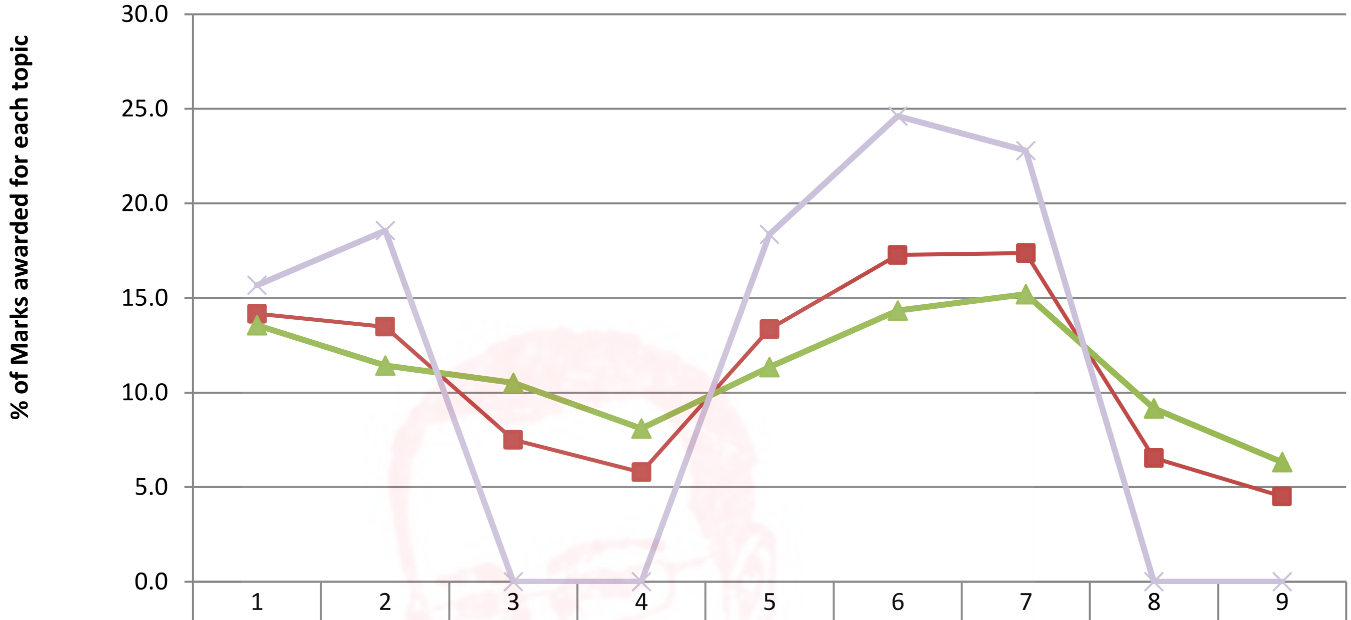
Name

iG Phx 2 EQ 14w to 02w P3 4Students 237marks

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 33

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)

Topic 3
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

5 (a) A water tank has a rectangular base of dimensions 1.5 m by 1.2 m and contains 1440 kg of water.

Calculate

(i) the weight of the water,

weight = ... [1]

(ii) the pressure exerted by the water on the base of the tank.

pressure = ... [2]

(b) Fig. 5.1 shows two water tanks **P** and **Q** of different shape. Both tanks are circular when viewed from above. The tanks each contain the same volume of water. The depth of water in both tanks is 1.4 m.

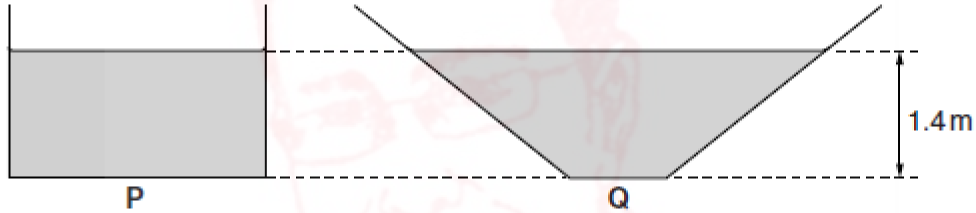


Fig. 5.1

(i) The density of water is 1000 kg/m^3. The pressures exerted by the water on the base of the two tanks are equal.

Calculate this pressure.

pressure = ... [2]

(ii) Equal small volumes of water are removed from each tank.

State which tank, **P** or **Q**, now has the greater water pressure on its base. Explain your answer.

....

....

.... [2]

[Total: 7]

4 Fig. 4.1 shows a heavy ball B of weight *W* suspended from a fixed beam by two ropes P and Q.

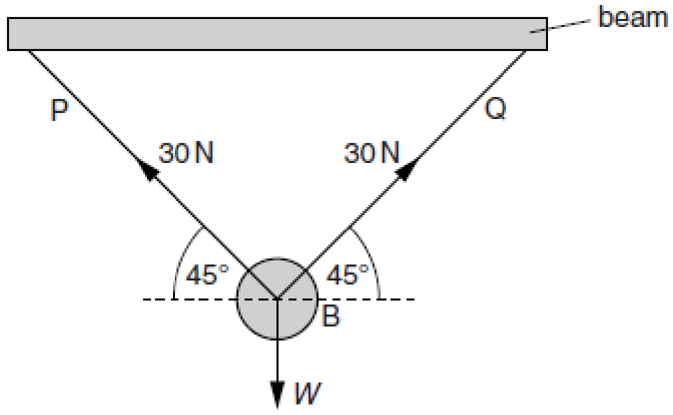


Fig. 4.1

P and Q are both at an angle of 45° to the horizontal. The tensions in P and Q are each 30 N.

(a) In the space below, draw a scale diagram to find the resultant of the tensions in P and Q. Use a scale of 1.0 cm to represent 5.0 N. Label the forces and show their directions with arrows.

resultant = ... [4]

(b) State the direction of the resultant. .... [1]

(c) State the magnitude of *W*. magnitude of *W* = ... [1]

[Total: 6]

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]

(ii) the resultant force acting on the train.

force = ... [2]

1 **(a)** State Hooke's law.

....

.... [1]

(b) Fig. 1.1 shows a graph of the stretching force F acting on a spring against the extension x of the spring.

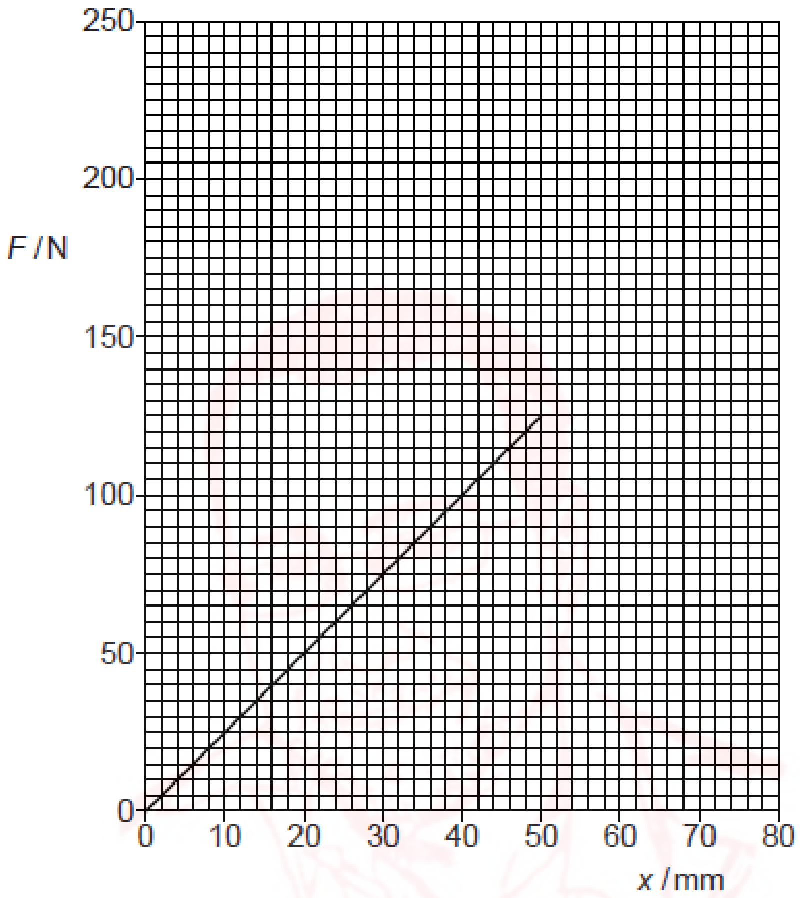


Fig. 1.1

(i) State the features of the graph that show that the spring obeys Hooke's law.

....

.... [1]

(ii) Calculate k, the force per unit extension of the spring.

k = ... [3]

(iii) The limit of proportionality of the spring is reached at an extension of 50 mm.

Continue the graph in Fig. 1.1 to suggest how the spring behaves when the stretching force is increased to values above 125 N. [1]

(iv) Another spring has a smaller value of *k*. This spring obeys Hooke's law for extensions up to 80 mm.

On the grid of Fig. 1.1, draw a possible line of the variation of *F* with *x* for this spring. [1]

[Total: 7]

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

3 **(a)** **(i)** Write down the names of **three** man-made devices in everyday use that depend, for their action, upon the moments of forces.

1. ....

2. ....

3. ....

[2]

(ii) Fig. 3.1 shows a uniform rod AB acted upon by three equal forces *F*.

Fig. 3.1

State **two** reasons why the rod is **not** in equilibrium.

1. ....

2. ....

[2]

(b) Fig. 3.2 shows a uniform rod PQ, supported at its centre and held in a horizontal position. The length of PQ is 1.00 m.

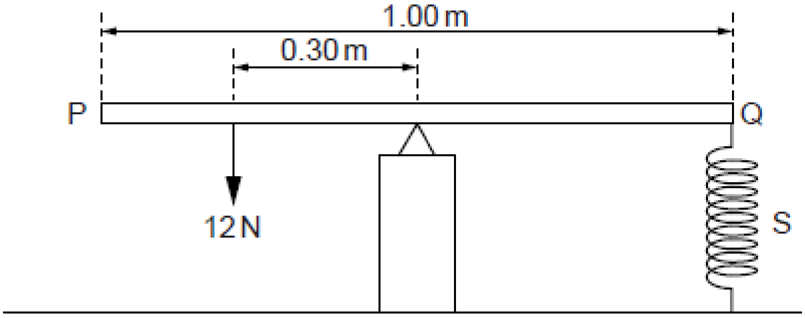


Fig. 3.2

A force of 12 N acts at a distance of 0.30 m from the support. A spring S, fixed at its lower end, is attached to the rod at Q.

(i) Calculate the force exerted on PQ by the spring.

force = ... [2]

(ii) Explain why it is not necessary to know the weight of PQ.

....

.... [1]

[Total: 7]

Q# 6/ iG Phx/2013/s/Paper 31/ www.SmashingScience.org
Gravity can be considered to be equal to 10N per Kg

3 Fig. 3.1 shows the descent of a sky-diver from a stationary balloon.

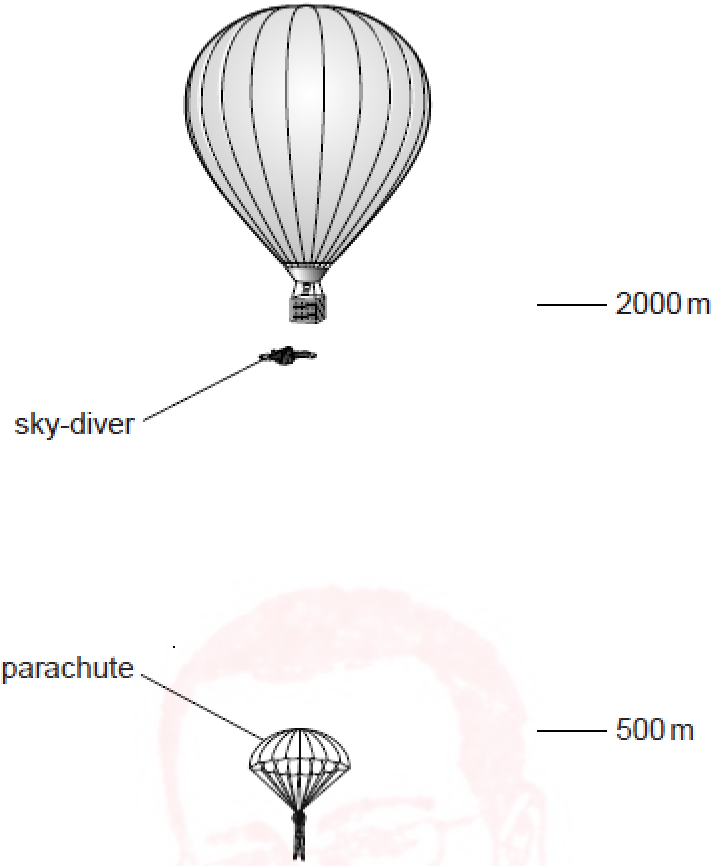


Fig. 3.1 (not to scale)

The sky-diver steps from the balloon at a height of 2000 m and accelerates downwards.

His speed is 52 m/s at a height of 500 m.

He then opens his parachute. From 400 m to ground level, he falls at constant speed.

(a) The total mass of the sky-diver and his equipment is 92 kg.

(b) State

(i) what happens to the air resistance acting on the sky-diver during the fall from 2000 m to 500 m,

.... [1]

(ii) the value of the air resistance during the fall from 400 m to ground.

air resistance = ... [1]

3 **(a)** A stationary body is acted upon by a number of forces. State the two conditions which must apply for the body to remain at rest.

1. ....

2. ....
[2]

(b) Fig. 3.1 shows a device used for compressing crushed material.

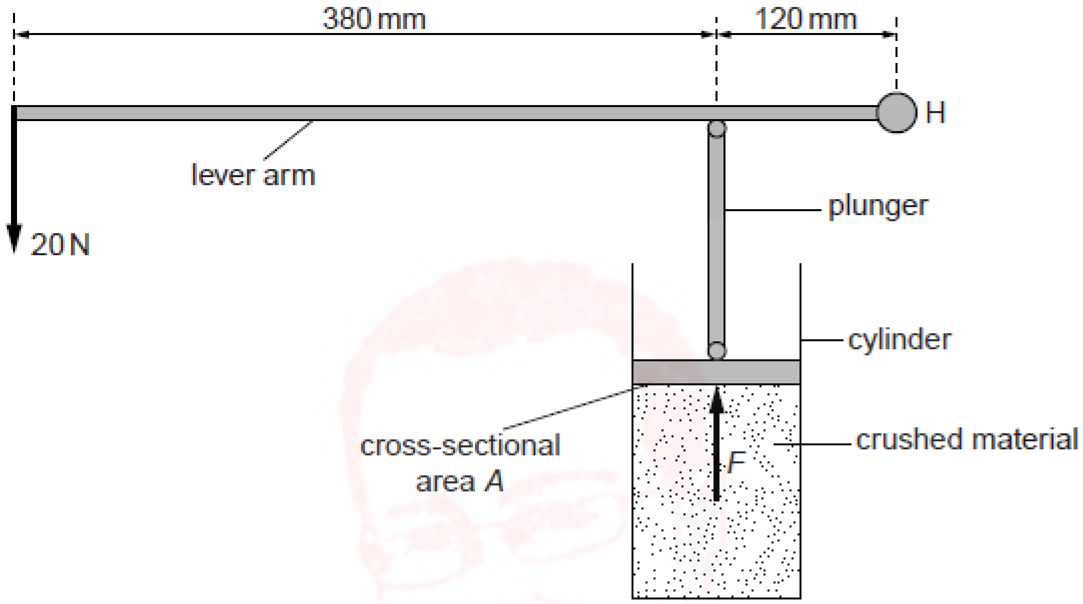


Fig. 3.1

The lever arm rotates about the hinge H at its right-hand end. A force of 20 N acts downwards on the left-hand end of the lever arm. The force *F* of the crushed material on the plunger acts upwards. Ignore the weight of the lever arm.

(i) Use the clockwise and anticlockwise moments about H to calculate the upward force *F* which the crushed material exerts on the plunger. The distances are shown on Fig. 3.1.

force *F* = ... [3]

3 **(a)** State the two conditions required for the equilibrium of a body acted upon by a number of forces.

1. ....

....

2. ....

....[2]

(b) Fig. 3.1 shows a diagram of an arm with the hand holding a weight of 120 N.

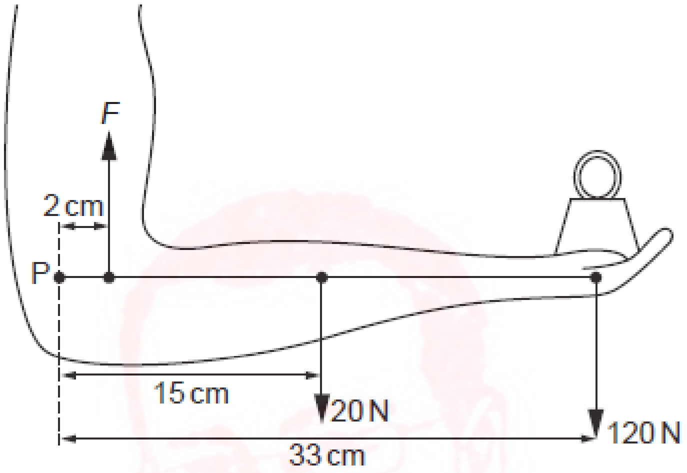


Fig. 3.1

The 20 N force is the weight of the forearm, acting at its centre of mass. *F* is the force in the muscle of the upper arm. P is the point in the elbow about which the arm pivots. The distances of the forces from point P are shown.

(i) By taking moments about point P, calculate the force *F*.

force *F* = ...[3]

(ii) A force acts on the forearm at point P. Calculate this force and state its direction.

force = ...

direction = ...[2]

[Total: 7]

1 In a laboratory, an experiment is carried out to measure the acceleration of a trolley on a horizontal table, when pulled by a horizontal force.

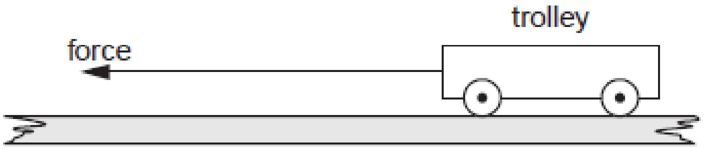


Fig. 1.1

The measurements are repeated for a series of different forces, with the results shown in the table below.

force / N	4.0	6.0	10.0	14.0
acceleration / m/s^2	0.50	0.85	1.55	2.25

(a) On Fig. 1.2, plot these points and draw the best straight line for your points. [2]

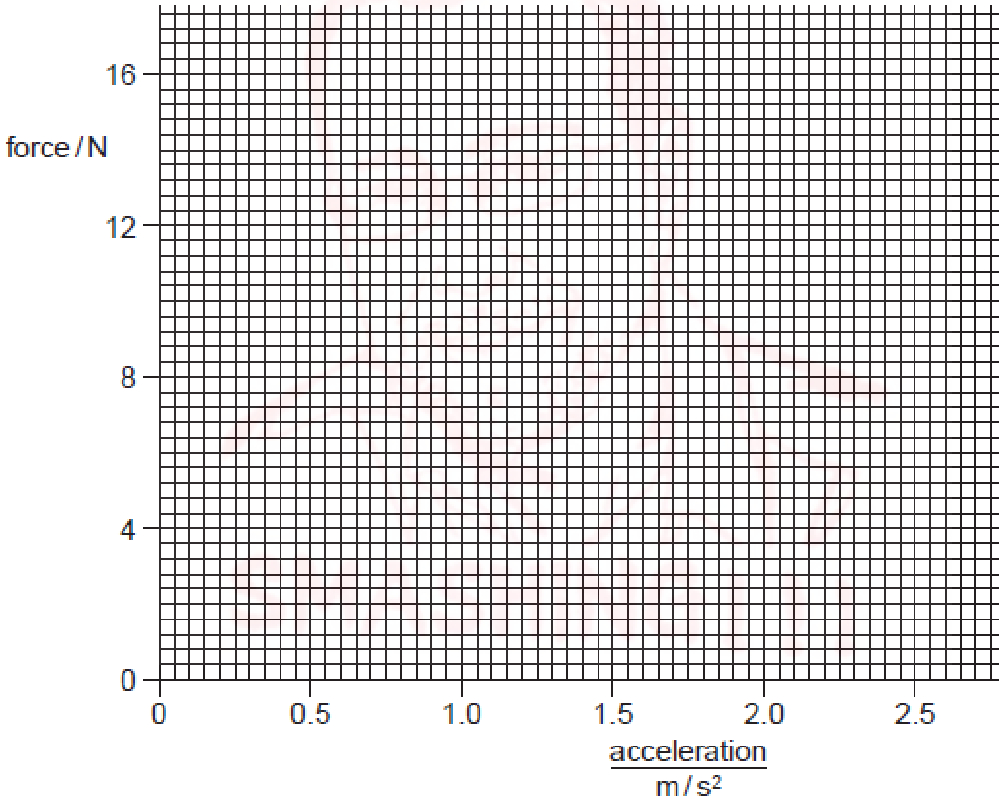


Fig. 1.2

(b) The graph shows that below a certain force there is no acceleration.

(i) Find the value of this force. .... [1]

(ii) A force smaller than that in **(b)(i)** is applied to the stationary trolley. Suggest what happens to the trolley, if anything.

.... [1]

(c) Show that the gradient of your graph is about 5.7.

gradient = ... [1]

(d) **(i)** State the equation that links resultant force *F*, mass *m* and acceleration *a*.

[1]

(ii) Use your gradient from **(c)** to find the mass of the trolley.

mass = ... [2]

(e) On Fig. 1.3, sketch a speed/time graph for a trolley with constant acceleration.

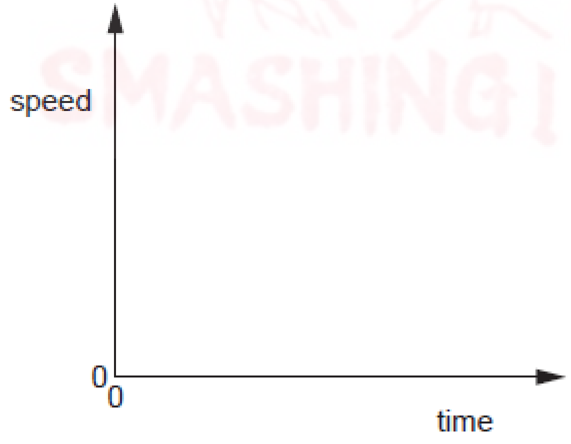


Fig. 1.3

[1]

[Total: 9]

Q# 10/_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]

(b) A force is required to maintain the circular motion.

(i) Explain why a force is required.

....

....

.... [2]

(ii) In which direction does this force act?

.... [1]

(iii) Suggest what provides this force.

.... [1]

[Total: 5]

Q# 11/_iG Phx/2010/w/Paper 31/ www.SmashingScience.org

1 An object of weight *W* is suspended by two ropes from a beam, as shown in Fig. 1.1.

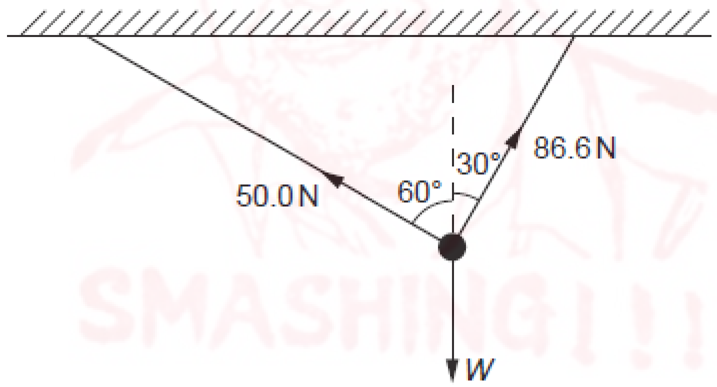


Fig. 1.1

The tensions in the ropes are 50.0 N and 86.6 N, as shown.

(a) In the space below, draw a scale diagram to find the resultant of the two tensions.

Use a scale of 1.0 cm = 10 N.

Clearly label the resultant. [3]

(b) From your diagram, find the value of the resultant.

resultant = ... [1]

(c) State the direction in which the resultant is acting.

.... [1]

(d) State the value of W. W = ... [1]

[Total: 6]

Q# 12/ iG Phx/2010/s/Paper 31/ www.SmashingScience.org

3 Two students make the statements about acceleration that are given below.

Student A: For a given mass the acceleration of an object is proportional to the resultant force applied to the object.

Student B: For a given force the acceleration of an object is proportional to the mass of the object.

(a) One statement is correct and one is incorrect.

Re-write the incorrect statement, making changes so that it is now correct.

For a given .... the acceleration of an object is ....

.... [1]

(b) State the equation which links acceleration a, resultant force F and mass m.

[1]

(c) Describe what happens to the motion of a moving object when

(i) there is no resultant force acting on it,

.... [1]

(ii) a resultant force is applied to it in the opposite direction to the motion,

.... [1]

(iii) a resultant force is applied to it in a perpendicular direction to the motion.

.... [1]

[Total: 5]

Q# 13/ iG Phx/2009/w/Paper 31/ www.SmashingScience.org

3 A student investigated the stretching of a spring by hanging various weights from it and measuring the corresponding extensions. The results are shown below.

weight / N	0	1	2	3	4	5
extension / mm	0	21	40	51	82	103

(a) On Fig. 3.1, plot the points from these results. Do not draw a line through the points yet. [2]

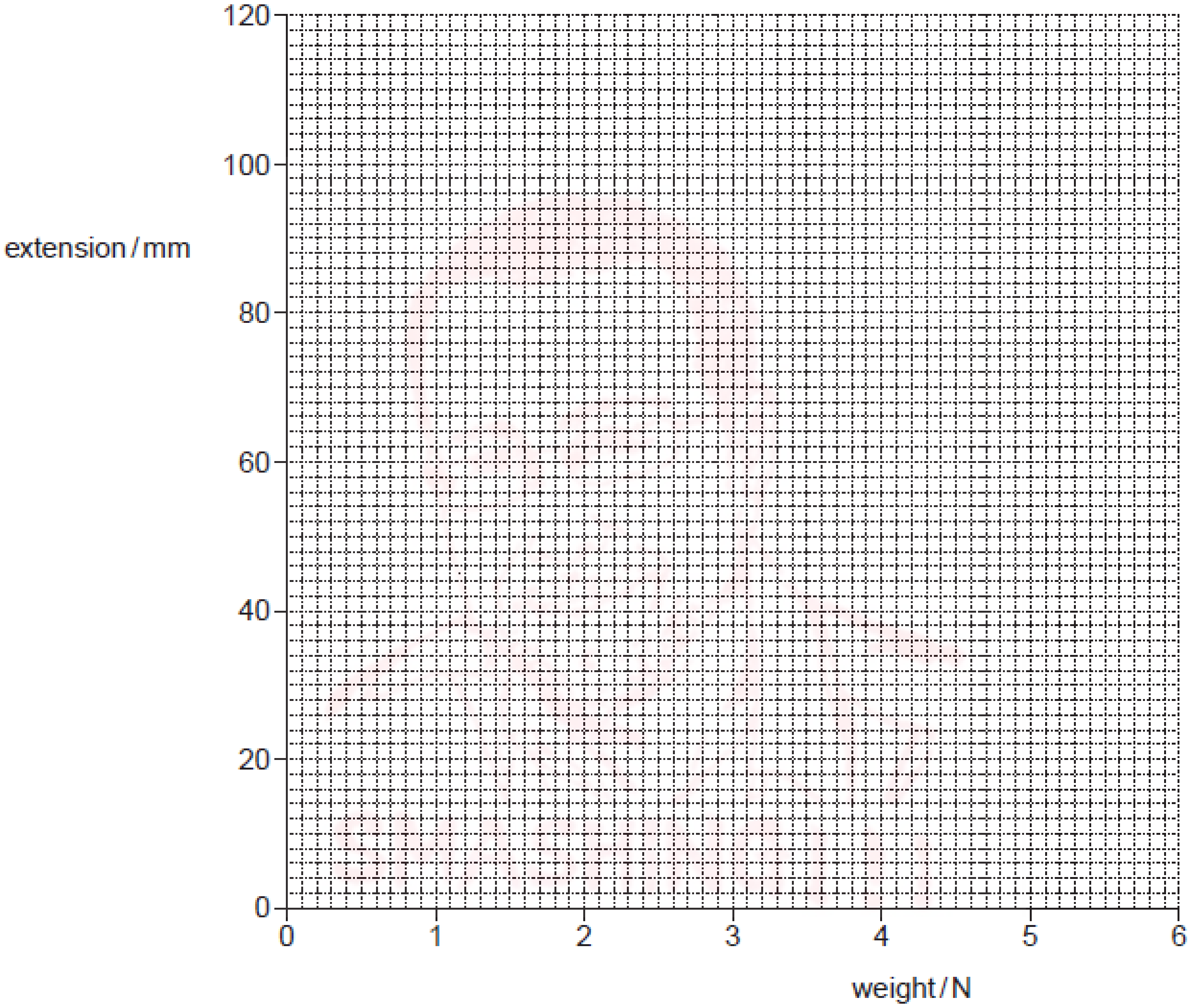


Fig. 3.1

(b) The student appears to have made an error in recording one of the results.

Which result is this?

.... [1]

(c) Ignoring the incorrect result, draw the best straight line through the remaining points. [1]

(d) State and explain whether this spring is obeying Hooke's Law.

....

....

....

....

.... [2]

(e) Describe how the graph might be shaped if the student continued to add several more weights to the spring.

....

....

....

.... [1]

(f) The student estimates that if he hangs a 45 N load on the spring, the extension will be 920 mm.

Explain why this estimate may be unrealistic.

....

....

....

.... [1]

[Total: 8]

4 **(a)** A force acting on an object causes the object to accelerate.

In which direction is the acceleration?

.... [1]

(b) Any object moving in a circle has a force acting on it towards the centre of the circle.

What does this force do to the object?

.... [1]

(c) A woman of mass 60 kg is standing in a lift at a shopping centre.

(i) The lift is at rest.

1. State the value of the weight of the woman.

.... [1]

2. State the value of the force exerted on the woman by the floor of the lift.

.... [1]

(ii) Calculate the force required to accelerate a mass of 60 kg at 2.5 m/s^2.

force = ... [2]

(iii) The lift accelerates upwards at 2.5 m/s^2.

Calculate the force exerted on the woman by the floor when the lift is accelerating.

force = ... [1]

(iv) The lift reaches a steady upward speed.

State the value of the force exerted on the woman by the floor at this steady speed.

.... [1]

[Total: 8]

4 **(a)** In an accident, a truck goes off the road and into a ditch. Two breakdown vehicles A and B are used to pull the truck out of the ditch, as shown in Fig. 4.1.

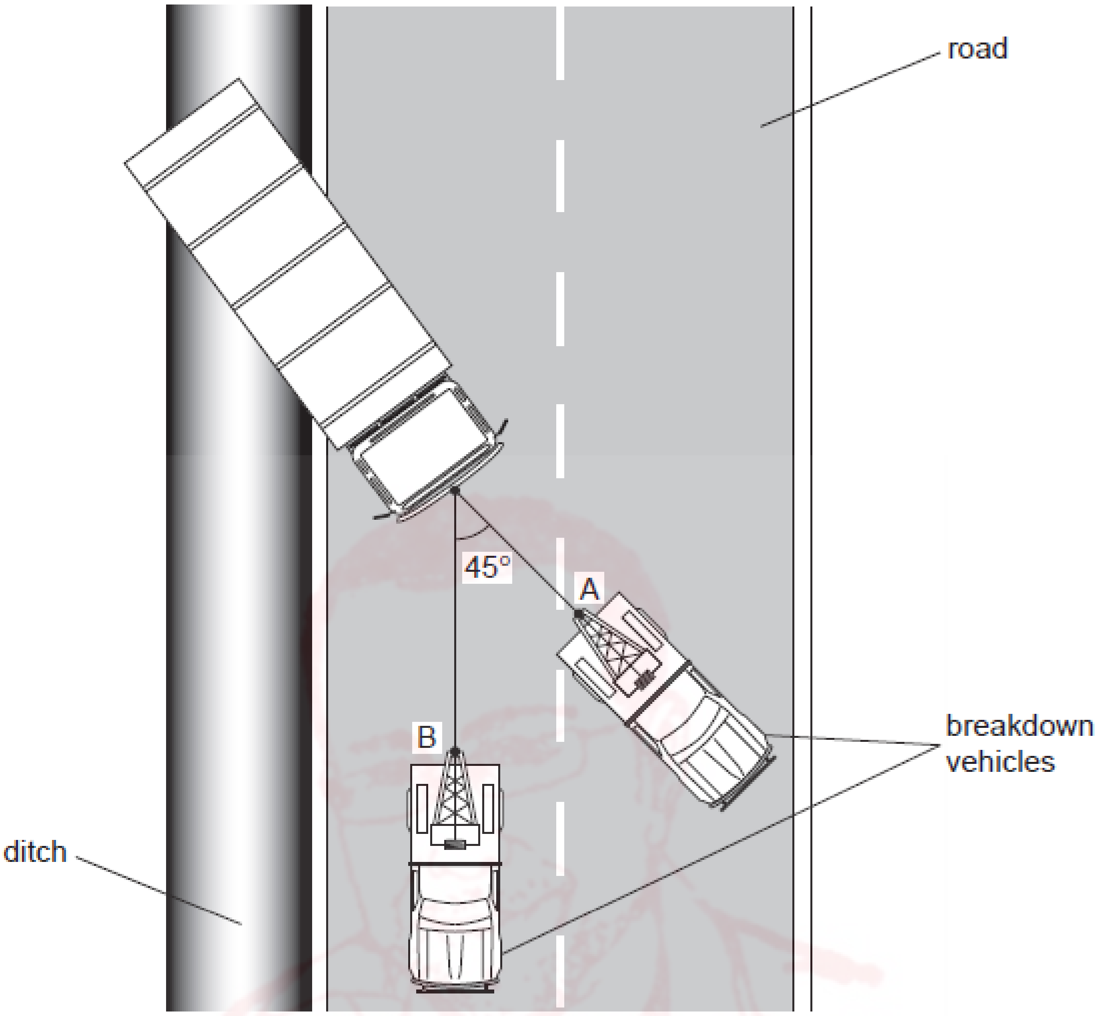


Fig. 4.1

At one point in the rescue operation, breakdown vehicle A is exerting a force of 4000 N and breakdown vehicle B is exerting a force of 2000 N.

(i) Using a scale of 1 cm = 500 N, make a scale drawing to show the resultant force on the truck.

[4]

(ii) Use your diagram to find the magnitude and direction of the resultant force on the truck.

magnitude of resultant force = ...

direction of resultant force = ... to direction of road [2]

(b) **(i)** State why the resultant force is an example of a vector quantity.

.... [1]

(ii) Give an example of a vector quantity that is not a force.

.... [1]

[Total: 8]

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

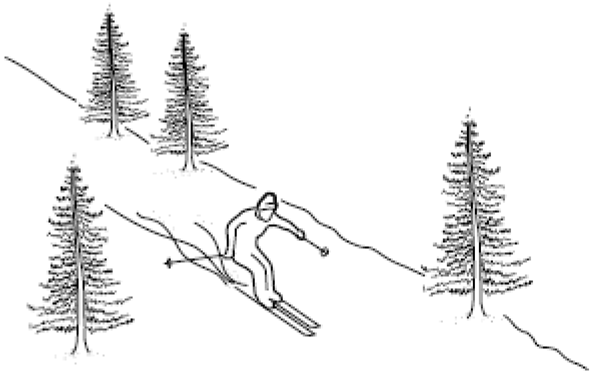


Fig. 3.1

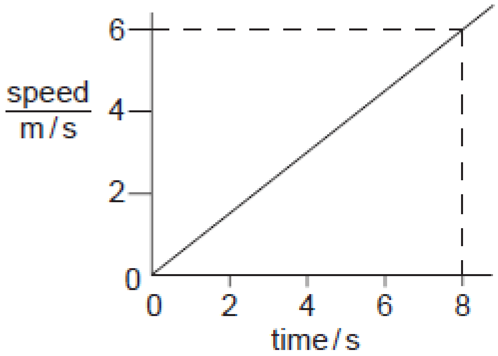


Fig. 3.2

(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.

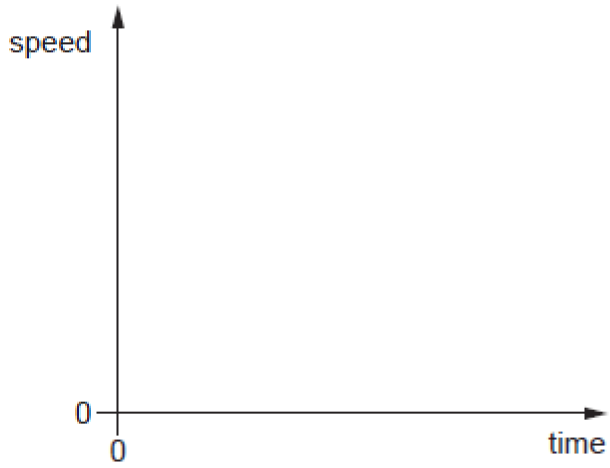


Fig. 3.3

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]

2 Fig. 2.1 shows a circular metal disc of mass 200 g, freely pivoted at its centre.

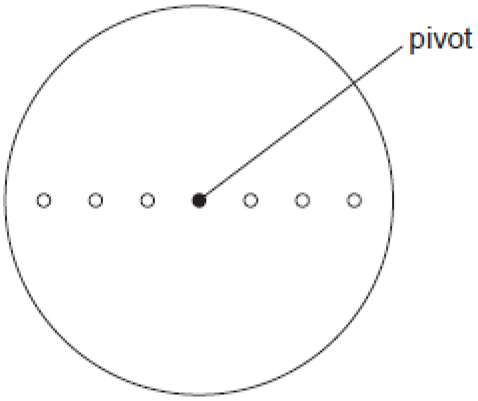


Fig. 2.1

Masses of 100 g, 200 g, 300 g, 400 g, 500 g and 600 g are available, but only one of each value. These may be hung with string from any of the holes. There are three small holes on each side of the centre, one at 4.0 cm from the pivot, one at 8.0 cm from the pivot and one at 12.0 cm from the pivot.

The apparatus is to be used to show that there is no net moment of force acting on a body when it is in equilibrium.

(a) On Fig. 2.1, draw in **two different** value masses hanging from appropriate holes. The values of the masses should be chosen so that there is no net moment. Alongside the masses chosen, write down their values. [2]

(b) Explain how you would test that your chosen masses give no net moment to the disc.

....

....

....

.... [1]

(c) Calculate the moments about the pivot due to the two masses chosen.

moment due to first mass = ...

moment due to second mass = ...

[2]

(d) Calculate the force on the pivot when the two masses chosen are hanging from the disc.

force = ... [2]

[Total: 7]

1 Fig. 1.1 shows apparatus used to find a relationship between the force applied to a trolley and the acceleration caused by the force.

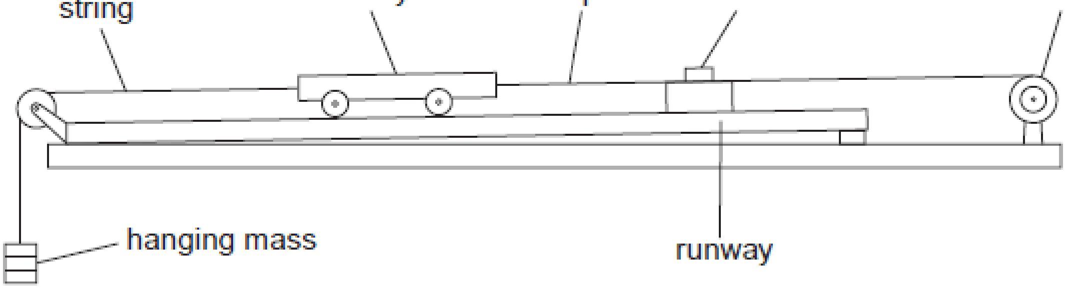


Fig. 1.1

For each mass, hung as shown, the acceleration of the trolley is determined from the tape. Some of the results are given in the table below.

weight of the hanging mass / N	acceleration of the trolley m/s^2
0.20	0.25
0.40	0.50
0.70	
0.80	1.0

(a) **(i)** Explain why the trolley accelerates.

....

.... [2]

(ii) Suggest why the runway has a slight slope as shown.

....

.... [1]

(b) Calculate the mass of the trolley, assuming that the accelerating force is equal to the weight of the hanging mass.

mass = ... [2]

(c) Calculate the value missing from the table. Show your working.

value = ... [2]

(d) In one experiment, the hanging mass has a weight of 0.4 N and the trolley starts from rest.

Use data from the table to calculate

(i) the speed of the trolley after 1.2 s,

speed = ... [2]

(ii) the distance travelled by the trolley in 1.2 s.

distance = ... [2]

[Total: 11]

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

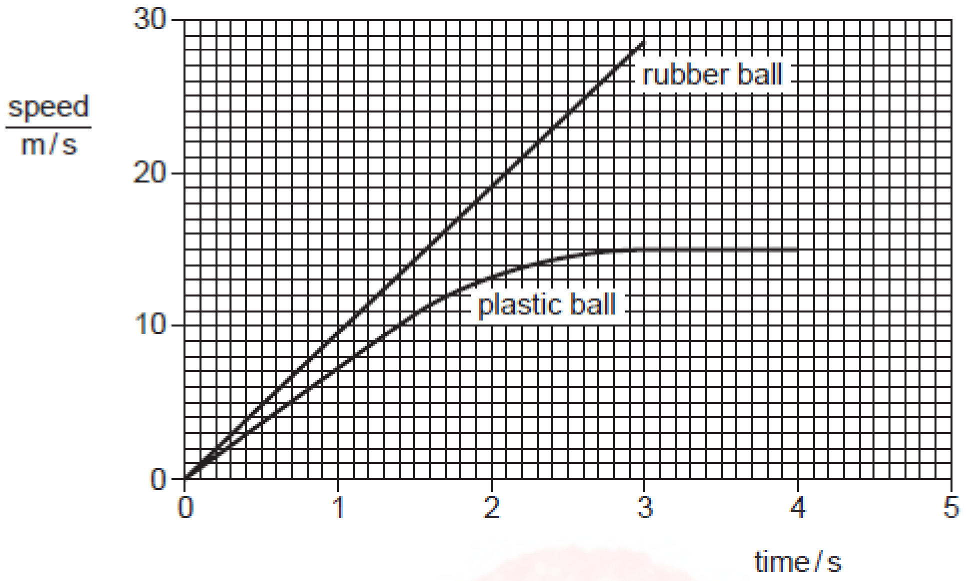


Fig. 1.1

Both balls fall from the same height above the ground.

The acceleration of the rubber ball is 8.3m/s^2

(b) Both balls have the same mass but the volume of the plastic ball is much greater than that of the rubber ball. Explain, in terms of the forces acting on each ball, why the plastic ball reaches a terminal velocity but the rubber ball does not.

....

....

....

....

....

.... [3]

(c) The rubber ball has a mass of 50 g. Calculate the gravitational force acting on the rubber ball.

force = ... [2]

[Total: 10]

3 **(a)** A spring of original length 3.0 cm is extended to a total length of 5.0 cm by a force of 8.0 N.

Assuming the limit of proportionality of the spring has not been reached, calculate the force needed to extend it to a total length of 6.0 cm.

force = ... [3]

(b) Fig. 3.1 shows the arrangement for an experiment on moments.

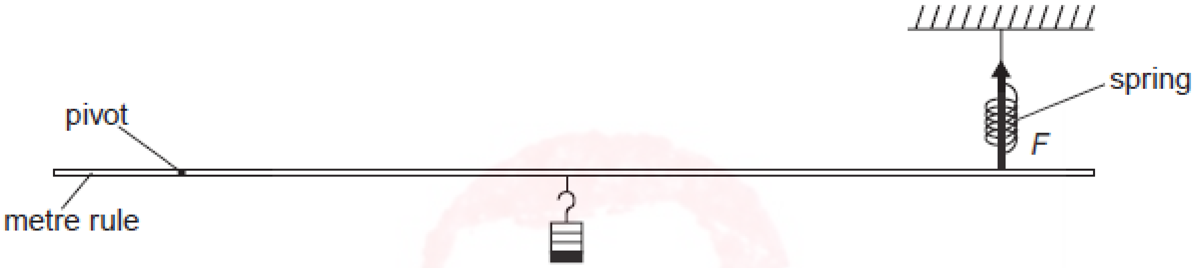


Fig. 3.1

The spring exerts a force *F* on the metre rule.

(i) On Fig. 3.1, mark another quantity which must be measured to find the moment of the force *F*. [1]

(ii) State how the moment of the force *F* is calculated.

....

.... [1]

[Total: 5]

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

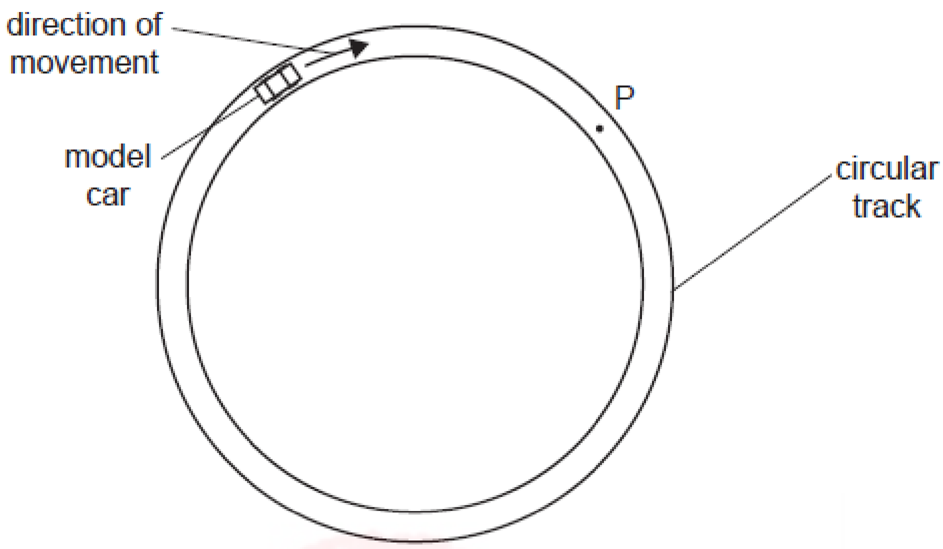


Fig. 1.1

(a) A force acts on the car to keep it moving in a circle.

(i) Draw an arrow on Fig. 1.1 to show the direction of this force. [1]

(ii) The speed of the car increases. State what happens to the magnitude of this force.

.... [1]

(b) **(i)** The car travels too quickly and leaves the track at P. On Fig. 1.1, draw an arrow to show the direction of travel after it has left the track. [1]

(ii) In terms of the forces acting on the car, suggest why it left the track at P.

....

....

.... [2]

2 Fig. 2.1 shows a steam safety valve. When the pressure gets too high, the steam lifts the weight W and allows steam to escape.

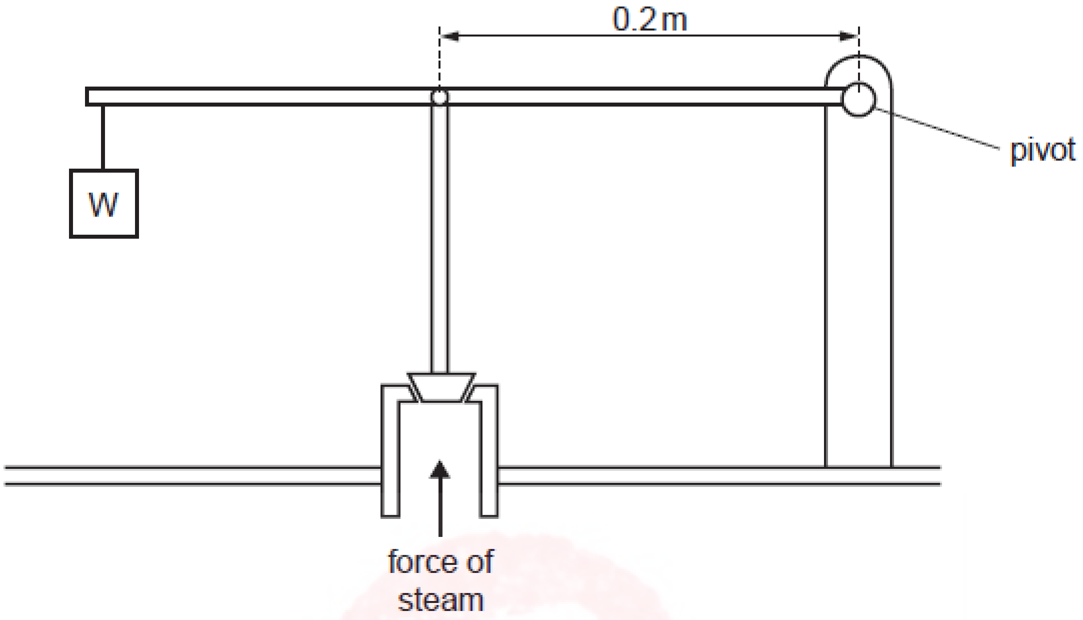


Fig. 2.1

(a) Explain, in terms of moments of forces, how the valve works.

....

....

....

.... [2]

(b) The moment of weight W about the pivot is 12 N m. The perpendicular distance of the line of action of the force of the steam on the valve from the pivot is 0.2 m.

The area of the piston is 0.0003 m^2.

Calculate

(i) the minimum steam force needed for the steam to escape,

force = ... [2]

(ii) the minimum steam pressure for the steam to escape.

pressure = ... [2]

[Total: 6]

2 In an experiment, forces are applied to a spring as shown in Fig. 2.1a. The results of this experiment are shown in Fig. 2.1b.

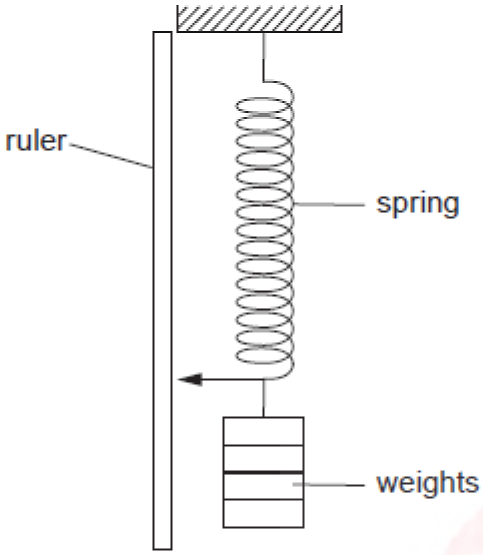


Fig. 2.1a

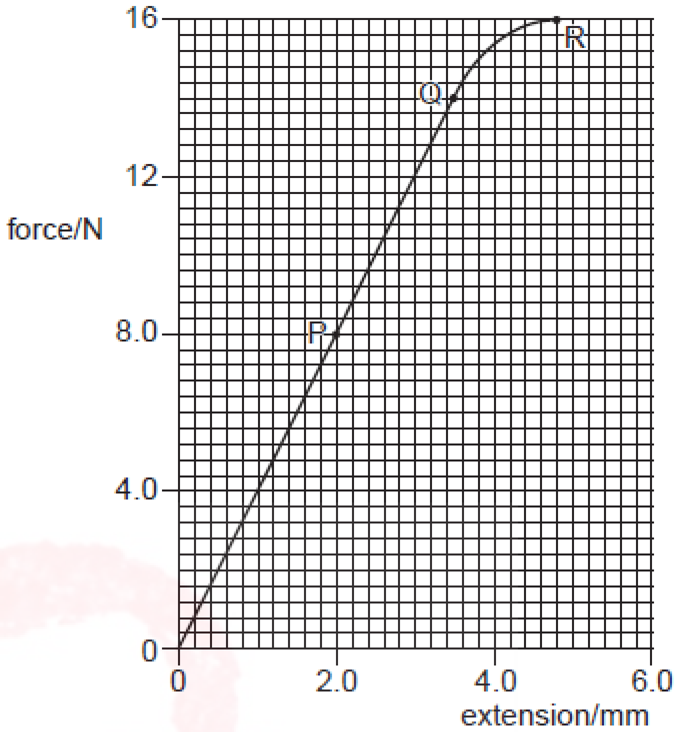


Fig. 2.1b

(a) What is the name given to the point marked Q on Fig. 2.1b?

....[1]

(b) For the part OP of the graph, the spring obeys Hooke's Law.
State what this means.

....

....[1]

(c) The spring is stretched until the force and extension are shown by the point R on the graph. Compare how the spring stretches, as shown by the part of the graph OQ, with that shown by QR.

....

....[1]

(d) The part OP of the graph shows the spring stretching according to the expression

$$F = kx.$$

Use values from the graph to calculate the value of k.

k = ...[2]

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.

(d) On leaving the second bus stop, the uniform acceleration of the bus is 1.2 m/s^2. The mass of the bus and passengers is 4000 kg.
Calculate the accelerating force that acts on the bus.

force = ...[2]

2 A student sets up the apparatus shown in Fig. 2.1 in order to find the resultant of the two tensions T_1 and T_2 acting at P. When the tensions T_1, T_2 and T_3 are balanced, the angles between T_1 and the vertical and T_2 and the vertical are as marked on Fig. 2.1.

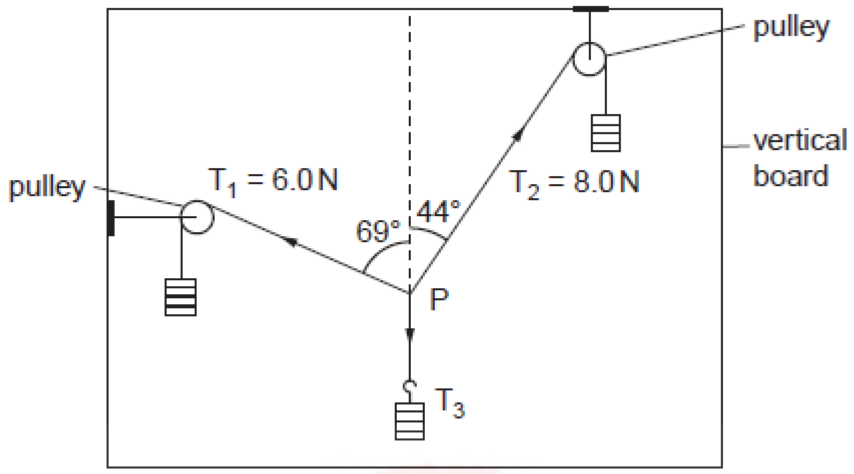


Fig. 2.1

In the space below, draw a scale diagram of the forces T_1 and T_2. Use the diagram to find the resultant of the two forces.

State

(a) the scale used, scale = ...

(b) the value of the resultant, value = ...

(c) the direction of the resultant. direction = ...

[6]

Q# 26/_iG Phx/2005/w/Paper 31/Q1

(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]

(c) Fig. 1.1 shows three forces acting on an object of mass 0.5 kg. All three forces act through the centre of mass of the object.

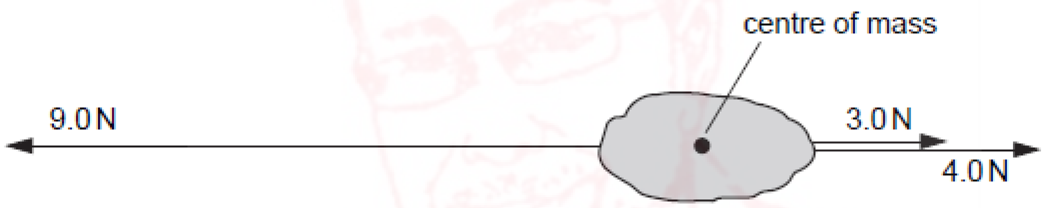


Fig. 1.1

Calculate

(i) the magnitude and direction of the resultant force on the object,

magnitude = ... direction .... [2]

(ii) the magnitude of the acceleration of the object.

acceleration = ... [2]

2 Fig. 2.1 shows apparatus for investigating moments of forces.

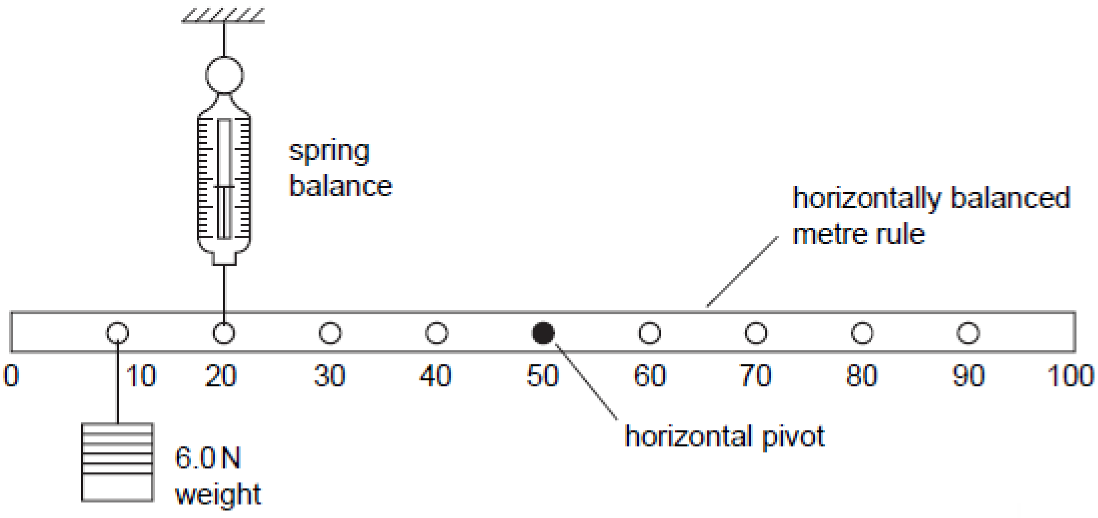


Fig. 2.1

The uniform metre rule shown in Fig. 2.1 is in equilibrium.

(a) Write down two conditions for the metre rule to be in equilibrium.

condition 1 ....

....

....

condition 2 ....

....

.... [2]

(b) Show that the value of the reading on the spring balance is 8.0 N. [2]

(c) The weight of the uniform metre rule is 1.5 N.

Calculate the force exerted by the pivot on the metre rule.

magnitude of force = ...

direction of force .... [2]

Q# 28/_iG Phx/2005/s/3

3 A mass of 3.0 kg accelerates at 2.0 m/s^2 in a straight line.

(a) State why the velocity and the acceleration are both described as vector quantities.

....

.... [1]

Q# 29/ iG Phx/2005/s/3

3 A mass of 3.0 kg accelerates at 2.0 m/s^2 in a straight line.

(a) State why the velocity and the acceleration are both described as vector quantities.

....

.... [1]

(b) Calculate the force required to accelerate the mass.

force = ... [2]

(c) The mass hits a wall.
The average force exerted on the wall during the impact is 120 N.
The area of the mass in contact with the wall at impact is 0.050 m^2.
Calculate the average pressure that the mass exerts on the wall during the impact.

pressure = ... [2]

Q# 30/ iG Phx/2005/s/3

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

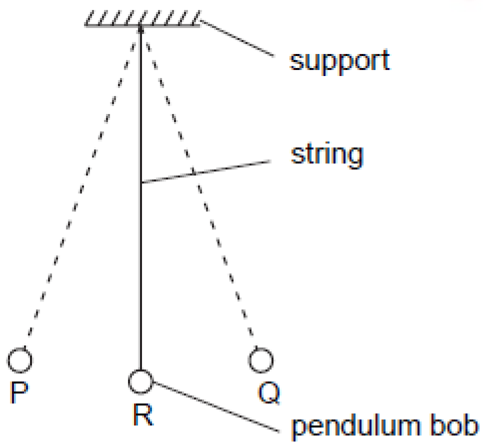


Fig. 2.1

(c) The mass of the bob is 0.2 kg. During the swing it moves so that P is 0.05 m higher than R.

Calculate the increase in potential energy of the pendulum bob between R and P.

potential energy = ... [2]

Q# 31/_iG Phx/2005/s/3

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

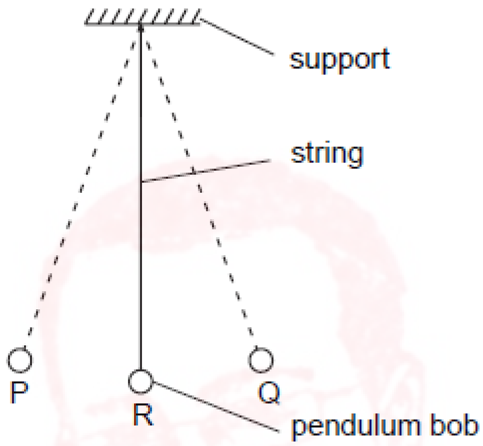


Fig. 2.1

(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]

(b) **(i)** State the two vertical forces acting on the pendulum bob when it is at position R.

1. ....

2. .... [1]

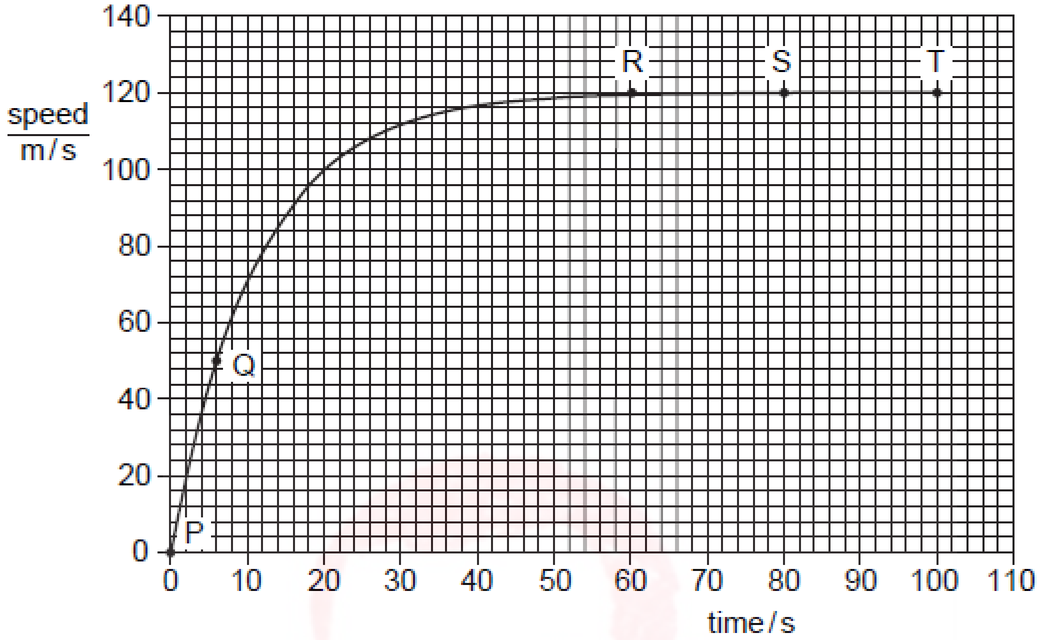
(ii) The pendulum bob moves along the arc of a circle. State the direction of the resultant of the two forces in **(i)**.

.... [1]

Q# 32/_iG Phx/2005/s/3

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.



(b) On Fig. 1.2, draw arrows to show the directions of the forces acting on the sphere when it is at the position shown by point S on the graph. Label your arrows with the names of the forces. [2]

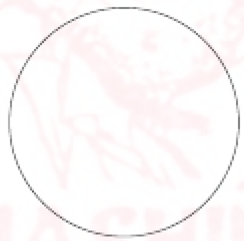


Fig. 1.2

(c) Explain why the sphere is moving with constant speed at S.

....

....

.... [2]

Q# 33/_iG Phx/2004/s/3

3 A large spring is repeatedly stretched by an athlete to increase the strength of his arms. Fig. 3.1 is a table showing the force required to stretch the spring.

extension of spring / m	0.096	0.192	0.288	0.384
force exerted to produce extension / N	250	500	750	1000

Fig. 3.1

(a) **(i)** State Hooke's law.

....

....[1]

(ii) Use the results in Fig. 3.1 to show that the spring obeys Hooke's law.

[1]

(b) Another athlete using a different spring exerts an **average** force of 400 N to enable her to extend the spring by 0.210 m.

(i) Calculate the work done by this athlete in extending the spring once.

work done = ...

(ii) She is able to extend the spring by this amount and to release it 24 times in 60 s. Calculate the power used by this athlete while doing this exercise.

power = ...
[4]

Q# 34/_iG Phx/2004/s/3

2 Fig. 2.1 shows a rock that is falling from the top of a cliff into the river below.

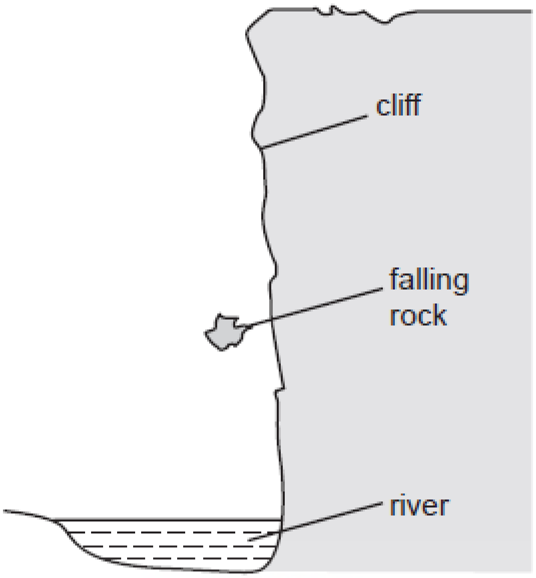


Fig. 2.1

(a) The mass of the rock is 75 kg. The acceleration of free fall is 10 m/s^2.
Calculate the weight of the rock.

weight = ...[1]

(b) The rock falls from rest through a distance of 15 m before it hits the water.
Calculate its kinetic energy just before hitting the water. Show your working.

kinetic energy = ...[3]

(c) The rock hits the water. Suggest what happens to the kinetic energy of the rock during the impact.

....

....

....[3]

Q# 35/_iG Phx/2004/s/3

1 Fig. 1.1 shows a cycle track.

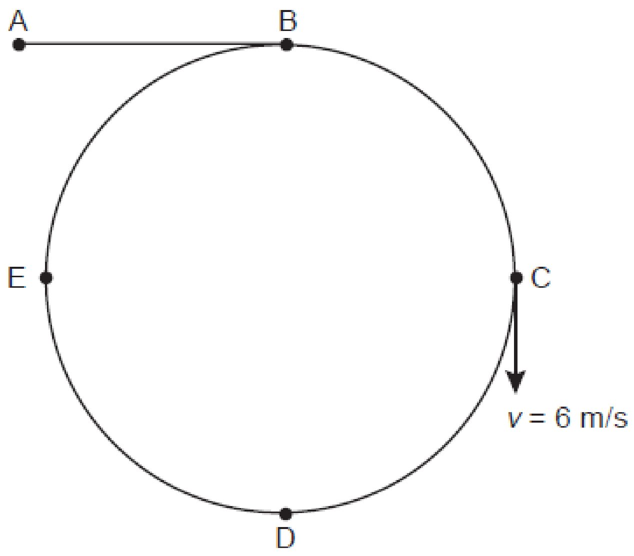


Fig. 1.1

A cyclist starts at A and follows the path ABCDEB.

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

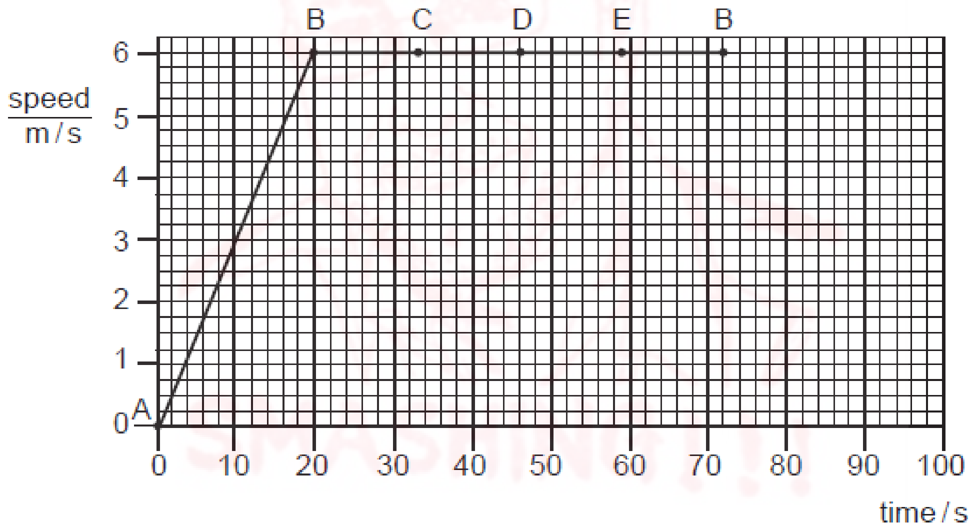


Fig. 1.2

(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]

Q# 36/ iG Phx/2003/w/Paper 3/Q1

(c) Fig. 1.2 shows a sketch graph of the magnitude of the acceleration for the bus when it is travelling around a circular track at constant speed.

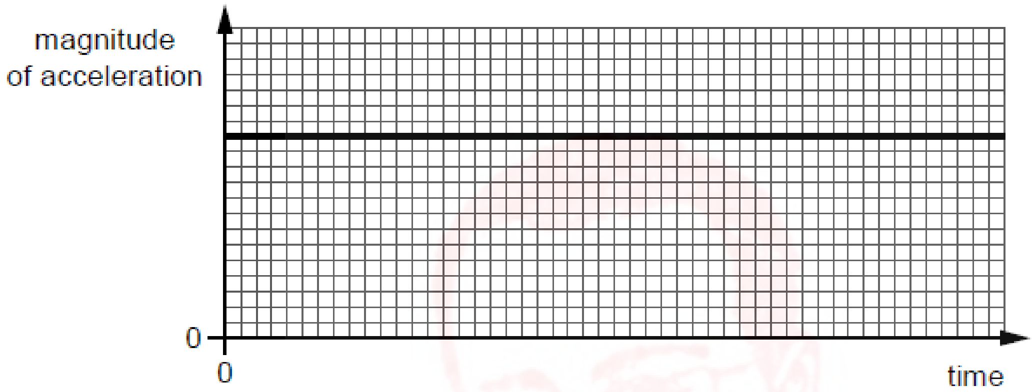


Fig. 1.2

(i) Use the graph to show that there is a force of constant magnitude acting on the bus.

....

....

(ii) State the direction of this force.

....

[3]

Q# 37/ iG Phx/2003/w/Paper 3/Q1

(c) Fig. 1.2 shows a sketch graph of the magnitude of the acceleration for the bus when it is travelling around a circular track at constant speed.

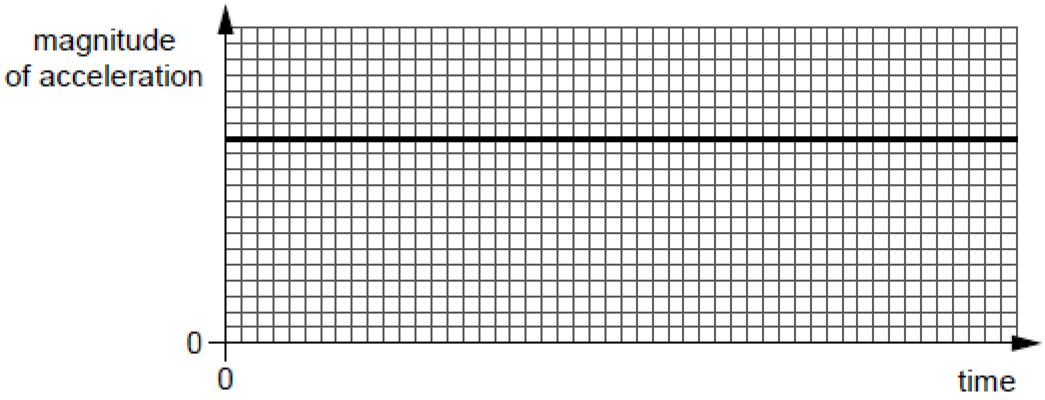


Fig. 1.2

(i) Use the graph to show that there is a force of constant magnitude acting on the bus.

....

....

(ii) State the direction of this force.

....

[3]

3 Fig. 3.1 shows a simple see-saw. One child A sits near to end X and another child B sits near to end Y. The feet of the children do not touch the ground when the see-saw is balanced.

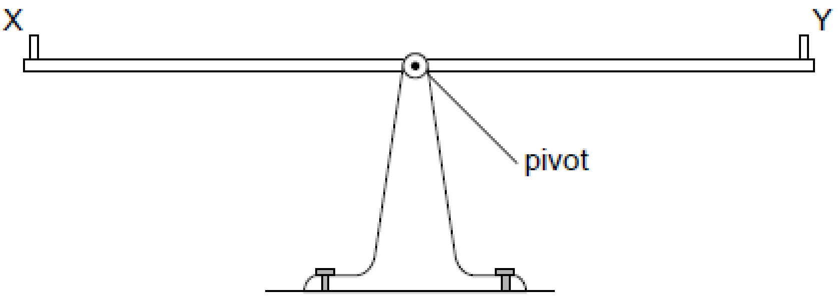


Fig. 3.1

(a) Child A has a mass of 18.0 kg and child B has a mass of 20.0 kg.

Without calculation, indicate where the children could sit so that the see-saw balances horizontally. You may draw on Fig. 3.1 if you wish.

....

....

.... [2]

(b) State the relationship between the moment caused by child A and that caused by child B.

....

.... [1]

(c) Child A is 2.50 m from the pivot. Calculate the distance of child B from the pivot.

distance = ... [2]

Q# 39/_iG Phx/2003/s/3

3 Fig. 3.1 shows the arm of a crane when it is lifting a heavy box.

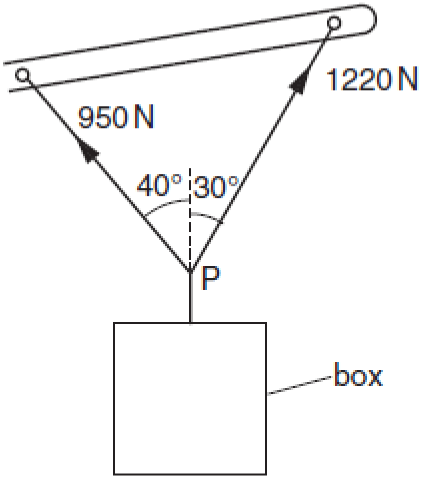


Fig. 3.1

(a) By the use of a scale diagram (**not** calculation) of the forces acting at P, find the weight of the box. [5]

1 Fig. 1.1 shows apparatus that may be used to compare the strengths of two springs of the same size, but made from different materials.

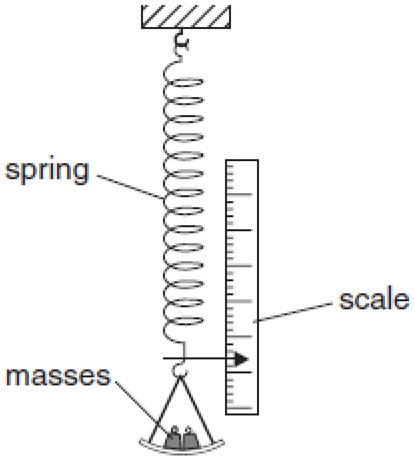


Fig. 1.1

(a) **(i)** Explain how the masses produce a force to stretch the spring.

....

(ii) Explain why this force, like all forces, is a vector quantity.

....

....

[2]

(b) Fig. 1.2 shows the graphs obtained when the two springs are stretched.

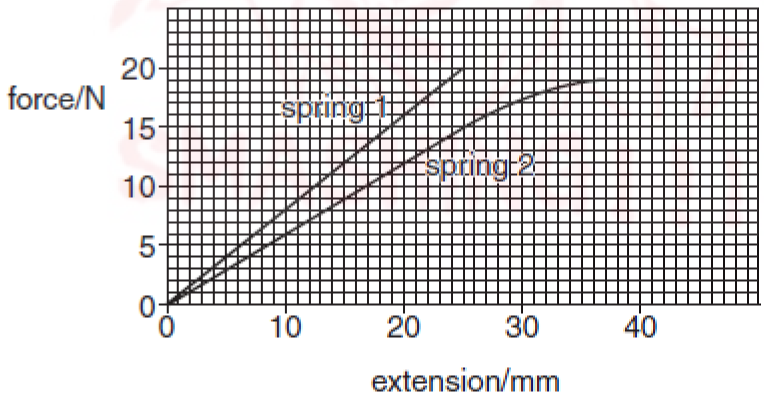


Fig. 1.2

(i) State which spring is more difficult to extend. Quote values from the graphs to support your answer.

....

....

....

....

(ii) On the graph of spring 2, mark a point P at the limit of proportionality. Explain your choice of point P.

....

....

....

(iii) Use the graphs to find the difference in the extensions of the two springs when a force of 15 N is applied to each one.

difference in extensions = ...

[6]

v

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

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.

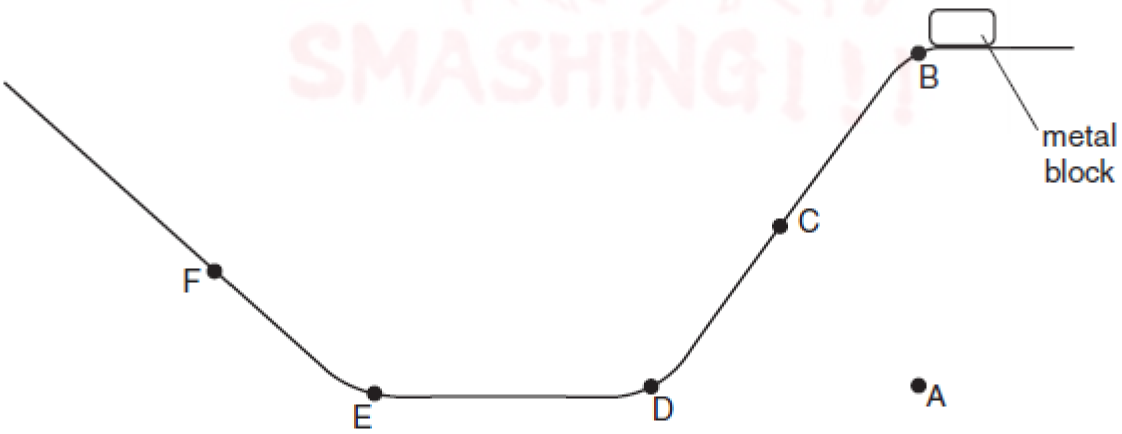


Fig. 1.1

(b) The mass of the block is 0.2 kg. The vertical height of B above A is 0.6 m. The acceleration due to gravity is 10 m/s^2.

(i) Calculate the work done in lifting the block from A to B.

work done = ...

(ii) At C, the block is moving at a speed of 2.5 m/s. Calculate its kinetic energy at C.

kinetic energy = ...

[5]

(c) As it passes D, the speed of the block remains almost constant but the velocity changes. Using the terms *vector* and *scalar*, explain this statement.

....

....

....[2]

(d) F is the point where the kinetic energy of the block is zero. In terms of energy changes, explain why F is lower than B.

....

....

....

....[3]

Mark Scheme

Q# 1/ iG Phx/2014/s/Paper 31/ www.SmashingScience.org

5	(a)	(i)	($W = mg$ = 1440 × 10 =) 14400 N	B1
		(ii)	(P =) F / A OR 14400 / (1.5 × 1.2)	C1
			8000 Pa OR N / m^2	A1
	(b)	(i)	(P =) $h\rho g$ OR 1.4 × 1000 × 10	C1
			14000 Pa OR N / m^2	A1
	(b)	(ii)	pressure on base of **P** smaller / **Q** greater	M1
			(with same volume removed) smaller decrease in depth in Q OR height in **Q** is greater	A1
				[Total: 7]

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

4	(a)	2 lines at 90° to each other of same length labelled 30 N or 6 cm	B1
		both lines 6.0 ± 0.2 cm.	B1
		arrows on the two lines drawn, either head to tail OR a complete square shown with diagonal and arrows on adjacent sides	B1
		resultant in range 40–45 N	B1
	(b)	(vertically) upwards	B1
	(c)	same as value in **(a)**, only if answer to **(a)** is a force OR 40–45 N	B1
			[Total: 6]

Q# 3/ iG Phx/2013/w/Paper 31/ www.SmashingScience.org

2	(a)	(i)	$v = u + at$ OR (a =) $(v - u) / t$ OR 24 = a × 60 OR 24 / 60	C1
			0.4(0) m / s^2	A1
		(ii)	(F =) ma OR 7.5 × 10^5 × 0.40	C1
			300 000 N OR 300 kN	A1

Q# 4/_iG Phx/2013/w/Paper 31/ www.SmashingScience.org

1 (a) extension (of spring) proportional to load/force (applied)
OR load/force (applied) proportional to extension
OR force = constant × extension
OR extension = constant × force
OR $F = kx$ in any form with symbols explained — B1

(b) (i) graph is through the origin AND is a straight line/has a constant gradient — B1

(ii) $F = kx$ in any form OR $(k =) F/x$ — C1
use of a point anywhere on graph e.g. 50/20 — C1
2.5 N/mm OR 2500 N/m — A1

(iii) from 50 mm extension, graph curves with no negative gradient — B1

(iv) straight line through origin with smaller gradient than graph shown finishing at more than 50 mm — B1

[Total: 7]

Q# 5/_iG Phx/2013/w/Paper 31/ www.SmashingScience.org

3 (a) (i) 3 appropriate examples: e.g. spanner, scissors, tap etc. –1e.e.o.o. — B2

(ii) there is a resultant force OR more force down than up — B1
there is a resultant moment OR clockwise moment is not equal to anticlockwise moment — B1

(b) (i) $F \times 0.5 = 12 \times 0.3$ — C1
7.2 N — A1

(ii) weight has no moment about centre of rod/has no perpendicular distance from centre of rod
OR weight acts at centre of rod/pivot/centre of mass — B1

[Total: 7]

Q# 6/_iG Phx/2013/s/Paper 31/Q3

(b) (i) increases — B1

(ii) 920 N — B1

[Total 7]

Q# 7/_iG Phx/2012/w/Paper 31/ www.SmashingScience.org

3 (a) No resultant/net force OR no resultant force in any direction
OR no resultant force in any two perpendicular directions — B1

No resultant/net moment/turning effect/couple/torque
OR (total) clockwise moment = (total) anticlockwise moment — B1

Either order

(b) (i) F × 120 / F × 0.12 — C1
= 20 × 500 OR 20 × 0.5 — C1
F = 83.3 N at least 2 significant figures. Allow $83^{1}/_{3}$ *Unit penalty applies — A1

Q# 8/_iG Phx/2011/w/Paper 31/ www.SmashingScience.org

3 **(a)** 1. no resultant force acts / no net force acts
OR total force up / in any direction = total force down / in opposite direction — B1
allow sum of forces or resultant force for total force

2. no resultant moment / couple / torque acts
OR (sum of) clockwise moments and (sum of) anti-clockwise moments (about any point / axis) balance — B1

(b) **(i)** (anti-clockwise moment =) $F \times 2$ — C1
(total clockwise moment =) (120 × 33) + (20 × 15) = 4260 (N cm) — C1
2130 N — A1

(ii) 1990 N OR candidate's **(b)(i)** – 140 N — B1
force is downwards — B1 [7]

Q# 9/_iG Phx/2011/s/Paper 31/ www.SmashingScience.org

1 **(a)** all points correctly plotted ±½ small square — B1
straight line of best fit for candidate's points — B1

(b) **(i)** candidate's correct value with unit (± 0.2), (expect 1.2 N) — B1

(ii) remains stationary / nothing happens / no acceleration NOT constant speed — B1

(c) Correct data from candidates graph for ΔF and Δm, used in $\Delta F/\Delta m$ — B1

(d) **(i)** $F = ma$ in any form, letters, words — B1

(ii) gradient = F/a OR gradient = m ignore $m=F/a$ — C1
candidate's **(c)** with correct unit — A1

(e) straight line of positive gradient — B1 [9]

Q# 10/_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

(b) **(i)** if no force, then constant velocity in straight line OR force is needed to change direction — B1

body moving in circle is changing direction/velocity/accelerating so force is needed — B1

(ii) towards centre (of circle)/at right angles to motion/inwards — B1

(iii) friction between tyres and road/reaction from banking of track — B1

[Total: 5]

Q# 11/ iG Phx/2010/w/Paper 31/ www.SmashingScience.org

1	(a)	(parallelogram or triangle may have any orientation) NOT a copy of Fig. 1.1	
		two sides at right angles, by eye	B1
		one side longer than the other	B1
		diagonal or completion of triangle drawn **and** labelled "resultant" OR R Ignore numerical values. Condone arrows in wrong direction	B1
	(b)	98 N – 102 N (accept value found by calculation)	B1
	(c)	(vertically) up/opposite to W NOT North	B1
	(d)	his **(b)** OR correct value calculated ignore mass	B1
			[Total: 6]

Q# 12/ iG Phx/2010/s/Paper 31/ www.SmashingScience.org

3	(a)	2^{nd} statement re-written to include force in first gap and <u>inversely</u> proportional to mass in second gap. NOT indirectly proportional	B1	
	(b)	F = ma OR in words in any correct arrangement	B1	
	(c) (i)	nothing OR continues as before OR same / constant velocity OR same / constant speed & direction OR no acceleration	B1	
	(ii)	idea of retardation. Ignore stop. Ignore brakes. Ignore goes in opposite direction	B1	
	(iii)	moves in (arc of a) circle or curve OR deflected OR turns OR changes direction	B1	[5]

Q# 13/ iG Phx/2009/w/Paper 31/ www.SmashingScience.org

3	(a)	5 points correctly plotted ±½ small square –1 e.e.o.o. (ignore 0,0)	B2
	(b)	3 N one, however identified OR 3^{rd} value OR 4^{th} value	B1
	(c)	good straight line through origin and candidate's remaining points	B1
	(d)	straight line / constant gradient	M1
		does obey Hooke's Law	A1
		OR	
		special case: obeys Hooke's law because force ∝ extension or wtte	B1

(e) graph becomes non-linear / curves / bends B1
Ignore reference to direction of curve or bend.

(f) will have exceeded / reached proportional / elastic limit
OR permanently deformed or equiv OR staightened
OR will have broken OR no longer elastic or wtte B1

[8]

Q# 14/_iG Phx/2009/w/Paper 31/ www.SmashingScience.org

4 **(a)** in direction of the force Do not accept forward on is own. B1

(b) changes direction / causes acceleration / stops straight line motion / keeps object from leaving circle / keeps path circular / pulls object into circle B1

(c) **(i)** 1. 600 N B1
2. same as his 1. accept 600 N if no value given in **(c)** **(i)** 1. B1

(ii) ma OR 60×2.5 C1
150 N A1

(iii) 750 N e.c.f. from **(c)** **(i)** 2 and/or **(c)** **(ii)** B1

(iv) same as his **(c)** **(i)** 2 accept 600 N if no value given in **(c)** **(i)** 2. B1

[8]

Q# 15/_iG Phx/2009/s/Paper 31/ www.SmashingScience.org

4 **(a)** **(i)** (note: diagram may be drawn in any orientation)
sides correct length, by eye B1
forces drawn at 45°, by eye B1
parallelogram completed B1
correct diagonal drawn / correct resultant if intersecting arcs shown B1

(ii) magnitude: between 5500 N and 5700 B1
direction: between 28° and 32° B1

(b) **(i)** it has direction (as well as magnitude) B1

(ii) any example which is clearly a vector B1 [8]

Q# 16/_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 0.75 m/s^2	C1 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 equal to component of weight (down slope)	 C1 A1	
	(iii)	1	graph starting at origin curved from start AND decreasing gradient AND horizontal final part	B1 B1	
		2	label A on any correct curved region label B on horizontal region	B1 B1	 [10]

Q# 17/_iG Phx/2008/w/Paper 31/ www.SmashingScience.org

2	(a)	two masses chosen with ratio 2:1 or 3:1 or 3:2 chosen masses in correct holes to balance	M1 A1	
	(b)	disc does not rotate/is balanced/in equilibrium/no movement NOT spin the disc NOT anything to do with calculating moments NOT when disturbed, returns to original position	B1	
	(c)	moment of one mass correct (ignore units) accept mass × distance calculated equal answers	 B1 B1	
	(d)	correct addition of masses/weights, including 200g any mass correctly converted to N	B1 B1	 [7]

Q# 18/_iG Phx/2008/w/Paper 31/ www.SmashingScience.org

1 (a) (i) any mention of force or weight ignore mass — C1
Force to left > force to right)
OR resultant force) any 1 — A1
OR unbalanced force)
OR weight > friction)

(ii) to overcome/compensate for friction/resistance — B1

(b) 2/2.5 or 4/5 etc. or F/a or F = ma — C1
0.8 kg — A1

(c) 0.7/0.8 e.c.f. from **(b)** — B1
0.875 (m/s^2) e.c.f. from **(b)** could be scored on table (no unit needed) — B1

(d) (i) v = at or 0.5 × 1.2 — C1
0.6 m/s — A1

(ii) any velocity × time or speed × time — C1
0.36 m c.a.o. (note: 0.72 m gets C1, A0) — A1 [11]

Q# 19/_iG Phx/2008/s/Paper 31/Q1

(b) (plastic ball larger so) upward force/air resistance/drag more (or vice versa for rubber ball)
IGNORE wind resistance — B1
rubber ball, this force not big enough to balance weight/gravity (force) — B1
plastic ball, upward force/air resistance big enough to balance/equal weight/gravity (force) — B1

(c) mg or 0.05 × 10 or 50 x 10 accept 9.8 or 9.81 instead of 10 — C1
0.5 N or 0.49N or 0.4905N nothing else — A1

Q# 20/_iG Phx/2007/w/Paper 31/ www.SmashingScience.org

3 (a) any logical method e.g.
extension is 2 cm for 8 N or 1 cm for 4 N — C1
final extension is 3 cm — C1
need 12 N to extend to 6 cm — A1

(b) (i) shown on diagram:
distance from pivot to *F* OR value of weights OR dist from weights to pivot — B1

(ii) force/weight of load × distance from pivot to force
(accept symbols if clear) — B1

[Total: 5]

Q# 21/_iG Phx/2007/s/Paper 31/ www.SmashingScience.org

1	(a)	(i)	straight arrow towards centre, by eye	B1	[1]
		(ii)	force larger	B1	[1]
	(b)	(i)	straight arrow along tangent at P clockwise, by eye	B1	[1]
		(ii)	friction between tyres and track provide centripetal force	B1	
			friction too small (to provide required force)	B1	[2]

Q# 22/_iG Phx/2007/s/Paper 31/ www.SmashingScience.org

2	(a)		moment of W down/anticlockwise, moment of steam opposite	C1	
			when moment of steam > moment of W, steam escapes OR when clockwise moment > anticlockwise moment, steam escapes	A1	[2]
	(b)	(i)	12 = 0.2 F	C1	
			F = 60 N c.a.o. allow 60–61 for ans if working for 60 N shown	A1	[2]
		(ii)	(P =) F/A or 60/0.0003 e.c.f.	C1	
			2×10^5 Pa or 200 000 Pa e.c.f. (accept N/m^2) OR 20 N/cm^2	A1	[2]
					[Total: 6]

Q# 23/_iG Phx/2006/w/Paper 31/ www.SmashingScience.org

2	(a)	limit of proportionality (allow elastic limit)	B1	[1]
	(b)	force is proportional to extension or in terms of doubling	B1	[1]
	(c)	(up to Q extension proportional to force applied) Q to R extension/unit force more however expressed	B1	[1]
	(d)	k = force/extension or 8/2 or other correct ratio	C1	
		= 4.0 N/mm	A1	[2]
				[Total: 5]

Q# 24/_iG Phx/2006/s/Paper 31/Q1

(d)	F = ma or 4000 x 1.2	C1	
	= 4800 N	A1	2

Q# 25/_iG Phx/2006/s/Paper 31/ www.SmashingScience.org

2	any closed triangle or parallelogram	C1	
	forces in correct directions relative to each other	C1	
	correct resultant indicated	C1	
	resultant 7.7 N to 8.1 N	A1	4
	scale stated	B1	
	resultant vertically upwards	B1	2
			[6]

Q# 26/_iG Phx/2005/w/Paper 31/ www.SmashingScience.org

1	(a)	force of gravity on a mass or mg	B1	
		mass/volume	B1	[2]
	(b) (i)	hang object from spring balance, reading in N taken	B1	
		divide reading in N by 10 or g	B1	
	(iii)	volume of water in cylinder or fill overflow can to top	B1	
		add object find increase in volume or measure overflow volume	B1	[4]
		{no credit for mass unless not scored in (i) and no credit for density = mass/ volume unless not scored in a) }		
	(c) (i)	2N	B1	
		left	B1	
	(ii)	F = ma or 2 = 0.5 a	C1	
		a = 4.0 m/s^2	A1	[4]
				Total [10]

Q# 27/_iG Phx/2005/w/Paper 31/ www.SmashingScience.org

2	(a)	upwards force = downwards force or no resultant force	B1	
		opposing moments equal or A.C.M. = C. M.	B1	[2]
	(b)	30 x spring balance reading = 40 x 6.0 or equivalent	C1	
		spring balance reading = 8.0 N	A1	[2]
	(c)	0.5 N	B1	
		downwards	B1	[2]
				Total [6]

Q# 28/_iG Phx/2005/s/3

3	(a)	in a straight line or (vector) has direction	B1	1

Q# 29/_iG Phx/2005/s/3

3	(a)	in a straight line or (vector) has direction	B1	1
	(b)	f = ma or f = 3.0 x 2.0	C1	
		= 6(.0) N	A1	2
	(c)	P = F/a or P = 120/0.05	C1	
		= 2400 N/m^2 (or Pa)	A1	2
				[5]

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

	(c)	p.e. = mgh or 0.2 x 10 x 0.05	C1	
		= 0.1 J	A1	2

Q# 31/_iG Phx/2005/s/3

2	(a)	time a number of swings (if number stated, >5)	M1	
		time divided by [2 x number of swings]	A1	2
	(b) (i)	weight of gravity and tension	B1	
	(ii)	force towards centre of circular motion or towards support point	B1	2

Q# 32/_iG Phx/2005/s/3Q1

(b)		air resistance or friction (force) up (accept upthrust) weight/(force of) gravity down	B1 B1	2
(c)		air resistance (up) = weight (down) or two forces equal no (net) force, no acceleration	B1 B1	2

Q# 33/ iG Phx/2004/s/3

3	(a)	(i)	Extension proportional to load however expressed	B1	
		(ii)	Any relevant arithmetic to show direct proportion (or straight line graph with values)	B1	2
	(b)	(i)	Work done = force x distance / 400 x 0.210	C1	
			84.0 J	A1	
		(ii)	(total) work/time or (24 x) 84/60 (apply e.c.f from (i))	C1	
			33.6 W	A1	4
					[6]

Q# 34/ iG Phx/2004/s/3

2	(a)	750 N	A1	1
	(b)	p.e. lost / converted = mgh or weight x height	C1	
		750 x 15 or 75 x10 x15 = 11250 (J)	C1	
		p.e. lost = k.e. gained = 11250 (J)	A1	3
	(c)	Any 3 of: heat in water / rock (kinetic) energy of (moved) water / to make water move/ make waves some k.e. still in (sinking) rock sound energy on impact / of splash	B3	3
		(just heat and sound **C1**)		
				[7]

Q# 35/ iG Phx/2004/s/3

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/2003/w/Paper 3/Q1

(c) (i)	graph shows constant acceleration	B1	
	force = ma (and m is also constant) so force is constant	B1	
(ii)	towards the centre of the motion/circle	A1	3
			[11]

Q# 37/ iG Phx/2003/w/Paper 3/Q1

(c) (i)	graph shows constant acceleration	B1	
	force = ma (and m is also constant) so force is constant	B1	
(ii)	towards the centre of the motion/circle	A1	3

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

3	(a)	one slightly nearer the centre than the other	C1	
		20 kg is the nearer one to the pivot	A1	2
	(b)	Clockwise moments = anticlockwise moments (about point/pivot)	A1	1
		(accept opposite directions and equal)		
	(c)	18x2.5=20xB	C1	
		distance = 2.25(m)	A1	2
				[5]

Q# 39/_iG Phx/2003/s/3

3	(a)	attempt to use triangle or parallelogram of forces	M1	
		stated scale used	A1	
		950 N and 1220 N in correct relative directions	C1	
		correct resultant drawn in	C1	
		weight = 1785 N [limits 1700 N to 1850 N]	A1	5

Q# 40/_iG Phx/2003/s/3

1	(a)	(i)	force of gravity acts on masses/weight of masses	B1	
		(ii)	vector has direction/force has direction	B1	2
	(b)	(i)	spring 1 (more difficult)	M1	
			any correct relevant pair of values	A1	
		(ii)	P marked at extension 25 mm to 28 mm	A1	
			explanation in terms of end of proportionality	B1	
		(iii)	each graph read at 15 N, approx. 25 mm, 19 mm	C1	
			difference correct, 6 mm +/- 1 mm	A1	6
					[8]

Q# 41/_iG Phx/2002/w/Paper 3/Q1

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. = 0.5mv²		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
d	work done against friction		B1	
	(more) friction on EF		B1	
	(k)e. changed to heat		B1	
	less k.e. changed to p.e.	3	B1	M3*
			QT 13	