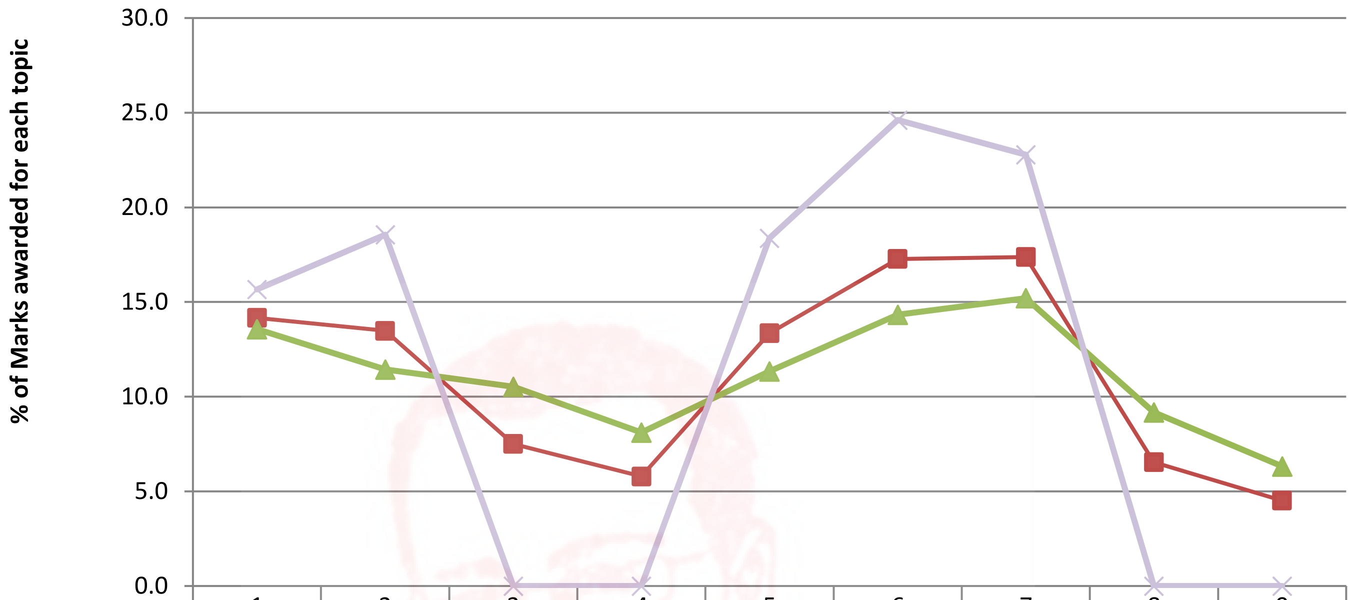
Name

iG Phx 1 EQ 14w to 02w P3 281marks

For these stats only papers 3 (which after 2016 became paper 4) and paper 6 were used to examine the topics.

iG Phx CIE 0625 PAPERS 3 and 6

Percentage of all WEIGHTED marks awarded for P3 & 6 each topic from s2002 to w2014 (red squares) and % of Paper 3 marks (green triangles) and paper 6 (purple crosses)

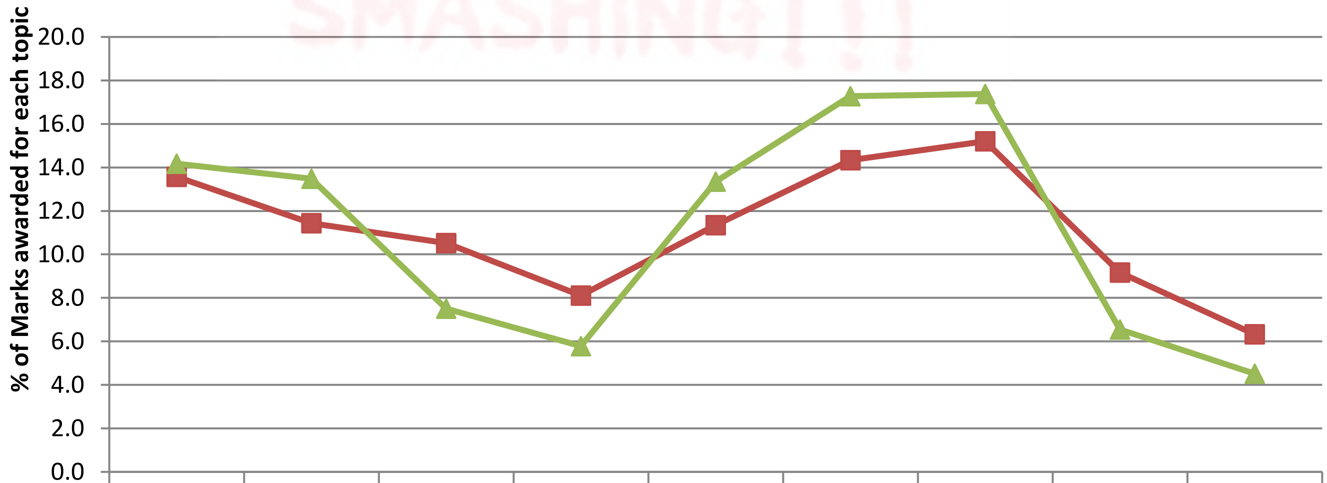


	1	2	3	4	5	6	7	8	9
PhxBoth P3&6	14.2	13.5	7.5	5.8	13.4	17.3	17.4	6.5	4.5
PhxP3	13.6	11.4	10.5	8.1	11.3	14.3	15.2	9.2	6.3
PhxP6	15.7	18.6	0.0	0.0	18.4	24.6	22.8	0.0	0.0

Papers 3 and 6 Topic Number

PAPER 3

Percentage of all marks awarded for each topic from s2002 to w2014 in Paper 3 (red squares) and marks per topic for papers 3 and 6 (green triangles)



	1	2	3	4	5	6	7	8	9
ALL P3 %	13.6	11.4	10.5	8.1	11.3	14.3	15.2	9.2	6.3
P3 & 6	14.2	13.5	7.5	5.8	13.4	17.3	17.4	6.5	4.5

Paper 3 Topic Number

Papers covered in this sample

	1st Paper	Last Paper	Marks/ paper	Theor. All Papers	Actual All Marks	Difference	Difference %	Weight per paper	Weight per mark
Paper 3	2002w	2014w	80	2000	2072	72	3.6	50	0.63
Paper 6	2002s	2015w	40	1120	1040	-80	-7.1	20	0.50

There are a few missing:

Got all Paper 31s (except 2014w Paper 31), and got 2014w
So papers in time zones 2 and 3 are not covered.

All topics ranked by frequency of marks in exams (P3 and 6 only)

Topic	PhxBoth P3&6	PhxP3	PhxP6
7	17.4	15.2	22.8
6	17.3	14.3	24.6
1	14.2	13.6	15.7
2	13.5	11.4	18.6
5	13.4	11.3	18.4
3	7.5	10.5	0.0
8	6.5	9.2	0.0
4	5.8	8.1	0.0
9	4.5	6.3	0.0

Other statistics that might be of interest:

	Topics:	1	2	3	4	5	6	7	8	9
P3/4 marks	2072	281	237	218	168	235	297	315	190	131
P3/4 %		13.6	11.4	10.5	8.1	11.3	14.3	15.2	9.2	6.3
P6	1040	163	193	0	0	191	256	237	0	0
P6 %		15.7	18.6	0.0	0.0	18.4	24.6	22.8	0.0	0.0
Total Marks (WIEGHTED)	1815	257	245	136	105	242	314	315	119	82
% of Marks (Weighted)	1815	14.2	13.5	7.5	5.8	13.4	17.3	17.4	6.5	4.5
# of Questions		63	64	35	16	63	74	70	26	20
Average marks per Q		**4.1**	**3.8**	**3.9**	**6.6**	**3.8**	**4.2**	**4.5**	**4.6**	**4.1**

Final note:

My iG and IB chemistry papers were broken down more carefully than these were, so there may be a mark or two in the wrong topic especially in topics 3 to 5, but if you learnt or taught these topics in sequence than you shouldn't have a problem with seeing material from an earlier topic.

Defining the Topics: Why not use the units given in the syllabus?

Artificial topics have been created for the physics syllabus by me so that each topic is roughly the same size. Topics go in syllabus order. I have decided to use the number of marks allocated in previous exams to each syllabus point to determine how many go into each topic.

1. General physics

Topic 1

1.1 Length and time
1.2 Motion
1.3 Mass and weight
1.4 Density

Topic 2

1.5 Forces
1.6 Momentum (Extended candidates only)
1.7 Energy, work and power
1.8 Pressure

2. Thermal physics

Topic 4

2.1 Simple kinetic molecular model of matter

Topic 5

2.2 Thermal properties and temperature
2.3 Thermal processes

3. Properties of waves, including light and sound

Topic 6

3.1 General wave properties
3.2 Light
3.3 Electromagnetic spectrum
3.4 Sound

4. Electricity and magnetism

Topic 7

4.1 Simple phenomena of magnetism
4.2 Electrical quantities
4.3 Electric circuits
4.4 Digital electronics (Extended candidates only)
4.5 Dangers of electricity

Topic 8

4.6 Electromagnetic effects

5. Atomic physics

Topic 9

5.1 The nuclear atom
5.2 Radioactivity

1 A free-fall parachutist jumps from a helium balloon, but does not open his parachute for some time.

Fig. 1.1 shows the speed-time graph for his fall. Point B indicates when he opens his parachute.

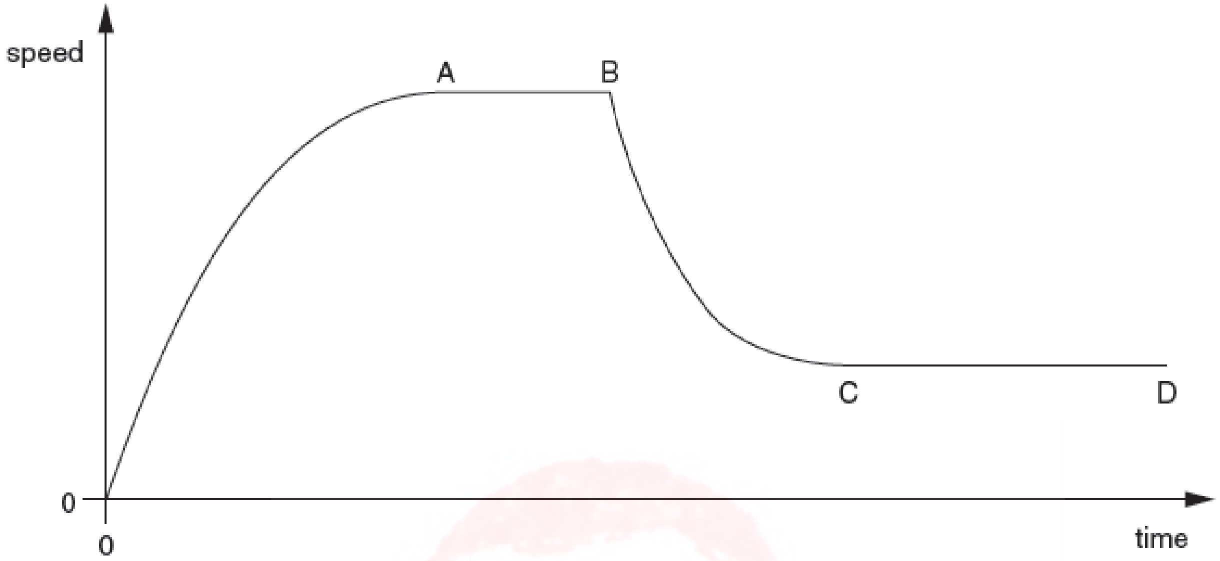


Fig. 1.1

(a) **(i)** State the value of the gradient of the graph immediately after time $t = 0$.

gradient = ... [1]

(ii) Explain why the gradient has this value.

....

....[1]

(b) State how Fig. 1.1 shows that the acceleration decreased between time $t = 0$ and the time to A.

....

....[1]

(c) Explain, in terms of forces, what is happening in section AB of the graph in Fig. 1.1.

....

....

....[2]

(d) A second parachutist of the same size and mass jumps from the balloon with a larger parachute. He also opens his parachute at point B.

On Fig. 1.1, sketch a possible speed-time graph for his fall after he opens his parachute. [3]

[Total: 8]

2 A student has a large number of coins of different diameters, all made of the same metal. She wishes to find the density of the metal by a method involving placing the coins in water.

(a) State the formula needed to calculate the density.

.... [1]

(b) Describe how the measurements of the required quantities are carried out.

....

....

....

....

....

....

....

....

....

....

.... [5]

(c) State **one** precaution taken when carrying out the measurements in **(b)** to ensure that the result is as accurate as possible.

....

.... [1]

[Total: 7]

2 A train has a total mass of 7.5×10^5 kg.

(a) The train accelerates from rest at a constant rate along a straight, horizontal track. It reaches a speed of 24 m / s in 60 s.

Calculate

(i) the train's acceleration,

acceleration = ... [2]

2 **(a)** Underline the vectors in the following list of quantities.

density energy force mass velocity volume [2]

(b) A small metal ball is projected into the air with a velocity of 40 m/s vertically upwards.

The graph in Fig. 2.1 shows how the velocity changes with time until the ball reaches its maximum height.

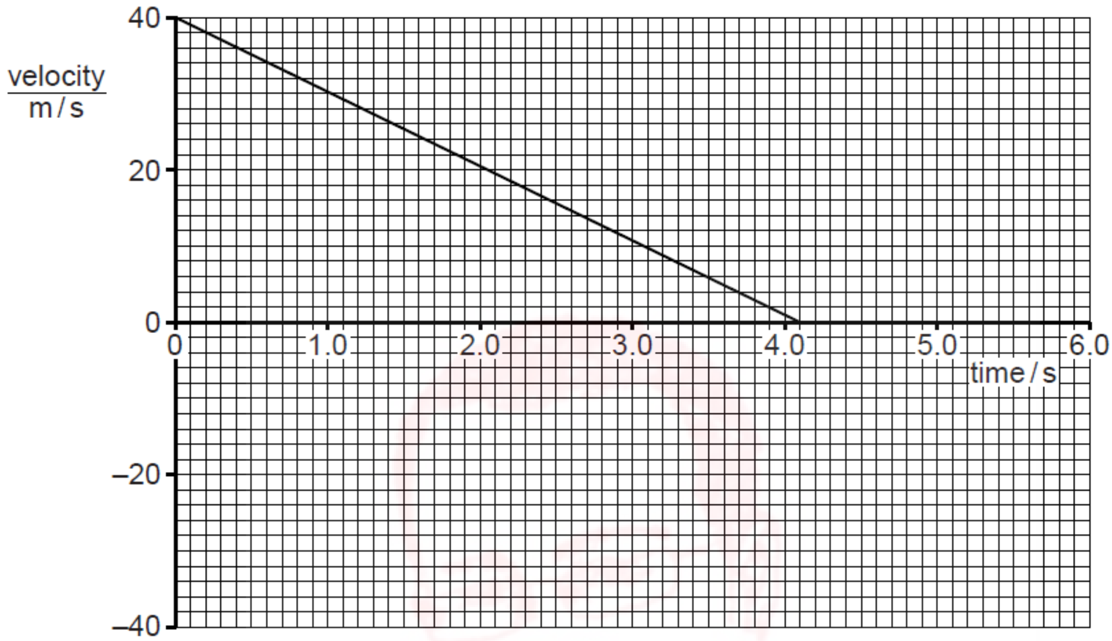


Fig. 2.1

Use the graph to find,

(i) the time at which the ball reaches its maximum height,

time = ... [1]

(ii) the deceleration of the ball,

deceleration = ... [2]

(iii) the maximum height reached by the ball.

maximum height = ...[2]

(c) On Fig. 2.1, add a line to the graph to show how the velocity of the ball changes after it reaches its maximum height. Your line should extend to time 6.0 s. [1]

[Total: 8]

1 **(a)** Define *density*.

....

....[1]

(b) The density of aluminium is 2.70 g / cm^3. The thickness of a rectangular sheet of aluminium foil varies, but is much less than 1 mm.

A student wishes to find the average thickness. She obtains the following measurements.

mass of sheet = 60.7 g
length of sheet = 50.0 cm
width of sheet = 30.0 cm

Calculate the student's values for

(i) the volume of the sheet,

volume = ...[2]

(ii) the average thickness of the sheet.

thickness = ...[2]

(c) Another student, provided with a means of cutting the sheet, decides to find its average thickness using a single measuring instrument. Assume the surfaces of the sheet are perfectly smooth.

(i) Name a measuring instrument she could use.

....[1]

(ii) Describe the procedure she should follow to obtain an accurate value of the average thickness of the sheet.

Details of how to read the instrument are not required.

....

....

....

....

....

....[3]

[Total: 9]

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....

....[1]

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Details of how to read the instrument are not required.

....

....

....

....

....

.... [3]

[Total: 9]

Q# 7/ iG Phx/2012/w/Paper 31/ NOT with Q1a

Q1. The acceleration of the train in the que/s/tion belo/w/ is 1.iG Phx/2008/m/s/²

(b) The mass of the train is 1.1×10^5 kg.

Calculate the resultant force acting on the train in the first 10 s.

resultant force = ... [2]

(c) The force generated by the engine of the train is called the driving force.

Write down, in words, an equation relating the driving force to any other forces acting on the train during the period t = 10 s to t = 130 s.

.... [1]

1 Fig. 1.1 shows the graph of speed v against time t for a train as it travels from one station to the next.

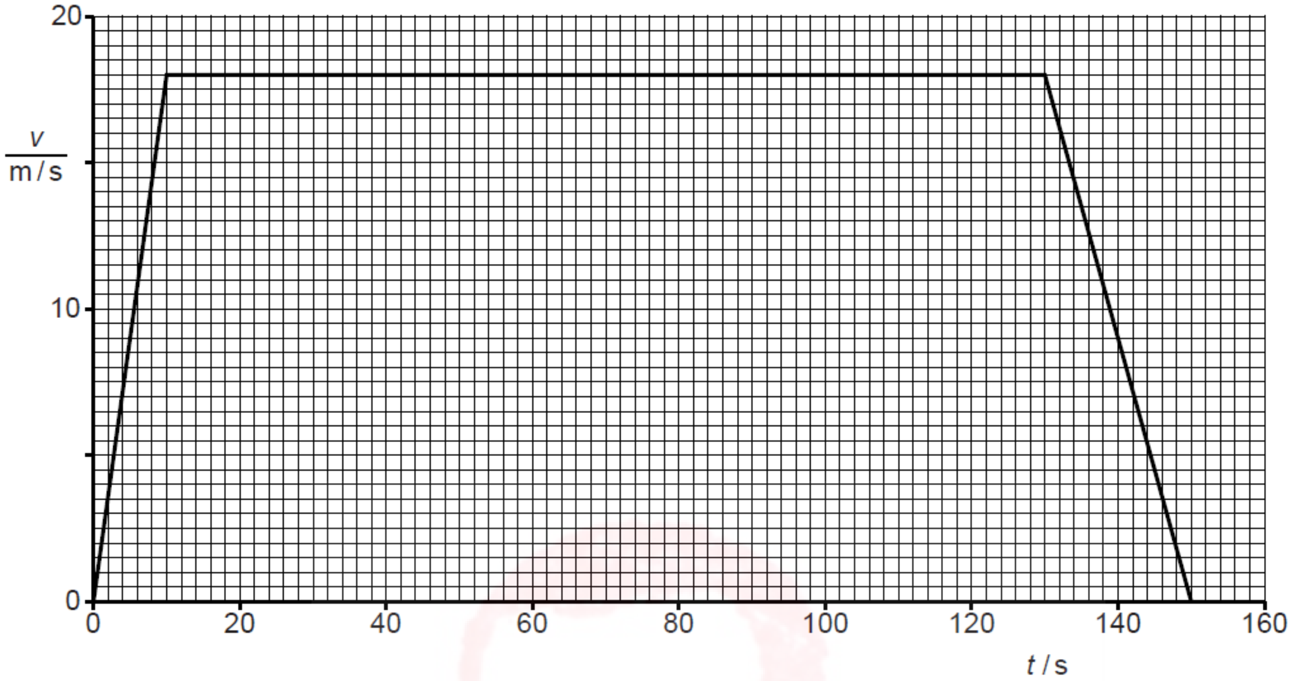

Fig. 1.1

(a) Use Fig. 1.1 to calculate

(i) the distance between the two stations,

distance = ... [4]

(ii) the acceleration of the train in the first 10 s.

acceleration = ... [2]

Q# 9/ iG Phx/2012/w/Paper 31/ www.SmashingScience.org

2 (a) State the factors which completely describe a vector quantity.

....

.... [1]

(b) An aeroplane is flying towards the east in still air at 92 m/s. A wind starts to blow at 24 m/s towards the north.

Draw a vector diagram to find the resultant velocity of the aeroplane. Use a scale of 1.0 cm = 10 m/s.

resultant speed = ...

angle between resultant and easterly direction = ...

[5]

[Total: 6]

Q# 10/ iG Phx/2012/w/Paper 31/

1 Fig. 1.1 shows the graph of speed v against time t for a train as it travels from one station to the next.

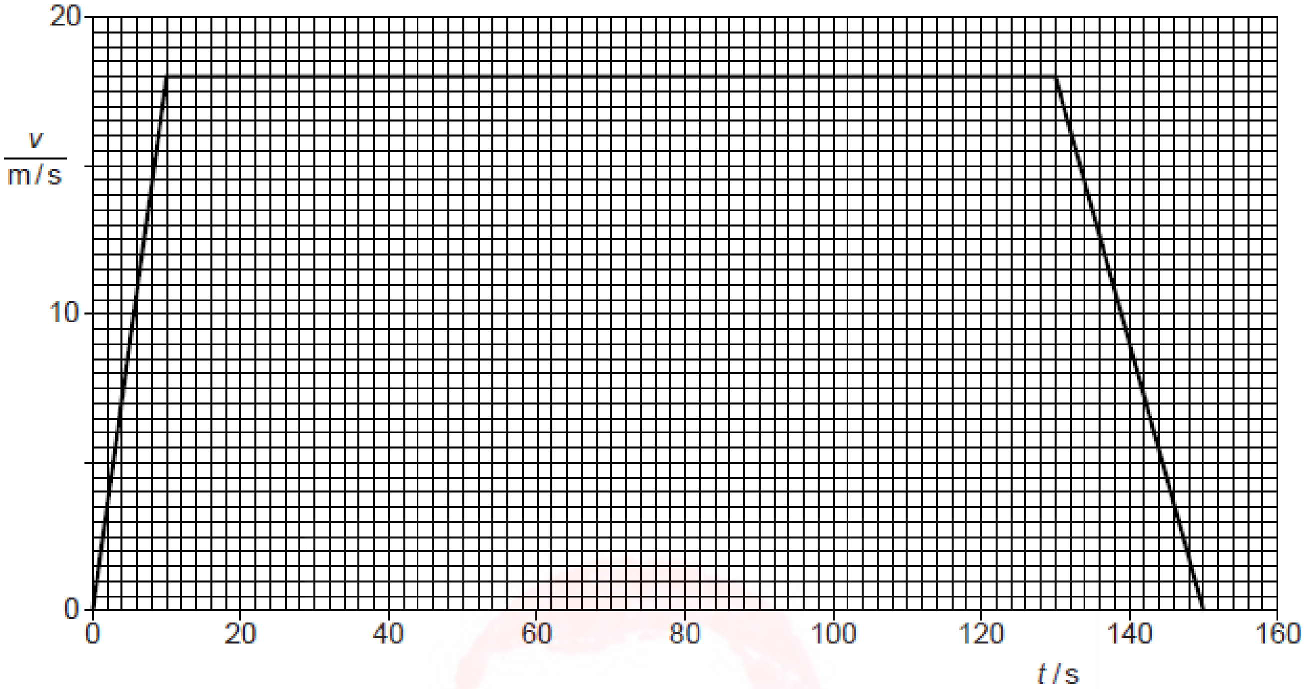

Fig. 1.1

(a) Use Fig. 1.1 to calculate

(i) the distance between the two stations,

distance = ... [4]

(ii) the acceleration of the train in the first 10 s.

acceleration = ... [2]

1 The period of the vertical oscillations of a mass hanging from a spring is known to be constant.

(a) A student times single oscillations with a stopwatch. In 10 separate measurements, the stopwatch readings were:

1.8 s, 1.9 s, 1.7 s, 1.9 s, 1.8 s, 1.8 s, 1.9 s, 1.7 s, 1.8 s, 1.8 s.

What is the best value obtainable from these readings for the time of one oscillation? Explain how you arrive at your answer.

best value = ...

explanation ....

....

.... [1]

(b) Describe how, using the same stopwatch, the student can find the period of oscillation more accurately.

....

....

....

....

....

....

.... [4]

[Total: 5]

2 A girl rides her bicycle along a straight level road. Fig. 2.1 shows a graph of her distance moved against time.

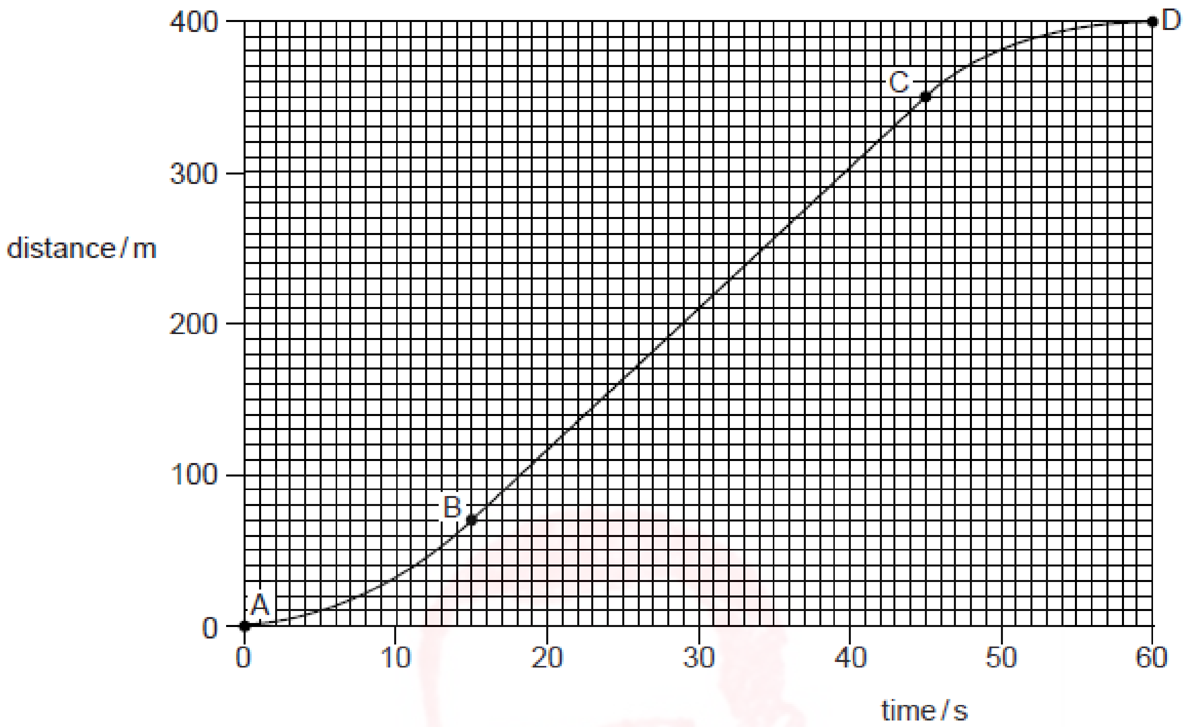

Fig. 2.1

(a) Describe her motion

(i) from A to B, ...

(ii) from B to C, ...

(iii) from C to D. ....
[3]

(b) Calculate

(i) her average speed from A to D,

average speed = ... [2]

(ii) her maximum speed.

maximum speed = ... [3]

[Total: 8]

1 **(a)** Define *acceleration*. Explain any symbols in your definition.

....

....[1]

(b) Fig. 1.1 shows a graph of speed against time for a train. After 100 s the train stops at a station.

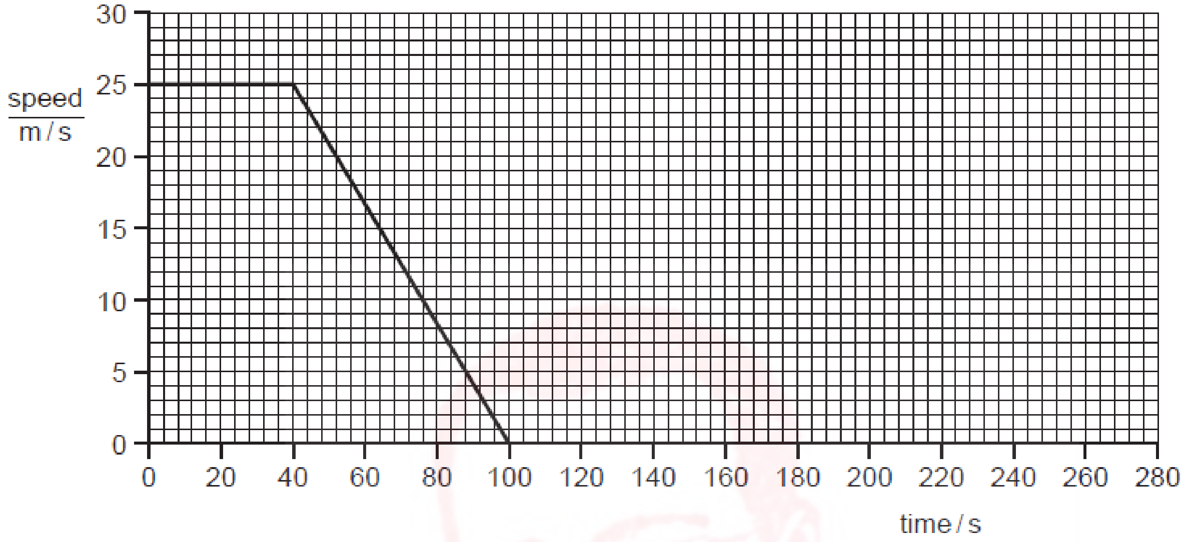

Fig. 1.1

(i) For the time interval between 40 s and 100 s, calculate the distance travelled by the train.

distance = ...[2]

(ii) The train stops for 80 s, then accelerates to 30 m / s with an acceleration of 0.60 m / s^2. It then travels at constant speed.

Complete the graph for the interval 100 s to 280 s, showing your calculations in the space below.

[5]

[Total: 8]

Q# 14/_iG Phx/2010/w/Paper 31/ www.SmashingScience.org

2 A car travels around a circular track at constant speed.

(a) Why is it incorrect to describe the circular motion as having constant velocity?

.... [1]

Q# 15/_iG Phx/2010/w/Paper 31/ www.SmashingScience.org

5 Fig. 5.1 shows a model cable-car system. It is driven by an electric motor coupled to a gear system.

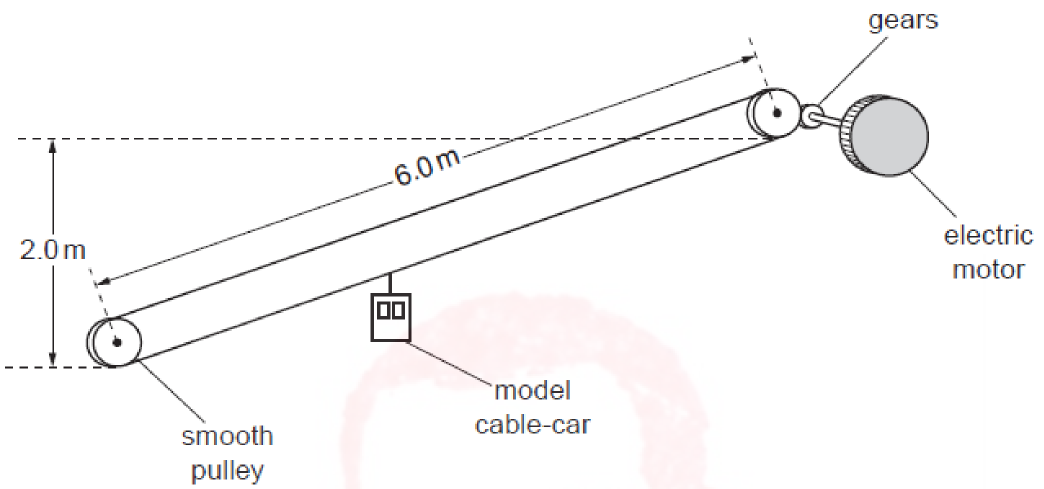

Fig. 5.1

The model cable-car has a mass of 5.0 kg and is lifted from the bottom pulley to the top pulley in 40 s. It stops automatically at the top.

(a) Calculate

(i) the average speed of the cable-car,

average speed = ... [2]

1 Fig. 1.1 shows the speed/time graph for a car travelling along a straight road.

The graph shows how the speed of the car changes as the car passes through a small town.

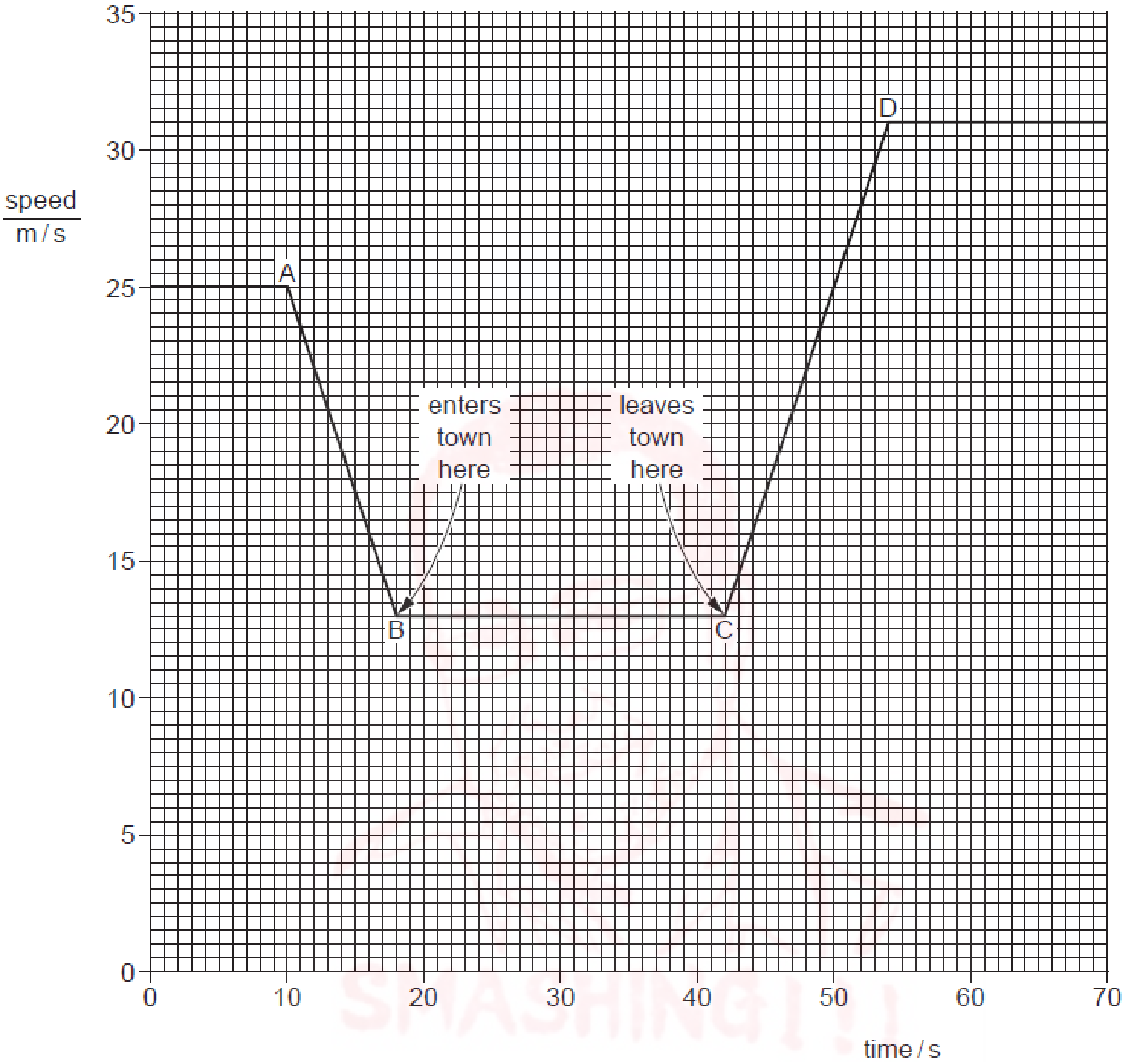

Fig. 1.1

(a) Describe what happens to the speed of the car

(i) between A and B, ...

(ii) between B and C, ...

(iii) between C and D. ....

[1]

(b) Calculate the distance between the start of the town and the end of the town.

distance = ... [3]

(c) Calculate the acceleration of the car between C and D.

acceleration = ... [3]

(d) State how the graph shows that the deceleration of the car has the same numerical value as its acceleration.

....

.... [1]

[Total: 8]

1 Fig 1.1 shows part of a measuring instrument.

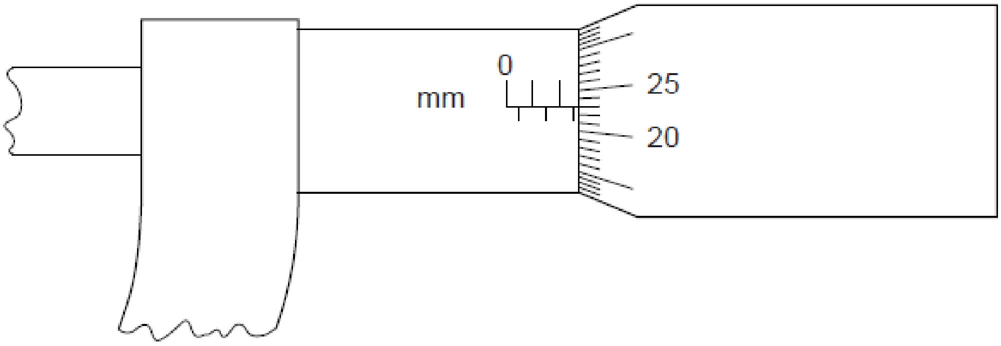

Fig. 1.1

(a) State the name of this instrument.

.... [1]

(b) Record the reading shown in Fig. 1.1.

.... [1]

(c) Describe how you would find the thickness of a sheet of paper used in a magazine.

....

....

....

....

....

.... [3]

[Total: 5]

2 The list below gives the approximate densities of various metals.

gold	19 g / cm^3
lead	11 g / cm^3
copper	9 g / cm^3
iron	8 g / cm^3

At an antiques market, a collector buys what is advertised as a small ancient gold statue. When the collector tests it in the laboratory, he finds its mass is 600 g and its volume is 65 cm^3.

(a) In the space below, describe how the volume of the statue could be measured. You may draw diagrams if you wish.

[3]

(b) Use the figures given above to decide whether the statue was really made of gold. Show your working.

Was the statue made of gold? (Tick one box.)

yes	
no	

[3]

[Total: 6]

2 The list below gives the approximate densities of various metals.

gold	19 g / cm^3
lead	11 g / cm^3
copper	9 g / cm^3
iron	8 g / cm^3

At an antiques market, a collector buys what is advertised as a small ancient gold statue. When the collector tests it in the laboratory, he finds its mass is 600 g and its volume is 65 cm^3.

(a) In the space below, describe how the volume of the statue could be measured. You may draw diagrams if you wish.

[3]

(b) Use the figures given above to decide whether the statue was really made of gold. Show your working.

Was the statue made of gold? (Tick one box.)

yes	
no	

[3]

[Total: 6]

1 An engineering machine has a piston which is going up and down approximately 75 times per minute.

Describe carefully how a stopwatch may be used to find accurately the time for one up-and-down cycle of the piston.

[4]

[Total: 4]

3 **(a)** Fig. 3.1 shows a skier descending a hillside. Fig. 3.2 shows the speed/time graph of his motion.

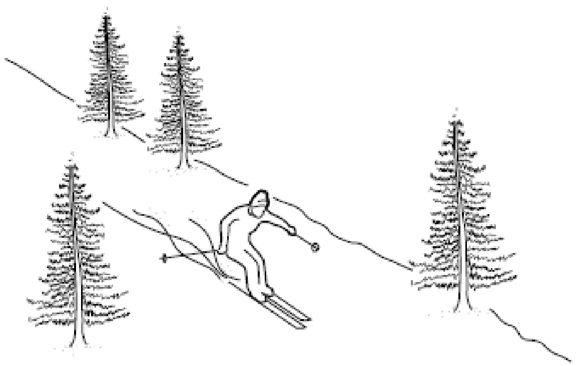

Fig. 3.1

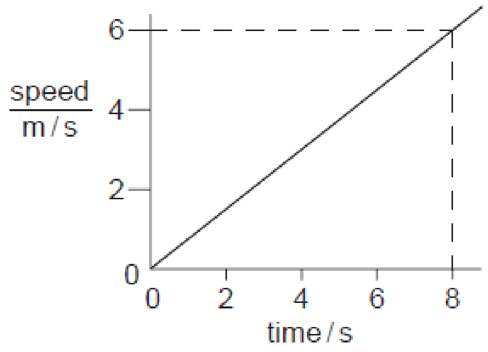

Fig. 3.2

(i) How can you tell that the acceleration of the skier is constant during the 8 s shown on the graph?

.... [1]

(ii) Calculate the acceleration of the skier.

acceleration = ... [2]

(b) Another skier starts from rest at the top of the slope. As his speed increases the friction force on the skier increases.

(i) State the effect of this increasing friction force on the acceleration.

.... [1]

(ii) Eventually the speed of the skier becomes constant.

What can be said about the friction force when the speed is constant?

.... [2]

(iii) 1. On the axes of Fig. 3.3, sketch a possible speed/time graph for the motion of the second skier.

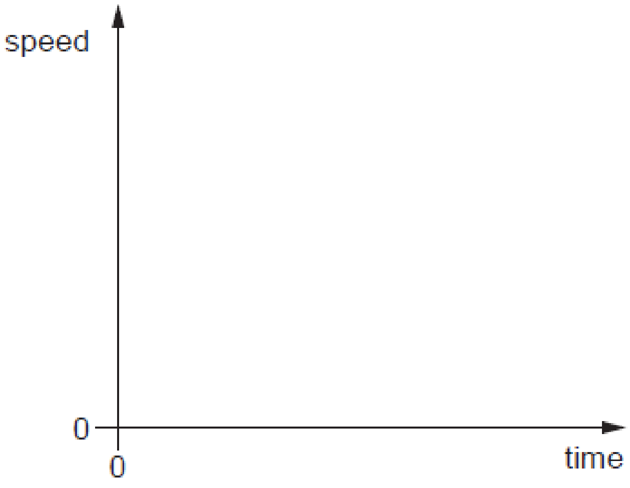

Fig. 3.3

2. On your graph, mark with the letter A a region where the acceleration is not constant. Mark with the letter B the region where the speed is constant. [4]

[Total: 10]

1 Fig. 1.1 shows the speed-time graphs for two falling balls.

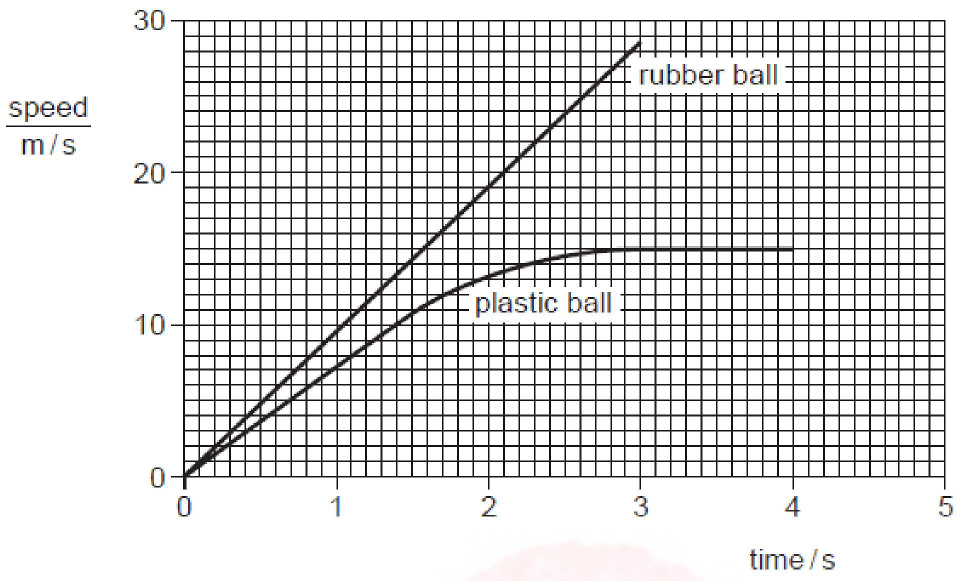

Fig. 1.1

Both balls fall from the same height above the ground.

(a) Use the graphs to find

(i) the average acceleration of the falling rubber ball during the first 3.0 s,

acceleration = ... [2]

(ii) the distance fallen by the rubber ball during the first 3.0 s,

distance = ... [2]

(iii) the terminal velocity of the plastic ball.

terminal velocity = ... [1]

1 A large plastic ball is dropped from the top of a tall building.

Fig. 1.1 shows the speed-time graph for the falling ball until it hits the ground.

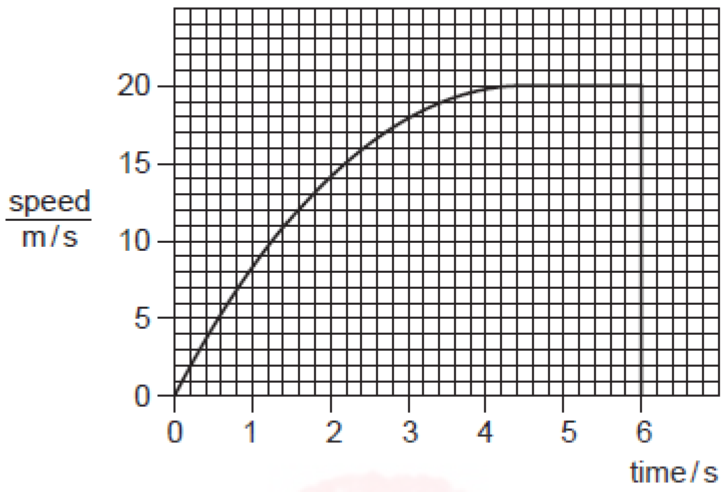

Fig. 1.1

(b) Explain, in terms of the forces acting on the ball, why

(i) the acceleration of the ball decreases,

....

....

....

.... [3]

(ii) the ball reaches terminal velocity.

....

.... [2]

1 A large plastic ball is dropped from the top of a tall building.

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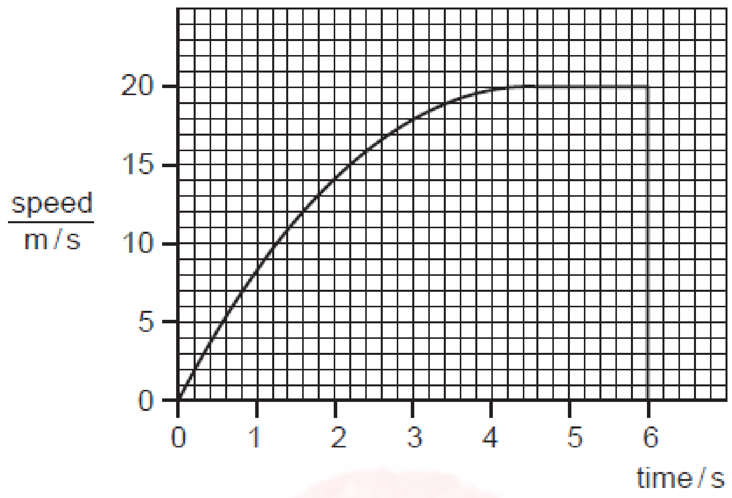

Fig. 1.1

(a) From the graph estimate,

(i) the time during which the ball is travelling with terminal velocity,

time = ... [1]

(ii) the time during which the ball is accelerating,

time = ... [1]

(iii) the distance fallen while the ball is travelling with terminal velocity,

distance = ... [2]

(iv) the height of the building.

height = ... [2]

1 Fig. 1.1 shows a model car moving clockwise around a horizontal circular track.

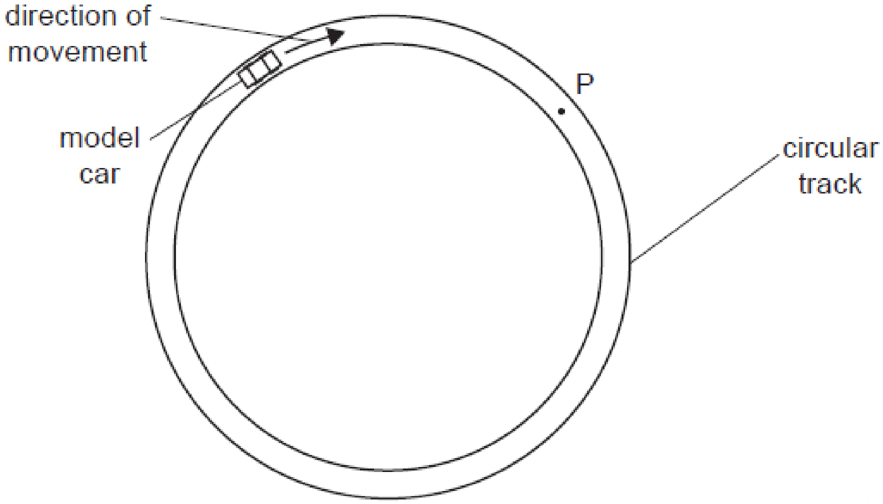

Fig. 1.1

(c) The car, starting from rest, completes one lap of the track in 10 s. Its motion is shown graphically in Fig. 1.2.

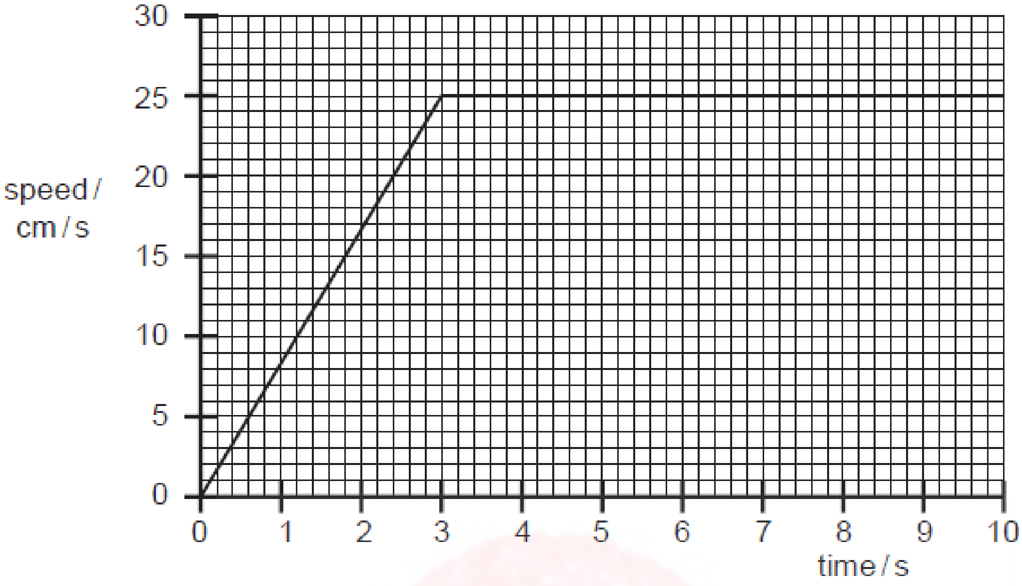

Fig. 1.2

(i) Describe the motion between 3.0 s and 10.0 s after the car has started.

.... [1]

(ii) Use Fig. 1.2 to calculate the circumference of the track.

circumference = ... [2]

(iii) Calculate the increase in speed per second during the time 0 to 3.0 s.

increase in speed per second = ... [2]

1 **(a)** A stone falls from the top of a building and hits the ground at a speed of 32 m/s. The air resistance-force on the stone is very small and may be neglected.

(i) Calculate the time of fall.

time = ...

(ii) On Fig. 1.1, draw the speed-time graph for the falling stone.

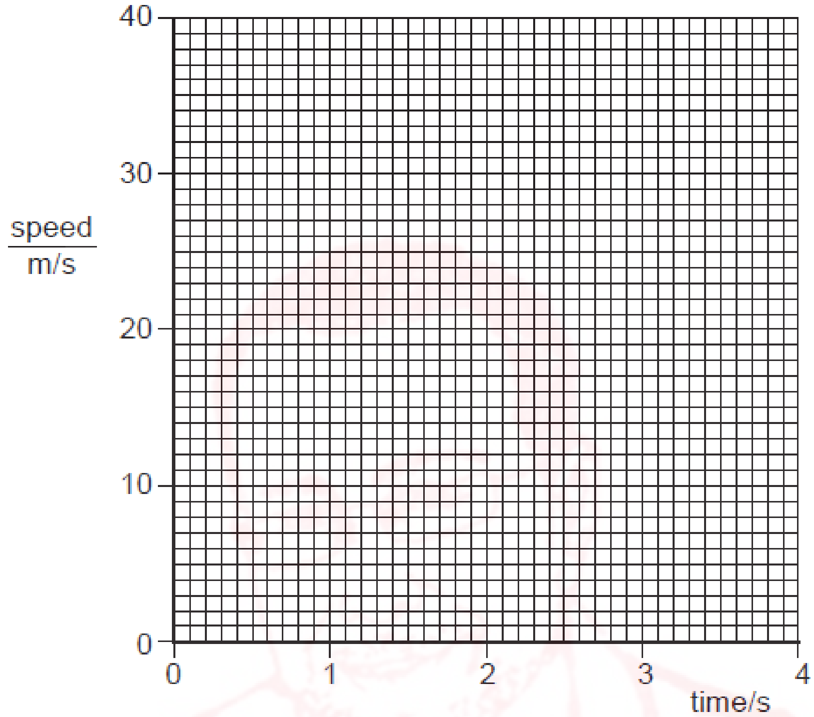

Fig. 1.1

(iii) The weight of the stone is 24 N. Calculate the mass of the stone.

mass = ...

[5]

(b) A student used a suitable measuring cylinder and a spring balance to find the density of a sample of the stone.

(i) Describe how the measuring cylinder is used, and state the readings that are taken.

....

....

....

....

(ii) Describe how the spring balance is used, and state the reading that is taken.

....

....

(iii) Write down an equation from which the density of the stone is calculated.

....

(iv) The student then wishes to find the density of cork. Suggest how the apparatus and the method would need to be changed.

....

....

....

[6]

1 A bus travels from one bus stop to the next. The journey has three distinct parts. Stated in order they are

uniform acceleration from rest for 8.0 s,
uniform speed for 12 s,
non-uniform deceleration for 5.0 s.

Fig. 1.1 shows only the deceleration of the bus.

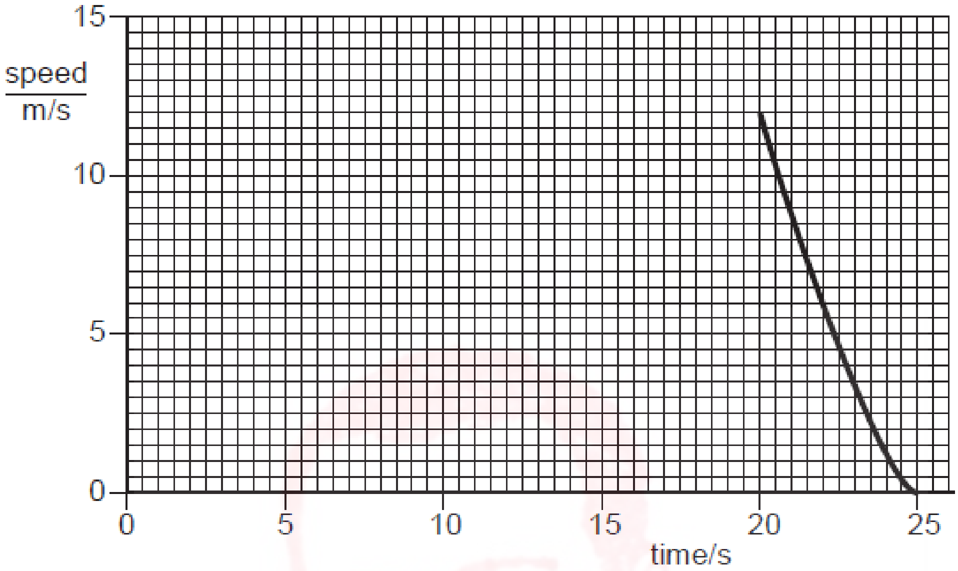

Fig. 1.1

(a) On Fig. 1.1, complete the graph to show the first two parts of the journey. [3]

(b) Calculate the acceleration of the bus 4.0 s after leaving the first bus stop.

acceleration = ... [2]

(c) Use the graph to estimate the distance the bus travels between 20 s and 25 s.

estimated distance = ... [2]

(e) The acceleration of the bus from the second bus stop is less than that from the first bus stop.
Suggest two reasons for this.

1. ....

....

2. ....

.... [2]

Q# 28/_iG Phx/2005/w/Paper 31/ www.SmashingScience.org

1 **(a)** State what is meant by the terms

(i) *weight*, ...

.... [1]

(ii) *density*. ....

.... [1]

Q# 29/_iG Phx/2005/w/Paper 3/ www.SmashingScience.org

1 **(a)** State what is meant by the terms

(i) *weight*, ...

.... [1]

(ii) *density*. ....

.... [1]

(b) A student is given a spring balance that has a scale in newtons. The student is told that the acceleration of free-fall is $10\,m/s^2$.

(i) Describe how the student could find the mass of an irregular solid object.

....

....

.... [2]

(ii) Describe how the student could go on to find the density of the object.

....

....

....

.... [2]

2 Fig. 2.1 shows a simple pendulum that swings backwards and forwards between P and Q.

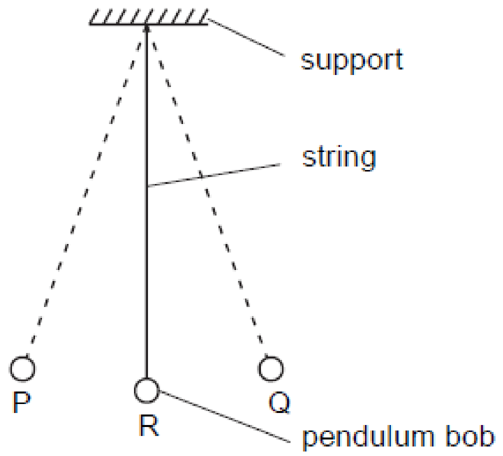

Fig. 2.1

(a) The time taken for the pendulum to swing from P to Q is approximately 0.5 s.

Describe how you would determine this time as accurately as possible.

....

....

.... [2]

1 A solid plastic sphere falls towards the Earth.

Fig. 1.1 is the speed-time graph of the fall up to the point where the sphere hits the Earth's surface.

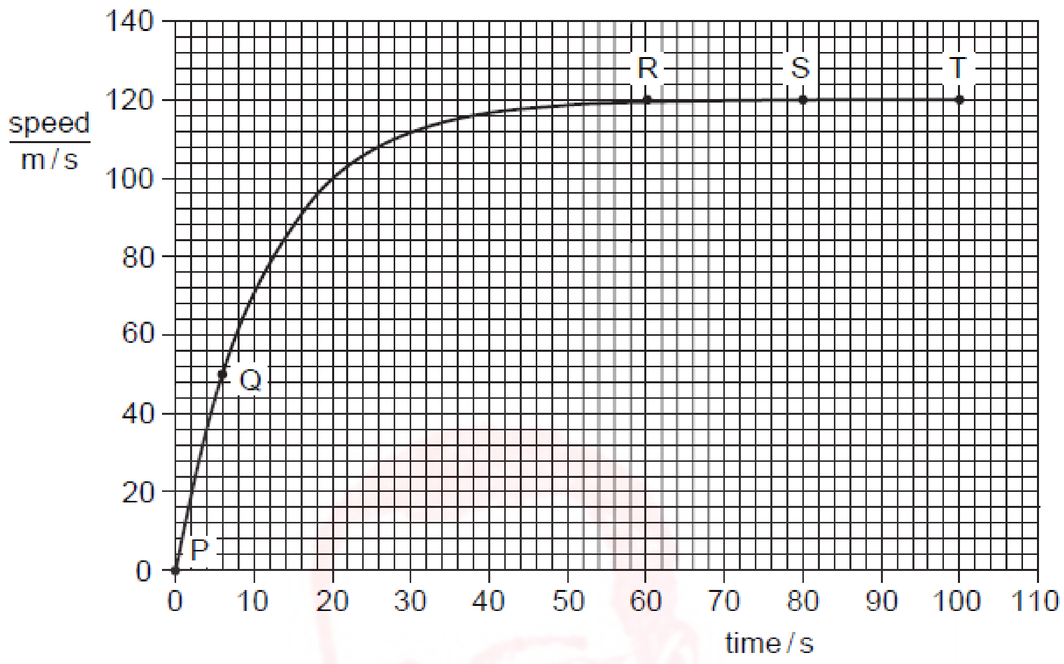

Fig. 1.1

(a) Describe in detail the motion of the sphere shown by the graph.

....

....

....

....

.... [3]

(d) Use the graph to calculate the approximate distance that the sphere falls

(i) between R and T,

distance = ... [2]

(ii) between P and Q.

distance = ... [2]

3 A scientist needs to find the density of a sample of rock whilst down a mine. He has only a spring balance, a measuring cylinder, some water and some thread.

(a) In the space below, draw two labelled diagrams, one to show the spring balance being used and the other to show the measuring cylinder being used with a suitable rock sample. [2]

(b) The spring balance is calibrated in newtons. State how the mass of the rock sample may be found from the reading of the spring balance.

....[1]

(c) State the readings that would be taken from the measuring cylinder.

....

....[1]

(d) State how the volume of the rock would be found from the readings.

....[1]

(e) State in words the formula that would be used to find the density of the sample.

density =

[1]

1 Fig. 1.1 shows the path of one drop of water in the jet from a powerful hose.

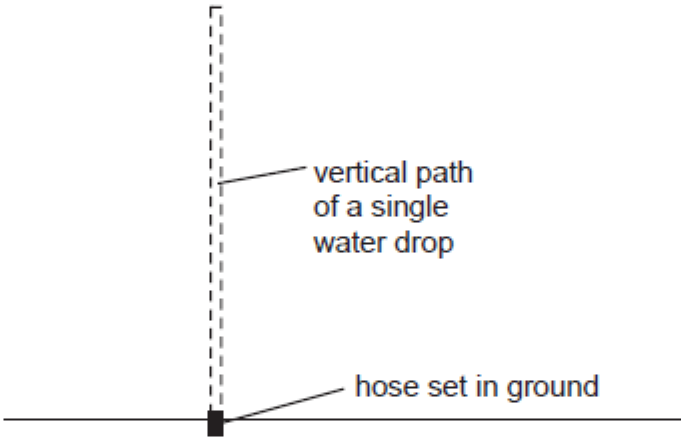

Fig. 1.1

Fig. 1.2 is a graph of speed against time for the water drop shown in Fig. 1.1.

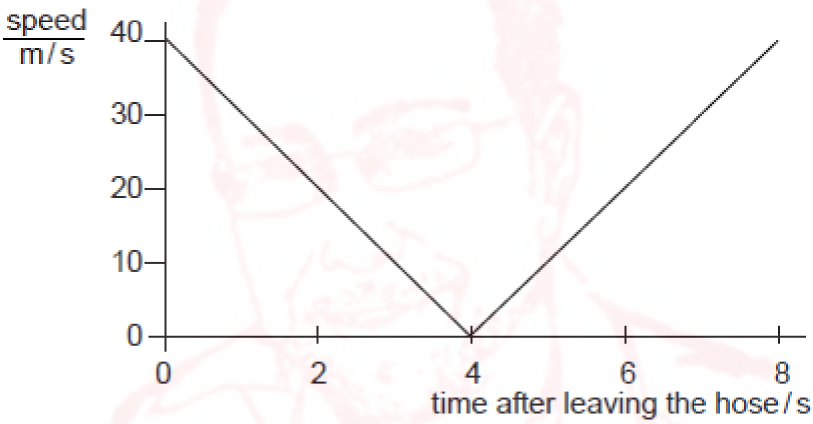

Fig. 1.2

(a) Describe the movement of the water drop in the first 4 s after leaving the hose.

....

....

....[2]

(b) Use Fig. 1.2 to find

(i) the speed of the water leaving the hose,

speed = ...

(ii) the time when the speed of the water is least.

time = ...
[2]

(c) Use values from Fig. 1.2 to calculate the acceleration of the drop as it falls back towards the ground. Show your working.

acceleration = ...[3]

(d) Calculate the greatest distance above the ground reached by the drop.

distance = ...[3]

1 Fig. 1.1 shows the path of one drop of water in the jet from a powerful hose.

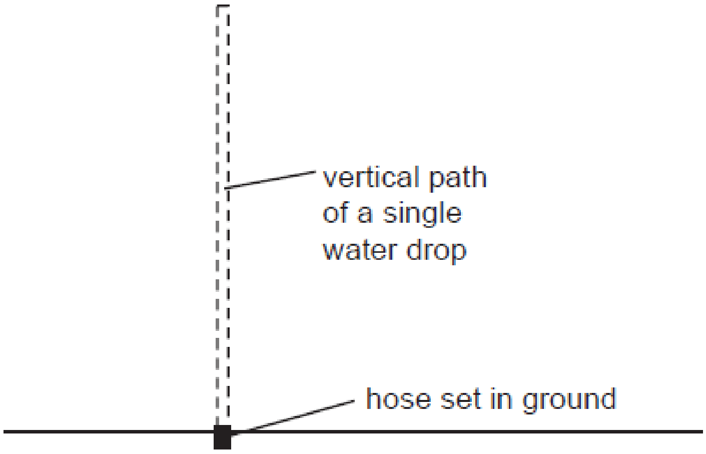

Fig. 1.1

Fig. 1.2 is a graph of speed against time for the water drop shown in Fig. 1.1.

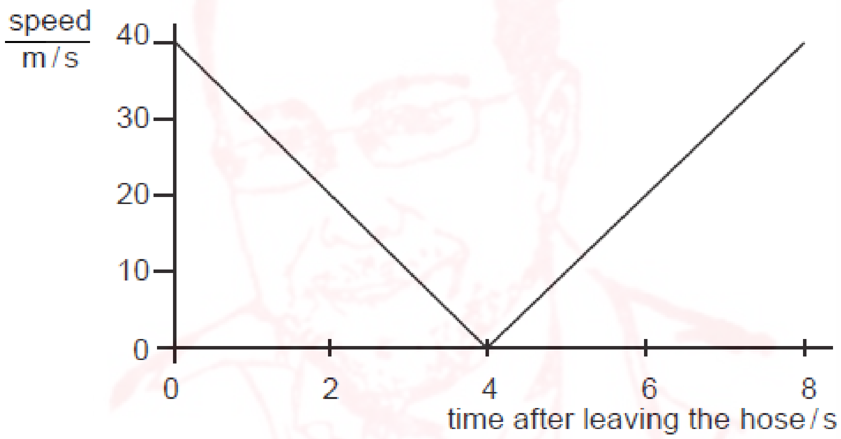

Fig. 1.2

(a) Describe the movement of the water drop in the first 4 s after leaving the hose.

....

....

.... [2]

(b) Use Fig. 1.2 to find

(i) the speed of the water leaving the hose,

speed = ...

(ii) the time when the speed of the water is least.

time = ...
[2]

(c) Use values from Fig. 1.2 to calculate the acceleration of the drop as it falls back towards the ground. Show your working.

acceleration = ...[3]

(d) Calculate the greatest distance above the ground reached by the drop.

distance = ...[3]

1 Fig. 1.1 shows a cycle track.

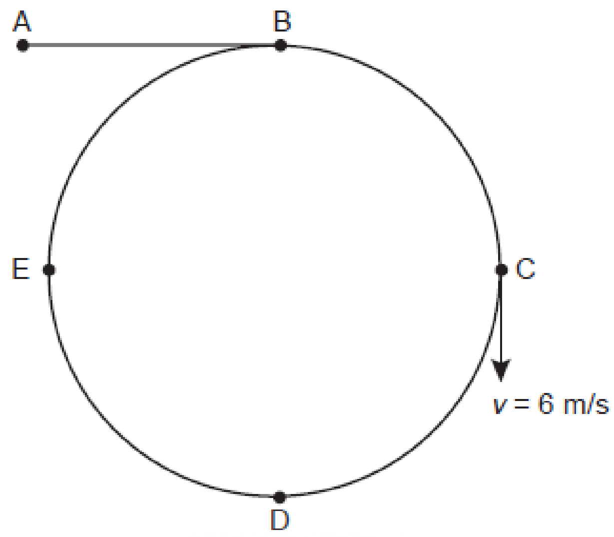

Fig. 1.1

A cyclist starts at A and follows the path ABCDEB.

The speed-time graph is shown in Fig. 1.2.

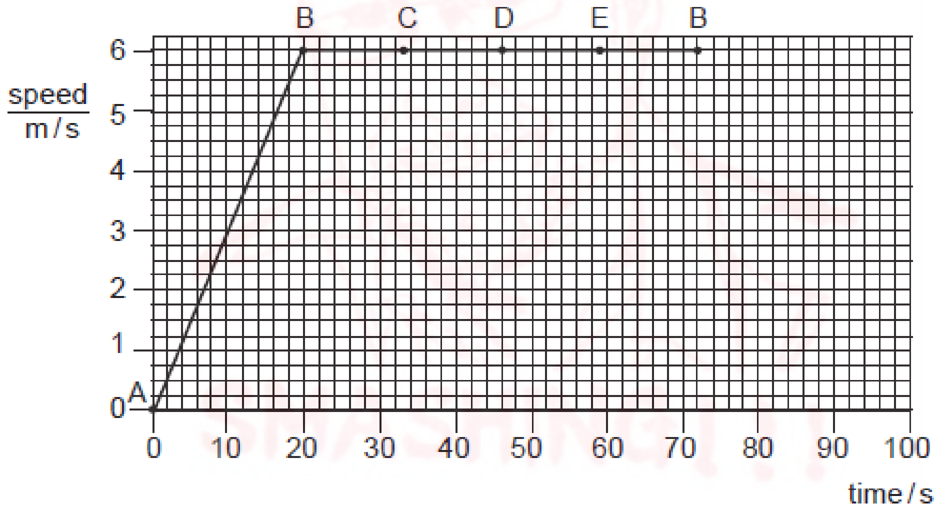

Fig. 1.2

(a) Use information from Fig. 1.1 and Fig. 1.2 to describe the motion of the cyclist

(i) along AB,

....

(ii) along BCDEB.

....

....

[4]

(b) The velocity *v* of the cyclist at C is shown in Fig. 1.1.

State one similarity and one difference between the velocity at C and the velocity at E.

similarity ....

difference ....[2]

(c) Calculate

(i) the distance along the cycle track from A to B,

distance = ...

(ii) the circumference of the circular part of the track.

circumference = ...
[4]

1 Fig. 1.1 shows a cycle track.

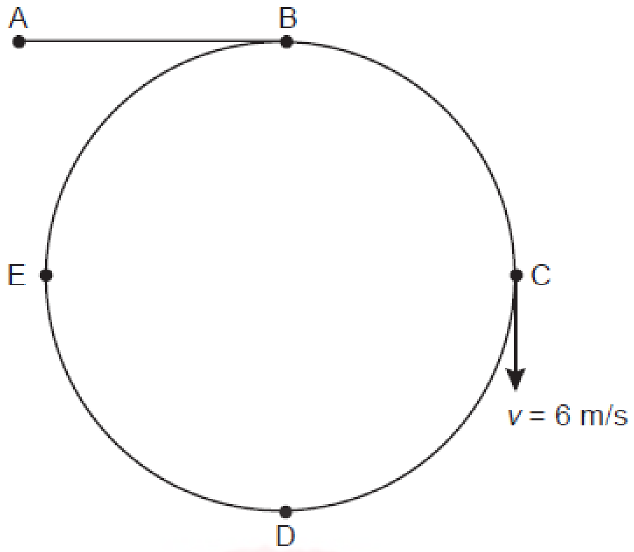

Fig. 1.1

A cyclist starts at A and follows the path ABCDEB.

The speed-time graph is shown in Fig. 1.2.

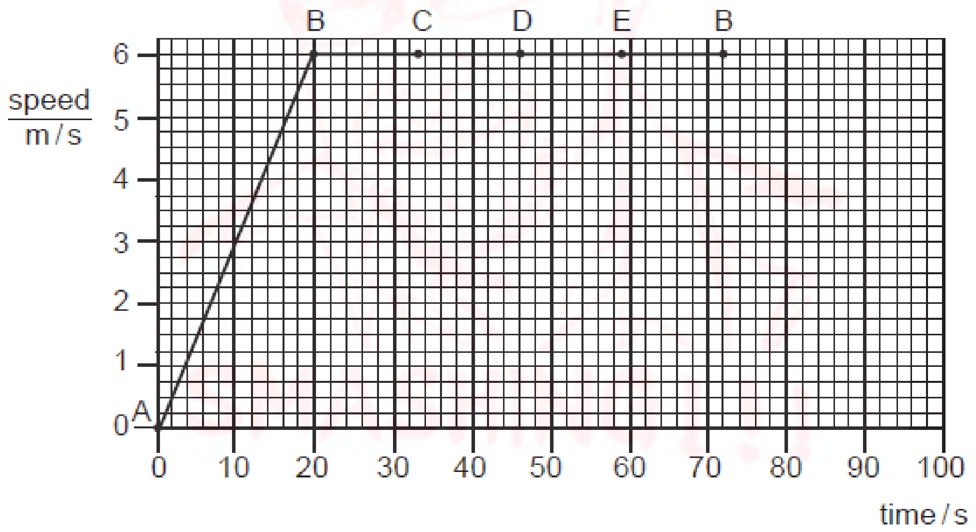

Fig. 1.2

(a) Use information from Fig. 1.1 and Fig. 1.2 to describe the motion of the cyclist

(i) along AB,

....

(c) Calculate

(i) the distance along the cycle track from A to B,

distance = ...

(ii) the circumference of the circular part of the track.

circumference = ...

[4]

1 Fig. 1.1 shows the speed-time graph for a bus during tests.

At time t = 0, the driver starts to brake.

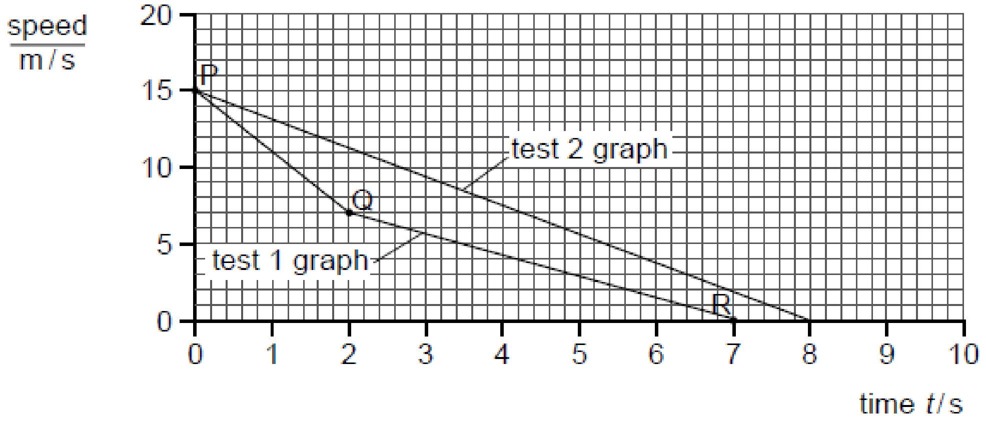

Fig. 1.1

(a) For test 1,

(i) determine how long the bus takes to stop,

....

(ii) state which part of the graph shows the greatest deceleration,

....

(iii) use the graph to determine how far the bus travels in the first 2 seconds.

distance = ...

[4]

(b) For test 2, a device was fitted to the bus. The device changed the deceleration.

(i) State two ways in which the deceleration during test 2 is different from that during test 1.

1 ....

2 ....

(ii) Calculate the value of the deceleration in test 2.

deceleration = ...

[4]

1 Fig. 1.1 shows the speed-time graph for a bus during tests.

At time t = 0, the driver starts to brake.

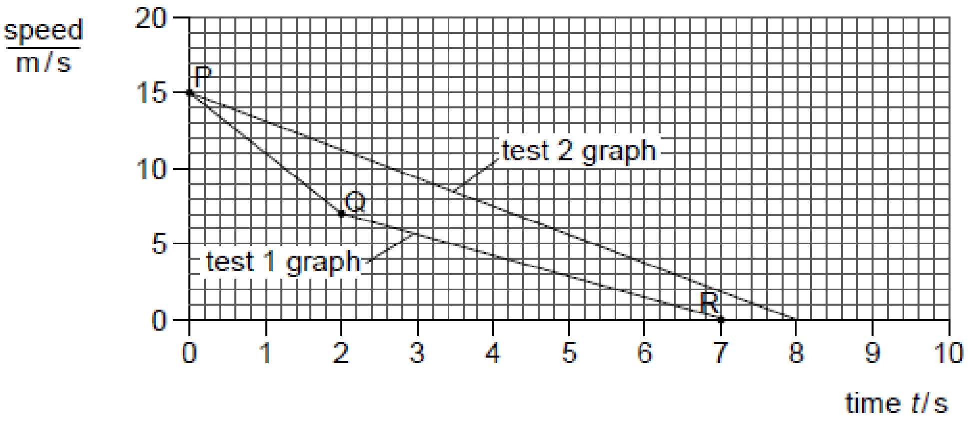

Fig. 1.1

(a) For test 1,

(i) determine how long the bus takes to stop,

....

(ii) state which part of the graph shows the greatest deceleration,

....

(iii) use the graph to determine how far the bus travels in the first 2 seconds.

distance = ...

[4]

(b) For test 2, a device was fitted to the bus. The device changed the deceleration.

(i) State two ways in which the deceleration during test 2 is different from that during test 1.

1 ....

2 ....

(ii) Calculate the value of the deceleration in test 2.

deceleration = ...

[4]

Q# 39/_iG Phx/2003/s/www.SmashingScience.org

2 The speed of a cyclist reduces uniformly from 2.5 m/s to 1.0 m/s in 12 s.

(a) Calculate the deceleration of the cyclist.

deceleration = ...[3]

(b) Calculate the distance travelled by the cyclist in this time.

distance = ...[2]

Q# 40/_iG Phx/2003/s/www.SmashingScience.org

2 The speed of a cyclist reduces uniformly from 2.5 m/s to 1.0 m/s in 12 s.

(a) Calculate the deceleration of the cyclist.

deceleration = ...[3]

(b) Calculate the distance travelled by the cyclist in this time.

distance = ...[2]

1 Fig. 1.1 shows a smooth metal block about to slide down BD, along DE and up EF. BD and DE are friction-free surfaces, but EF is rough. The block stops at F.

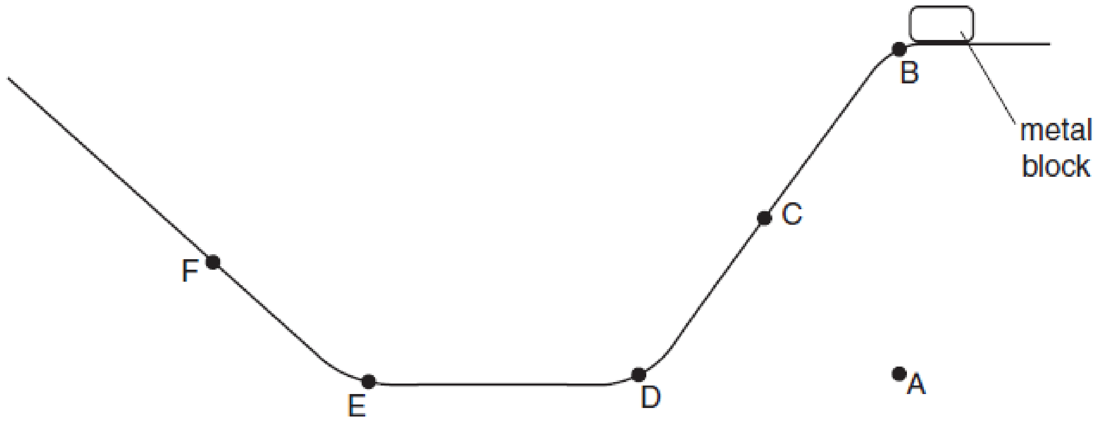

Fig. 1.1

(a) On Fig. 1.2, sketch the speed-time graph for the journey from B to F. Label D, E and F on your graph. [3]

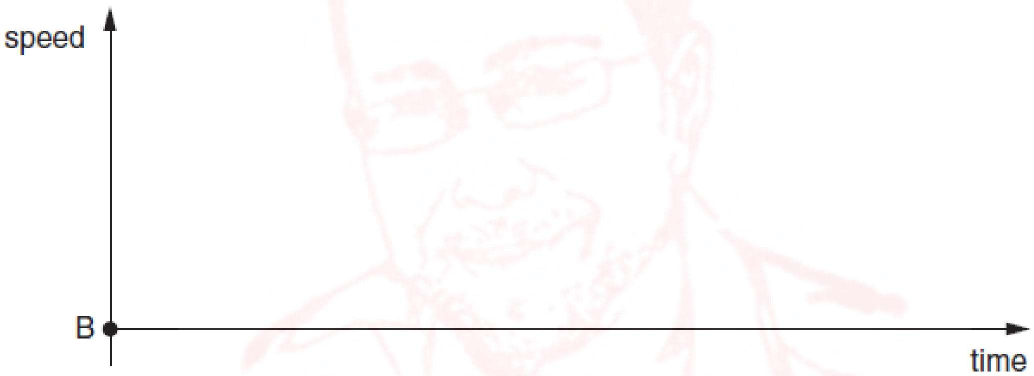

Fig. 1.2

2 A student is given the following apparatus in order to find the density of a piece of rock.

100 g mass
metre rule
suitable pivot on which the rule will balance
measuring cylinder that is big enough for the piece of rock to fit inside
cotton
water

The rock has a mass of approximately 90 g.

(a) **(i)** In the space below, draw a labelled diagram of apparatus from this list set up so that the student is able to find the mass of the piece of rock.

(ii) State the readings the student should take and how these would be used to find the mass of the rock.

....

....

....
[5]

(b) Describe how the volume of the rock could be found.

....

....

....[2]

(c) The mass of the rock is 88 g and its volume is 24 cm^3.
Calculate the density of the rock.

density of rock = ... [2]

1 Fig. 1.1 shows a smooth metal block about to slide down BD, along DE and up EF. BD and DE are friction-free surfaces, but EF is rough. The block stops at F.

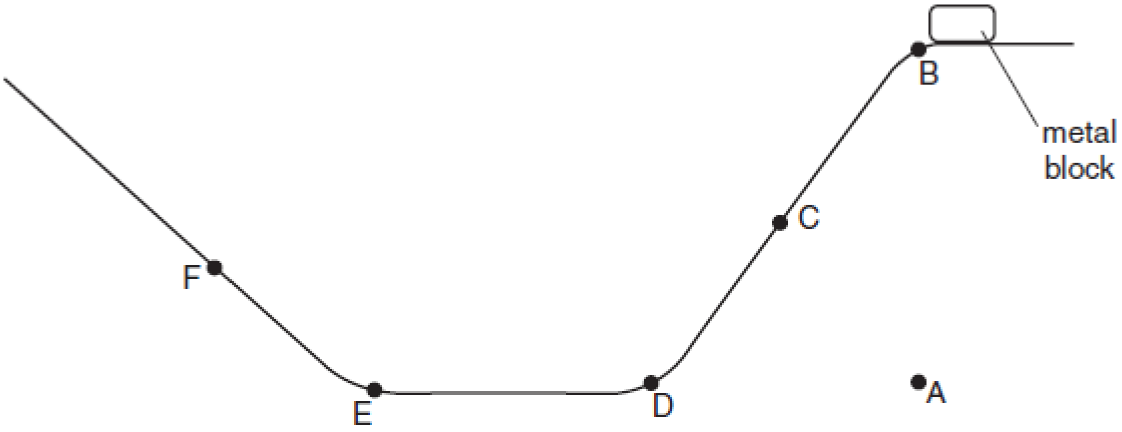

Fig. 1.1

(a) On Fig. 1.2, sketch the speed-time graph for the journey from B to F. Label D, E and F on your graph. [3]

Fig. 1.2

2 A student is given the following apparatus in order to find the density of a piece of rock.

100 g mass
metre rule
suitable pivot on which the rule will balance
measuring cylinder that is big enough for the piece of rock to fit inside
cotton
water

The rock has a mass of approximately 90 g.

(a) (i) In the space below, draw a labelled diagram of apparatus from this list set up so that the student is able to find the mass of the piece of rock.

(ii) State the readings the student should take and how these would be used to find the mass of the rock.

....

....

.... [5]

(b) Describe how the volume of the rock could be found.

....

....

....[2]

(c) The mass of the rock is 88 g and its volume is 24 cm^3.
Calculate the density of the rock.

density of rock = ... [2]

Mark Scheme

Q# 1/ iG Phx/2014/w/Paper 33/ www.SmashingScience.org

1	(a)	(i)	(gradient =) 10 (m/s^2)	B1
		(ii)	any linking of gradient to acceleration of freefall **OR** gravitational field strength	B1
	(b)		gradient decreases	B1
	(c)		speed / velocity stays constant **OR** terminal velocity / speed	B1
			no resultant force **OR** forces cancel / balance	B1
	(d)		initially gradient steeper	B1
			graph lower in second half of BC	B1
			horizontal final section **and** lower than CD	B1

[Total: 8]

Q# 2/ iG Phx/2014/s/Paper 31/ www.SmashingScience.org

2	(a)	(density =) mass / volume	B1
	(b)	water used in measuring / graduated cylinder	B1
		volume of water known or read / recorded / taken	B1
		place the coins in the water and read / record / take new level of water in cylinder	B1
		subtract readings	B1
		OR ALTERNATIVE METHOD:	
		pour water into displacement can to level of spout	(B1)
		place the coins / several coins in the water	(B1)
		collect overflow	(B1)
		measure volume of overflow water using measuring graduated cylinder	(B1)
		measure mass / weigh the coins used with balance / spring balance	B1

(c) one from:
read measuring cylinder levels at bottom of meniscus
repeat volume measurement and find average
place eye level with surface in measuring cylinder (to avoid parallax error)
place coins one at a time to avoid air bubbles between coins
avoid splashing when adding coins to water
make sure coins are dry / clean
use narrow / small measuring cylinder
place containers on horizontal surface
check zero of balance / spring balance / scales
displacement can method: make sure dripping finishes before and after adding coins — B1

[Total: 7]

Q# 3/ iG Phx/2013/w/Paper 3/ www.SmashingScience.org

2	(a)	(i)	$v = u + at$ OR (a =) $(v - u)/t$ OR $24 = a \times 60$ OR $24/60$	C1
			$0.4(0)\,m/s^2$	A1

Q# 4/ iG Phx/2013/s/Paper 31/ www.SmashingScience.org

2	(a)	underline or circle force underline or circle velocity	B1 B1
	(b) (i)	4.07 – 4.1 (s)	B1
	(ii)	$(v - u)/t$ OR $\Delta v/t$ OR in words OR use of 40 ÷ (ans. to **(b)(i)**) OR other correct values from graph answer between 9.7 and 10 m/s^2 or m/s/s	 C1 A1
	(iii)	area under graph OR ½ $(u + v)t$ OR ½ × 40 × (ans. to **(b)(i)**) OR $s = ut + ½at^2$ OR $v^2 = u^2 + 2as$ OR numbers substituted 82 m	C1 A1
	(c)	graph continues in straight line to 6 s	B1

[Total 8]

Q# 5/ iG Phx/2013/s/Paper 31/ www.SmashingScience.org

1	(a)	(density =) mass/volume OR mass per unit volume OR m/V with symbols explained	 B1
	(b) (i)	(vol =) mass/density OR 60.7/2.70 = 22.48 cm^3 to 2 or more sig. figs	C1 A1
	(ii)	$V = A \times$ (average) thickness OR thickness = V/A OR 22.48 / (50 × 30) 0.01499 cm to 2 or more sig. figs. e.c.f. **(b)(i)**	 C1 A1
	(c) (i)	micrometer/screw gauge / (vernier/digital) callipers	B1
	(ii)	check zero of device used / cut sheet into several pieces / detail of how to use device / fold sheet	B1
		measure thickness of sheet <u>in different places</u> OR measure thickness of several pieces together calculate/obtain average thickness OR divide answer by number of measurements/ pieces/places	 B1 B1

[Total 9]

Q# 6/_iG Phx/2013/s/Paper 31/ www.SmashingScience.org

1	**(a)** (density =) mass/volume OR mass per unit volume OR m/V with symbols explained	B1
	(b) (i) (vol =) mass/density OR 60.7/2.70	C1
	= 22.48 cm^3 to 2 or more sig. figs	A1
	(ii) $V = A \times$ (average) thickness OR thickness = V/A OR 22.48 / (50 × 30)	C1
	0.01499 cm to 2 or more sig. figs. e.c.f. **(b)(i)**	A1
	(c) (i) micrometer/screw gauge / (vernier/digital) callipers	B1
	(ii) check zero of device used / cut sheet into several pieces / detail of how to use device / fold sheet	B1
	measure thickness of sheet in different places OR measure thickness of several pieces together	B1
	calculate/obtain average thickness OR divide answer by number of measurements/ pieces/places	B1
		[Total 9]

Q# 7/_iG Phx/2012/w/Paper 31/Q1

(b)	(F=) ma OR 1.1 × 10^5 × 1.8 ecf from **(a)(ii)**	C1
	= 1.98 × 10^5 N at least 2 significant figures. *Unit penalty applies	A1
(c)	driving force = friction/air resistance/drag	B1 **[9]**

*Apply unit penalty once only

Q# 8/_iG Phx/2012/w/Paper 31/ www.SmashingScience.org

1	**(a) (i)** s = area under graph, stated or clearly used	C1
	= (½ × 18 × 10) + (120 × 18) + (½ × 18 × 20) Award if at least one term correct	C1
	= 90 + 2160 +180	C1
	= 2430 m / 2.43 km at least 2 significant figures. *Unit penalty applies	A1
	(ii) v = u + at in any form OR (a=) gradient OR 18/10	C1
	= 1.8 m/s^2 *Unit penalty applies	A1

Q# 9/_iG Phx/2012/w/Paper 31/ www.SmashingScience.org

2	**(a)** Size / magnitude (NOT distance) and direction	B1
	(b) Vectors towards East and North with arrows correct by eye	B1
	Complete triangle or rectangle for candidate's vectors	B1
	Resultant with correct arrow	B1
	Resultant 94 to 96 m/s by scale OR 95 m/s by calculation *Unit penalty applies	B1
	Angle measured 13.5° – 15.5° OR 15° by calculation *Unit penalty applies	B1 **[6]**

*Apply unit penalty once only

Q# 10/ iG Phx/2012/w/Paper 31/ www.SmashingScience.org

1	(a)	(i)	s = area under graph, stated or clearly used	C1
			= (½ × 18 × 10) + (120 × 18) + (½ × 18 × 20) Award if at least one term correct	C1
			= 90 + 2160 +180	C1
			= 2430 m / 2.43 km at least 2 significant figures. *Unit penalty applies	A1
		(ii)	v = u + at in any form OR (a=) gradient OR 18/10	C1
			= 1.8 m/s^2 *Unit penalty applies	A1

Q# 11/ iG Phx/2012/s/Paper 31/ www.SmashingScience.org

1	(a)	Period: 1.81 s OR 1.8 s as mean value OR 1.8 s as most common reading / the mode	B1
	(b)	Time a minimum of 2 (successive) oscillations	B1
		Divide result by the number of oscillations	B1
		OR	
		Count no. of oscillations in at least 20 s	(B1)
		Divide the time by the number of oscillations OR Divide no. of oscillations by time and find reciprocal	(B1)
		2 of: Repeat (several times) and find mean Time with reference to fixed / fiducial point or top or bottom of oscillation Check / set zero of stop-watch Show knowledge of what is meant by one oscillation	B2

[Total: 5]

Q# 12/ iG Phx/2012/s/Paper 31/ www.SmashingScience.org

2	(a)	(i)	Increasing speed / acceleration	B1
		(ii)	Constant / steady / uniform speed or motion	B1
		(iii)	Decreasing speed / deceleration / braking / slowing / stopping / negative acceleration	B1
	(b)	(i)	(Total) distance / (total) time OR *d* / *t* OR 400 / 60	C1
			6.67 m/s at least 2 s.f.	A1
		(ii)	Mention of maximum gradient OR clear that whole or part of B to C is used	C1
			Use of correct data from graph to +/– ½ square	C1
			Answer rounds to 9.2 to 9.4 m/s, at least 2 s.f.	A1

[Total: 8]

Q# 13/_iG Phx/2011/w/Paper 31/ www.SmashingScience.org

1 (a) acceleration = $\frac{v - u}{t}$ OR $\frac{\Delta v}{t}$ (symbols used to be explained)
OR change of velocity ÷ time
OR rate of change of velocity
OR change of velocity per second / in 1 sec (allow 'in a certain time') — B1
accept speed for velocity

(b) (i) use of any area under graph — C1
750 m — A1

(ii) time = change of speed ÷ acceleration OR 30/0.60 — C1
= 50 (s) — A1
if working for t = 50 s not shown, allow 2 marks for correct use of 50 s
graph: along y-axis to 180 s / rise starts at 180 s — B1
from x-axis rises to 30 m/s at 230 s / candidate's calculated time — B1
horizontal from top of slope to 280 s — B1 [8]
allow ½ square tolerance at 180 s where relevant
allow ecf from wrong t

Q# 14/_iG Phx/2010/w/Paper 31/ www.SmashingScience.org

2 (a) constant velocity must be in a straight line/direction of motion is changing — B1

Q# 15/_iG Phx/2010/w/Paper 31/ www.SmashingScience.org

Q# 16/_iG Phx/2010/s/Paper 31/ www.SmashingScience.org

1 (a) decreases / braking / decelerating)
constant / steady / nothing) all 3 — B1
increases / accelerate)

(b) speed x time in any form, symbols, numbers or words
OR any area under graph used or stated — C1
13 (m/s) OR 24 (s) seen or used in correct context — C1
312 m — A1

(c) rate of change of speed OR gradient of graph OR 18/12 — C1

18 (m/s) OR 12 (s) seen or used in correct context — C1
1.5 m/s^2 — A1

(d) <u>same</u> gradient / slope OR equal speed changes in equal times OR
allow graph symmetrical — B1 [8]

Q# 17/_iG Phx/2009/w/Paper 31/ www.SmashingScience.org

1 (a) micrometer OR screw gauge OR vernier scale NOT vernier callipers — B1

(b) 2.73 mm — B1

(c) check/set zero)
close instrument on to paper)
not too tight/use ratchet) any 3 — B1 × 3
take reading of both scales)
use several sheets)
divide reading by no. of sheets)

[5]

Q# 18/_iG Phx/2009/w/Paper 31/ www.SmashingScience.org

2 (a) measuring cylinder with liquid — B1
immerse statue — B1
volume from difference of readings from measuring cylinder — B1
OR
displacement can/equivalent/beaker, filled to overflowing with liquid — (B1)
immerse statue — (B1)
measure volume displaced with measuring cylinder — (B1)

(b) (D =) M/V OR 600/65 — B1
9.23 g/cm^3 (minimum 2 s.f.) N.B. unit penalty applies — B1
OR
(For gold) (M =) V × D OR 65 × 19 — (B1)
1235 g (minimum 2 s.f.) N.B. unit penalty applies — (B1)
OR
(For gold) (V =) M / D OR 600/19 — (B1)
31.6 cm^3 (minimum 2 s.f.) N.B. unit penalty applies — (B1)

'NO' ticked if justified by previous work in **(a)** or **(b)**.
e.c.f from wrong values above — B1

[6]

Q# 19/ iG Phx/2009/w/Paper 31/ www.SmashingScience.org

2 (a) measuring cylinder with liquid B1
immerse statue B1
volume from difference of readings from measuring cylinder B1
OR
displacement can/equivalent/beaker, filled to overflowing with liquid (B1)
immerse statue (B1)
measure volume displaced with measuring cylinder (B1)

(b) (D =) M/V OR 600/65 B1
9.23 g/cm^3 (minimum 2 s.f.) N.B. unit penalty applies B1
OR
(For gold) (M =) V × D OR 65 × 19 (B1)
1235 g (minimum 2 s.f.) N.B. unit penalty applies (B1)
OR
(For gold) (V =) M / D OR 600/19 (B1)
31.6 cm^3 (minimum 2 s.f.) N.B. unit penalty applies (B1)

'NO' ticked if justified by previous work in **(a)** or **(b)**.
e.c.f from wrong values above B1

[6]

Q# 20/ iG Phx/2009/s/Paper 31/ www.SmashingScience.org

1 check zero on stopwatch OR repeat OR other sensible precaution B1
start stopwatch at some recognisable point in the cycle B1
stop stopwatch after at least 10 cycles OR count no. of cycles in at least 10 s B1
divide time by number of cycles B1 [4]

Q# 21/ iG Phx/2009/s/Paper 31/ www.SmashingScience.org

3 (a) (i) straight line OR constant gradient / slope OR
change in speed with time constant OR speed proportional to time B1

(ii) increase in velocity / time OR $a = v/t$, symbols, words or numbers C1
0.75 m/s^2 A1

(b) (i) decreases OR acceleration slows (down) NOT 'it slows down' C1

(ii) equal to forward / downward force / force down slope OR
constant / maximum OR (giving) no resultant force C1
equal to component of weight (down slope) A1

(iii) 1 graph starting at origin B1
curved from start AND decreasing gradient AND
horizontal final part B1

2 label A on any correct curved region B1
label B on horizontal region B1 [10]

Q# 22/ iG Phx/2008/s/www.SmashingScience.org

1 (a) (i) v/t or (v-u)/t or 28.5/3 or his correct ratio C1
9.3 to 9.5 m/s^2 A1

(ii) area under graph or 0.5 × 3 × 28.5 or ½b×h C1
42 to 44 m (allow reasonable e.c.f.) A1

(iii) 15 m/s B1

Q# 23/ iG Phx/2007/w/Paper 31/Q1

(b) (i) weight of ball down and (air) resistance up
OR friction opposes weight)
upward/resistance/friction force increases
with time/distance/speed/as ball falls) any 3 B1×3
net force reduces)
less force, so less acceleration)

(ii) up force = down force OR no resultant force OR air res. = weight B1
no net force, no acceleration/constant speed B1

Q# 24/_iG Phx/2007/w/Paper 3/ www.SmashingScience.org

1 (a) (i) 1.6s to 1.8s ALLOW 4.2 – 6s ALLOW 4.4 – 6s NOT 2s NOT 4.0 – 6s B1

(ii) 6 – his (i), evaluated ALLOW 0 – 4.2s ALLOW 0 – 4.4s NOT 0 – 4s e.c.f. B1

(iii) his (i) × 20 C1
32 – 36m or his (i) × 20 evaluated
allow B1 only for 40m with no working A1

(iv) area under whole graph or ½vt + his(iii) C1
70 – 95m A1

Q# 25/_iG Phx/2007/s/3 Q1

(c) (i) constant speed/velocity OR uniform motion OR no acceln. B1 [1]
NOT constant motion

(ii) (3 × 25)/2 + (7 × 25) OR area under graph C1

212.5 cm any no s.f. ⩾ 2 A1 [2]

(iii) 25/3 or increase in speed/time C1

8.33 cm/s any no s.f. ⩾ 2 OR 8⅓ cm/s accept cm/s^2 A1 [2]

Q# 26/_iG Phx/2006/w/Paper 3/ www.SmashingScience.org

1 (a) (i) t = v/g or 32/10 C1
= 3.2 s A1

(ii) straight line starting at zero, inclined C1
line joining 0,0 and 3.2, 32, accept c.f. from time (i) A1

(iii) 2.4 kg A1 [5]

(b) (i) take volume of water before use B1
(totally) immerse stone and take new volume B1
(Not clearly measured before and after C1)

(ii) hang rock from balance and take reading B1

(iii) density = mass/volume B1

(iv) need to tie "sinker" or cork or press cork down B1
need volume with sinker then volume with sinker and cork or just completely submerge cork B1 [6]

[Total: 11]

Q# 27/_iG Phx/2006/s/www.SmashingScience.org

1	(a)	point 8,12 identified	B1	
		straight line joining 0,0 and 8,12	B1	
		straight line joining 8,12 and 20,12	B1	3
	(b)	acceleration = change in v/change in t or 12/8 etc	C1	
		= 1.5 m/s^2	A1	2
	(c)	distance = area under graph between t = 20 and t = 25	C1	
		= 24 m to 28 m	A1	2

Q# 28/_iG Phx/2005/w/Paper 31/ www.SmashingScience.org

1	(a)	force of gravity on a mass or mg mass/volume	B1 B1	[2]

Q# 29/_iG Phx/2005/w/Paper 3/ www.SmashingScience.org

1	(a)	force of gravity on a mass or mg mass/volume	B1 B1	[2]
	(b) (i)	hang object from spring balance, reading in N taken divide reading in N by 10 or g	B1 B1	
	(iii)	volume of water in cylinder or fill overflow can to top add object find increase in volume or measure overflow volume {no credit for mass unless not scored in (i) and no credit for density = mass/ volume unless not scored in a) }	B1 B1	[4]

Q# 30/_iG Phx/2005/s/3 Q2

2	(a)	time a number of swings (if number stated, >5) time divided by [2 x number of swings]	M1 A1	2

Q# 31/_iG Phx/2005/s/www.SmashingScience.org

1	(a)	acceleration, speed increases acceleration getting less acc. zero/constant speed along RT or terminal velocity	B1 B1 B1	3
	(d) (i)	distance = speed x time or 120 x 40 distance = 4800 m	C1 A1	
	(ii)	distance = average speed x time or 25 x 6 or area under graph distance = 150 m	C1 A1	4 [11]

Q# 32/_iG Phx/2004/w/Paper 3/ www.SmashingScience.org

3 (a)	one mark for each labelled diagram both diagrams sensible but no labels	max 1	2	2
(b)	newtons/10 is kg or equivalent		1	1
(c)	volume/level/reading of water then volume etc. water + rock		1	1
(d)	difference in the two readings		1	1
(e)	density = mass/volume		1	1
				(6)

Q# 33/_iG Phx/2004/w/Paper 3/ www.SmashingScience.org

1 (a)	deceleration/slows down/speed reduces	1	
	deceleration uniform/comes to rest at 4 s	1	2
(b) (i)	40 (m/s)	1	
(ii)	4 (s)	1	2
(c)	speed falls from 0 to 40 m/s in 4 s	1	
	acceleration = change in speed/time taken or 40(m/s)/4(s)	1	
	acceleration = 10 m/s^2	1	3
(d)	distance = average speed x time or area of triangle under graph	1	
	= 20 x 4 or 2 x 40	1	
	= 80 m	1	3
			(10)

Q# 34/_iG Phx/2004/w/Paper 3/ www.SmashingScience.org

1 (a)	deceleration/slows down/speed reduces	1	
	deceleration uniform/comes to rest at 4 s	1	2
(b) (i)	40 (m/s)	1	
(ii)	4 (s)	1	2
(c)	speed falls from 0 to 40 m/s in 4 s	1	
	acceleration = change in speed/time taken or 40(m/s)/4(s)	1	
	acceleration = 10 m/s^2	1	3
(d)	distance = average speed x time or area of triangle under graph	1	
	= 20 x 4 or 2 x 40	1	
	= 80 m	1	3
			(10)

Q# 35/_iG Phx/2004/s/www.SmashingScience.org

1	(a)	(i)	Acceleration / increase in speed	M1	
			Uniform / constant or in a straight line	A1	
		(ii)	Uniform speed	B1	
			Velocity changes / motion in a circle / accelerates	B1	4
	(b)		Similarity: same value / 6m/s or velocity changing	B1	
			Difference: opposite directions / up at E, down at C	B1	2
	(c)	(i)	Average speed x time / area under graph / 3 x 20	C1	
			60 m	A1	
		(ii)	6 x 52	C1	
			312m	A1	4
					[10]

Q# 36/_iG Phx/2004/s/www.SmashingScience.org

1	(a)	(i)	Acceleration / increase in speed	M1	
			Uniform / constant or in a straight line	A1	
		(ii)	Uniform speed	B1	
			Velocity changes / motion in a circle / accelerates	B1	4
	(b)		Similarity: same value / 6m/s or velocity changing	B1	
			Difference: opposite directions / up at E, down at C	B1	2
	(c)	(i)	Average speed x time / area under graph / 3 x 20	C1	
			60 m	A1	
		(ii)	6 x 52	C1	
			312m	A1	4
					[10]

Q# 37/_iG Phx/2003/w/Paper 3/ www.SmashingScience.org

1 (a)	(i)	7(.0 s)	A1	
	(ii)	PQ or 0 – 2s or other correct description	A1	
		distance = av. speed x time or area under graph	C1	
		distance 11 x 2 m= 22 m	A1	4
(b)	(i)	deceleration (now) uniform (test 2)	B1	
		slower/lower (average) value/value between that of PQ and QR/takes longer (or values) time to come to rest.	B1	
	(ii)	deceleration = change in speed/time or 15/8	C1	
		value = 1.9 m/s^2	A1	4

Q# 38/_iG Phx/2003/w/Paper 3/ www.SmashingScience.org

1 (a)	(i)	7(.0 s)	A1	
	(ii)	PQ or 0 – 2s or other correct description	A1	
		distance = av. speed x time or area under graph	C1	
		distance 11 x 2 m= 22 m	A1	4
(b)	(i)	deceleration (now) uniform (test 2)	B1	
		slower/lower (average) value/value between that of PQ and QR/takes longer (or values) time to come to rest.	B1	
	(ii)	deceleration = change in speed/time or 15/8	C1	
		value = 1.9 m/s^2	A1	4

Q# 39/ iG Phx/2003/s/www.SmashingScience.org

2	(a)	change in speed is 1.5 m/s	C1	
		deceleration = decrease in speed/time or 1.5/12	C1	
		a = (-/+) 0.125 m/s	A1	3
	(b)	average speed = 1.75 m/s	C1	
		distance = 21 m	A1	2
				[5]

Q# 40/ iG Phx/2003/s/www.SmashingScience.org

2	(a)	change in speed is 1.5 m/s	C1	
		deceleration = decrease in speed/time or 1.5/12	C1	
		a = (-/+) 0.125 m/s	A1	3
	(b)	average speed = 1.75 m/s	C1	
		distance = 21 m	A1	2
				[5]

Q# 41/ iG Phx/2002/w/Paper 3/ www.SmashingScience.org

Accept D & E marked on time axis

No labels -1

1 a	BD correct, (straight line i.e. constant acceleration)		B1	
	DE correct, (constant speed or slightly reducing speed only)		B1	
	EF correct, (speed reduced to zero, gradient steeper than BD)	3	B1	3
b(i)	force = 2 (N)		C1	
	work = (2 x 0.6) = 1.2 J*	2	A1	
(ii)	k.e. = $0.5mv^2$		C1	
	= 0.5 x 0.2 x 2.5 x2.5		C1	
	= 0.625 J*	3	A1	5
c	velocity - vector, speed scalar		B1	
	direction changes so velocity changes	2	B1	2

Q# 42/ iG Phx/2002/w/Paper 3/ www.SmashingScience.org

2 a(i)	outline, ruler pivoted (at centre), mass one side, rock other side		C1	
	quality set-up, each mass at (marked) point + labels	2	A1	
(ii)	~~rod must be balanced before readings can be taken or record mass as 100 g~~		~~B1~~	
	distances to pivot from rock ~~and mass~~ B1 distance pivot to mass B1		B2	
	mass or 100 x distance to pivot = mass of rock x distance rock to pivot	3	B1	5
b	put water in cylinder, read value		B1	
	insert rock until covered, read value		B1	
	difference in values is volume of rock	2	B1	M2*
c	density = mass/volume or 88/24		C1	
	= 3.7 g/cm³* (accept $3\frac{2}{3}$ g/cm³) (accept 3.6)	2	A1	2
			QT	9

Q# 43/ iG Phx/2002/w/Paper 3/ www.SmashingScience.org

Accept D & E marked on time axis

No labels -1

1 a	BD correct, (straight line i.e. constant acceleration)		B1	
	DE correct, (constant speed or slightly reducing speed only)		B1	
	EF correct, (speed reduced to zero, gradient steeper than BD)	3	B1	3
b(i)	force = 2 (N)		C1	
	work = (2 x 0.6) = 1.2 J*	2	A1	

2 a(i)	outline, ruler pivoted (at centre), mass one side, rock other side	C1	
	quality set-up, each mass at (marked) point + labels	2 A1	
(ii)	~~rod must be balanced before readings can be taken or record mass as 100 g~~	B1	
	distances to pivot from rock ~~and mass~~ B1 distance pivot to mass B1	B2	
	mass or 100 x distance to pivot = mass of rock x distance rock to pivot	3 B1	5
b	put water in cylinder, read value	B1	
	insert rock until covered, read value	B1	
	difference in values is volume of rock	2 B1	M2*
c	density = mass/volume or 88/24	C1	
(accept 3.6)	= 3.7 g/cm^3 (accept $3\frac{2}{3}$ g/cm^3)	2 A1	2
		QT	9