Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2019

GCSE Physics

Unit 1

Foundation Tier

GPY11

[GPY11]

THURSDAY 30 MAY, AFTERNOON

TIME

1 hour 15 minutes.

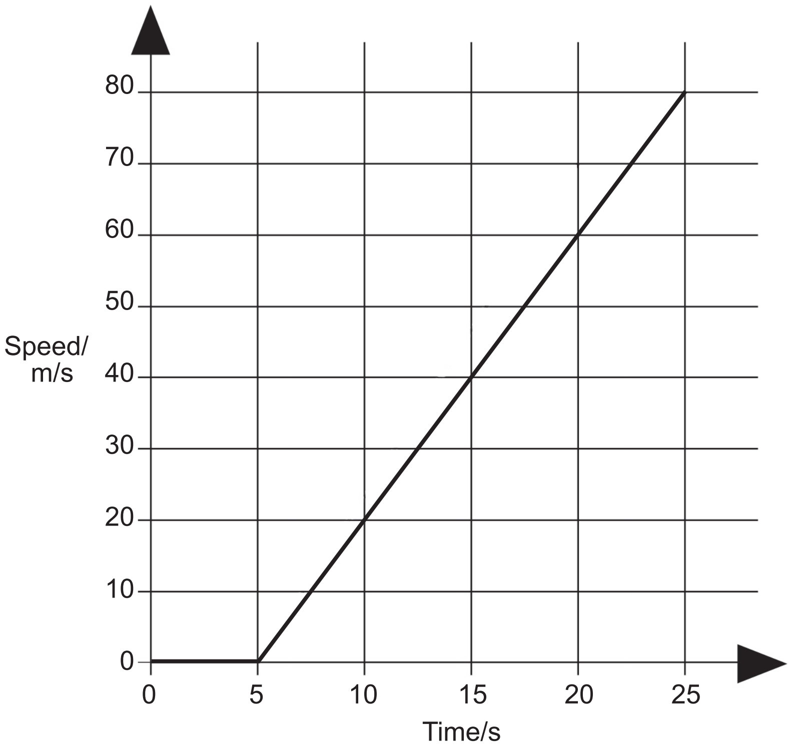
INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
You must answer the questions in the spaces provided.
Do not write outside the boxed area on each page or on blank pages.
Complete in black ink only. **Do not write with a gel pen.**
Answer **all** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 80.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Quality of written communication will be assessed in Question **1(c)**.

1 (a) A jet aircraft requires a speed of 80 m/s for a successful take-off. The speed–time graph below represents its motion on the runway until take off.



(i) Which statement below best describes the motion of the jet?

1. Constant speed for 25 seconds.

2. Constant rate of change of speed (acceleration) for 25 seconds.

3. No motion for 5 seconds followed by constant rate of change of speed (acceleration) for 20 seconds.

4. No motion for 5 seconds followed by constant speed for 20 seconds.

Statement __________ [1]

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(ii) Using the graph, or otherwise, calculate the rate of change of speed (acceleration) of the jet during take-off.
Show clearly how you get your answer, starting with the equation you plan to use.
Remember to include a unit with your answer.

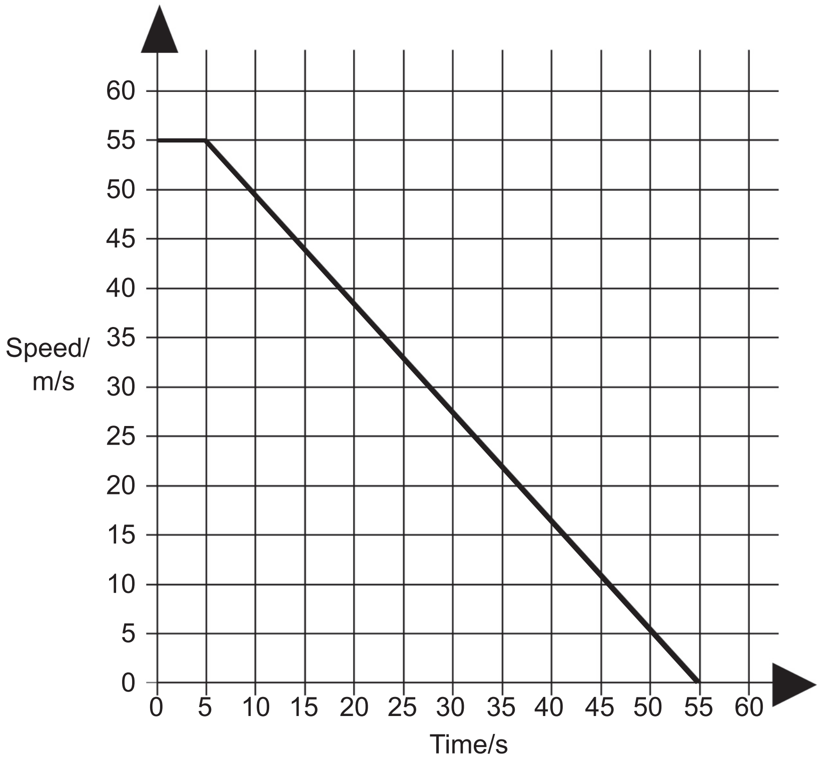
Rate of change of speed (acceleration) = _______________________ [4]

(iii) The total take-off mass of the jet was 89 000 kg. Using your answer to part **(ii)** above, calculate the resultant forward force provided by the engines.
Show clearly how you get your answer, starting with the equation you plan to use.
Remember to include a unit with your answer.

Resultant forward force = _______________________ [4]

[Turn over

(b) On reaching its destination, the jet had a touchdown velocity of 55 m/s. The speed–time graph below represents its motion in coming to a stop on the runway. The aircraft touches down at time = 0.



Using the graph above, calculate the length of runway used by the jet in coming to a stop.
Give your answer in kilometres.
Show clearly how you get your answer, starting with the equation you plan to use.

Length of runway used = ______________________ km [5]

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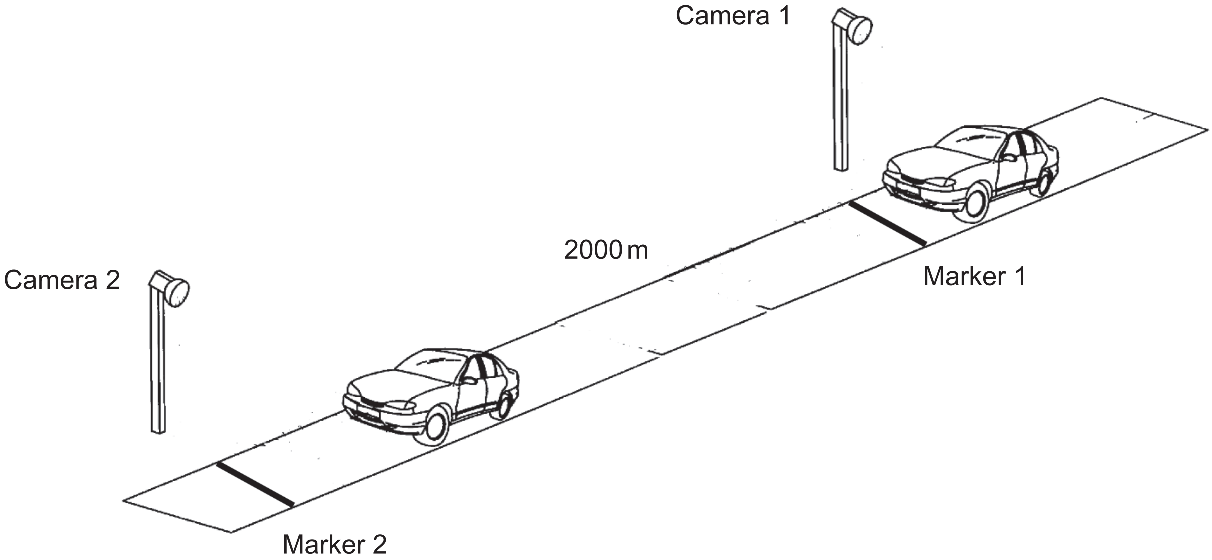
(Questions continue overleaf)

(c) Excessive speed frequently plays a major role in traffic accidents. Average speed cameras are used to detect and prosecute speeding motorists. The diagram below represents the layout of such a system.



Source: Principal Examiner

Average speed cameras operate as a pair. Camera 1 is the entry camera. It films the number plate of the car as it enters the control zone and passes marker 1. When the car leaves the zone, at marker 2, the exit camera, camera 2, also films the car and its number plate.

The speed is calculated and if the car is over the speed limit the evidence is passed to the police. In the system shown above the cameras are 2000 m apart.

Describe how the system works.
In your answer you should explain the following points:

- apart from photographing the number plate of the car, what happens when the car passes marker 1 and then marker 2
- what measurement indicates excessive speed
- how the average speed is calculated
- why the number plate of the car is recorded
- why a short period of excessive speed between the cameras may not be detected by this system.

In this question, you will be assessed on your written communication skills including the use of specialist scientific terms.

What happens at marker 1 and marker 2 ______________________________

What indicates excessive speed ______________________________

Calculation of average speed ______________________________

Number plate recording ______________________________

Short period of excessive speed between the cameras ______________________________

[6]

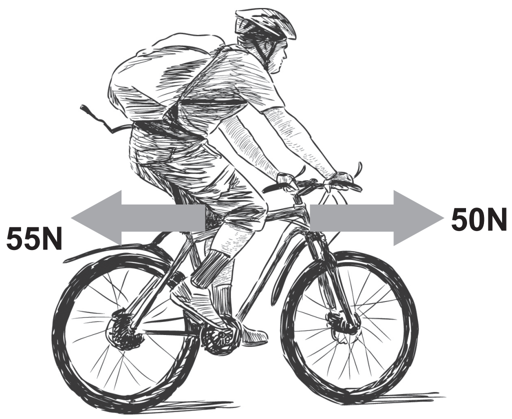
2 **(a)** **(i)** State Newton's First Law of Motion.

____

____

____ [2]

(ii) Calculate the resultant of the forces acting on the cyclist and state its direction.



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Resultant = __________ N

Direction ________________ [2]

(iii) Is the case of the cyclist above an example of Newton's First Law? Explain your answer.

____

____

____ [1]

(b) **(i)** Complete the following sentences using words listed in the box.

The weight of an object is the ______________ on the object due to gravity.

The __________ of an object is defined as the amount of __________ in an object and is measured in __________

Force	*Kilograms*	*Mass*	*Volume*	*Density*	*Length*	*Matter*

[4]

(ii) State the weight of an object of mass 1.0 kg.

Weight = ____________________ N [1]

(iii) Two objects of the **same size** and shape, one of mass 1.0 kg and the other of mass 2.0 kg, are dropped at the same time from the same height. Which one of the statements below is correct? Tick the appropriate box.

The two objects take the same time to reach the ground. ☐

The 1.0 kg object reaches the ground first. ☐

The 2.0 kg object reaches the ground first. ☐

Explain your answer.

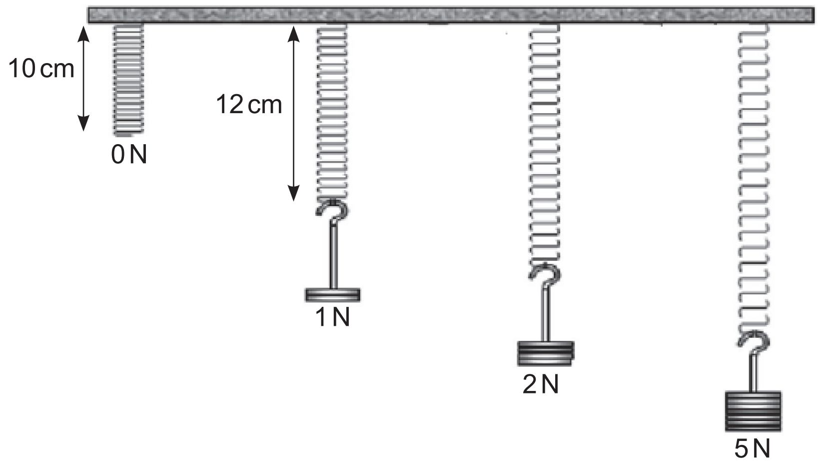
____

____

____

____ [2]

(c) Four identical springs are suspended from a beam and various weights are added as shown in the diagram below.



Source: Chief Examiner

Using the information from the diagram, calculate the following.

(i) The extension of the spring with a force of 2 N attached.

Extension = ____________ cm [1]

(ii) The **total length** of the spring when a force of 5 N is attached.

Total length = ____________ [2]

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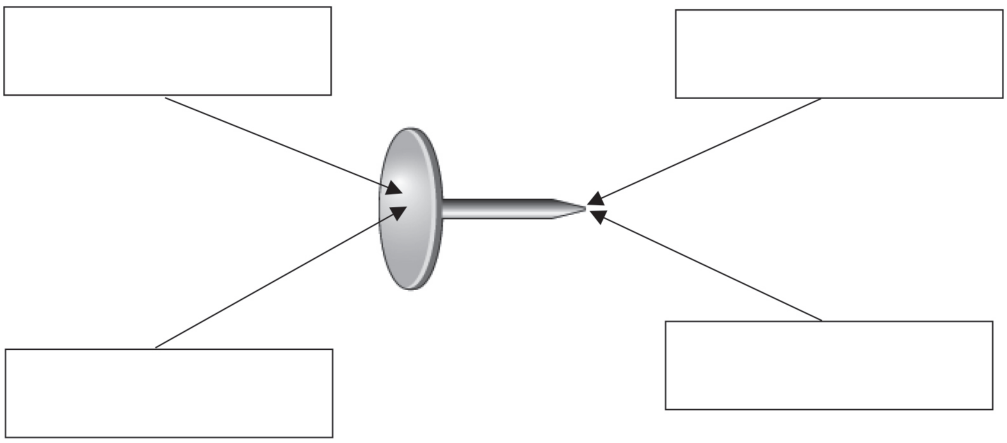
(d) (i) A man weighs 700 N and is standing on the ground.
The total area in contact with the ground is $0.05\,m^2$.
Calculate the pressure he exerts on the ground.
Show clearly how you get your answer, starting with the equation you plan to use.

Pressure = ____________________ Pa [3]

(ii) Drawing pins are used to fix drawings to noticeboards.
They are an example of how a force can produce a low pressure and a high pressure.
Using the words below, write the appropriate words in the boxes provided. [2]

Low pressure *Small area* *Large area* *High pressure*



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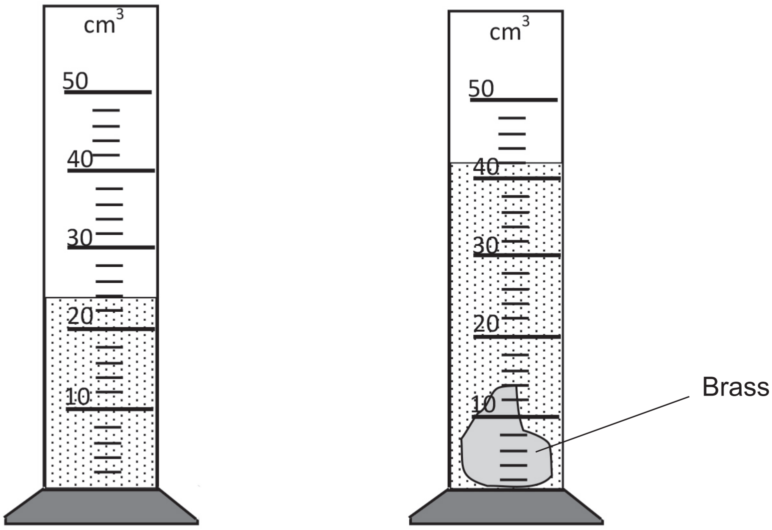
[Turn over

3 **(a)** State the equation used to calculate the density of a substance.

Density =

[1]

(b) To find the density of an irregular-shaped piece of brass, its mass was measured and found to be 153 g.
The piece of brass was then added to some water in a measuring cylinder as shown in the diagram below.



Source: Principal Examiner

(i) What is the volume of the piece of brass?

Volume = ____________ cm^3 [2]

(ii) Calculate the density of brass.
Show clearly how you get your answer, starting with the equation you plan to use.

Density = ____________ g/cm^3 [2]

(iii) State one precaution that the student should have made when doing the experiment to ensure an accurate value for the density.

____

____ [1]

(iv) Aluminium has a density which is less than that of brass.
Would a mass of 153 g of aluminium have a volume which is smaller than, larger than or the same as 153 g of brass?

Volume would be ________________ [1]

(c) (i) Lead has a density of 11.3 g/cm^3 but air has a density of 0.0013 g/cm^3.
Use the kinetic theory of matter to explain why the difference in the density of lead and air is so large.

____

____

____

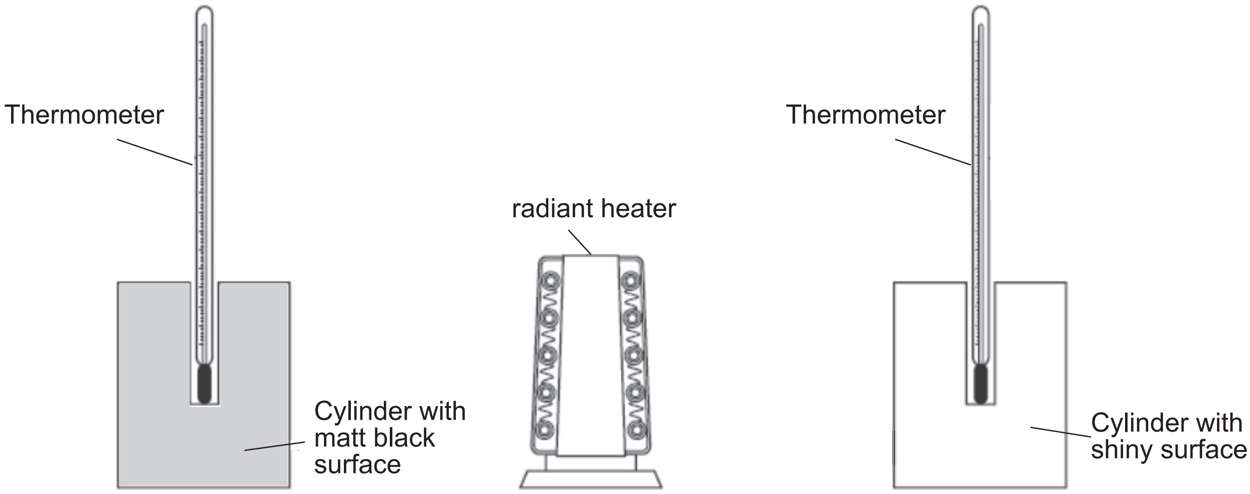
____

____ [2]

(ii) The density of ice is 0.9 g/cm^3 and the density of water is 1.0 g/cm^3.
What does this tell you about average separation of the molecules in ice compared with water?

____ [1]

4 **(a)** The nature of the surfaces of materials was investigated in a laboratory to find their effect on heat absorption. Two copper cylinders, identical in shape and size, with a thermometer in each were used. One cylinder had a matt black surface while the other had a shiny surface, as shown in the diagram below.



Source: CCEA

An electrical radiant heater was placed the same distance from each cylinder. After a time, the two thermometers showed different readings.

Which thermometer shows the higher reading?
Explain why.

____

____

____ [2]

(b) Heat loss through the walls of a house is often because of conduction and convection.

(i) What might a householder do to reduce heat loss through the walls?

____ [1]

(ii) What material would the householder use for this purpose?

____ [1]

(c) A fork lift truck raises a load of 500 N vertically to a height of 3 m.

(i) Calculate the work done in lifting the load.
Show clearly how you get your answer, starting with the equation you plan to use.

Work done = ______________ J [3]

(ii) The efficiency of this fork lift truck is 0.7.
How much energy does the truck require to do 2730 J of work?
Show clearly how you get your answer, starting with the equation you plan to use.

Energy required = ______________ J [4]

(iii) The owner of the fork lift truck is considering replacing it with another one. The truck being considered can do 2800 J of work in 3.5 s. Calculate the power of the new truck.
Show clearly how you get your answer, starting with the equation you plan to use.

Power = _______________ W [3]

(d) When a cricket ball is struck by a bat it is momentarily compressed.

(i) What type of energy is gained by the ball as it is being compressed?

_______________ [1]

(ii) In one match, the kinetic energy of the moving ball is 75 J.
The mass of the cricket ball is 0.2 kg.
Calculate the speed of the ball.
Show clearly how you get your answer, starting with the equation you plan to use.

Speed = _______________ m/s [5]

[Turn over

5 (a) A student reads in a textbook:

"Some nuclei are unstable and disintegrate randomly, spontaneously emitting alpha, beta or gamma radiation"

(i) What is meant by saying the disintegration is random?

____

____ [1]

(ii) What do physicists call such random, spontaneous disintegration of atomic nuclei?

____ [1]

(iii) The table below gives the details of alpha, beta and gamma radiations.
Identify each from the details given.
Write your answers in the spaces provided.

Details	Name of the radiation
High energy electromagnetic wave	
A helium nucleus consisting of two protons and two neutrons	
A high speed electron	

[3]

(b) Iodine-131 emits beta radiation and has a half-life of 8 hours. Shortly after a nuclear accident, spinach plants were highly radioactive because they absorbed iodine-131.

A sample of spinach leaves had an activity of 2096 counts per second (cps) before correcting for background activity. Background activity was 48 cps.

(i) What does it mean that the half-life of iodine-131 is 8 hours?

____

____ [1]

(ii) What was the activity of the spinach leaves after correcting for background activity?

__________ cps [1]

(iii) Calculate the corrected count rate of the spinach leaves after 24 hours.

Corrected count rate after 24 hours = __________ cps [3]

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Question Number	Marks
1	
2	
3	
4	
5	

Total Marks	

Examiner Number

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