Collins

AQA

GCSE

PHYSICS

F

SET B – Paper 2 Foundation 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 08.3 and 11 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.

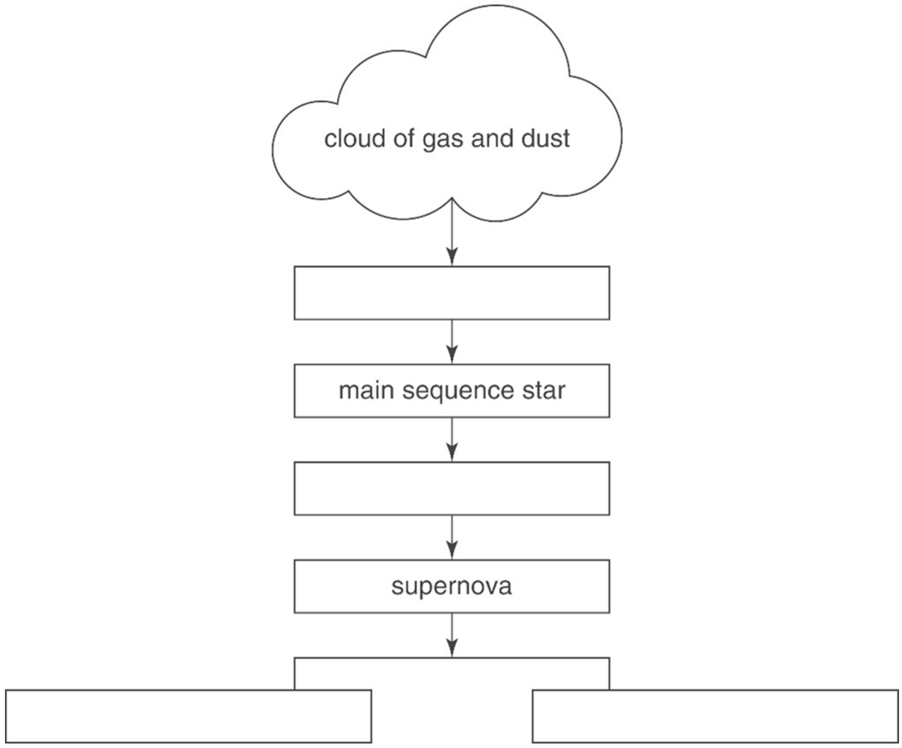
Advice

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

Name: ....

01.1 **Figure 1.1** shows some of the stages in the life cycle of a star **many times more massive** than the Sun.

Figure 1.1



Complete **Figure 1.1** by writing the names of the **four** missing stages for such a star.

[4 marks]

01.2 Describe what is meant by a **supernova.**

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

02.1 Explain the difference between the terms **speed** and **velocity**.

....

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

02.2 Typical walking speed is 1.5 m/s

Calculate the distance travelled by a person walking at this typical speed for 60 s

Use the following equation.

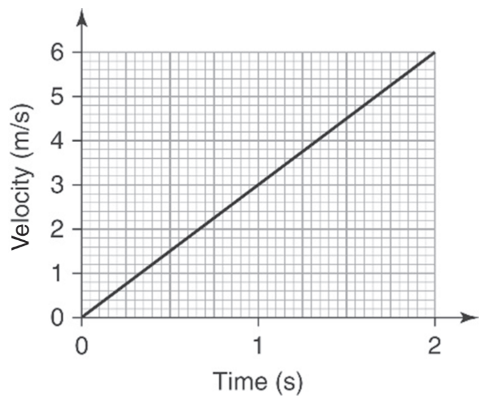
distance = speed × time

....

Distance = ... m **[2 marks]**

02.3 The graph in **Figure 2.1** shows the motion of a cyclist during the first two seconds of a race.

Figure 2.1



What is the correct description of the motion of the cyclist?

Tick **one** box.

accelerating ☐

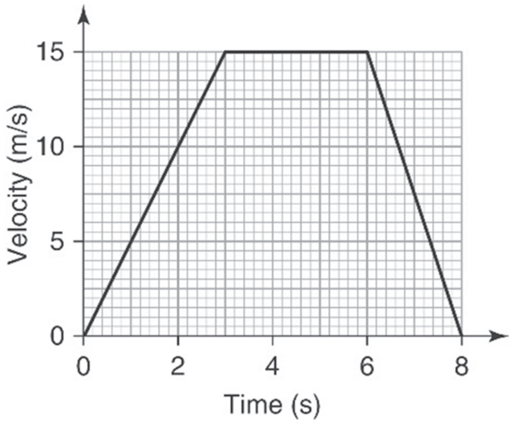
decelerating ☐

constant velocity ☐ **[1 mark]**

Question 2 continues on the next page

02.4 The graph in **Figure 2.2** shows the motion of a car on a straight track.

Figure 2.2



Describe the changing motion of the car shown in **Figure 2.2**

....

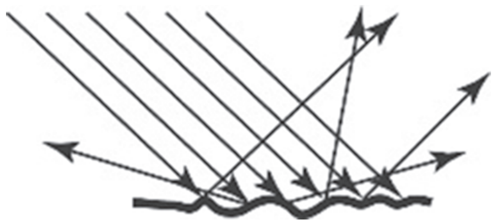
....

....

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

03 **Figure 3.1** shows light rays scattered by a surface.

Figure 3.1



03.1 What type of reflection is shown in **Figure 3.1**?

Tick **one** box.

diffuse ☐

specular ☐ **[1 mark]**

03.2 How is an object described if light cannot pass through it?

Tick **one** box.

transparent ☐

translucent ☐

opaque ☐ **[1 mark]**

03.3 An object appears red when white light is shone on it.

What colour does the object appear if green light is shone on it?

Tick **one** box.

black ☐

red ☐

green ☐ **[1 mark]**

Question 3 continues on the next page

03.4 White light is made up of a spectrum of different colours.

What has the same value for both red and blue light travelling through a vacuum?

Tick **one** box.

speed ☐

wavelength ☐

frequency ☐ **[1 mark]**

03.5 An object appears blue when white light shines on it.

What colour does the object appear if it is viewed through a red filter?

Tick **one** box.

blue ☐

red ☐

black ☐ **[1 mark]**

04.1 A car driver approaches a hazard.

Explain what is meant by the **thinking distance**.

....

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

04.2 Write down **one** factor that can affect thinking distance.

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

04.3 Explain what is meant by the **braking distance**, when someone is driving a car.

....

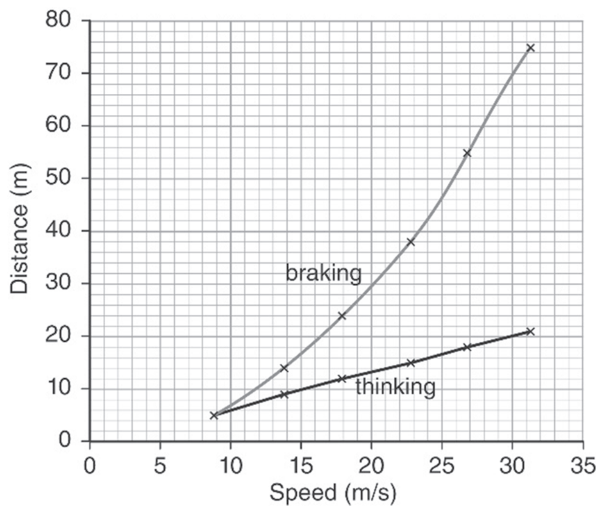
.... **[1 mark]**

04.4 Write down **one** factor that can affect **braking distance**.

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

04.5 **Figure 4.1** shows changes in thinking distance and braking distance with car speed.

Figure 4.1



Identify the trend in the **thinking distance** and in the **braking distance**, as the speed of a car varies.

Use the data in the graph in **Figure 4.1**

Thinking distance: ....

....

Braking distance: ....

....

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

Question 4 continues on the next page

04.6 What is the **total stopping distance** for a car travelling at 24 m/s?

Use the data in the graph in **Figure 4.1**

....

....

Stopping distance = ... m **[3 marks]**

04.7 Which energy transfer occurs when the brakes of a moving car are applied?

Tick **one** box.

Chemical energy to kinetic energy ☐

Gravitational potential energy to thermal energy ☐

Kinetic energy to thermal energy ☐ **[1 mark]**

04.8 Write down **one** effect that the energy transfer has on the car's brakes.

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

05.1 Which of the sentences below correctly describes the effect called **red-shift**?

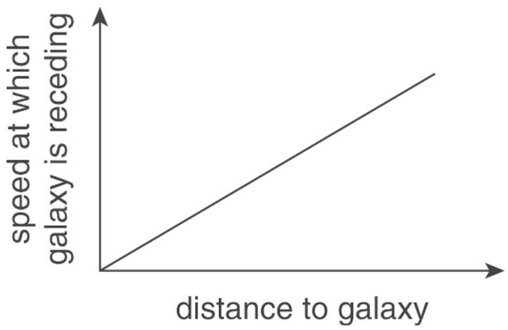
Tick **one** box.

Red-shift is the observed increase in **speed** of the light from distant galaxies	☐
Red-shift is the observed increase in **wavelength** of the light from distant galaxies	☐
Red-shift is the observed increase in **brightness** of the light from distant galaxies	☐

[1 mark]

05.2 **Figure 5.1** is a sketch graph showing how the recession speed of galaxies varies with their distance measured from Earth.

Figure 5.1



Draw a conclusion from this graph.

....

....

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

05.3 The data used to produce the graph in **Figure 5.1** provides evidence to support the **Big Bang** theory.

How does the Big Bang theory describe the beginning of the universe?

Tick **one** box.

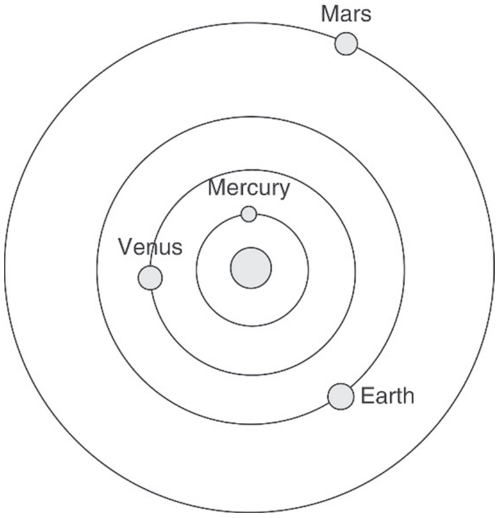
Cool and very dense	☐
Hot and very dense	☐
Hot with a very low density	☐

[1 mark]

Turn over >

06.1 **Figure 6.1** shows the orbits around the Sun of the four innermost planets of the Solar System.

Figure 6.1



Name the force that keeps the planets in orbit around the Sun.

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

06.2 **Table 6.1** shows the distance of the inner planets from the Sun, and their orbital speed.

Table 6.1

Planet	Distance from Sun in millions of km	Orbital speed in km/s
Mercury	57.9	47.4
Venus	108.2	35.0
Earth	149.6	29.8
Mars	227.9	24.1

Write a conclusion using this data.

....

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

06.3 Jupiter is the **fifth** planet from the Sun. It orbits at a distance of 778.3 million km from the Sun.

Using the data in **Table 6.1**, estimate the orbital speed of Jupiter.

Tick **one** box.

13 km/s ☐

24 km/s ☐

30 km/s ☐ **[1 mark]**

06.4 **Table 6.2** shows the distance from Jupiter of three of its moons.

Table 6.2

Moon of Jupiter	Distance from Jupiter in millions of km
Europa	0.671
Ganymede	1.07
Callisto	1.883

Which moon will have the greatest orbital speed?

Tick **one** box.

Europa ☐

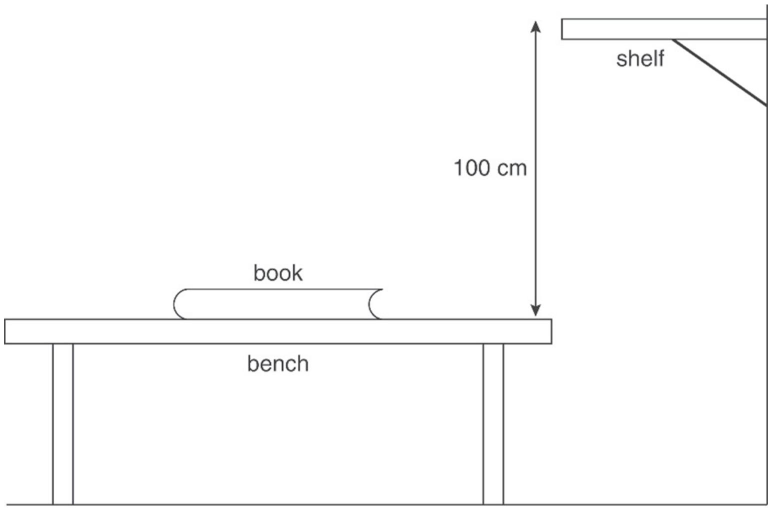
Ganymede ☐

Callisto ☐ **[1 mark]**

Turn over >

07 The book on the bench in **Figure 7.1** has a mass of 500 g

Figure 7.1



07.1 Write down the equation that links weight, mass and gravitational field strength.

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

07.2 Calculate the weight of the book.

Gravitational field strength = 9.8 N/kg

....

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

07.3 The weight of the book is the force of gravity exerted on the book by the Earth.

Complete the following sentences.

Choose from the words in the box below.

First	**Second**	**Third**	**mass**
Earth	**contact**	**non-contact**	**weight**

According to Newton's .... Law, the bench exerts a force on

the book equal in size to the book's ....

The force of gravity is a type of .... force. **[3 marks]**

07.4 A person lifts the book from the bench (**Figure 7.1**).

She lifts it up a distance of 100 cm to put it on the shelf.

Write down the equation which links work done to force and distance moved.

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

07.5 Calculate the work done by the person in lifting the book onto the shelf.

Give your answer in Nm.

....

....

Work done = ... Nm **[2 marks]**

07.6 Which energy store has increased once the book has been put on the shelf?

Tick **one** box.

Kinetic energy store ☐

Gravitational potential energy store ☐

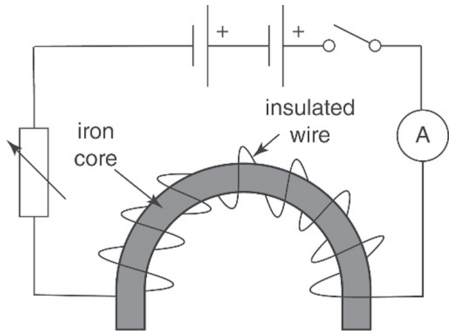
Elastic potential energy store ☐ **[1 mark]**

Turn over >

08 **Figure 8.1** shows an electromagnet made by a student.

The iron core is clamped vertically.

Figure 8.1



08.1 The student also has an iron nail.

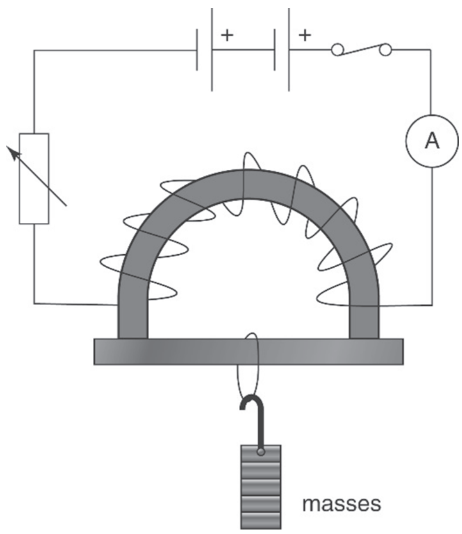
Describe how the student can use this to show that the electromagnet's iron core is only magnetised when there is a current in the wire.

[2 marks]

08.2 The student wants to measure the strength of her electromagnet.

She uses an iron bar and known masses on a mass hanger, as shown in **Figure 8.2**

Figure 8.2



The iron bar is attracted to the electromagnet.

The student gradually adds masses to the hanger.

When the total weight is large enough to overcome the strength of the electromagnet, the iron bar and the hanger with its masses falls to the ground.

The student records the size of the fallen weights:

Weight of iron bar = 1.0 N

Weight of hanger and attached masses = 1.2 N

What is the total weight needed to overcome the strength of the electromagnet?

Total weight = ... N **[1 mark]**

08.3 The student wants to investigate how the size of the current in the wire affects the strength of the electromagnet.

Write a step-by-step set of instructions for the student to follow to obtain the data required, using the apparatus in **Figure 8.2**

....

....

....

....

....

....

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

08.4 The student records the measurements shown in **Table 8.1**

Table 8.1

Current in A	Total weight supported by electromagnet in N Measurement 1	Total weight supported by electromagnet in N Measurement 2	Total weight supported by electromagnet in N Average
0.5	1.0	1.0	1.0
1.0	2.2	2.0	2.1
1.5	3.0	3.2	3.1
2.0	4.2	4.2	
2.5	5.1	5.3	

Suggest why the student repeated the **total weight** measurements.

....

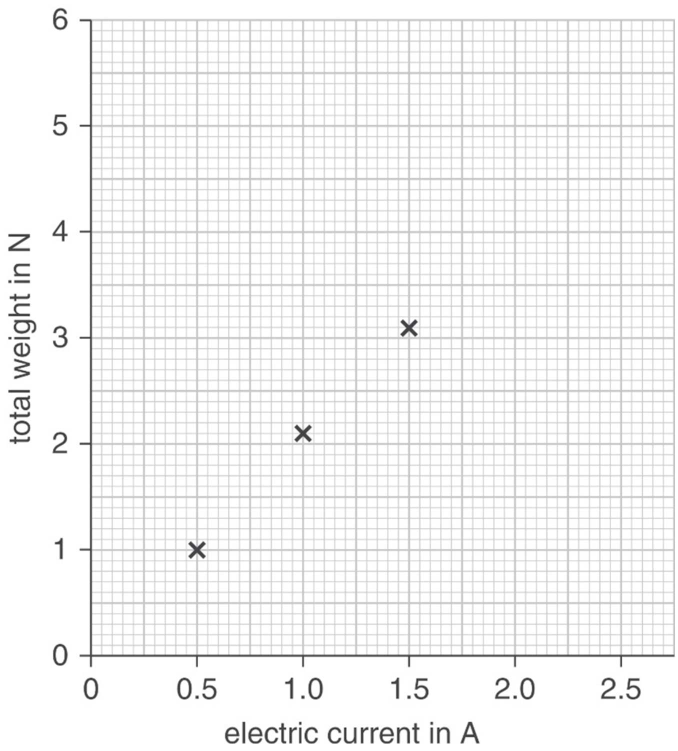
.... **[1 mark]**

Question 8 continues on the next page

08.5 Complete the **mean total weight** column of **Table 8.1** **[1 mark]**

08.6 **Figure 8.3** is a graph to show how the maximum total weight supported by the electromagnet depends on the current in the coil.

Figure 8.3



Three data points have been plotted but the graph is incomplete.

Plot the remaining points on **Figure 8.3**, using your completed **Table 8.1**

Draw a line of best fit. **[2 marks]**

08.7 Write a conclusion about how the size of the electric current in the wire affects the strength of the electromagnet.

Assume that the total weight attached, when the iron bar and weights fall, represents the strength of the electromagnet.

Use your completed graph in **Figure 8.3** to help you write your conclusion.

....

....

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

09 **Figure 9.1** shows the groups of waves in the electromagnetic spectrum.

Figure 9.1

Radio waves	Microwaves	Infrared	Visible light	Ultraviolet	X-rays	Gamma waves

09.1 Which group of waves in the electromagnetic spectrum has the **shortest wavelength**?

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

09.2 Which group of waves in the electromagnetic spectrum **causes a sun tan**?

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

09.3 Which group of waves in the electromagnetic spectrum **originates in the nucleus of atoms**?

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

09.4 Which group of waves in the electromagnetic spectrum is emitted by **all** objects?

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

09.5 Write down the equation linking wave speed, frequency and wavelength.

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

Question 9 continues on the next page

09.6 The X-rays used for medical purposes have a wavelength of 2.0×10^{-10} m

They travel at a speed of 3.0×10^{8} m/s

Calculate the frequency of the X-rays.

Give a suitable unit with your answer.

....

....

....

Frequency = ...

Unit: .... **[4 marks]**

09.7 **Table 9.1** shows information about doses and risks of some X-ray procedures.

Table 9.1

X-ray procedure	Typical dose in mSv	Equivalent period of background radiation	Lifetime additional risk of fatal cancer
teeth	0.01	1.5 days	1 in a 2 million
chest	0.02	3 days	1 in a million
skull	0.07	11 days	1 in 300 000
neck	0.08	2 weeks	1 in 200 000

[Data from Public Health England]

Suggest **two** conclusions that can be made from the data in **Table 9.1**

1. ....

....

2. ....

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

10.1 Write down the equation that links acceleration, change in velocity, and time.

[1 mark]

10.2 When a coin is dropped from a tower, it falls freely.

It is not affected by air resistance.

It reaches the ground after falling for 2.0 s

Calculate the velocity of the coin as it reaches the ground.

Take acceleration due to gravity = 10 m/s^2

Velocity = ... m/s **[3 marks]**

10.3 When a skydiver first jumps out of an aircraft, he accelerates freely downwards.

As his velocity increases, the effect of air resistance gets bigger.

The force of gravity on the skydiver is 600 N

At one instant, the air resistance acting on him is 360 N

What is the resultant force on the skydiver?

Resultant force = ... N **[1 mark]**

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

[1 mark]

10.5 The mass of the skydiver is 60 kg

Calculate the skydiver's acceleration at the instant when the air resistance is 360 N

Acceleration = ... m/s^2 **[3 marks]**

Question 10 continues on the next page

10.6 When the skydiver has been falling for about 20 s, the air resistance acting on him has reached 600 N

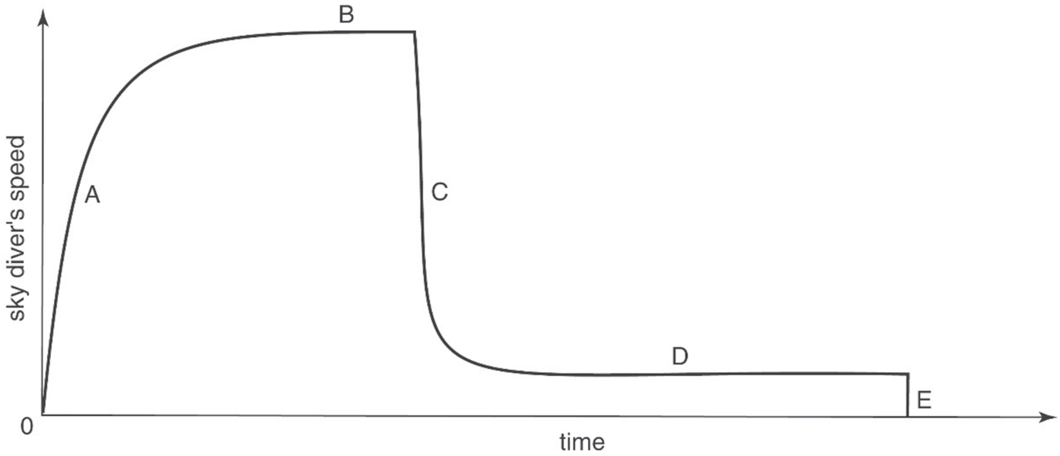
What is the resultant force on the skydiver now?

Resultant force = ... N **[1 mark]**

10.7 When the skydiver opens his parachute, the air resistance force increases considerably.

Figure 10.1 shows how the skydiver's speed changes, from the time he jumps out of the aircraft to the time he reaches the ground.

Figure 10.1



Which section of the graph represents the skydiver travelling at a terminal velocity before his parachute opens?

Tick **one** box.

A	B	C	D	E

[1 mark]

10.8 Which section of the graph represents the skydiver travelling at a terminal velocity after his parachute opens?

Tick **one** box.

A	B	C	D	E

[1 mark]

11.1 The law of reflection of light at a boundary is:

The angle of incidence is equal to the angle of reflection.

A student is asked to demonstrate the law of reflection. Describe a method for this practical demonstration.

Include ways of making the measurements as accurate as possible.

[6 marks]

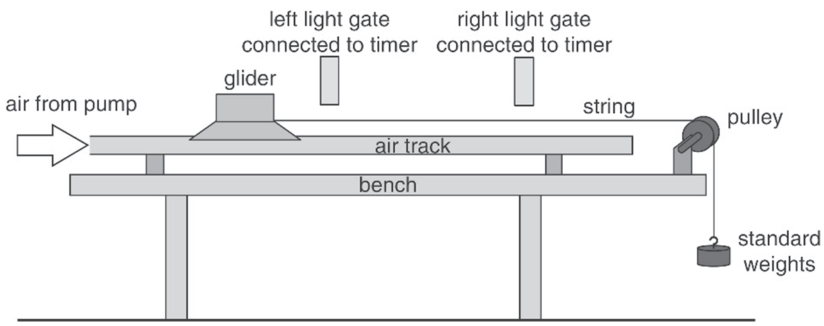
Turn over >

12 A student is to investigate how the size of the resultant force on an object affects the object's acceleration.

He uses the air track and glider shown in **Figure 12.1**

The glider has constant mass.

Figure 12.1



12.1 Identify the independent, dependent variables and control variables.

Independent variable: ....

Dependent variable: ....

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

12.2 What creates the force that accelerates the glider?

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

12.3 Air is pumped into the air track, lifting the glider up from the track slightly.

What effect would you expect this to have on the motion of the glider?

Explain your answer.

....

....

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

12.4 The student uses the times recorded by the light gate sensors to calculate the velocity of the glider as it passes through each gate.

One set of the student's measurements is shown in **Table 12.1**

Table 12.1

Velocity through left gate (initial velocity)	0.10 m/s
Velocity through right gate (final velocity)	0.20 m/s
Distance between gates	0.50 m
Force accelerating the glider	0.015 N

Use the following equation to calculate the glider's acceleration.

(final velocity)^2 – (initial velocity)^2 = 2 × acceleration × distance

....

Acceleration = ... m/s^2 **[3 marks]**

12.5 Suggest what the student should do next, to find out how changing the force affects the glider's acceleration.

....

....

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

END OF QUESTIONS

Physics Equation Sheet

Equation Number	Word Equation	Symbol Equation
1	(final velocity)^2 – (initial velocity)^2 = 2 × acceleration × distance	$v^2 - u^2 = 2\,a\,s$
2	elastic potential energy = 0.5 × spring constant × (extension)^2	$E_e = \frac{1}{2}\,ke^2$
3	change in thermal energy = mass × specific heat capacity × temperature change	$\Delta E = m\,c\,\Delta\theta$
4	period = $\frac{1}{\text{frequency}}$	
5	magnification = $\frac{\text{image height}}{\text{object height}}$	
6	thermal energy for a change of state = mass × specific latent heat	$E = m\,L$
7	potential difference across primary coil × current in primary coil = potential difference across secondary coil × current in secondary coil	$V_p I_p = V_s I_s$
8	For gases: pressure × volume = constant	pV = constant