Collins

AQA

GCSE

PHYSICS

H

SET A – Paper 2 Higher Tier

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Time allowed: 1 hour 45 minutes

Materials

For this paper you must have:

- a ruler
- a calculator
- the Physics Equation Sheet (found at the end of the paper).

Instructions

- Answer **all** questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- There are 100 marks available on this paper.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.
- When answering questions 03.1, 05.3 and 10 you need to make sure that your answer:
  – is clear, logical, sensibly structured
  – fully meets the requirements of the question
  – shows that each separate point or step supports the overall answer.

Advice

- In all calculations, show clearly how you work out your answer.

Name: ....

01.1 A sound wave is described as a **longitudinal wave**.

Describe **one** defining feature of a longitudinal wave.

....

.... **[1 mark]**

01.2 **Table 1.1** shows the speed at which sound travels through various materials.

Table 1.1

Material	Speed of sound in m/s
air	343
helium	972
water	1481
seawater	1522
brick	4000
steel	5000

Give **three** conclusions that can be made from the data in **Table 1.1**

1. ....

....

2. ....

....

3. .... **[3 marks]**

01.3 Write down the equation that links wave speed, frequency and wavelength.

.... **[1 mark]**

01.4 A sound wave is produced by a loudspeaker at a frequency of 500 Hz

The sound wave travels through a brick wall.

Calculate the wavelength of the sound wave while it is travelling through the wall.

Select the required data from **Table 1.1**

....

....

Wavelength = ... m **[3 marks]**

01.5 What is the frequency range of normal human hearing?

Tick **one** box.

200 Hz to 200 kHz ☐

20 Hz to 20 kHz ☐

2 Hz to 2kHz ☐ **[1 mark]**

01.6 Ultrasound waves have a frequency above the upper limit of hearing for humans.

Give an application of ultrasound waves.

.... **[1 mark]**

Turn over >

02.1 Which **two** of the following statements represent Newton's first law of motion?

Tick **two** boxes.

The resultant force on a stationary object is zero. ☐

Acceleration is proportional to resultant force. ☐

When two objects exert a force on each other, the forces are equal and opposite. ☐

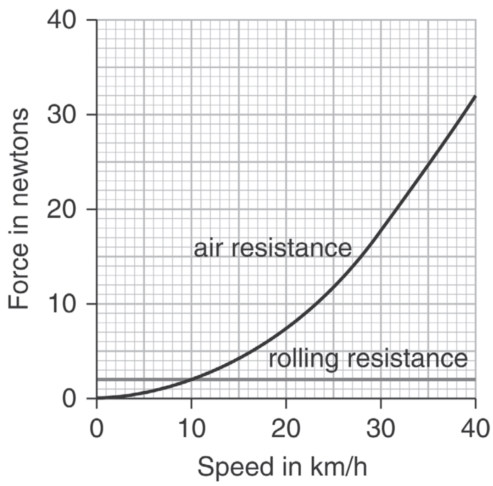
The resultant force on an object moving at a steady speed is zero. ☐ **[2 marks]**

02.2 The two main resistive forces acting on a cyclist and his bicycle are:

- air resistance
- rolling resistance between the bicycle's tyres and the road.

Figure 2.1 shows how these two forces vary with the bicycle's speed.

Figure 2.1



Write down **three** conclusions that you can make from **Figure 2.1**

1. ....

....

2. ....

....

3. ....

.... **[3 marks]**

02.3 Use **Figure 2.1** to determine the **total resistive force** acting on the cyclist and his bicycle when travelling at a steady speed of 20 km/h

Total resistive force = ... N **[3 marks]**

02.4 Write down the equation which links work done, force and distance travelled.

[1 mark]

02.5 Calculate the work done by the cyclist in maintaining a steady speed of 20 km/hour over a distance of 200 m along a flat road.

Give the correct unit with your answer.

Work done = ...

Unit: .... **[3 marks]**

02.6 Write down the equation that links resultant force, mass and acceleration.

[1 mark]

02.7 The cyclist now pedals faster so that he accelerates at 2.0 m/s^2

The mass of the cyclist and his bicycle is 70 kg

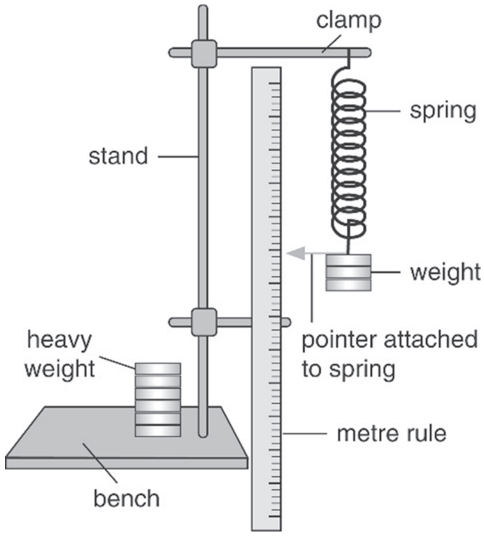
Calculate the resultant force on the cyclist and his bicycle.

Resultant force = ... N **[2 marks]**

Turn over >

03 A student uses the apparatus in **Figure 3.1** to obtain data on the extension of a spring under a stretching force.

Figure 3.1



03.1 Describe how an accurate extension measurement is obtained when a specific weight is attached to the spring in **Figure 3.1**

Include a description of how errors can be kept to a minimum.

....

....

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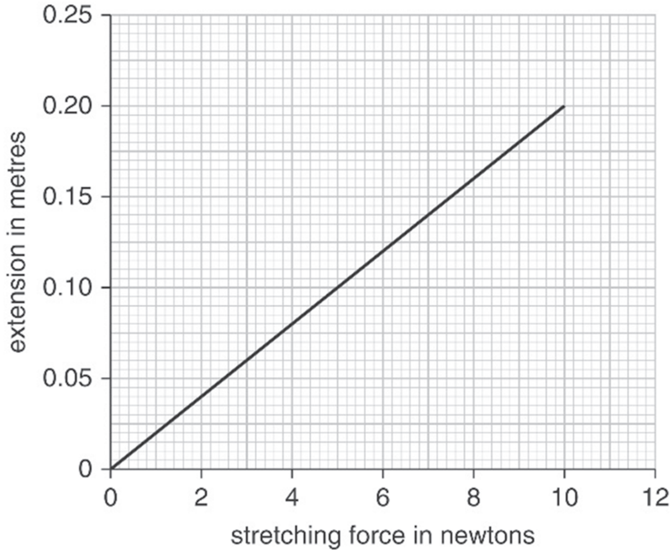
.... **[4 marks]**

03.2 **Figure 3.2** shows the student's extension and stretching force data plotted on a graph.

Figure 3.2



Give **two** conclusions from the graph about the behaviour of the spring.

1. ....

....

2. ....

.... **[2 marks]**

03.3 Write down the equation that links force, spring constant and extension.

.... **[1 mark]**

03.4 Calculate the spring constant of the spring.

Use data from **Figure 3.2**

....

....

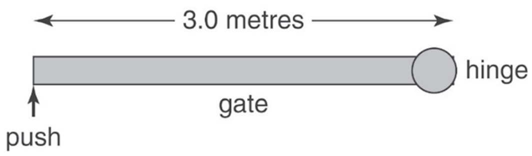
....

Spring constant = ... N/m **[4 marks]**

Turn over >

04.1 **Figure 4.1** is a plan view of a gate.

Figure 4.1



A moment of 18 N m is needed to open the gate.

The gate is pushed where shown in **Figure 4.1**

Calculate the push force that must be applied to open the gate.

....

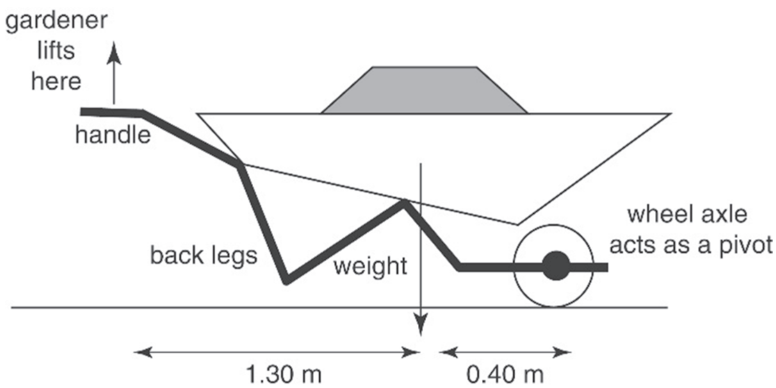
....

Force = ... N **[2 marks]**

04.2 A gardener is applying an upward force to the handle of the wheelbarrow as shown in **Figure 4.2**

The wheelbarrow is stationary and is balanced with its back legs just off the ground.

Figure 4.2



The total weight of the wheelbarrow and its contents is 400 N

Calculate the upward force exerted by the gardener on the handle of the wheelbarrow.

Give your answer to two significant figures.

....

....

Force = ... N **[3 marks]**

05.1 A car is travelling down a test track as part of a crash safety test.

The car has a velocity of 10 m/s

A crash dummy in the driver's seat of the car has a mass of 60 kg

Calculate the crash dummy's momentum.

....

Momentum = ... kg m/s **[1 mark]**

05.2 As part of the safety test, the car crashes into a barrier.

The crash dummy has no seat belt or air bag. It hits the windscreen and comes to a stop in 0.1 s

Calculate the impact force on the crash dummy.

Select the correct equation from the Physics Equation Sheet.

....

....

....

Force = ... N **[2 marks]**

05.3 An air bag is now fitted to the car for driver protection.

Explain the effect that the air bag will have on the crash dummy in a similar test crash.

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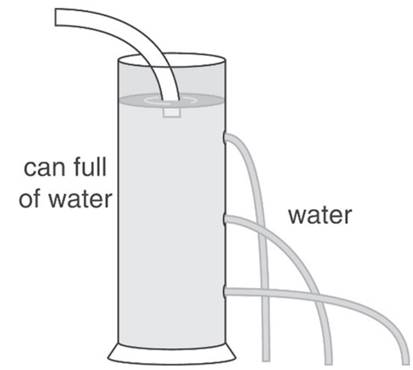
.... **[4 marks]**

Turn over >

06.1 **Figure 6.1** shows a tall can with three holes at different heights.

The can is continuously filled with water, which spurts out through the three holes.

Figure 6.1



Explain why the three jets of water from the three holes take the shapes shown.

....

....

.... **[2 marks]**

06.2 Calculate the water pressure at a depth of 1.0 km below the surface of the sea.

Gravitational field strength = 9.8 N/kg

Density of seawater = 1030 kg/m^3

Select the correct equation from the Physics Equation Sheet.

Give your answer in standard form to 2 significant figures.

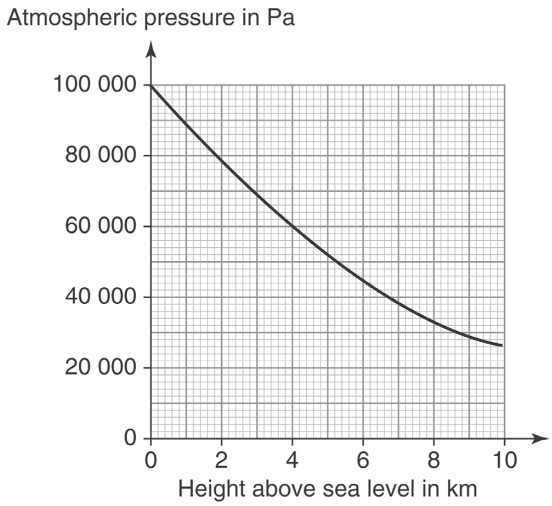
....

....

Water pressure = ... Pa **[3 marks]**

06.3 **Figure 6.2** shows how atmospheric pressure changes with height above sea level.

Figure 6.2



Describe the relationship shown by the graph.

....

.... **[1 mark]**

06.4 A student suggests that the graph in **Figure 6.2** shows that atmospheric pressure **halves** when height above sea level **doubles**.

Is the student's suggestion correct?

Justify your answer using data from the graph.

....

....

....

....

.... **[3 marks]**

Turn over >

07 A student investigates the refraction of light at the boundary between air and a transparent solid block.

She directs a ray of light from a ray box at a specific angle of incidence at the block (**Figure 7.1**).

She marks the path of the ray through the block.

She measures the angle of refraction produced for the following angles of incidence:

20°, 30°, 40°, 50°, 60°, 70°

07.1 Identify the independent, dependent and control variables in this investigation.

Independent variable: ....

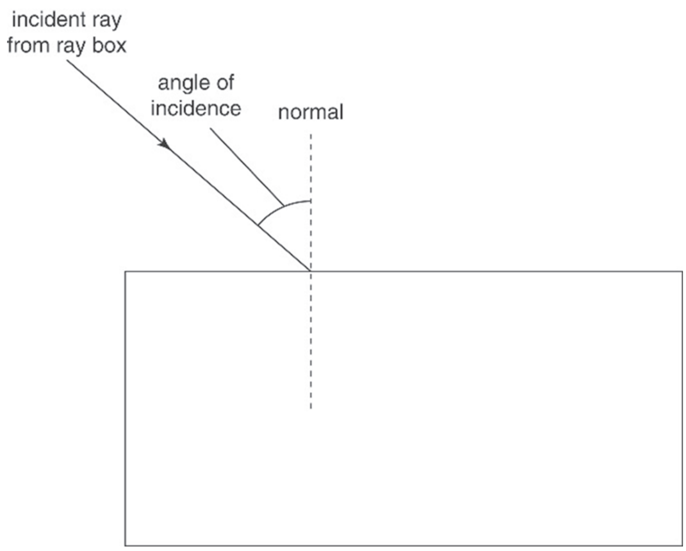
Dependent variable: ....

Control variable: .... **[3 marks]**

07.2 Complete the path of the ray in **Figure 7.1**:

- as it is refracted within the transparent block
- as it emerges from the block.

Figure 7.1



[2 marks]

07.3 **Table 7.1** shows the student's measurements.

Table 7.1

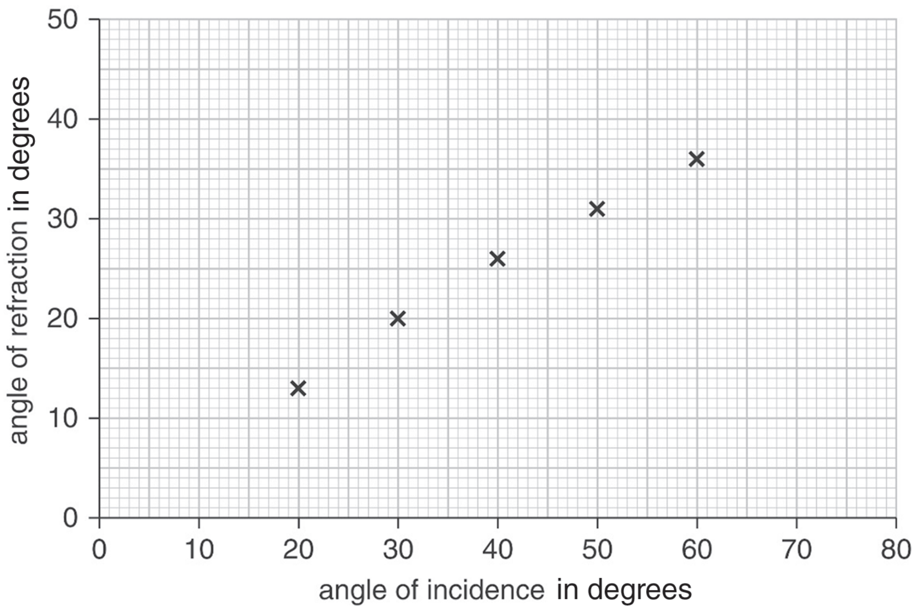
Angle of incidence in degrees	20	30	40	50	60	70	80
Angle of refraction in degrees	13	20	26	31	36	39	41

Figure 7.2 is a graph of the student's data, but it is incomplete.

Plot the missing points on **Figure 7.2**.

Draw a curve of best fit.

Figure 7.2



[2 marks]

07.4 Give **two** conclusions based on the graph.

....

....

....

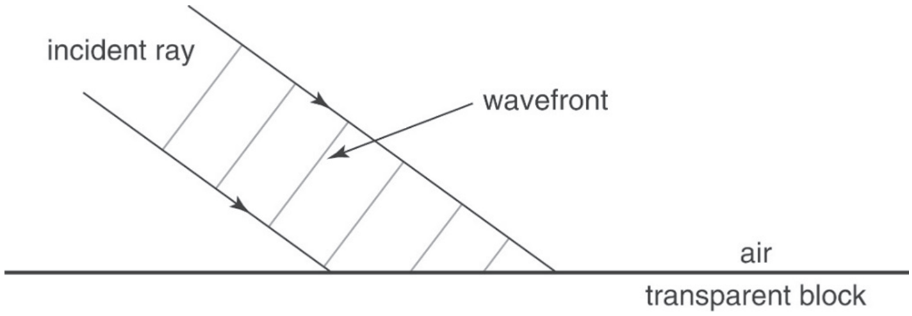
.... **[2 marks]**

Question 7 continues on the next page

07.5 **Figure 7.3** shows the light incident on the transparent block.

The incident wavefronts have been drawn.

Figure 7.3



Complete the diagram by drawing **four** refracted wavefronts. **[3 marks]**

07.6 The separation of wavefronts represents the wavelength of the light.

Describe how the wavelength of the light is affected by refraction in the transparent block.

.... **[1 mark]**

07.7 The frequency of light is **not** affected when the light enters a different material.

Predict how the **speed** of the light is affected when it enters the transparent block from air.

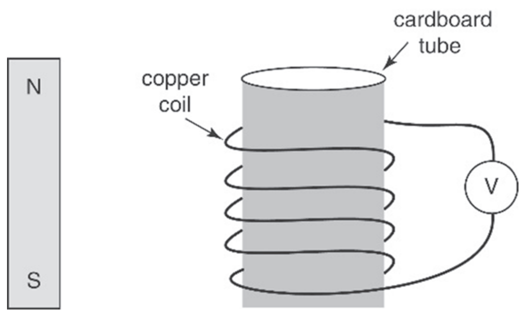
Justify your prediction.

....

.... **[2 marks]**

08.1 **Figure 8.1** shows bar magnet and a copper coil wrapped around a cardboard tube.

Figure 8.1



A student wants to induce a potential difference across the copper coil.

He can move either the magnet or the coil.

Describe **two** actions that he could carry out to produce a reading on the voltmeter.

....

....

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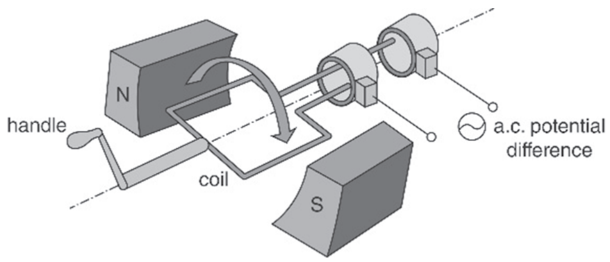
.... **[2 marks]**

Question 8 continues on the next page

08.2 **Figure 8.2** represents a hand-driven a.c. generator.

Figure 8.2



Explain why the generator in **Figure 8.2** produces a potential difference while the handle is being rotated.

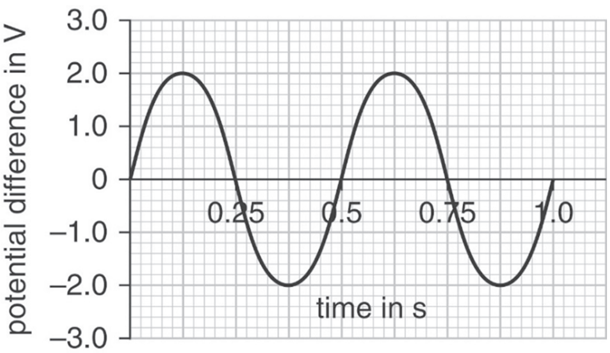
....

....

.... **[2 marks]**

08.3 **Figure 8.3** shows the output potential difference from the a.c. generator as the handle is rotated.

Figure 8.3



What feature of the graph shows that the output of the generator is a.c.?

....

.... **[1 mark]**

08.4 Use **Figure 8.3** to determine the time for the handle of the generator to complete one revolution.

Time = ... s **[1 mark]**

08.5 Use **Figure 8.3** to determine the generator's maximum output potential difference.

Potential difference = ... V **[1 mark]**

08.6 State **two** ways in which the graph in **Figure 8.3** would change if the handle were rotated at a faster speed.

....

....

....

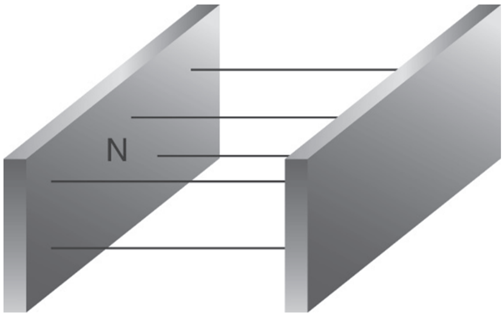
.... **[2 marks]**

Turn over >

09 **Figure 9.1** shows the magnetic field between two magnets.

The faces of the magnets are the poles and they are positioned with opposite poles facing.

Figure 9.1

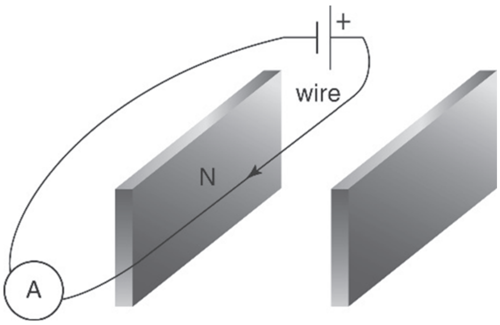


09.1 Add arrows to the field lines in **Figure 9.1** to show the direction of the magnetic field between the magnets.

[1 mark]

09.2 A wire carrying an electric current is placed between the poles of the two magnets **(Figure 9.2).**

Figure 9.2



The arrow on the wire shows the direction of the current.

Use Fleming's left-hand rule to determine the direction of the force on the wire.

Draw an arrow on **Figure 9.2** to show the direction of the force on the wire.

[1 mark]

09.3 The current in the wire in **Figure 9.2** is 3.2 A

The magnetic flux density of the magnetic field is 0.20 T

The length of wire within the field is 5.0 cm

Select the correct equation from the Physics Equation Sheet to calculate the size of the force on the wire.

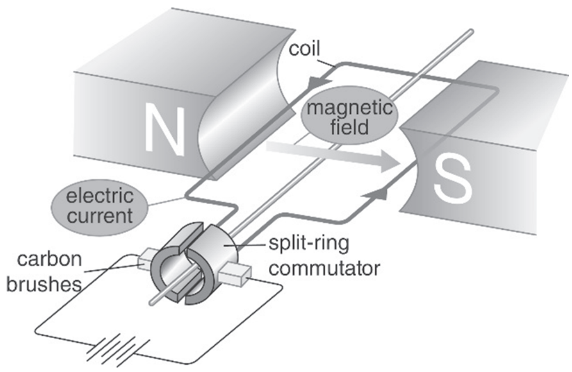
....

....

Force = ... N **[2 marks]**

09.4 **Figure 9.3** is a diagram of a d.c. electric motor.

Figure 9.3



Explain why the coil of the motor rotates.

....

....

.... **[3 marks]**

Turn over >

10.1 The life cycle of a star is determined by the mass of the star.

Describe the life cycles of **both**:

- a star the size of the Sun, and
- a star which is much more massive.

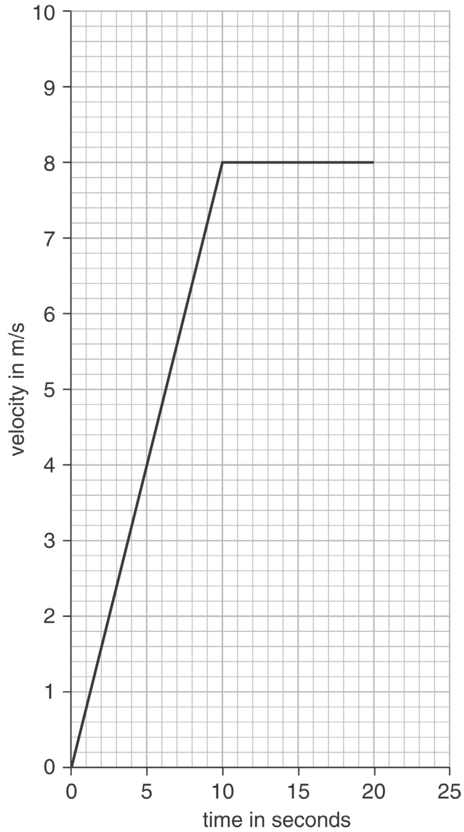
Outline their similarities and differences.

[6 marks]

11.1 A car is driven along a straight road.

Figure 11.1 shows the car's velocity–time graph during the first 20 s of its motion.

Figure 11.1



Determine the car's acceleration during the **first 10 s** of its motion.

....

Acceleration = ... m/s^2 **[2 marks]**

Question 11 continues on the next page

11.2 **Use Figure 11.1** to determine the **average speed of** the car during the first **20 s** of motion.

Show your working.

....

....

....

Average speed = ... m/s **[4 marks]**

END OF QUESTIONS

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Physics Equation Sheet

Equation Number	Word Equation	Symbol Equation
1	pressure due to a column of liquid = height of column × density of liquid × gravitational field strength	$p = h \rho g$
2	(final velocity)^2 – (initial velocity)^2 = 2 × acceleration × distance	$v^2 - u^2 = 2 a s$
3	force = $\frac{\text{change in momentum}}{\text{time taken}}$	$F = \frac{m\Delta v}{\Delta t}$
4	elastic potential energy = 0.5 × spring constant × (extension)^2	$E_e = \frac{1}{2} k e^2$
5	change in thermal energy = mass × specific heat capacity × temperature change	$\Delta E = m c \Delta\theta$
6	period = $\frac{1}{\text{frequency}}$	
7	magnification = $\frac{\text{image height}}{\text{object height}}$	
8	force on a conductor (at right-angles to a magnetic field) carrying a current = magnetic flux density × current × length	$F = B I l$
9	thermal energy for a change of state = mass × specific latent heat	$E = m L$
10	$\frac{\text{potential difference across primary coil}}{\text{potential difference across secondary coil}}$ = $\frac{\text{number of turns in primary coil}}{\text{number of turns in seconday coil}}$	$\frac{V_p}{V_s} = \frac{n_p}{n_s}$
11	potential difference across primary coil × current in primary coil = potential difference across secondary coil × current in secondary coil	$V_p I_p = V_s I_s$
12	For gases: pressure × volume = constant	pV = constant