Core 1

Read the sentences below then answer the questions which follow.

When potatoes are bought in a market, the weight of a bag full of potatoes is affected by the density of the potatoes. A lady fills her bag when she buys 5 kg of large potatoes. A man buys 5 kg of small potatoes. He puts them in a bag of the same size as the lady's, but his bag is not filled.

(a) Which word in these sentences describes a quantity which is a force?

…… [1]

(b) What does 5 kg measure. Tick **one** box.

the density of the potatoes ☐

the mass of the potatoes ☐

the volume of the potatoes ☐

the weight of the potatoes ☐

(c) Suggest one reason why the man's 5 kg of potatoes takes up less volume than the woman's.

Moving cars always experience friction. A driver goes on a short journey in a car.

Fig. 1 shows the car at four places during the journey. The arrows represent the size and direction of the horizontal forces on the car.

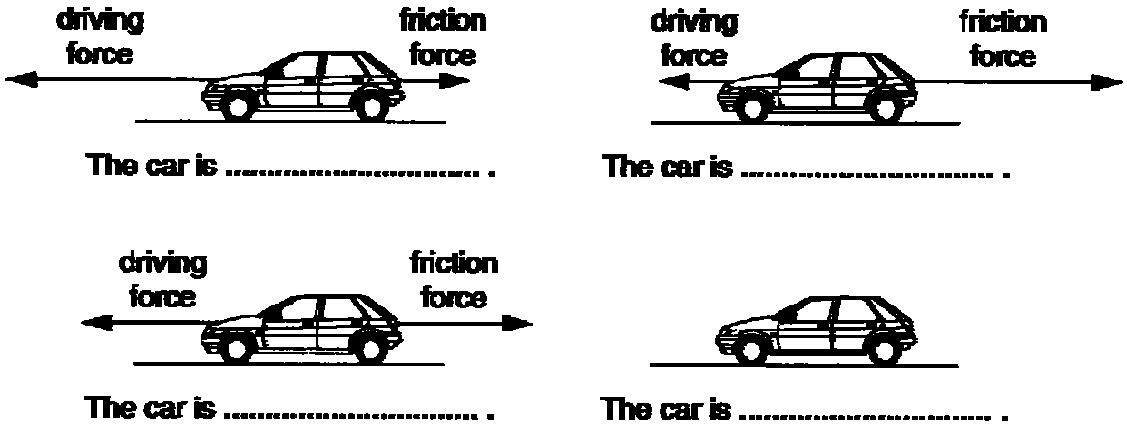


Fig. 1

On the line underneath each picture, state whether the car is

at rest,

speeding up,

going at steady speed,

slowing down. [4]

(a) Fig. 2 shows the speed/time graph for a motorcycle.

Fig. 2

(i) What is the maximum speed of the motorcycle? ..... m/s

(ii) Whilst accelerating, the motorcycle changes gear three times.

State **one** of the speeds at which the gear is changed. ..... m/s

(iii) For how long is the motorcycle slowing down? ..... s

[3]

(b) On another occasion the motorcycle's speed increases at a constant rate.

The speed / time graph is shown in Fig.3.

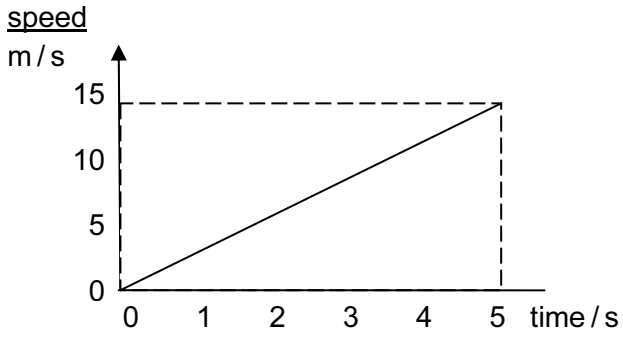
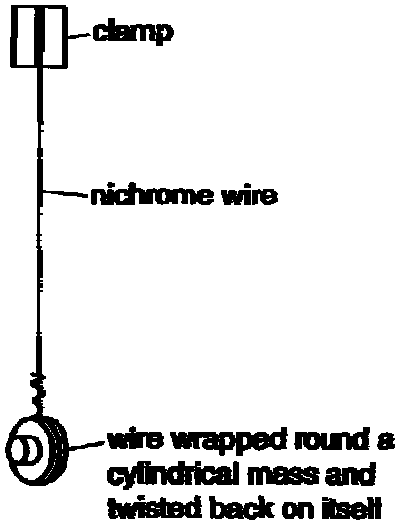


Fig. 3

Calculate how far the motorcycle travels in these 5 s.

distance travelled = ... m / s

The class is investigating the use of nichrome (resistance) wire instead of thin thread as part of a simple pendulum. The apparatus is shown in Fig.



Four tests are carried out.

Test A using very thin cotton thread for the suspension, (this thread is considered to have a negligible diameter).

Tests B, C and D in which nichrome wires of different diameters, d, are used.

In each test the length of the pendulum is 30.0 cm. The period, T, is determined by obtaining the total time, t, of a suitable number of oscillations. The period is given by $T = t/N$, where N is the number of oscillations.

The table gives the measurements taken by the class.

test	suspension	d/mm	N	t/s	T/s
A	cotton thread	negligible	50	54.8	
B	nichrome wire	0.31	50	53.4	
C	nichrome wire	0.56	50	50.3	
D	nichrome wire	0.91	50	43.3	

(a) For each test, determine the value T and record it in the table. [1]

(b) Suggest why 50 oscillations are used.

.....[1]

(c) (i) Plot a graph of T/s (y-axis) against d/mm (x-axis). Start the T/s axis at T/s = 0.7. Draw a neat thin curved line through the four points.

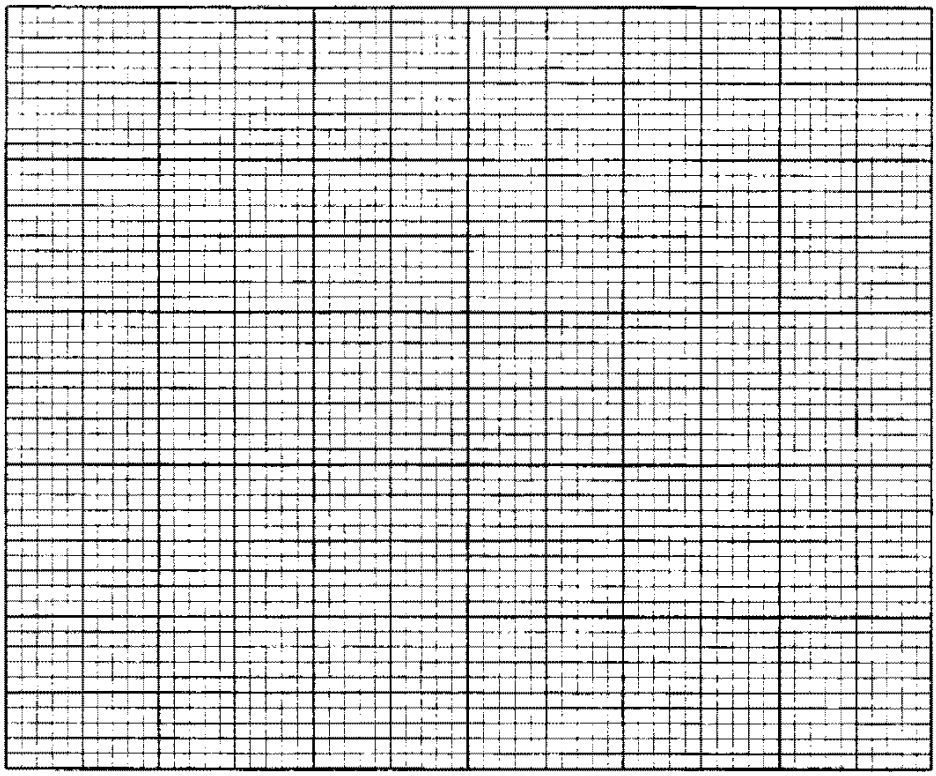
(ii) Label each plotted point with the correct test letter A, B, C or D.

Alternative to Practical

(iii) Describe how the values of T change when the values of d, the diameter of the wire, decrease.

.....

..... [1]



(d) In the laboratory you have enough time to take another set of measurements for one other value for the diameter of the nichrome wire. Study the shape of your graph line and then suggest an approximate value for the diameter that you think should be used. Give a reason for your choice.

choice for the value of d = ... mm

reason for this choice .....

.....

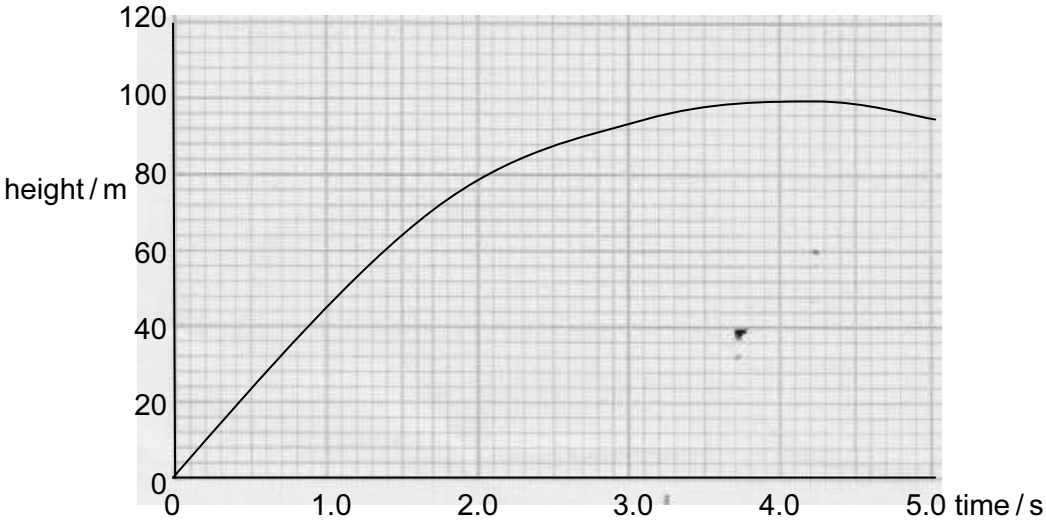
..... [2]

Extension 1

A firework leaves the ground with an initial speed of 45 m / s, travelling vertically upwards. it reaches a maximum height of 100 m.

At this point the firework fails to explode and falls back to Earth down the the same vertical path.

(a) The graph in Fig. 5 shows the height of the firework during the first 5 s of its flight.



Use the information on the graph to find

(i) the time taken for the firework to reach its maximum height.

time = ... s

(ii) Describe how the motion of the firework changes over the first 5 s of its journey.

.....

.....

.....

.....

(b) The acceleration of free fall Is 10 mls^2 and air resistance on the firework is negligible.

Find

(i) the deceleration of the firework as it is rising

deceleration = ...

(ii) The total time taken for the flrework to rise 100m and then to fall back to !he ground.

time taken = ...

(iii) State the speed with which the falling firework hits the ground.

speed = ... m / s

[8]

In an experiment to measure the acceleration of free fall close to the Earth an object is dropped and its velocity measured at different times. Fig. 2.1 shows the results of this experiment.

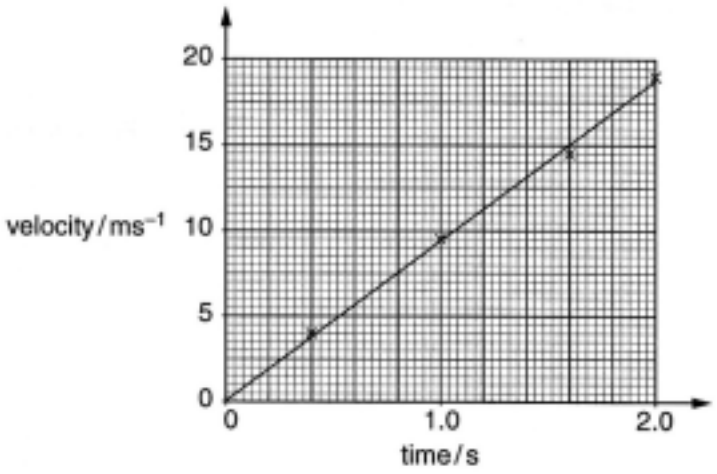


Fig. 2.1

(a) What can be deduced about the acceleration of gravity from the shape of the graph?

.....

[1]

(b) **(i)** Calculate the distance fallen by the object in the first second of its fall.

distance = ... [3]

(ii) On Fig. 2.2 mark suitable values on the axes and draw a graph to show how the distance fallen changes with time.

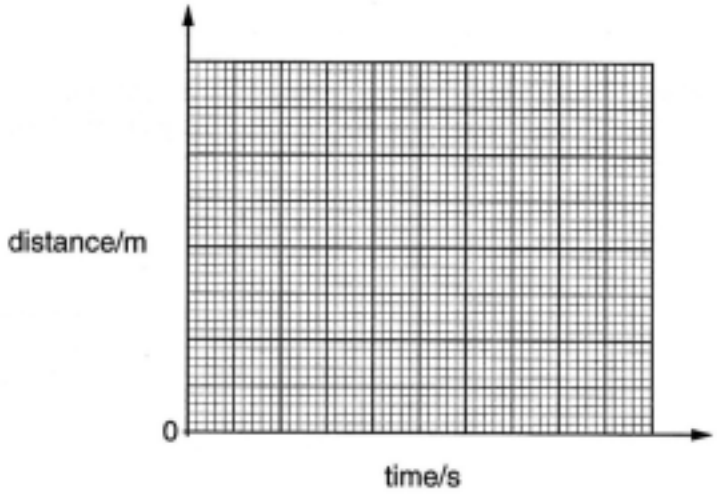


Fig. 2.2

[3]

Answers

Core 1

a weight

b mass

c greater density or less air gaps between the potatoes

Core 2

speeding up	slowing down
steady speed	at rest

Core 3

a(i) 31 m/s

(ii) 6 or 11 or 22 m/s

(ii) 10 s

b distance = area under the graph or the average speed x time

= ½ x 10 x 15

= 75 m

Alternative to practical

a 1.096 or 1.10
1.068 or 1.07
1.006 or 1.01
0.866 or 0.87

b greater accuracy c(i)

the graph should
show the scales the right way round
cover at least half the grid
suitable scales
scales labelled with quantity or unit
all plots correct to the nearest square

(ii) A B C D labelled

(ii) T increases

the increase is greatest for larger values of d d

1.1
increased range or largest difference in T value with larger d values

Extension1

(i)	1	4.5 +/- 0.1 s
	2	decelerates uniformly from a high velocity at zero seconds to zero velocity at 4.5 s
(ii)	1	10 m/s^2
	2	9.0 s
(iii)	45 m/s	+/- 1 m/s

Extension 2

(a) constant (acceleration)

(b)(i) Evidence for area under graph ✓

=1/2 x 1 x 9 ✓

= 4.5 m ✓

(ii) Calculation for distance travelled in 2 s = 18 m ✓
axes up to 20 m and 2 s ✓
correct curve on graph ✓