Adabistan-e-Soophia

General Certificate of Education Ordinary Level 3 **(Test 1)**

.Adabistan-e-Soophia
School for Boys & Girls

CANDIDATE NAME	

CENTER NUMBER						CANDIDATE NUMBER						

Physics **5054/21**

Session	2	0	2	0	-	2	**1**			
Time	**1**	**2**	**0**	m	i	n	u	t	e	s
Marks	**7**	**5**								

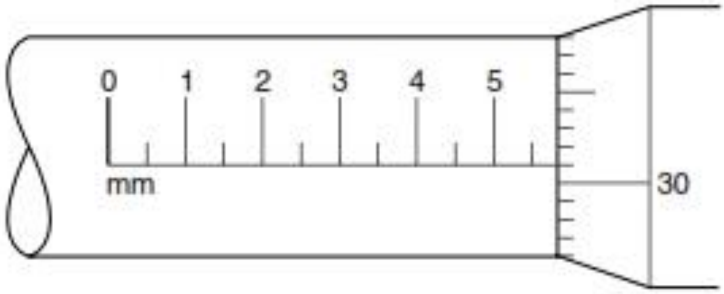
Additional Materials: *Answer Booklet/Paper*

READ THESE INSTRUCTIONS FIRST

1. Write in soft pencil.
2. Do not use staples, paper clips, highlighters, glue or correction fluid.
3. Write your name, Centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.
4. There are **Forty** questions on this paper. Answer **all** questions.
   For each question there are four possible answers **A, B, C** and **D**.
5. Choose the one you consider correct and record your choice in **soft pencil** on the **separate** Answer Sheet.
6. Read the instructions on the Answer Sheet very carefully.
7. Each correct answer will score one mark. A mark will not be deducted for a wrong answer. Any rough working should be done in this booklet.

MCQ Section : [Total 20 Marks]

1 The diagram shows part of a micrometer screw gauge.



What is the reading shown?

A 5.31 mm **B** 5.79 mm **C** 5.81 mm **D** 6.31 mm

2 Which property of a body is affected by a change in gravitational field?

A mass
B temperature
C volume
D weight

3 A stone of mass of 12 g and having a density of 3 g/cm^3 is carefully lowered into 25 cm^3 of water in a measuring cylinder.

What is the new reading on the measuring cylinder?

A 21 cm^3 **B** 28 cm^3 **C** 29 cm^3 **D** 37 cm^3

4 Which property of a solid object **cannot** be changed by the application of a force?

A length
B mass
C shape
D speed

5 Why does an object falling in the Earth's gravitational field reach a steady velocity?

A Air resistance increases with increase of velocity.

B The Earth's gravitational field decreases as the object falls.

C The mass of the object remains constant.

D The weight of the object increases as it falls.

6 The gravitational field strength on the surface of the Moon is 1.6 N/kg.

Which values of mass and weight are correct for an object placed on the Moon's surface?

	mass / kg	weight / N
A	10	1.6
B	10	16
C	16	10
D	16	160

7 Which set of equipment could be used in an experiment to determine the density of an irregularly shaped pebble?

A mass balance and measuring cylinder

B mass balance and micrometer

C measuring cylinder and vernier calipers

D newton-meter and vernier calipers

8 A ball falls freely (with no air resistance) near the surface of the Earth.

Which quantity remains constant?

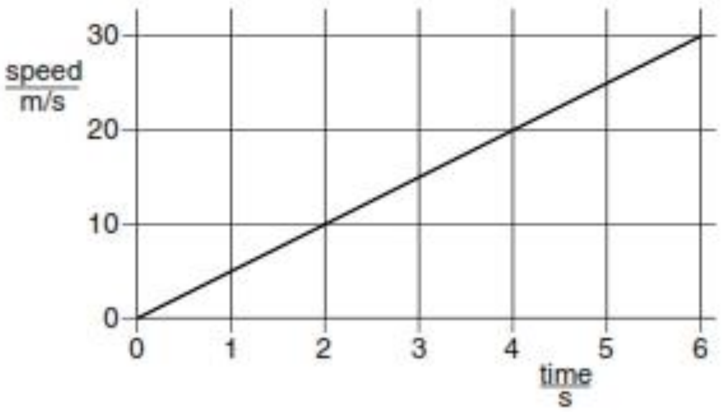
A acceleration

B distance travelled in 1 s

C speed

D velocity

9 A car starts from rest and is uniformly accelerated to a speed of 30 m/s in 6 s.



What is the distance travelled by the car?

A 5 m **B** 30 m **C** 90 m **D** 180 m

10 What causes a moving body to resist a change in its state of motion?

A its acceleration

B its inertia

C its speed

D its weight

11 A heavy lorry has a high inertia.

How difficult is it to start the lorry moving and to stop it moving?

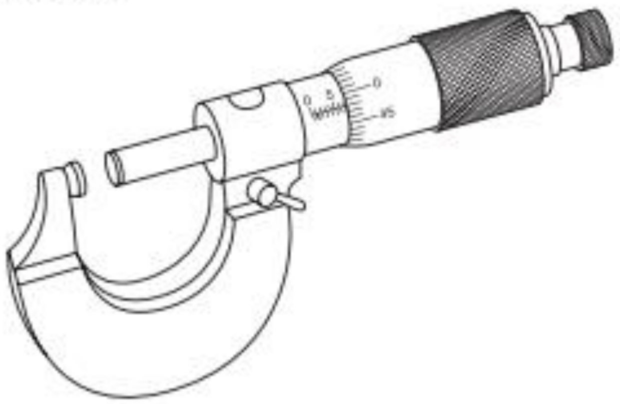
	to start	to stop
A	difficult	difficult
B	difficult	easy
C	easy	difficult
D	easy	easy

12 A rectangular block of wood has length 6.0 cm, width 5.0 cm and height 10.0 cm. It has mass 150 g.

What is the mass of a block of the same type of wood of length 3.0 cm, width 5.0 cm and height 20.0 cm?

A 75 g **B** 150 g **C** 300 g **D** 600 g

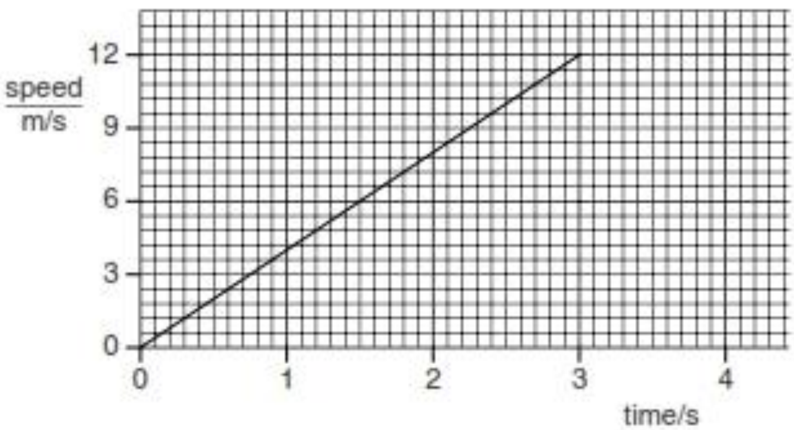
13 The diagram shows a micrometer screw gauge.



What is the reading shown?

A 5.25 mm **B** 5.48 mm **C** 7.02 mm **D** 7.48 mm

14 The graph shows the speed of a car as it moves from rest.



What is the average speed of the car during the first 3 s?

A 4 m/s **B** 6 m/s **C** 18 m/s **D** 36 m/s

15 In which direction does the frictional force always act on an object moving across a horizontal surface?

A in the direction of the gravitational force

B opposite to the direction of the gravitational force

C in the direction of motion

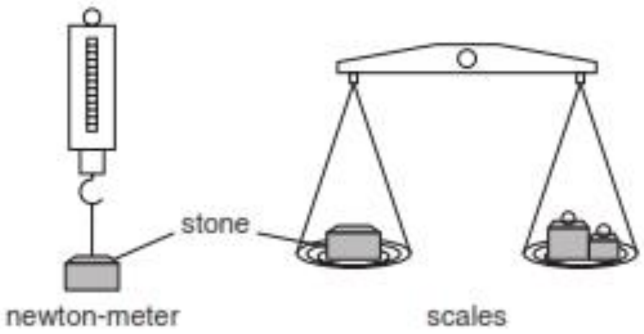
D opposite to the direction of motion

16 An object falls freely in a gravitational field.

Which of the following describes the resultant force acting on, and the acceleration of, the object at terminal velocity?

	resultant force	acceleration
A	decreasing	increasing
B	increasing	decreasing
C	increasing	increasing
D	zero	zero

17 A lump of stone is weighed using a newton-meter (spring balance) and a pair of scales (pan balance).

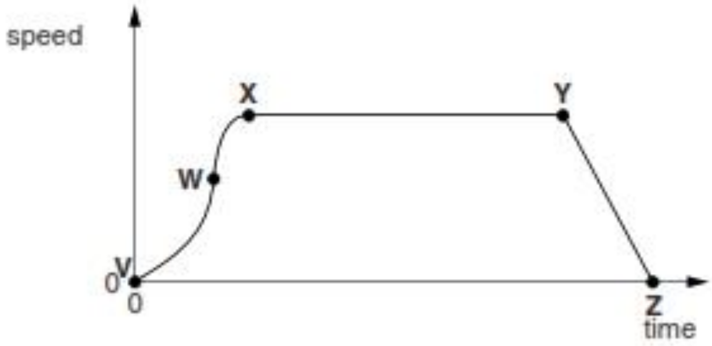


This experiment is repeated on the Moon.

Are the readings for each balance the same or different when taken on Earth and on the Moon?

	on newton-meter	on scales
A	different	different
B	different	same
C	same	different
D	same	same

18 The diagram shows a speed-time graph.



In which region is the acceleration decreasing?

A **V** to **W**

B **W** to **X**

C **X** to **Y**

D **Y** to **Z**

19 Two rubber balls of the same size are both dropped on the Earth and on the Moon.

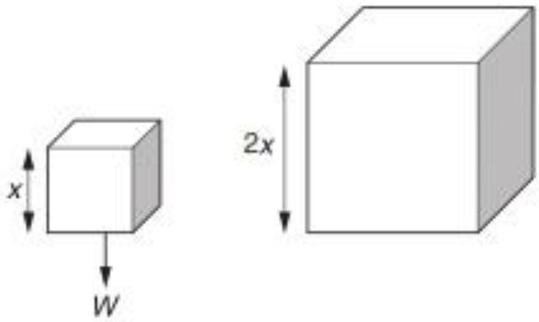
One ball is solid, and one is hollow.

The approximate gravitational field strength on the Earth is 10 N/kg and on the Moon is 1.7 N/kg.

Which ball has the greatest force acting on it?

	type of ball	where dropped
A	hollow	on the Earth
B	hollow	on the Moon
C	solid	on the Earth
D	solid	on the Moon

20 The diagram shows two cubes made from the same material. One cube has sides that are twice as long as the other cube.



The weight of the small cube is W.
What is the weight of the larger cube?

A $2W$ **B** $4W$ **C** $8W$ **D** $16W$

Paper 2 : [Total 40 Marks]

1 Fig. 1.1 shows the variation with time t of the speed of a stone that is thrown vertically downwards. In this question, air resistance may be ignored.

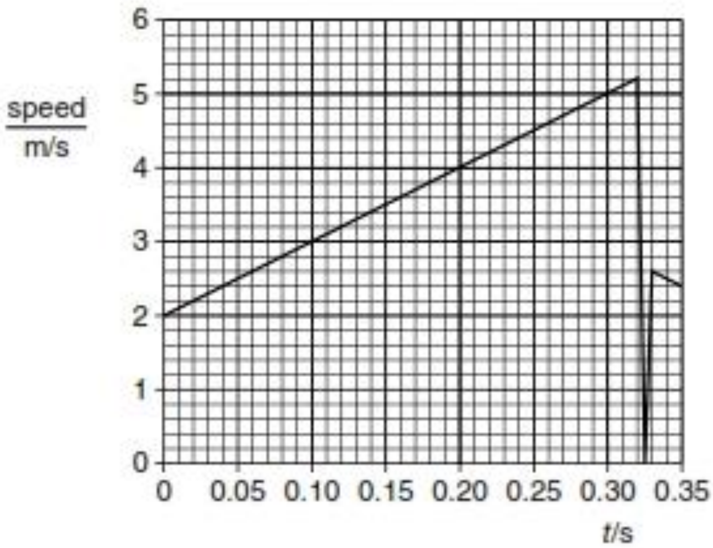


Fig. 1.1

The stone has mass 0.23 kg and leaves the thrower's hand at $t = 0$. It hits the ground at $t = 0.325$ s and rebounds with 50% of the speed with which it hit the ground.

(a) State the maximum speed of the stone.

maximum speed = ... [1]

(b) Show, using data from Fig. 1.1, that the acceleration of free fall is 10 m/s^2.

[2]

(c) Determine the speed of the stone just after it rebounds.

speed = ... [1]

[Total: 4]

2 Fig. 2.1 shows a car moving along a horizontal road.

Fig. 2.1

The car has mass 800 kg. At one point in its motion, when the combined forces of air resistance and friction acting backwards are 400 N, its acceleration is 1.4 m/s^2.

(a) Calculate the forward driving force required to accelerate the car.

forward driving force = ... [3]

(b) With the engine working at constant full power, the car's acceleration decreases as it goes faster.

Explain why this is so.

....

....

....

.... [2]

[Total: 5]

3 The mass of air in a classroom is 500 kg. The density of air is 1.2 kg/m^3.

(a) **(i)** Define the term *density*.

....

....

.... [1]

(ii) Calculate the volume of air in the classroom.

volume = ... [2]

[Total: 3]

4 Fig. 4.1 shows a catapult used to project an object. Force *F* pulls back the object, creating tension in the rubber cords.

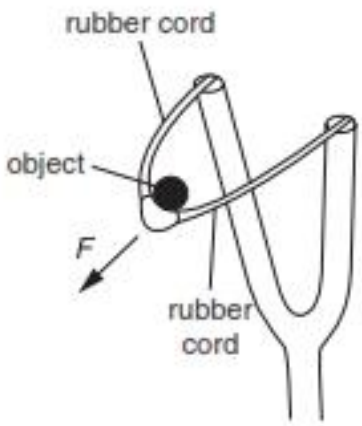


Fig. 4.1

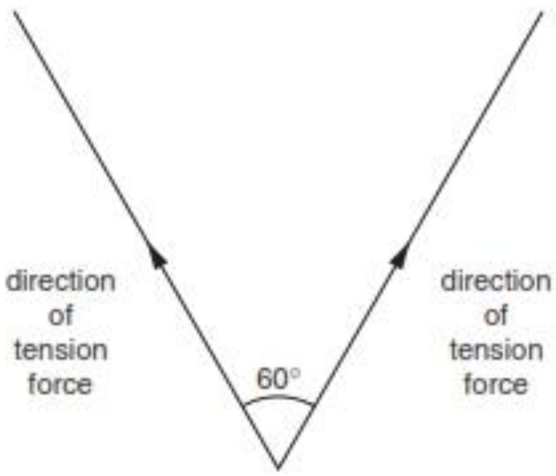


Fig. 4.2

(a) The tension force in each rubber cord is 20 N and the two cords are at 60° to each other. Fig. 4.2 shows the direction of the two tension forces acting on the object.

By making a scale drawing on Fig. 4.2, or otherwise, find the resultant of these two tension forces acting on the object. If you draw a scale drawing, state the scale that you use.

resultant force = ... [4]

[Total: 4]

5 Fig. 5.1 shows part of the speed–time graph for an athlete in a race.

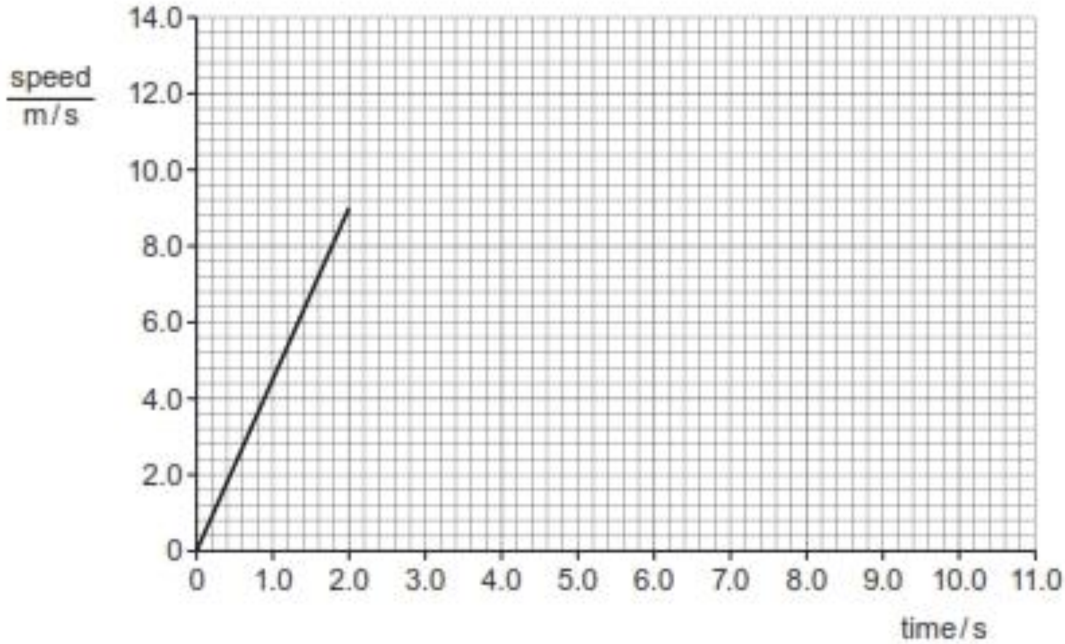


Fig. 5.1

(a) During the race, the acceleration of the athlete is uniform in the first 2.0 s.

State how the graph shows that the acceleration is uniform.

....

.... [1]

(b) Determine the distance travelled by the athlete in the first 2.0 s.

distance = ... [2]

(c) During the rest of the race:

- from 2.0 s to 5.5 s, the acceleration of the athlete decreases
- at 5.5 s, the athlete reaches a maximum speed of 12 m/s
- from 5.5 s to 8.0 s, the athlete travels at a speed of 12 m/s
- from 8.0 s to 11.0 s, the athlete decelerates, finishing the race at a speed of 10 m/s.

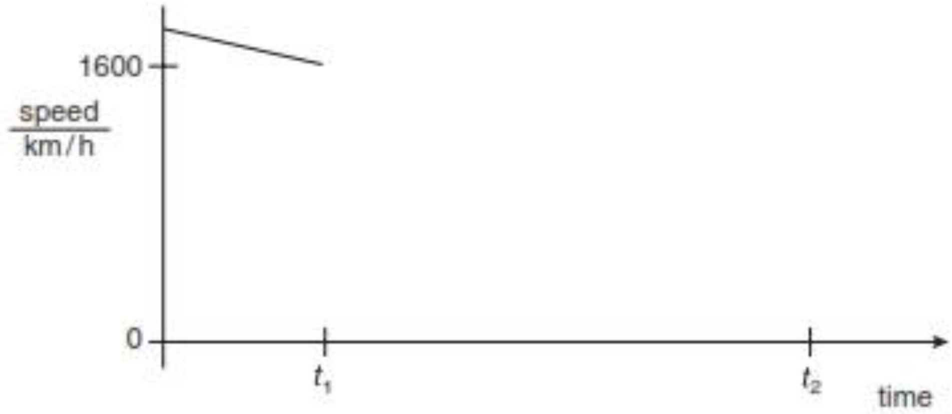
On Fig. 5.1, complete the speed–time graph for times between 2.0 and 11.0 s. [3]

[Total: 6]

6 A small spacecraft, known as Beagle 2, is to land on the planet Mars.

As the spacecraft enters the planet's atmosphere, it slows down. When the speed reaches 1600 km/h, parachutes open and the friction with the atmosphere increases. The spacecraft eventually reaches a steady speed, and then finally it hits the surface.

(a) On the axes of Fig. 6.1, complete the speed-time graph for the spacecraft. The parachutes open at time t_1, and the spacecraft hits the surface of Mars at time t_2.



[2]

Fig. 6.1

(b) The mass of the spacecraft is 65 kg. At one point the gravitational field strength of Mars is 3.0 N/kg and the total upwards force on the spacecraft is 500 N.

Determine

(i) the weight of the spacecraft,

weight = ...

(ii) the resultant force on the spacecraft,

force = ...

(iii) the deceleration of the spacecraft.

deceleration = ...

[4]

[Total: 6]

7 Fig. 7.1 shows a car travelling at a uniform speed of 18 m/s. At time $t = 0$, the driver sees a child run out in front of the car.

Fig. 7.1

At time $t = 0.6$ s the driver starts to apply the brakes. The car then decelerates uniformly, taking a further 3.0 s to stop.

(a) **(i)** On Fig. 7.2, draw a graph to show how the speed of the car varies with t.

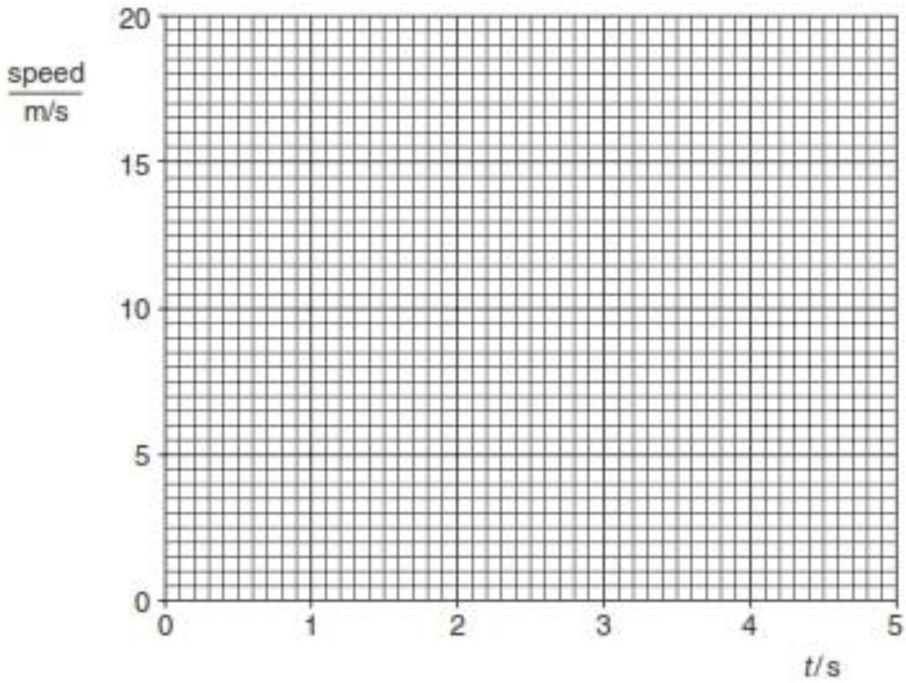


Fig. 7.2

(ii) Calculate the distance travelled in the first 0.6 s of the motion.

distance = ...

[5]

(b) The braking distance is the distance travelled by the car after the driver starts to apply the brakes. The braking distance is not the same each time that the car stops.

State two factors that could increase braking distance.

1. ....

....

2. ....

....[2]

[Total: 7]

8 Force is a vector quantity.

(a) State which **two** of the following are also vector quantities.

acceleration, distance, mass, speed, velocity

....[1]

(b) When two forces of 5 N are added, they may produce a resultant force that has any value between 0 and 10 N.

(i) Describe how it is possible to produce a zero resultant force from two forces of 5 N.

....

....

(ii) Describe how it is possible to produce a resultant force of 10 N from two forces of 5 N.

....

....

(iii) In the space below, draw a vector diagram to show how a resultant force of about 5 N may be obtained from the two 5 N forces. Clearly label the forces and the resultant.

[4]

[Total: 5]

Paper 4 : [Total 15 Marks]

1 A metal washer is placed in the middle of a square card. The card is supported by four vertical threads hanging from a square, held in a clamp, as illustrated in Fig. 1.1.

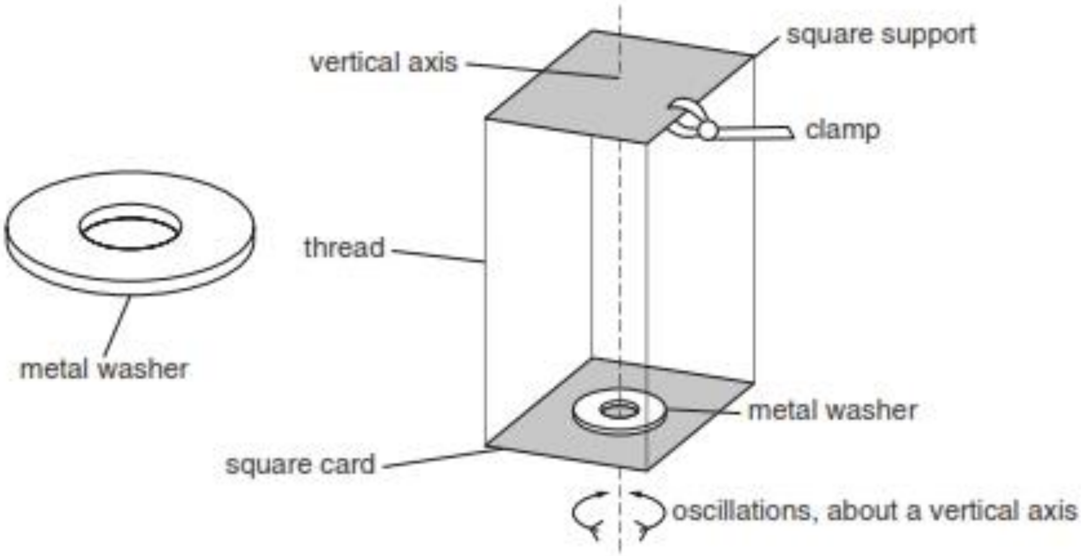


Fig. 1.1

The lower card is slightly rotated about the vertical axis and, when released, the card begins to oscillate. The time t for N complete oscillations is determined. The period T for one oscillation is calculated. The experiment is repeated with a different number W of washers placed on top of the first. In all, six experiments are performed for $W = 0, 1, 2, 3, 4$ and 5 washers of the same size.

(a) Draw up a carefully labelled table, suitable for your laboratory notebook, in which you could record the values of W, N, t and T.

[2]

(b) Fig. 1.2 shows a graph of the period T plotted against the number W of washers.

(i) When doing the experiment, 40 oscillations are timed. Discuss the reason for timing 40 oscillations. In your answer, you should make some comment about the value of T for $W = 5$ washers.

....

....

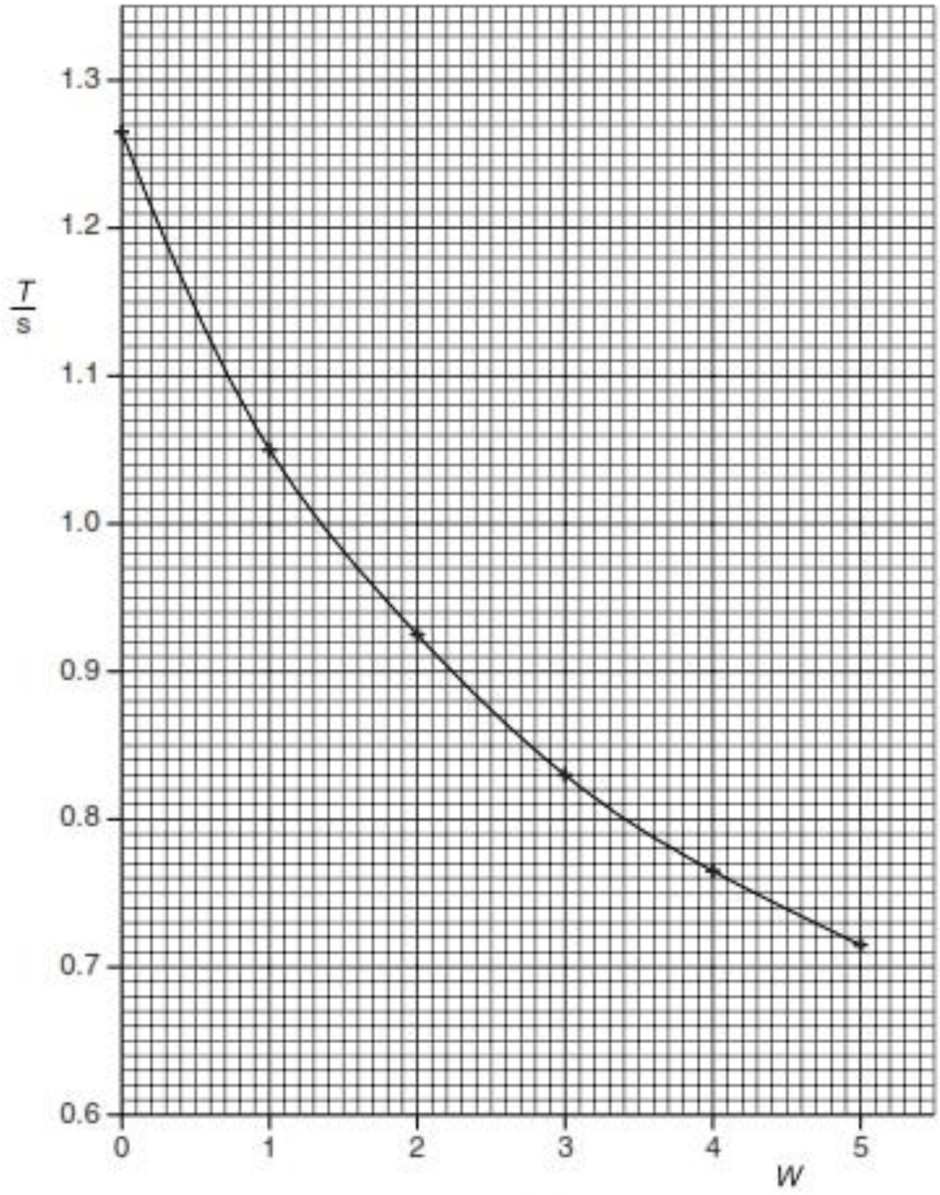


Fig. 1.2

(ii) The number *W* of similar washers is plotted along the x-axis. What other physical property of the washers increases as *W* increases?

....

[3]

(c) A different set of washers is used in order to repeat the investigation. *Compared with the first set*, the different washers

(i) are made of the same material,

(ii) have the same inner and outer radius,

(iii) are only half as thick.

What is the value of the period *T* when 5 of the new (thinner) washers are on the lower card?

T = ...

[2]

[Total: 7]

1 A metal bob attached to a length of thread is held in a clamp as shown in Fig. 1.1. The bob is made to swing by moving it to one side and then releasing it.

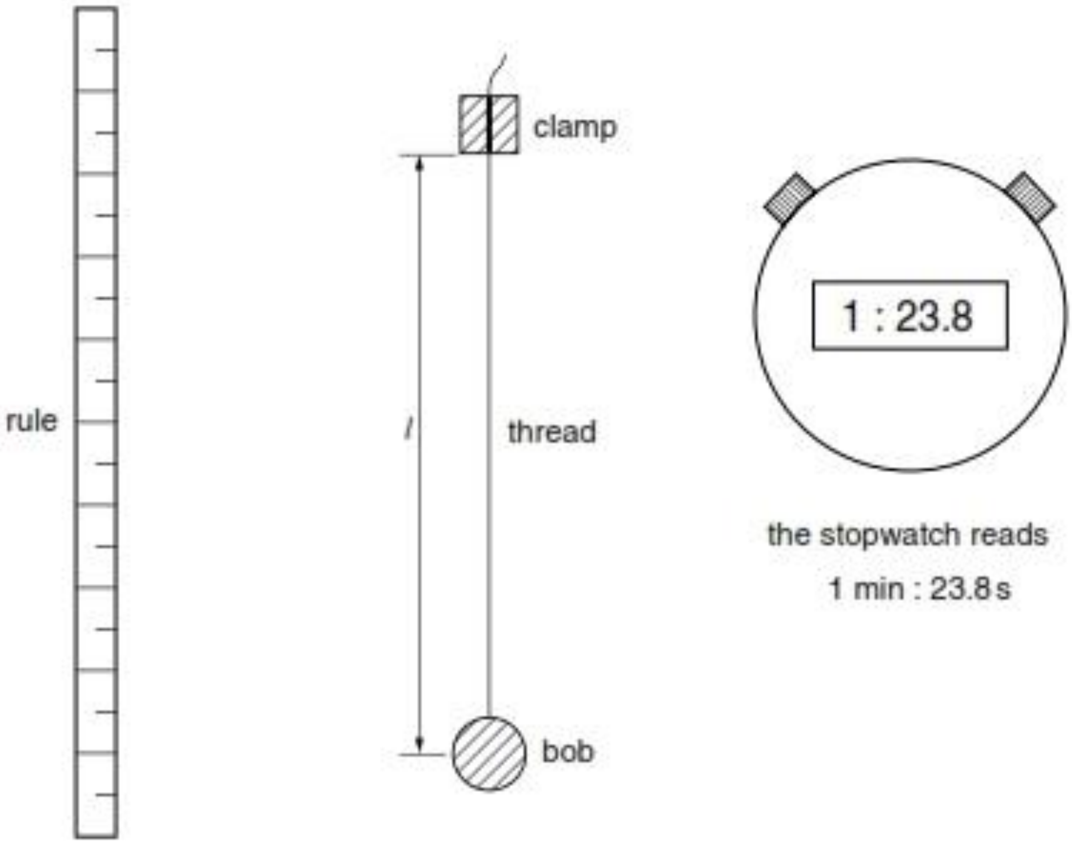


Fig. 1.1

The metre rule is used to measure the distance *l* between the centre of the bob and the clamp. The stopwatch is used to measure the time *t* for 20 complete swings. In the experiment, the time for 20 swings is measured for different values of *l*. In each case, the time *T* for one swing is calculated.

(a) Explain how you would use the metre rule to measure the value of *l* when *l* is about 90 cm. You should mention any additional apparatus you would use. You may draw a diagram if you wish.

....

....

....

....

....

.... [4]

(b) The stopwatch shown in Fig. 1.1 can measure time to the nearest 0.1 s. One value for T was $T = 1.03$ s. Why is it desirable to measure the time for at least 20 swings in order to determine this value of T?

....

....

....

....[3]

(c) On Fig. 1.2, show the numbers on the face of the stopwatch when $t = 106.6$ s.

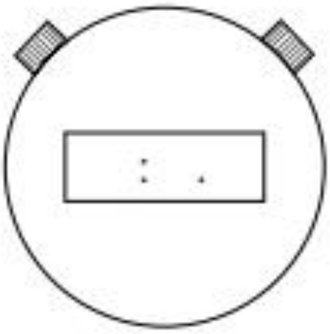


Fig. 1.2

[1]

[Total: 8]