SPECIMEN MATERIAL

GCSE
PHYSICS

Foundation Tier Paper 2F

F

Specimen 2018 Time allowed: 1 hour 45 minutes

Materials
For this paper you must have:
- a ruler
- a calculator
- a protractor
- the Physics Equation sheet (enclosed).

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, 10.6, 13.2 and 14 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.

Please write clearly, in block capitals.

Centre number Candidate number

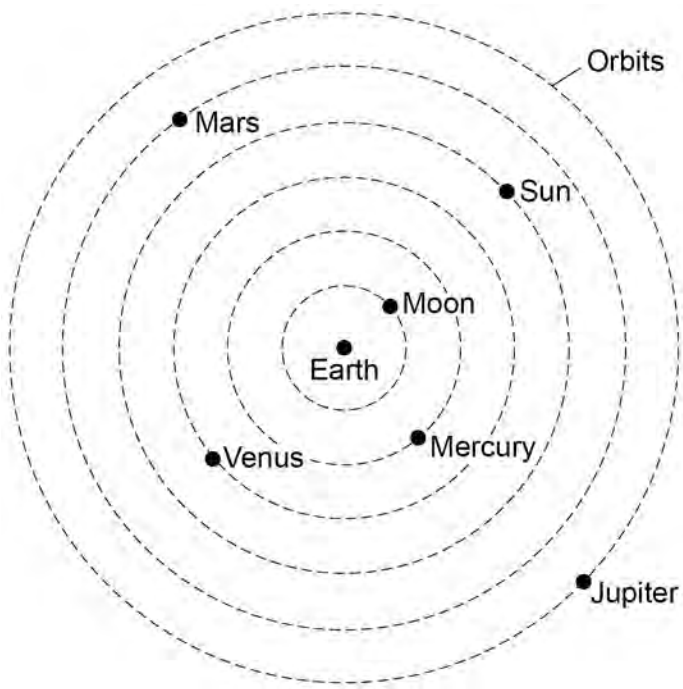
Surname

Forename(s)

Candidate signature

0 1 **Figure 1** shows what scientists over 1000 years ago thought the solar system was like.

Figure 1



0 1 . 1 Give **one** way that the historical model of the solar system shown in **Figure 1** is different from what we now know about the solar system.

[1 mark]

0 1 . 2 Give **one** way that the solar system shown in **Figure 1** is the same as what we now know about the solar system.

[1 mark]

PMT

0 1 . 3 The first artificial satellite to orbit the Earth was launched into space in 1957.

Describe the orbit of an artificial satellite.

[1 mark]

0 1 . 4 What provides the force needed to keep a satellite in its orbit?

Tick **one** box.

[1 mark]

friction ☐

gravity ☐

tension ☐

0 1 . 5 All stars go through a lifecycle.

The star Mira will go through a supernova stage in its lifecycle but the Sun will not.

How is the star Mira different to the Sun?

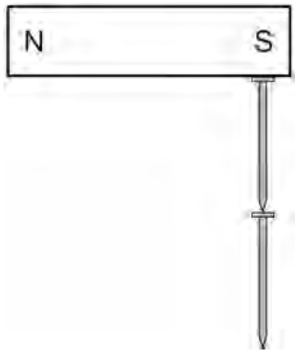
[1 mark]

Turn over for the next question

0 2 **Figure 2** shows two iron nails hanging from a bar magnet.

The iron nails which were unmagnetised are now magnetised.

Figure 2



0 2 . 1 Complete the sentence.

Use a word from the box.

[1 mark]

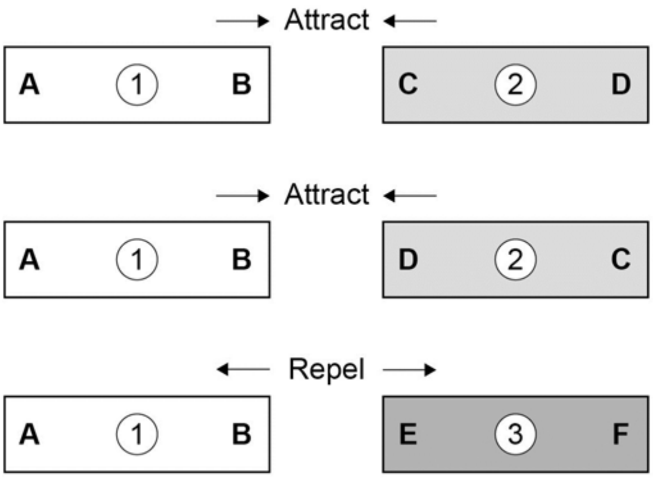
forced	**induced**	**permanent**

The iron nails have become ____________________________ magnets.

0 2 . 2 Each of the three metal bars in **Figure 3** is either a bar magnet or a piece of unmagnetised iron.

The forces that act between the bars when different ends are placed close together are shown by the arrows.

Figure 3



Which **one** of the metal bars is a piece of unmagnetised iron?

[2 marks]

Tick **one** box.

Bar 1 ☐

Bar 2 ☐

Bar 3 ☐

Give the reason for your answer.

____

____

A student investigated the strength of different fridge magnets by putting small sheets of paper between each magnet and the fridge door.

The student measured the maximum number of sheets of paper that each magnet was able to hold in place.

0 2 . 3 Why was it important that each small sheet of paper had the same thickness?

[1 mark]

0 2 . 4 Before starting the investigation the student wrote the following hypothesis:

'The bigger the area of a fridge magnet the stronger the magnet will be.'

The student's results are given in **Table 1**.

Table 1

Fridge magnet	Area of magnet in mm^2	Number of sheets of paper held
A	40	20
B	110	16
C	250	6
D	340	8
E	1350	4

Give **one** reason why the results from the investigation **do not** support the student's hypothesis.

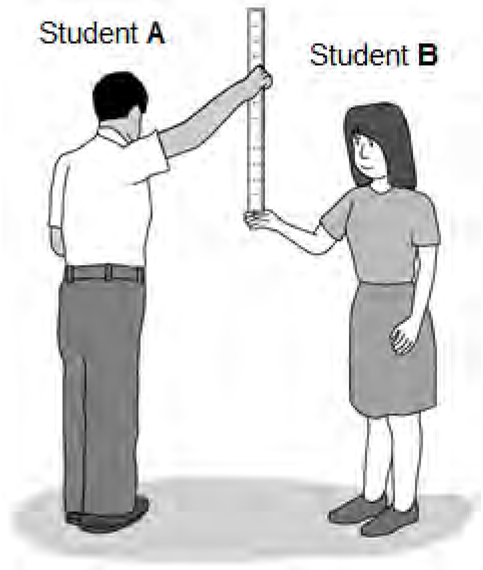
[1 mark]

PMT

Turn over for the next question

0 3 . 1 **Figure 4** shows two students investigating reaction time.

Figure 4



Student **A** lets the ruler go.

Student **B** closes her hand the moment she sees the ruler fall.

This investigation can be used to find out if listening to music changes the reaction times of a student.

Explain how.

[4 marks]

A second group of students used a stop clock and computer simulation test to measure their reaction times.

Table 2 shows their results.

Table 2

Student	**Reaction time in seconds**		
	Test 1	**Test 2**	**Test 3**
X	0.44	0.40	0.34
Y	0.28	0.24	0.22
Z	0.36	0.33	0.47

0 3 . 2 Give **one** conclusion that can be made from the results for student **X** and student **Y**.

[1 mark]

0 3 . 3 Test **3** for student **Z** gave an anomalous result.

Suggest **two** possible reasons why this anomalous result occurred.

[2 marks]

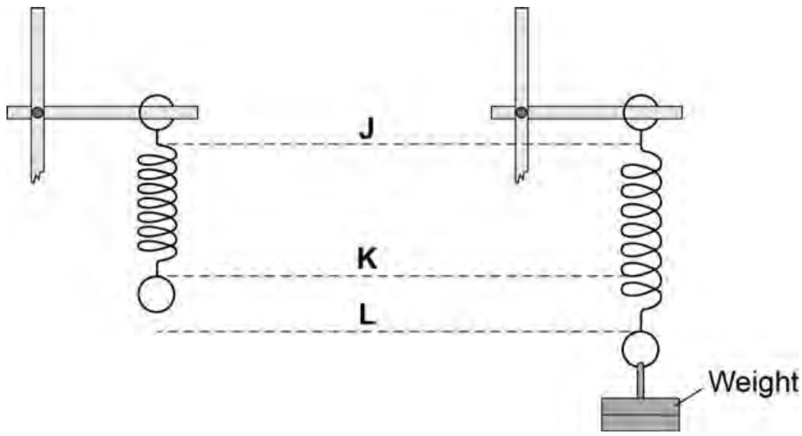
1

2

0 4 A student suspended a spring from a laboratory stand and then hung a weight from the spring.

Figure 5 shows the spring before and after the weight is added.

Figure 5



0 4 . 1 Which distance gives the extension of the spring?

Tick **one** box.

[1 mark]

from **J** to **K** ☐

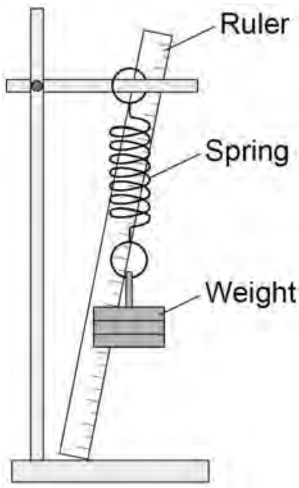
from **K** to **L** ☐

from **J** to **L** ☐

The student used the spring, a set of weights and a ruler to investigate how the extension of the spring depended on the weight hanging from the spring.

Figure 6 shows that the ruler is in a tilted position and not upright as it should be.

Figure 6



0 4 . 2 How would leaving the ruler tilted affect the weight and extension data to be recorded by the student?

Use answers from the box to complete each sentence.

Each answer may be used once, more than once or not at all.

[2 marks]

greater than	**the same as**	**smaller than**

The weight recorded by the student would be ______________________________ the actual weight.

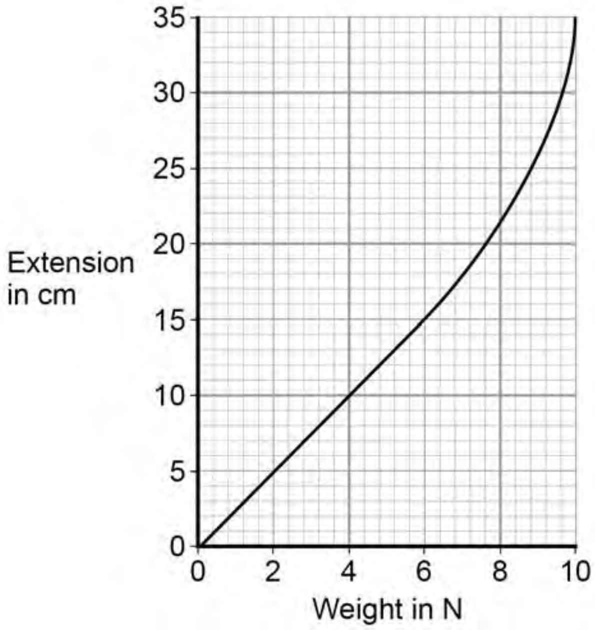
The extension recorded by the student would be ____________________________ the actual extension of the spring.

The student moves the ruler so that it is upright and not tilted.

The student then completed the investigation and plotted the data taken in a graph.

The student's graph is shown in **Figure 7**.

Figure 7



0 4 . 3 Use **Figure 7** to determine the additional force needed to increase the extension of the spring from 5cm to 15cm.

[1 mark]

Additional force = ______________________ N

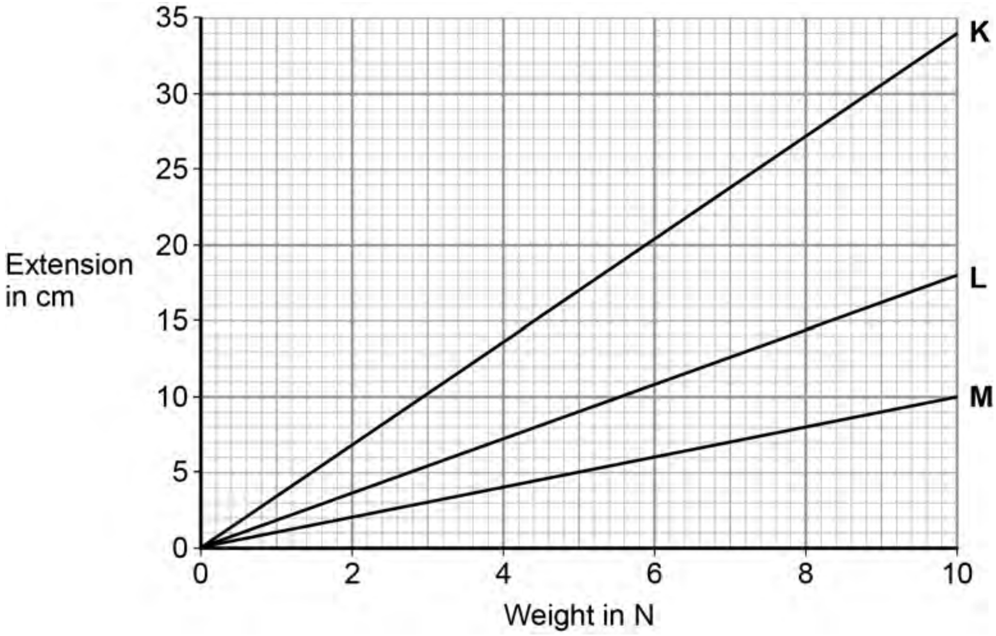
0 4 . 4 What can you conclude from **Figure 7** about the limit of proportionality of the spring?

[1 mark]

The student repeated the investigation with three more springs, **K**, **L** and **M**.

The results for these springs are given in **Figure 8**.

Figure 8



0 4 . 5 All three springs show the same relationship between the weight and extension.

What is that relationship?

[1 mark]

Tick **one** box.

The extension increases non-linearly with the increasing weight. ☐

The extension is inversely proportional to the weight. ☐

The extension is directly proportional to the weight. ☐

0 4 . 6 Which statement, **A**, **B** or **C**, should be used to complete the sentence?

Write the correct letter, **A**, **B** or **C**, in the box below.

[1 mark]

A a lower spring constant than

B the same spring constant as

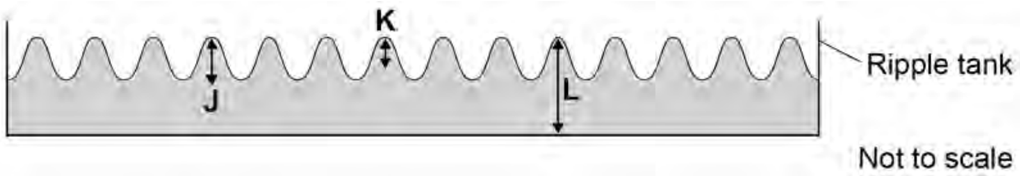
C a greater spring constant than

From **Figure 8** it can be concluded that spring **M** has ☐ the other two springs.

0 5 Small water waves are created in a ripple tank by a wooden bar. The wooden bar vibrates up and down hitting the surface of the water.

Figure 9 shows a cross-section of the ripple tank and water.

Figure 9



0 5 . 1 Which letter shows the amplitude of a water wave?

Tick **one** box.

[1 mark]

J ☐

K ☐

L ☐

0 5 . 2 The speed of the wooden bar is changed so that the bar hits the water fewer times each second.

What happens to the frequency of the waves produced?

Tick **one** box.

[1 mark]

Increases ☐

Does not change ☐

Decreases ☐

0 5 . 3 Describe how the wavelength of the water waves in a ripple tank can be measured accurately.

[2 marks]

0 5 . 4 The speed of a wave is calculated using the following equation.

wave speed = frequency × wavelength

The water waves in a ripple tank have a wavelength of 1.2 cm and a frequency of 18.5 Hz.

How does the speed of these water waves compare to the typical speed of a person walking?

[4 marks]

Turn over for the next question

0 6 **Figure 10** shows an incomplete electromagnetic spectrum.

Figure 10

A	**microwaves**	**B**	**C**	**ultraviolet**	**D**	**gamma**

0 6 . 1 What name is given to the group of waves at the position labelled **A** in **Figure 10**?

[1 mark]

Tick **one** box.

infrared ☐

radio ☐

visible light ☐

X-ray ☐

0 6 . 2 Electromagnetic waves have many practical uses.

Draw **one** line from each type of electromagnetic wave to its use.

[3 marks]

Electromagnetic wave	**Use**
	For fibre optic communications
Gamma rays	
	For communicating with a satellite
Microwaves	
	To see security markings
Ultraviolet	
	To sterilise surgical instruments

PMT

0 6 . 3 Complete the sentence.

Use an answer from the box.

[1 mark]

black body	**ionising**	**nuclear**

X-rays can be dangerous to people because X-rays

are ____________________________ radiation.

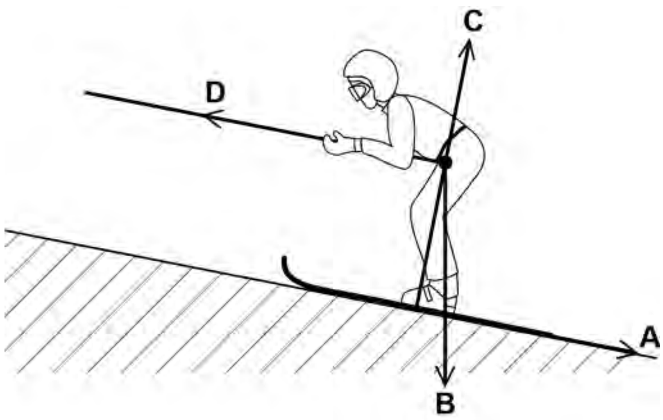
Turn over for the next question

0 7 **Figure 11** shows a skier using a drag lift.

The drag lift pulls the skier from the bottom to the top of a ski slope.

The arrows, **A**, **B**, **C** and **D** represent the forces acting on the skier and her skis.

Figure 11



0 7 . 1 Which arrow represents the force pulling the skier up the slope?

[1 mark]

Tick **one** box.

A ☐

B ☐

C ☐

D ☐

0 7 . 2 Which arrow represents the normal contact force?

[1 mark]

Tick **one** box.

A ☐

B ☐

C ☐

D ☐

0 7 . 3 The drag lift pulls the skier with a constant resultant force of 300N for a distance of 45 m.

Use the following equation to calculate the work done to pull the skier up the slope.

work done = force × distance

[2 marks]

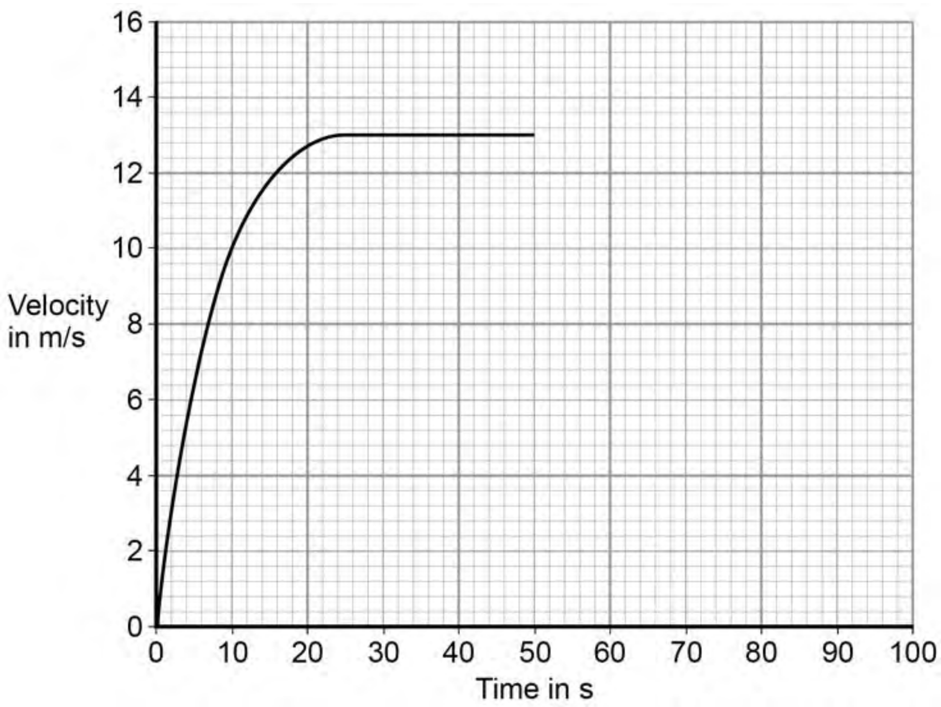
Work done = ________________ J

Question 7 continues on the next page

At the top of the slope the skier leaves the drag lift and skis back to the bottom of the slope.

Figure 13 shows how the velocity of the skier changes with time as the skier moves down the slope.

Figure 13



0 7 . 4 After 50 seconds the skier starts to slow down.

The skier decelerates at a constant rate coming to a stop in 15 seconds.

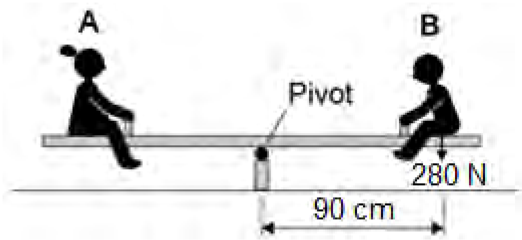
Draw a line on **Figure 13** to show the change in velocity of the skier as she slows down and comes to a stop.

[2 marks]

0 8 Two children, **A** and **B**, are sitting on a see-saw, as shown in **Figure 14**.

The see-saw is balanced.

Figure 14



0 8 . 1 Use the following equation to calculate the moment of child **B** about the pivot of the see-saw.

moment of a force = force x distance

Give your answer in newton-metres

[2 marks]

Moment = ____________________ Nm

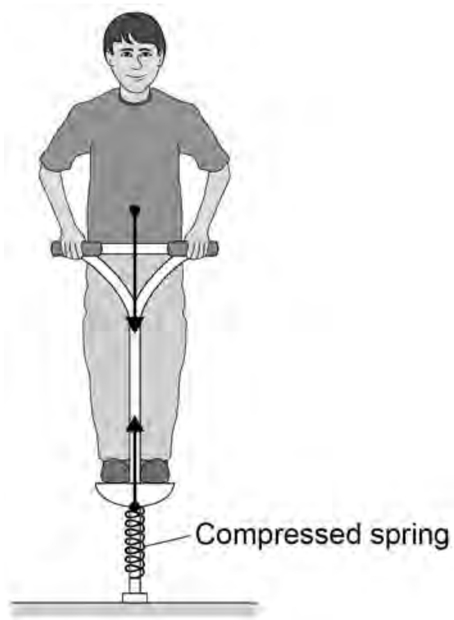
0 8 . 2 Use the idea of moments to explain what happens when child **B** moves closer to the pivot.

[3 marks]

0 9 **Figure 15** shows the forces acting on a child who is balancing on a pogo stick.

The child and pogo stick are not moving.

Figure 15



0 9 . 1 The downward force of the child on the spring is equal to the upward force of the spring on the child.

This is an example of which one of Newton's Laws of motion?

[1 mark]

Tick **one** box.

First Law ☐

Second Law ☐

Third Law ☐

0 9 . 2 Complete the sentence.

Use an answer from the box.

[1 mark]

elastic potential	**gravitational potential**	**kinetic**

The compressed spring stores ________________________ energy.

The child has a weight of 343 N.

Gravitational field strength = 9.8 N/kg

0 9 . 3 Write down the equation which links gravitational field strength, mass and weight.

[1 mark]

0 9 . 4 Calculate the mass of the child.

[3 marks]

Mass = ____________________ kg

The weight of the child causes the spring to compress elastically from a length of 30cm to a new length of 23cm.

0 9 . 5 Write down the equation which links compression, force and spring constant.

[1 mark]

0 9 . 6 Calculate the spring constant of the spring.

Give your answer in newtons per metre.

[4 marks]

Spring constant = ____________________ N/m

1 0 **Figure 16** shows the horizontal forces acting on a car.

Figure 16

1 0 . 1 Which **one** of the statements describes the motion of the car?

[1 mark]

Tick **one** box.

It will be slowing down. ☐

It will be stationary. ☐

It will have a constant speed. ☐

It will be speeding up. ☐

1 0 . 2 During part of the journey the car is driven at a constant speed for five minutes.

Which one of the equations links distance travelled, speed and time?

[1 mark]

Tick **one** box.

distance travelled = speed + time ☐

distance travelled = speed x time ☐

distance travelled = speed – time ☐

distance travelled = speed ÷ time ☐

During a different part of the journey the car accelerates from 9m/s to 18m/s in 6 s.

1 0 . 3 Use the following equation to calculate the acceleration of the car.

$$\text{acceleration} = \frac{\text{change in velocity}}{\text{time taken}}$$

[2 marks]

acceleration = ______________ m/s^2

1 0 . 4 Which equation links acceleration, mass and resultant force?

[1 mark]

Tick **one** box.

resultant force = mass + acceleration ☐

resultant force = mass × acceleration ☐

resultant force = mass - acceleration ☐

resultant force = mass ÷ acceleration ☐

1 0 . 5 The mass of the car is 1120 kg. The mass of the driver is 80 kg.

Calculate the resultant force acting on the car and driver while accelerating.

[2 marks]

Resultant force = ______________ N

1 0 . 6 Calculate the distance travelled while the car is accelerating.

Use the correct equation from the Physics Equation Sheet.

[3 marks]

Distance = ______________ m

PMT

10 . 7 A car driver sees a fallen tree lying across the road ahead and makes an emergency stop.

The braking distance of the car depends on the speed of the car.

For the same braking force, explain what happens to the braking distance if the speed doubles.

You should refer to kinetic energy in your answer.

[4 marks]

1 1

In 1929, the astronomer Edwin Hubble observed that the light from galaxies moving away from the Earth had longer wavelengths than expected.

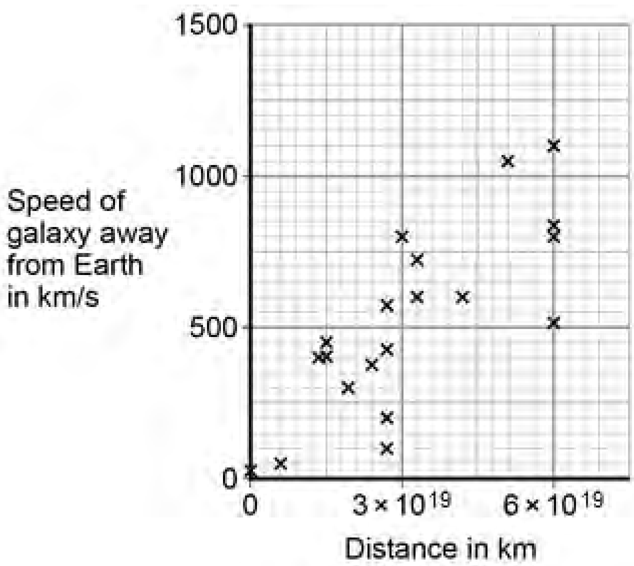
1 1 . 1 What name is given to this effect?

[1 mark]

1 1 . 2 From his observations, Hubble was able to calculate the speed of a galaxy and the distance of the galaxy from the Earth.

Figure 17 shows the results of Hubble's calculations.

Figure 17



What relationship between the speed of a galaxy and the distance is suggested by Hubble's results?

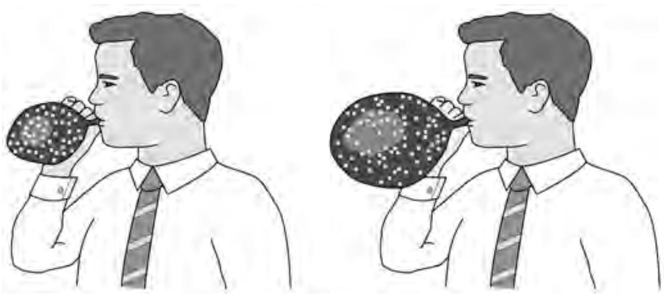
[1 mark]

The observations made by Hubble support the idea that the Universe is expanding. This means that galaxies are continually moving away from each other and from the Earth.

Figure 18 shows a student using a balloon to model the idea of an expanding Universe.

Some dots, which represent galaxies, were marked on the balloon.
The balloon was then inflated.

Figure 18



1 1 . 3 Give **one** strength and **one** weakness of this model in representing the idea of an expanding Universe.

[2 marks]

Strength ____

____

Weakness ____

____

In the 1950s there were two main theories to explain how the Universe began.

Theory 1	The Universe has always existed, it is continually expanding. New galaxies are formed as older galaxies die out.
Theory 2	The Universe began from a very small region that was extremely hot and dense. The Universe has been expanding ever since.

1 1 . 4 In what way do the observations made by Hubble support both Theory 1 and Theory 2?

[1 mark]

1 1 . 5 Most scientists now believe that Theory 2 is correct.

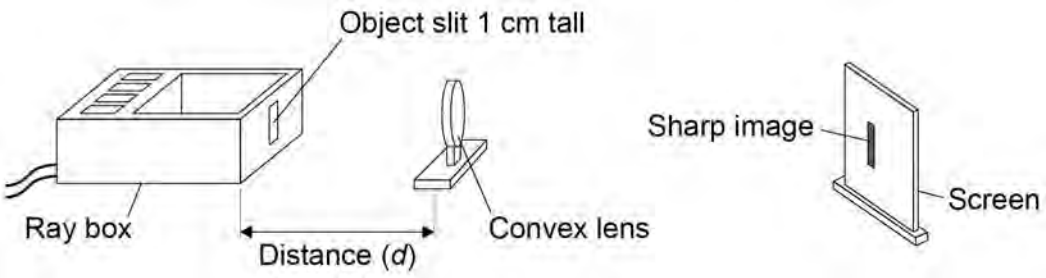
Suggest what is likely to have caused scientists to start thinking Theory 1 is wrong.

[1 mark]

1 2 A student investigated how the magnification produced by a convex lens varies with the distance (*d*) between the object and the lens.

The student used the apparatus shown in **Figure 19**.

Figure 19



1 2 . 1 The student measured the magnification produced by the lens by measuring the image height in centimetres.

Explain why the image height in centimetres was the same as the magnification.

[2 marks]

PMT

The data recorded by the student is given in **Table 4**.

Table 4

Distance between the object and the lens in cm	**Magnification**
25	4.0
30	2.0
40	1.0
50	0.7
60	0.5

1 2 . 2 It would be difficult to obtain accurate magnification values for distances greater than 60 cm.

Suggest **one** change that could be made so that accurate magnification values could be obtained for distances greater than 60 cm.

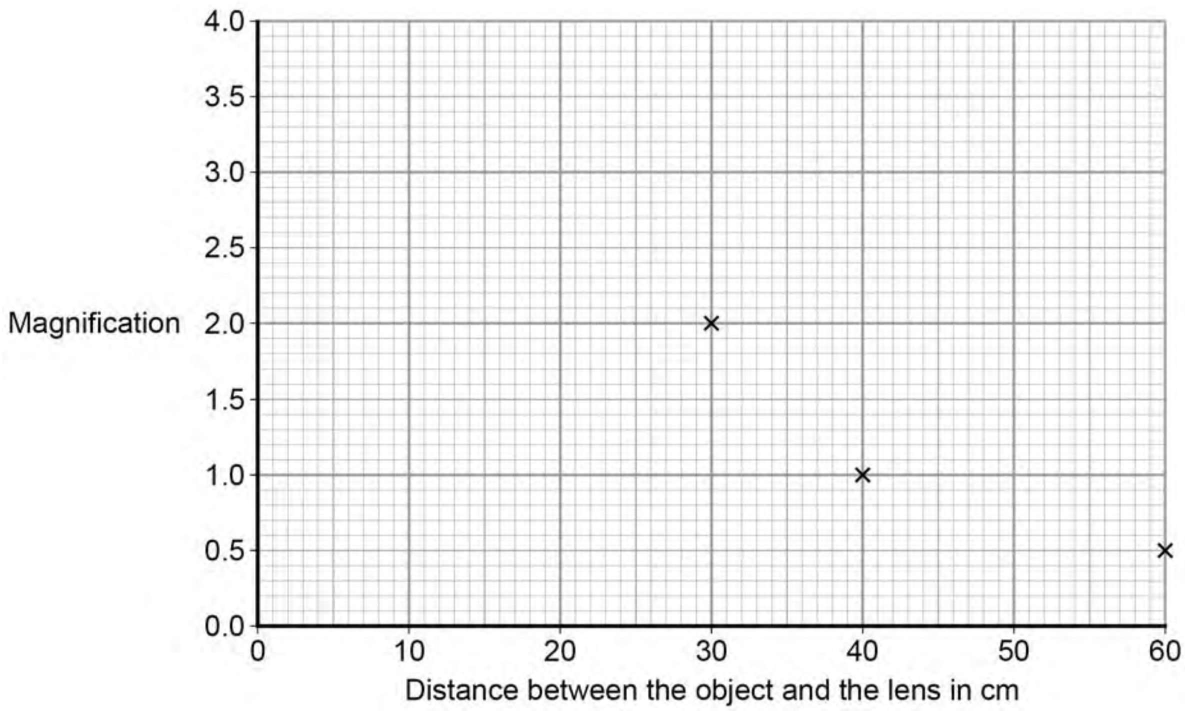
[1 mark]

Question 12 continues on the next page

PMT

The graph in **Figure 20** is incomplete.

Figure 20



1 2 . 3 Complete the graph in **Figure 20** by plotting the missing data and then drawing a line of best fit.

[2 marks]

1 2 . 4 How many times bigger is the image when the object is 35 cm from the lens compared to when the object is 55 cm from the lens?

[2 marks]

PMT

1 2 . 5 During the investigation the student also measured the distance between the lens and the image.

Table 5 gives both of the distances measured and the magnification.

Table 5

Distance between the lens and the image in cm	Distance between the lens and the object in cm	Magnification
100	25	4.0
60	30	2.0
40	40	1.0
33	50	0.7
30	60	0.5

Consider the data in **Table 5**.

Give a second way that the student could have determined the magnification of the object.

Justify your answer with a calculation.

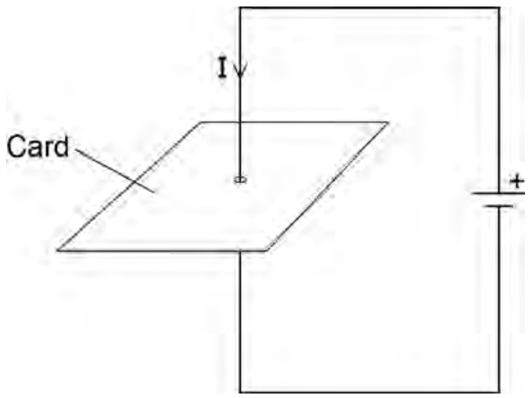
[2 marks]

Turn over for the next question

1 3 **Figure 21** shows a straight wire passing through a piece of card.

A current (I) is passing down through the wire.

Figure 21



1 3 . 1 Describe how you could show that a magnetic field has been produced around the wire.

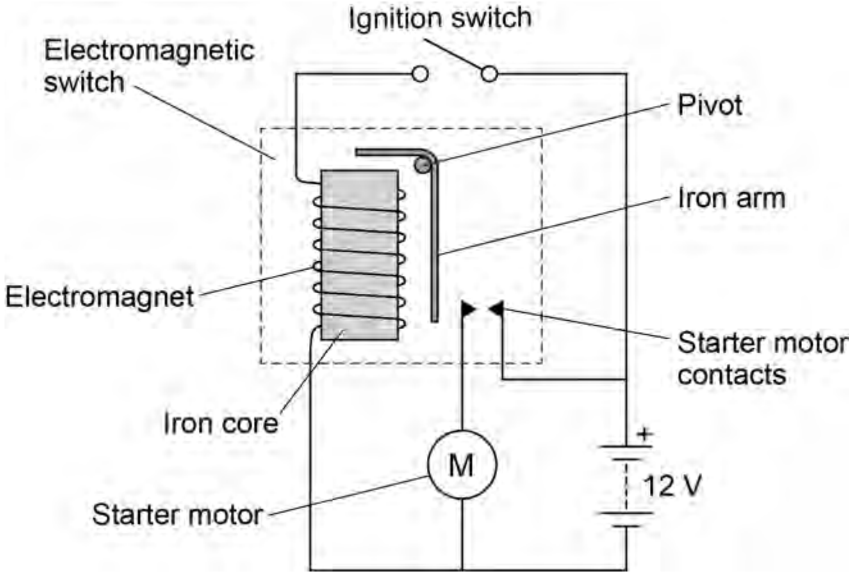
[2 marks]

.

1 3 . 2 **Figure 22** shows the ignition circuit used to switch the starter motor in a car on.

The circuit includes an electromagnetic switch.

Figure 22



Explain how the ignition circuit works.

[4 marks]

1	4

The data given in **Table 6** was obtained from an investigation into the refraction of light at an air to glass boundary.

Table 6

Angle of incidence	**Angle of refraction**
20°	13°
30°	19°
40°	25°
50°	30°

Describe an investigation a student could complete in order to obtain similar data to that given in **Table 6**.

Your answer should consider any cause of inaccuracy in the data.

A labelled diagram may be drawn as part of your answer.

[6 marks]

PMT

END OF QUESTIONS

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