins and drives the bike up the hill so the cyclist doesn’t need to do any work.

Is this a good answer?

# Student Response 1: Verdict

When the switch is closed a current flows in the wire and it becomes an electromagnet. The motor then spins and drives the bike up the hill so the cyclist doesn’t need to do any work.

This answer is very basic and would have scored a possible 2/5. They have made two good statements but these require more detail to gain higher marks.

# Student Response 1: Improvements

When the switch is closed a current flows in the wire

The student needs to be more specific and identify that the current flows through the coil.

and it becomes an electromagnet.

Correct idea.

More detail is now required in order to score higher marks. The student would need to identify that the magnetic field around the coil interacts with the permanent magnetic field surrounding the coil.

This then results in a force acting on the wire causing the coil to spin.

The student could comment on how Fleming's left-hand rule could be used to identify how it might rotate.

The motor then spins and drives the bike up the hill so the cyclist doesn't need to do any work.

The student should explain that the motor spins due to the turning effect created by the force being applied.

# Student Response 2

If the switch is closed the current flows around the coil of wire and creates a magnetic field around it. This magnetic field interacts with the external magnetic field provided by the permanent magnets. This provides a force that acts in opposite directions on either side of the coil causing it to spin.

Is this a good answer?

# Student Response 2: Commentary

If the switch is closed the current flows around the coil of wire and [1]

Need to say flows around the coil of wire to get a mark.

creates a magnetic field around it. [1]

What is the consequence of the current in the wire? the magnetic field

This magnetic field interacts with the external magnetic field provided by the permanent magnets. [1]

Why is the magnetic field around the wire important? Because it acts like another magnet and will respond to the external magnetic field.

This provides a force [1] that acts in opposite directions [1] on either side of the coil causing it to spin.

The effect of the two magnets interacting is the movement of the coil.

The examiner needs to see that you understand the cause and effect of each of the steps above.