AQA Style

GCSE

PHYSICS

H

Higher Tier Physics Paper 2

Time allowed: 1 hour 45 minutes

Materials

- A ruler
- A pen and pencil
- A calculator

Instructions and Information

- Answer all the questions using a black pen.
- Answer the questions in the space available and cross out any work you do not want to be marked.
- In any calculations make sure you show your working out.
- The marks for each question are shown in brackets.
- The maximum mark for the paper is 100.
- You must make your work as neat as possible and use good English in your answers.
- You should make sure you leave time to check your answers.

Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
Total	

Name _____

Date _____

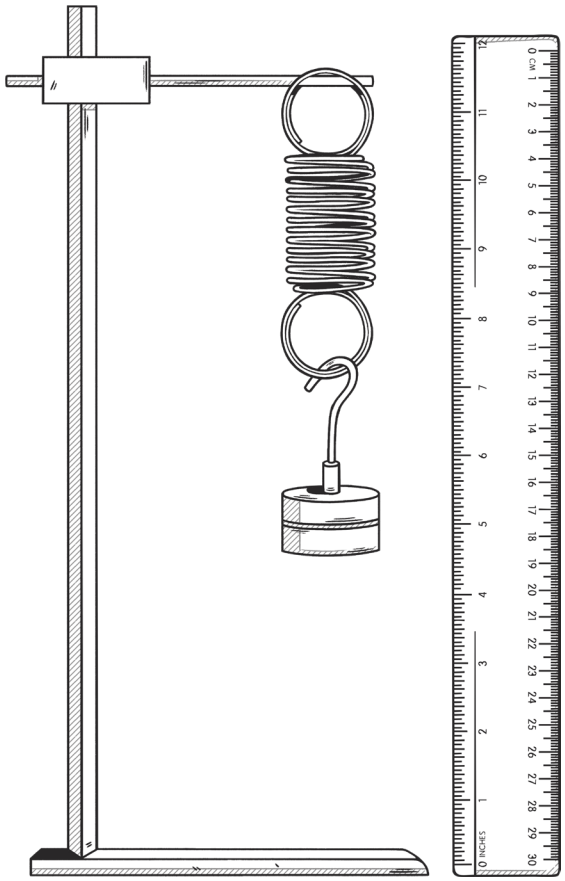
BEYOND SCIENCE

0 1 A student investigated the behaviour of springs using the method below.

1. Suspend a spring from a clamp stand.
2. Measure the length of the spring.
3. Apply a force to the spring by attaching a 100g mass hanger to the spring.
4. Measure the extension of the spring.
5. Add a 100g mass to the mass hanger and measure the new extension of the spring.
6. Repeat step 5 another three times.

Figure 1 shows the equipment used in the investigation.

Figure 1



0 1 . 1 Write down the independent variable in this investigation.

[1 mark]

0 1 . 2 Give **one** control variable in this investigation.

[1 mark]

0 1 . 3 Each 100g mass provided 1N of force on the spring.

A second student's results are shown in **Table 1**.

Table 1

Force (N)	Extension (cm)			Mean Extension (cm)
	Repeat 1	Repeat 2	Repeat 3	
1	2.1	2.1	2.2	2.1
2	4.0	4.1	4.0	4.0
3	6.0	12.0	6.0	8.0
4	8.1	7.9	8.0	8.0
5	10.0	10.2	10.2	

Calculate the mean extension at 5N.

Write your answer to an appropriate number of significant figures.

[2 marks]

mean extension = _____ cm

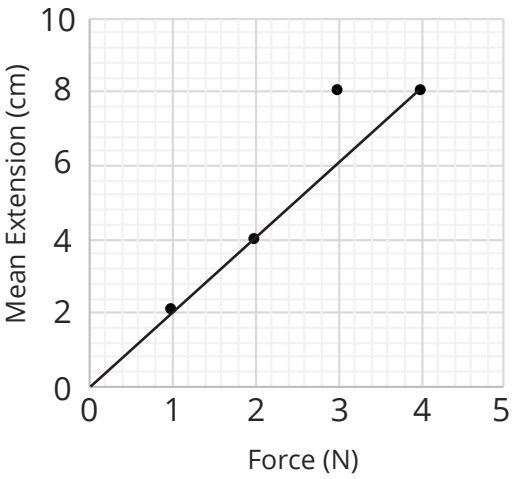
0 1 . 4 One of the results in **Table 1** was anomalous.

Suggest how the anomalous result may have occurred.

[1 mark]

0 1 . 5 The student plotted a graph of their results and drew a line of best fit. The graph is shown in **Figure 2**.

Figure 2



Complete the sentence to describe the relationship between the extension of the spring and the force applied.

[1 mark]

The extension of the spring is _____ to the force applied.

0 1 . 6 Write down the equation that links extension, force and spring constant.

[1 mark]

_____

0 1 . 7 Calculate the spring constant of the spring used by the student.

Use a force of 2N and an extension of 0.04m.

[3 marks]

_____

_____

_____

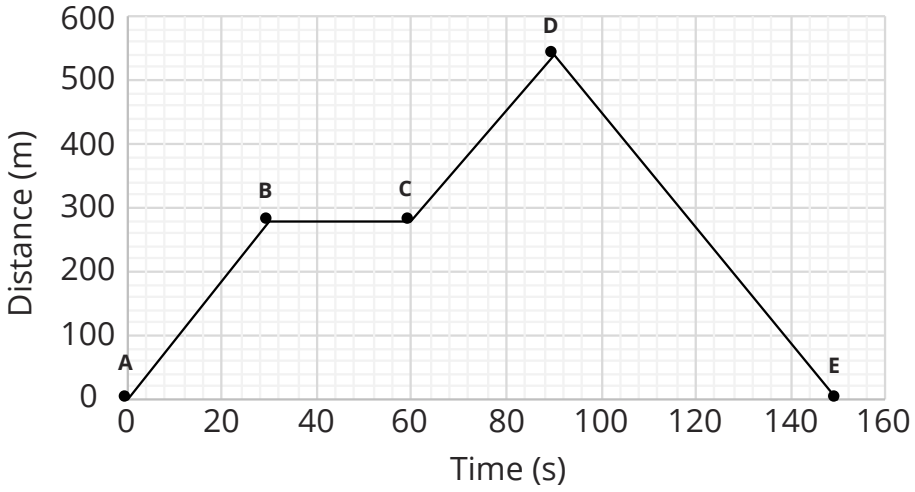
_____

spring constant = _____ N/m

10

0 2 **Figure 3** shows a distance-time graph for the journey made by a car.

Figure 3



0 2 . 1 Describe what **Figure 3** shows about the motion of the car between points **A** and **E**.

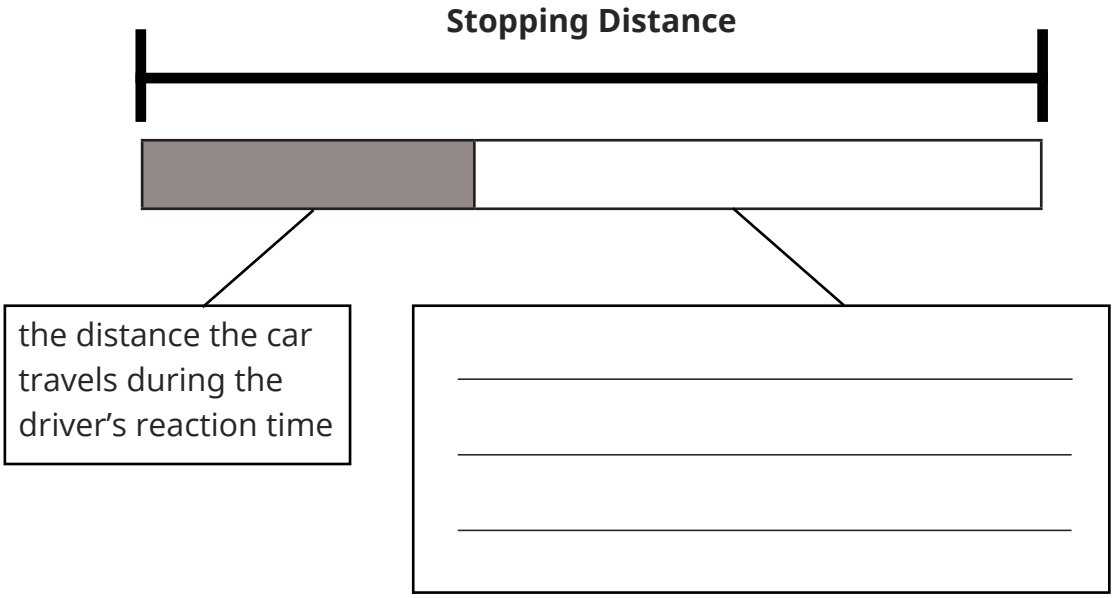
You should refer to data from **Figure 3** in your answer.

[4 marks]

0 2 . 2 A car is travelling at constant speed. When the driver applies the brakes, the car slows down and stops.

Figure 4 shows the two different sections that make up the total stopping distance of the car.

Figure 4



Complete **Figure 4** by labelling the second part of the stopping distance.

[1 mark]

0 2 . 3 Give **two** factors that could affect the distance the car travels during the driver's reaction time.

[2 marks]

1. _____

_____

2. _____

_____

0 2 . 4 When the driver applies the brakes, the car decelerates.

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

[1 mark]

_____

0 2 . 5 Before the driver applies the brakes, the car is travelling at a speed of 17m/s. It takes 3.4s for the car to come to a complete stop.

Calculate the deceleration of the car between the driver first applying the brakes and the car coming to a complete stop.

[2 marks]

_____

_____

_____

_____

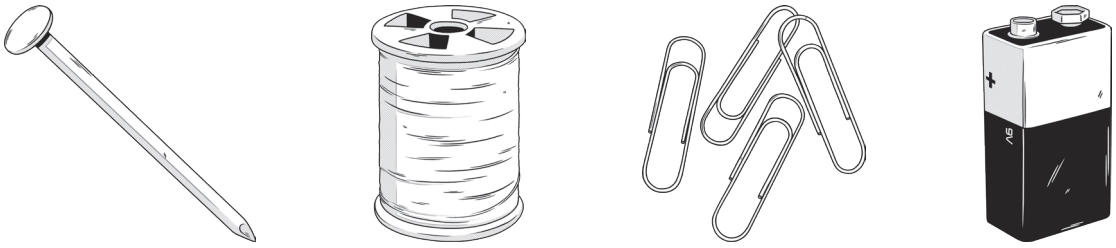
_____

deceleration = _____ m/s^2

10

0 3 Some students want to find out how the number of coils affects the strength of an electromagnet. **Figure 5** shows some equipment that could be used in this investigation.

Figure 5



nail | insulated copper wire | paper clips | power supply

0 3 . 1 Describe a method you could use to investigate how the number of coils affects the strength of an electromagnet.

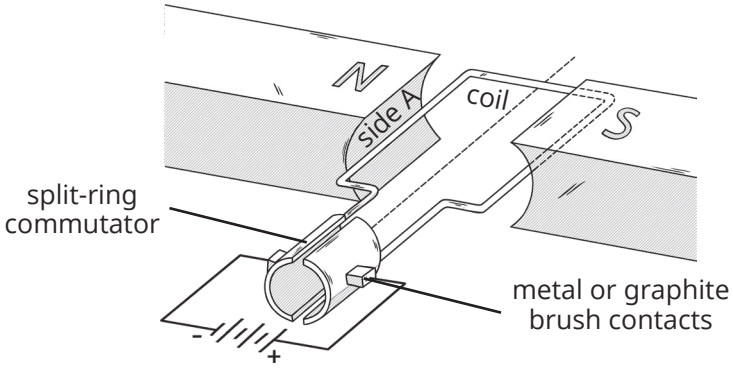
You should include:

- how you would make an electromagnet from the equipment;
- how you would use the equipment to carry out the investigation;
- how you would make sure your results are valid.

[6 marks]

0 3 . 2 **Figure 6** shows a single coil of wire in a magnetic field.

Figure 6



When a current passes through the wire, the coil spins.

Give the name of this effect.

[1 mark]

0 3 . 3 Give the direction in which **side A** of the coil moves when a current flows.

[1 mark]

0 3 . 4 Suggest **one** change to the system that would make the coil spin in the opposite direction.

[1 mark]

0 3 . 5 Suggest **two** changes to the system that would make the coil spin at a greater speed.

[2 marks]

1.

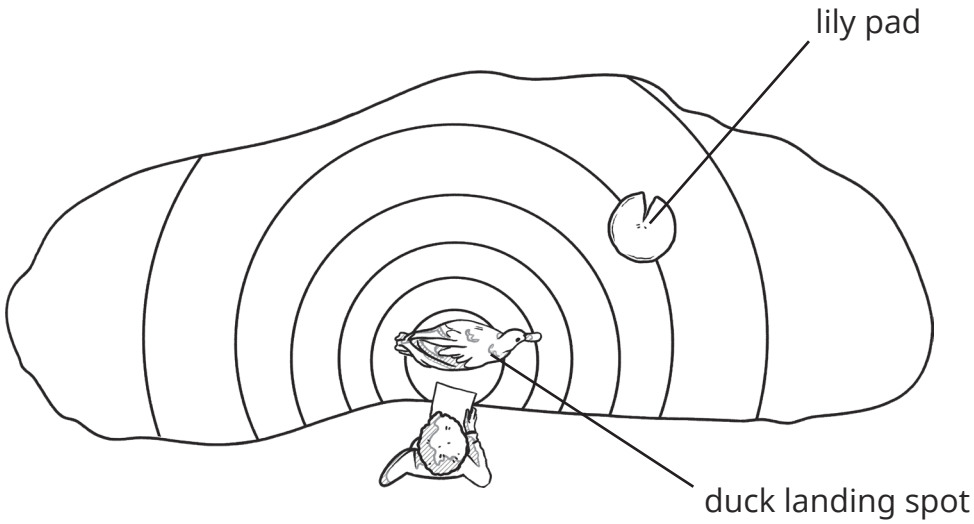
2.

11

0 4 A scientist is observing some ducks on a lake.

The lake is shown in **Figure 7**.

Figure 7



When a duck lands on the water, it makes a sound and causes ripples on the surface of the water.

0 4 . 1 Sound is transmitted by a longitudinal wave.

The ripples caused by the duck landing on the water are transverse waves.

Describe the difference between transverse and longitudinal waves.

[2 marks]

0 4 . 2 The ripples cause a lily pad on the lake to move up and down.

The scientist concludes that it is the wave, not the water itself, that travels out from the impact site.

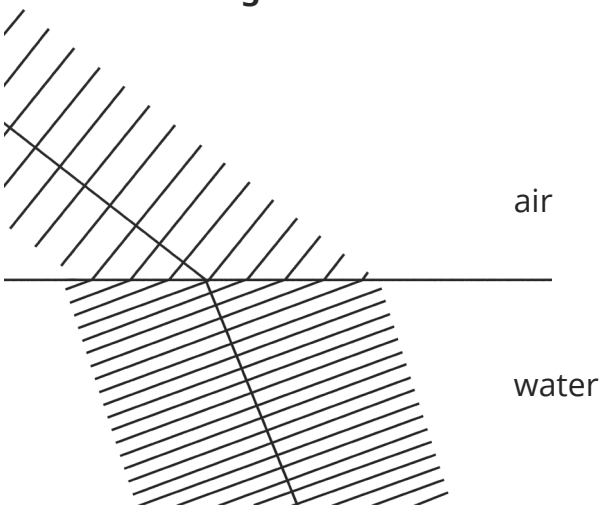
Explain whether the scientist's conclusion is correct.

[3 marks]

Question 4 continues on the next page.

0 4 . 3 Light waves travel from the air into the pond water. **Figure 8** shows how light is refracted as it passes from the air to the water.

Figure 8



Explain why the wave front appears different in the water compared to the air.

[3 marks]

0 4 . 4 The scientist cannot see the bottom of the lake. She uses an echo sounder to measure the depth of the lake.

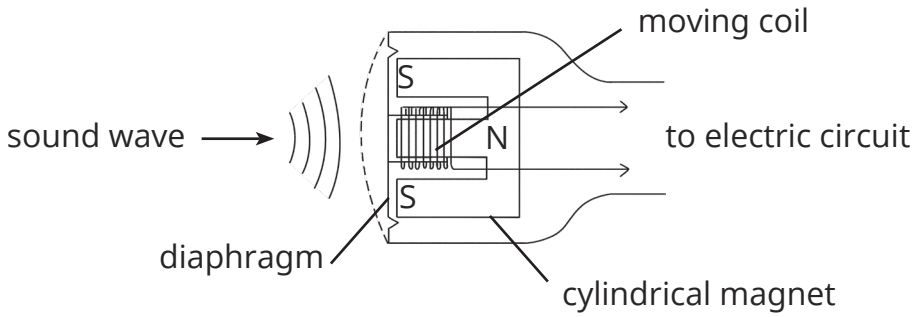
One part of the echo sounder is called a transducer.

The transducer converts changes in electrical pulses into sound waves.

The transducer also acts as a microphone.

Figure 9 shows a diagram of a moving coil microphone

Figure 9



Explain how the moving coil microphone works.

[4 marks]

0 4 . 5 The speed of sound through the water is 1500m/s.

The echo sounder records a time of 0.056s.

Calculate the depth of the pond.

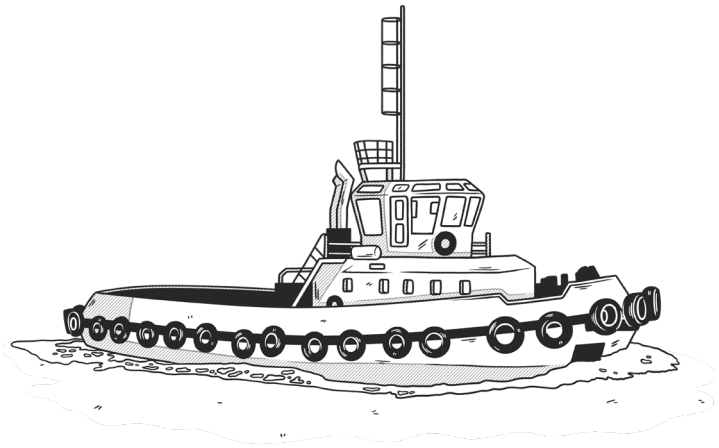
[3 marks]

depth = _____ m

15

0 5 **Figure 10** shows a tugboat moving at a constant speed.

Figure 10



The weight of the tugboat is 24 000N.

The thrust force caused by the propeller is 15 000N.

0 5 . 1 Describe the other forces acting on the tugboat when it is moving at a constant speed.

[4 marks]

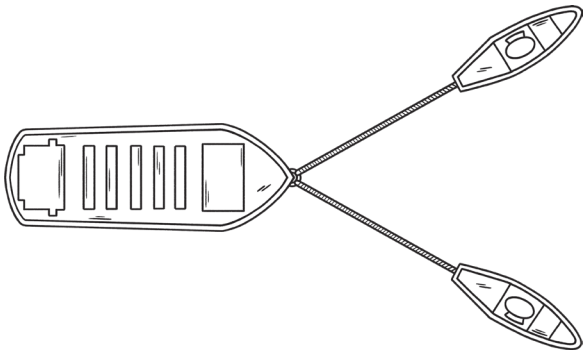
0 5 . 2 The tugboat slows down as it approaches a ship.

Draw and label a free body diagram to show the forces acting on the tugboat as it slows down.

[3 marks]

0 5 . 3 **Figure 11** shows two tugboats pulling the ship into the harbour.

Figure 11



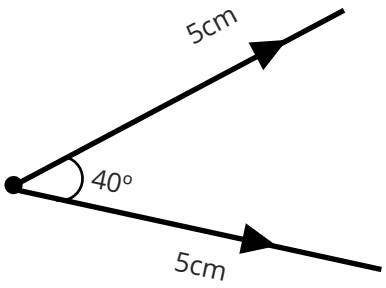
Each tugboat exerts a force of 100 000N.
The angle between the two forces is 40°.

Complete the vector diagram in **Figure 12** to determine the resultant of both forces.

[2 marks]

1cm = 20 000N

Figure 12



resultant force = _____ N

9

0 6 **Figure 13** shows the waves that form the electromagnetic spectrum.

Figure 13

gamma rays	x-rays	A	visible light	infrared	B	radio waves

Two electromagnetic waves are missing from **Figure 13**. Their positions are labelled **A** and **B**.

0 6 . 1 Give the name of the type of electromagnetic wave at position **A**.

[1 mark]

_____

0 6 . 2 Give the name of the type of electromagnetic wave at position **B**.

[1 mark]

_____

0 6 . 3 Complete the sentences.

[2 marks]

The type of electromagnetic wave with the longest wavelength is

_____.

The type of electromagnetic wave with the highest frequency is

_____ .

0 6 . 4 X-ray therapy is used to destroy cancerous tumours. X-rays used for medical imaging carry less energy than those used in x-ray therapy.

Explain why low-energy x-rays are suitable for medical imaging.

[3 marks]

_____

_____

_____

_____

_____

0 6 . 5 Electromagnetic waves travel at a speed of 300 000 000m/s.

A radio station transmits waves with a wavelength of 20 metres.

Calculate the frequency of the waves.

Give the unit.

[3 marks]

frequency = _____ unit _____

0 6 . 6 The radio waves are absorbed by an aerial.

Describe how this produces signals in the electrical circuit of the radio.

[2 marks]

12

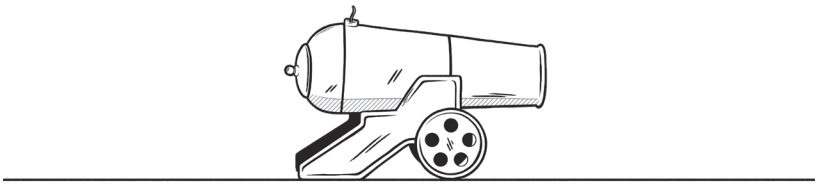
0 7 **Figure 14** shows a cannon before and after it is fired.

Before it is fired, the cannon is stationary.

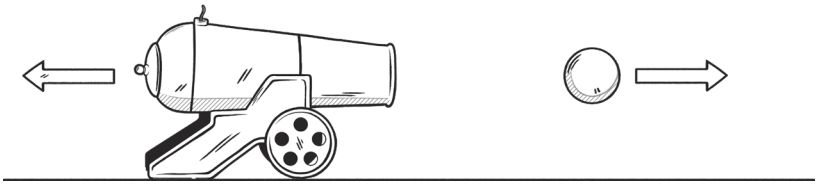
When the cannonball is fired, the cannon moves backwards.

Figure 14

Before



After



The arrows show the direction of movement of the cannon and the cannonball.

0 7 . 1 Explain why the cannon moves backwards.

[3 marks]

0 7 . 2 The mass of the cannon is 1500kg. The mass of the cannonball is 10kg.

The cannonball moves forward at a velocity of 67.5m/s.

Calculate the velocity at which the cannon moves backwards.

[3 marks]

velocity = _____m/s

6

0 8 The Sun is a star at the centre of our solar system.

0 8 . 1 A star is an example of a black body.

Give **one** property of a perfect black body.

[1 mark]

0 8 . 2 The Sun is a main sequence star. This is the stable period of its life cycle.

Explain why a main sequence star remains stable.

[2 marks]

0 8 . 3 **Table 2** shows data about different main sequence stars.

Table 2

Type of Star	Temperature (°C)	Radius (km)
A5	8500	1 183 778
B0	28 000	5 152 916
G2	5800	696 340
G3	5700	731 157
K5	4100	487 438
M8	2400	208 902
O5	40 000	12 394 852

Name the type of star in **Table 2** that gives out the highest intensity of infrared radiation. Give a reason for your answer.

[2 marks]

0 8 . 4 The Sun is a G2 star. A G3 star is about the same size as the Sun.

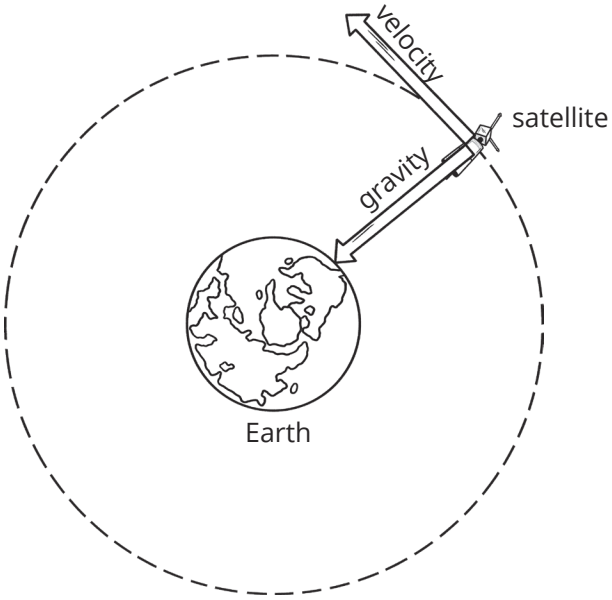
Describe, in as much detail as you can, the life cycle of star G3.

[6 marks]

0 8 . 5 The Earth orbits the sun.
There are artificial satellites that orbit the Earth.

Figure 15 shows the circular orbit of a satellite around Earth.

Figure 15

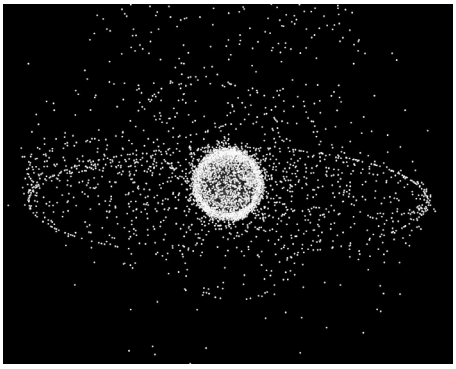


Explain why the velocity of the satellite changes as it orbits the Earth.

[3 marks]

0 8 . 6 **Figure 16** shows a ring of objects in geostationary orbit 35 786km above Earth's equator.

Figure 16



Geostationary satellites travel in the same direction and at the same rate as the rotation of the Earth. This means that they always appear above the same point on the Earth.

Explain why the satellites are all equal in distance from the Earth's surface.

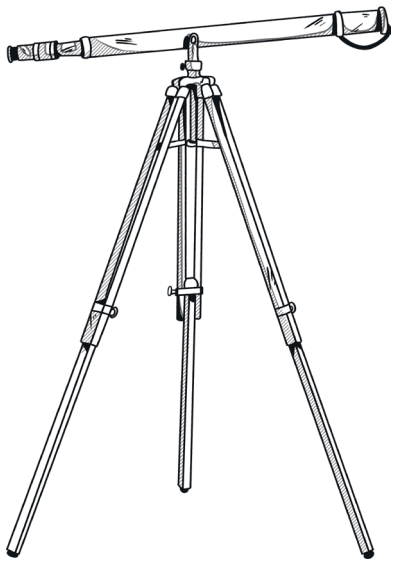
[3 marks]

17

0 9 A telescope can be used to observe faraway objects.

The telescope in **Figure 17** is positioned on a stand.

Figure 17



The stand acts as a pivot so that the telescope can be moved to view different parts of the sky.

An astronomer holds the telescope 16cm from the pivot and applies a force of 3N to turn the telescope.

0 9 . 1 Calculate the moment of the force.

[3 marks]

_____

_____

_____

_____

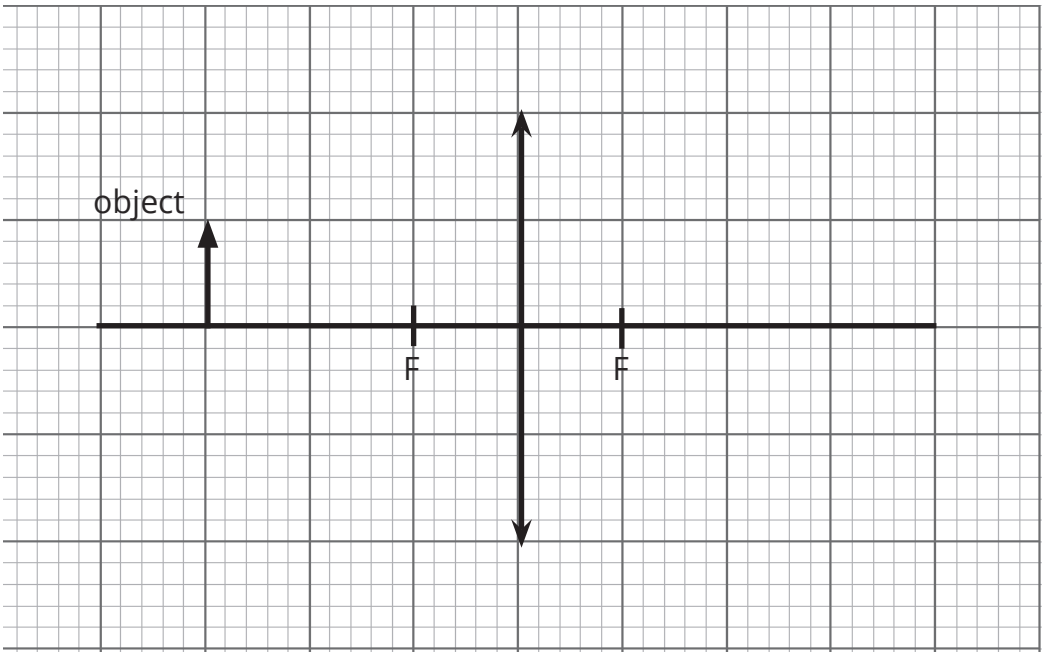
moment = _____ Nm

0 9 . 2 Early telescopes used convex lenses.

Complete the ray diagram in **Figure 18** to show how a convex lens produces an image of an object.

[4 marks]

Figure 18



0 9 . 3 Compare the image produced by a convex lens with the image produced by a concave lens.

[3 marks]

10