1 The stone with a mass of 98.4 g has a weight of 0.984 N.

Explain the difference between mass and weight.

.....

.....

..... [2]

[Total: 2]

2 The stone with a mass of 98.4 g has a weight of 0.984 N.

Explain the difference between mass and weight.

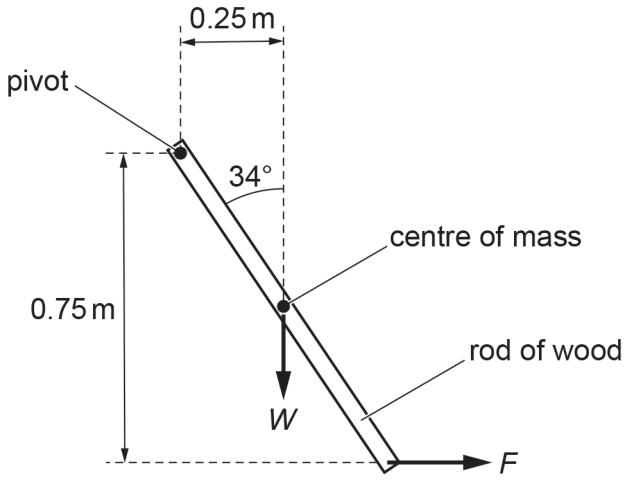
.....

.....

..... [2]

[Total: 2]

3 The diagram shows a uniform rod of wood suspended from a pivot.



(not to scale)

The rod is held stationary by a horizontal force *F* acting as shown.
The mass of the rod is 0.080 kg.

(a) Calculate the weight *W* of the rod.

weight = ... [1]

(b) Calculate the moment of *W* about the pivot.

moment = ... [2]

(c) Calculate the moment of *F* about the pivot.

moment = ... [1]

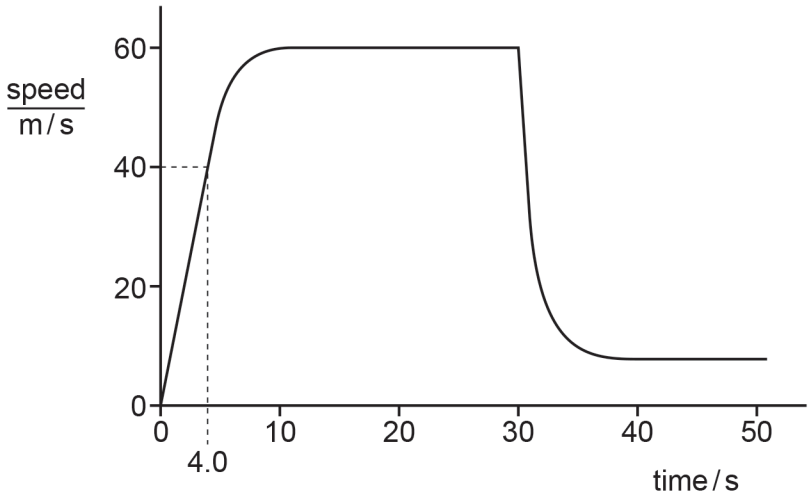
(d) Calculate the force *F*.

force = ... [2]

[Total: 6]

4 A sky-diver jumps out of a hot-air balloon, which is 4000 m above the ground. At time = 30 s, she opens her parachute.

The graph is the speed-time graph of her fall.



Describe, in terms of the forces acting on the sky-diver, her motion between leaving the balloon and opening her parachute.

.....

.....

.....

.....

.....

..... [4]

[Total: 4]

5 A bus is travelling along a straight road. The bus and the driver have a combined mass of 16 000 kg when there are no passengers in it. The bus has 73 passengers. The average mass of each of the passengers is 65 kg.

(a) Calculate the total mass of the bus, the driver and the 73 passengers.

mass = ... [2]

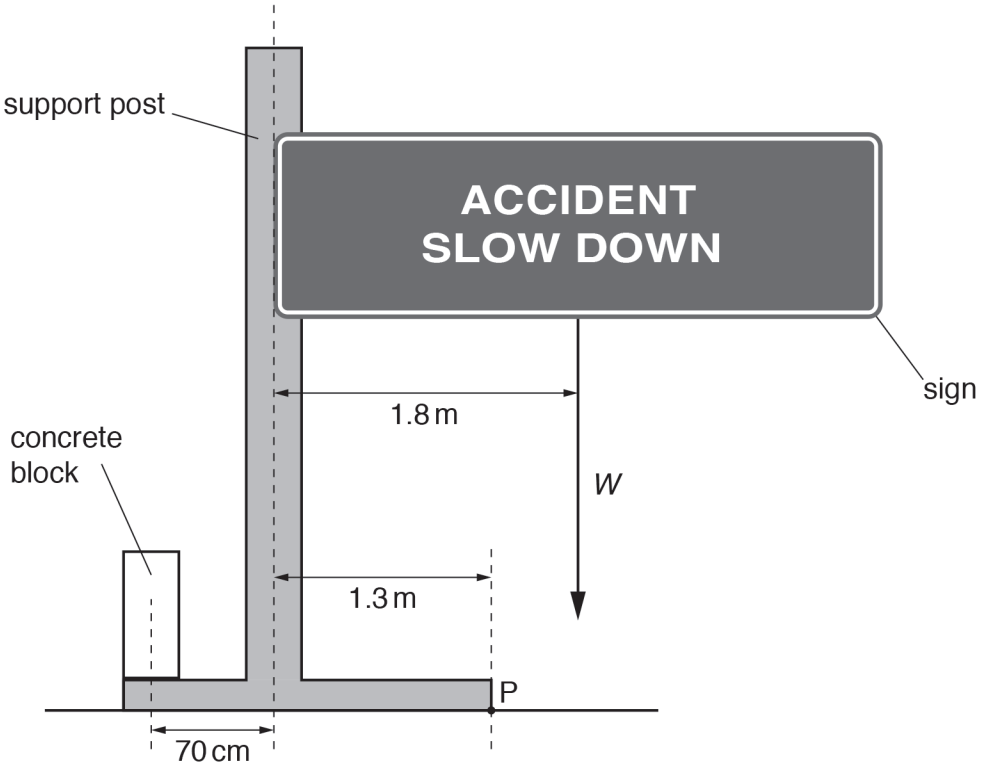
(b) The fully loaded bus accelerates uniformly from rest to a speed of 14 m / s. The time taken to reach a speed of 14 m / s is 20 s.

Calculate the resultant force on the bus during the acceleration.

force = ... [2]

[Total: 4]

6 The diagram shows a sign that extends over a road.



The mass of the sign is 3.4×10^3 kg.

(a) Calculate the weight *W* of the sign.

W = ... [2]

(b) The weight of the sign acts at a horizontal distance of 1.8 m from the centre of the support post and it produces a turning effect about point P.

Point P is a horizontal distance of 1.3 m from the centre of the support post.

(i) Calculate the moment about P due to the weight of the sign.

moment = ... [3]

(ii) A concrete block is positioned on the other side of the support post with its centre of mass a horizontal distance of 70 cm from the centre of the support post.

State what is meant by *centre of mass*.

.....

..... [1]

(iii) The weight of the concrete block produces a moment about point P that exactly cancels the moment caused by the weight *W*.

Calculate the weight of the concrete block.

weight = ... [2]

(c) The concrete block is removed. The sign and support post rotate about point P in a clockwise direction.

State and explain what happens to the moment about point P due to the weight of the sign as it rotates.

.....

.....

..... [2]

[Total: 10]

7 A rectangular container has a base of dimensions 0.12 m × 0.16 m. The container is filled with a liquid. The mass of the liquid in the container is 4.8 kg.

(a) Calculate

(i) the weight of liquid in the container,

weight = ... [1]

(ii) the pressure due to the liquid on the base of the container.

pressure = ... [2]

(b) Explain why the total pressure on the base of the container is greater than the value calculated in **(a)(ii)**.

.....

..... [1]

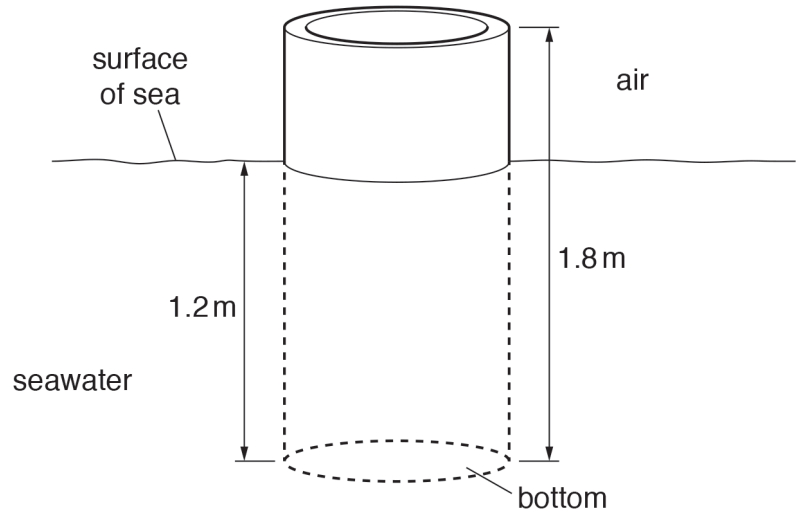
(c) The depth of liquid in the container is 0.32 m.

Calculate the density of the liquid.

density = ... [2]

[Total: 6]

8 The diagram shows a hollow metal cylinder containing air, floating in the sea.



(a) The density of the metal used to make the cylinder is greater than the density of seawater.

Explain why the cylinder floats.

.....

..... [1]

(b) The cylinder has a length of 1.8 m. It floats with 1.2 m submerged in the sea. The bottom of the cylinder has an area of cross-section of 0.80 m^2.

The density of seawater is 1020 kg / m^3.

Calculate the force exerted on the bottom of the cylinder due to the depth of the seawater.

force = ... [4]

(c) Deduce the weight of the cylinder. Explain your answer.

weight = ...

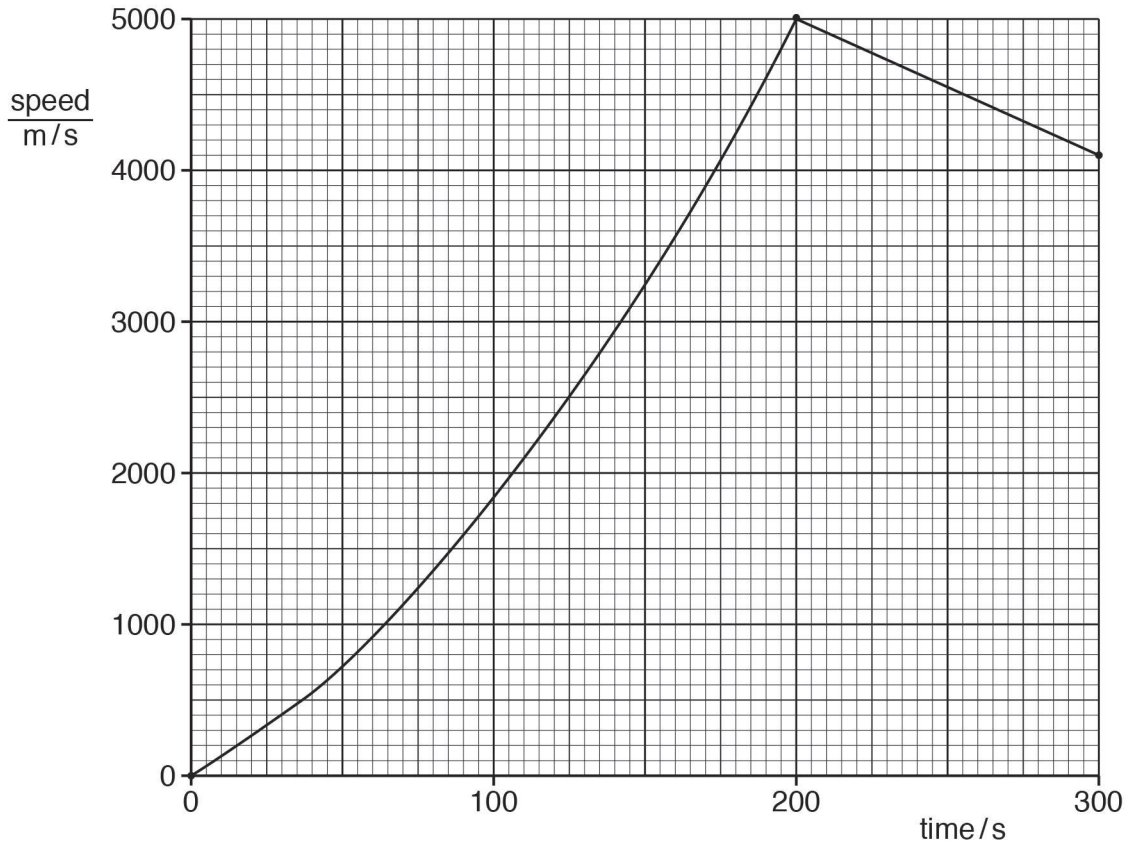
explanation .....

..... [2]

[Total: 7]

9 There is no atmosphere on the Moon.

A space probe is launched from the surface of the Moon. The graph is a speed-time graph of the space probe.



(a) Between time = 0 and time = 150 s, the acceleration of the space probe changes.

Without calculation, state how the graph shows this.

.....

..... [1]

(b) Between time = 0 and time = 150 s, the thrust exerted on the space probe by the motor remains constant.

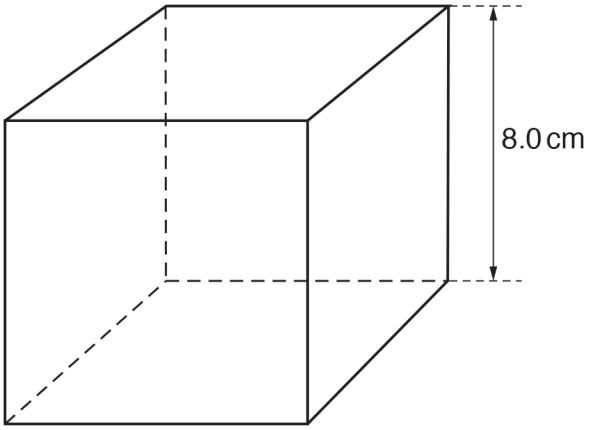
State one possible reason why the acceleration changes in the way shown in the speed-time graph.

.....

..... [1]

[Total: 2]

10 All the sides of a plastic cube are 8.0 cm long. The diagram shows the cube, (not to scale).



The mass of the cube is 0.44 kg.

(a) Explain what is meant by *mass*.

..... [1]

(b) **(i)** Calculate the density of the plastic from which the cube is made.

density = ... [2]

(ii) The density of one type of oil is 850 kg / m^3.

State and explain whether the cube floats or sinks when placed in a container of this oil.

.....

..... [1]

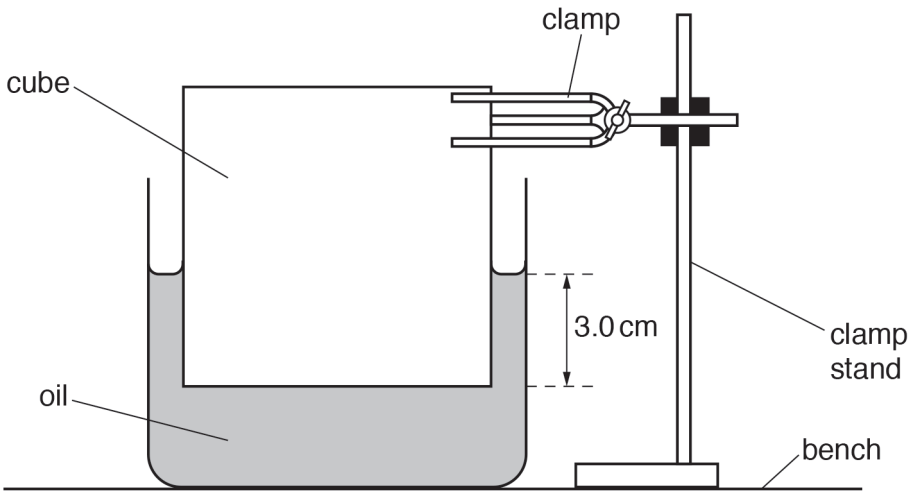
(c) On the Moon, the weight of the cube is 0.70 N.

(i) Calculate the gravitational field strength on the Moon.

gravitational field strength = ... [2]

(ii) In a laboratory on the Moon, the plastic cube is held stationary, using a clamp, in a beaker of the oil of density 850 kg / m^3.

The arrangement is shown in the diagram.



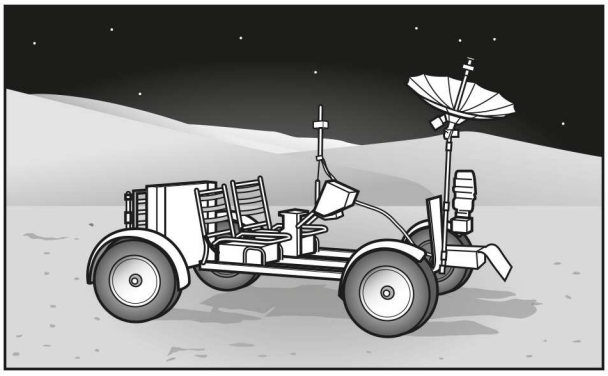
The lower face of the cube is 3.0 cm below the surface of the oil.

Use your answer to **(c)(i)** to calculate the pressure due to the oil on the lower face of the cube.

pressure = ... [2]

[Total: 8]

11 The diagram shows a vehicle designed to be used on the Moon.



The brakes of the vehicle are tested on Earth.

The acceleration of free fall on the Moon is one sixth ($\frac{1}{6}$) of its value on Earth.

Tick **one** box in each column of the table to predict the value of that quantity when the vehicle is used on the Moon, compared to the test on Earth.

	mass of vehicle on Moon	weight of vehicle on Moon	deceleration of vehicle on moon with same braking force
10 × value on Earth			
6 × value on Earth			
same value as on Earth			
$\frac{1}{6}$ × value on Earth			
$\frac{1}{10}$ × value on Earth			

[3]

[Total: 3]

12 A coal-fired power station generates electricity at night when it is not needed.

Some of this energy is stored by pumping water up to a mountain lake. When there is high demand for electricity, the water is allowed to flow back through turbines to generate electricity.

On one occasion, 2.05×10^8 kg of water is pumped up through a vertical height of 500 m.

(a) Calculate the weight of the water.

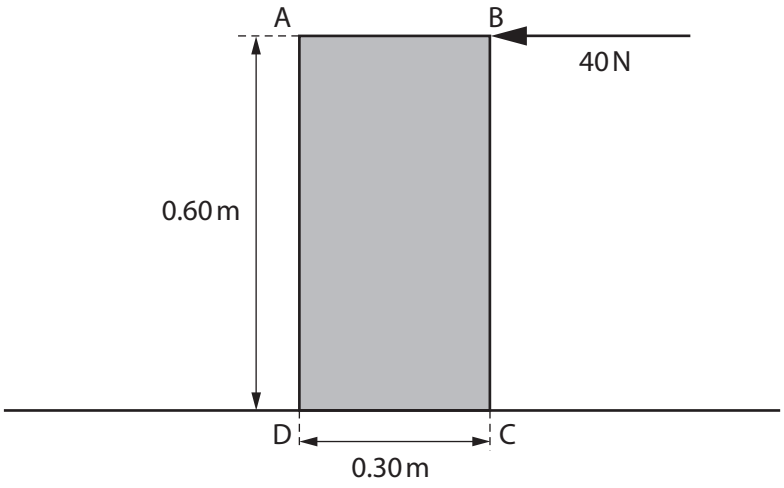
weight = ... [1]

(b) Calculate the gravitational potential energy gained by the water.

energy gained = ... [2]

[Total: 3]

13 The figure shows a uniform, rectangular slab of concrete ABCD standing upright on the ground. The slab has height 0.60 m, width 0.30 m and mass 18 kg. A force of 40 N acts horizontally to the left at B.



(a) **(i)** Calculate the weight *W* of the concrete slab.

W = ... [1]

(ii) The thickness of the slab is 0.040 m.

Calculate the pressure exerted by the slab on the ground.

pressure = ... [2]

(b) **(i)** On the figure, draw and label an arrow to show the weight *W* of the slab acting at its centre of mass. [1]

(ii) Calculate the moment of the 40 N force about point D.

moment = ... [2]

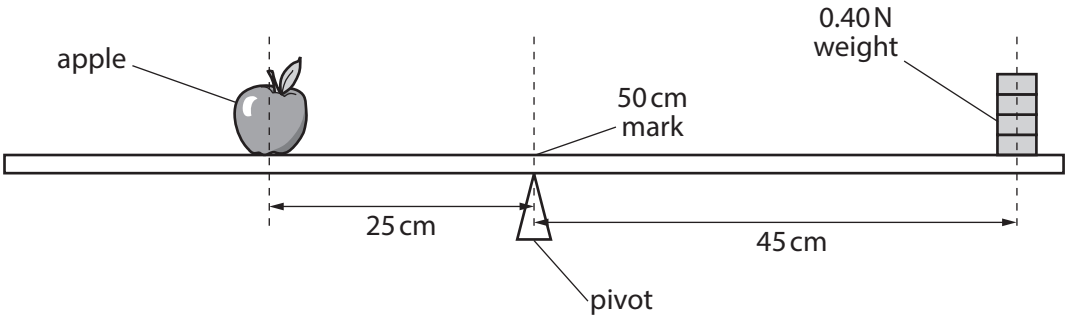
(iii) Calculate the moment of *W* about point D.

moment = ... [1]

[Total: 7]

14 A metre rule balances when the 50 cm mark is directly above a pivot.

The figure (not to scale) shows an apple and a 0.40 N weight placed on the rule so that the rule remains balanced at the 50 cm mark.



The centre of mass of the apple is 25 cm from the pivot and the centre of mass of the weight is 45 cm from the pivot.

Calculate

(a) the weight of the apple,

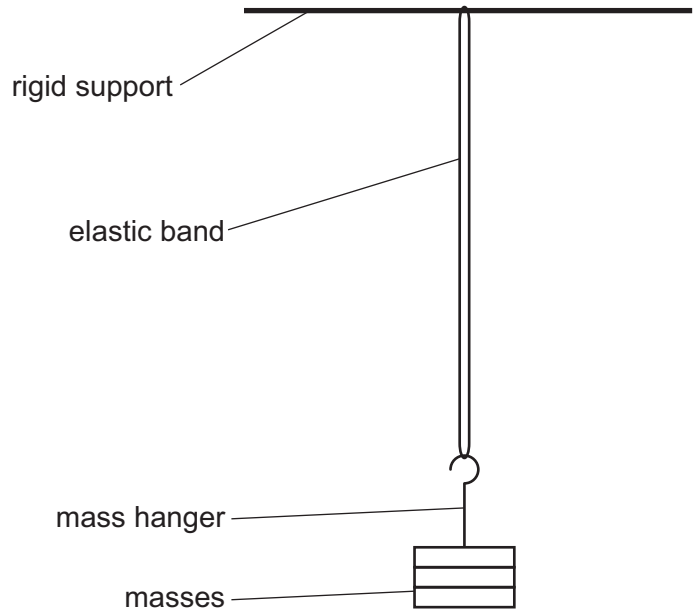
weight = ... [2]

(b) the mass of the apple.

mass = ... [1]

[Total: 3]

15 The diagram shows some masses on a mass hanger attached to an elastic band. The elastic band is stretched by the masses.



The total mass of the masses and the mass hanger is 300 g.

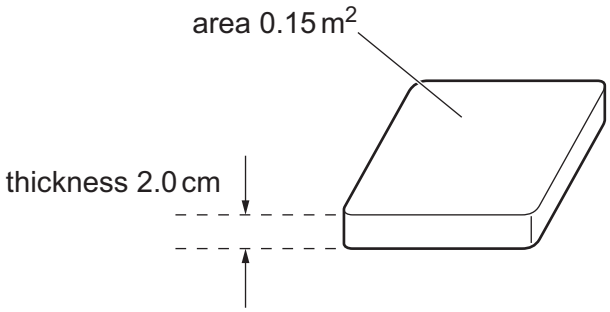
Calculate the total weight of the masses and the mass hanger.

total weight = ... N [3]

[Total: 3]

16 The diagram shows a piece of glass of thickness 2.0 cm and area 0.15 m^2.

The density of the glass is 2.6 10^3 kg / m^3.

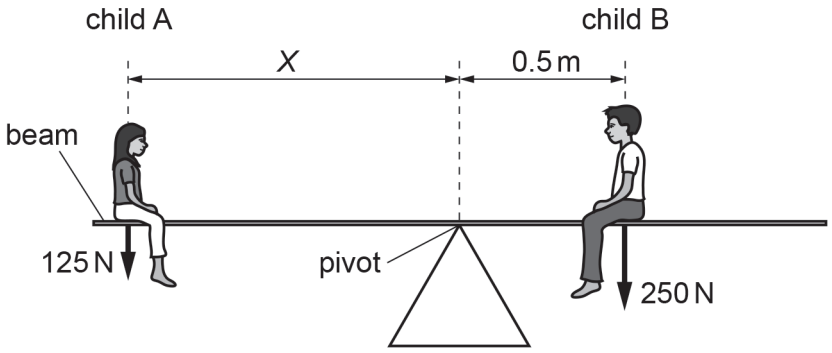


Calculate the weight of the piece of glass.

weight = ... [3]

[Total: 3]

17 The diagram shows two children sitting on a see-saw.



(not to scale)

The weight of child A is 125 N.

Calculate the mass of child A. Include the unit in your answer.

mass of child A = ... unit ..... [3]

[Total: 3]

18 Calculate the mass of an object that has a weight of 6.0 N.

mass = ... kg [3]

[Total: 3]

19 A student has a metal object.

(a) The mass of the metal object is 1260 g. The volume of the metal is 150 cm^3.

Calculate the density of the metal. Include the unit.

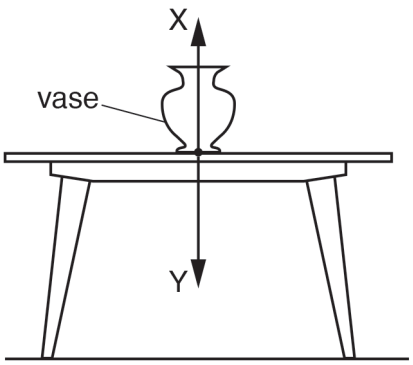
density = ... [4]

(b) The mass of the metal object is given in grams. State the mass in kg.

mass = ... kg [1]

[Total: 5]

20 A vase is placed on a table. Forces X and Y act on the vase, as shown in the diagram.



The mass of the vase is 0.25 kg. The vase is not moving.

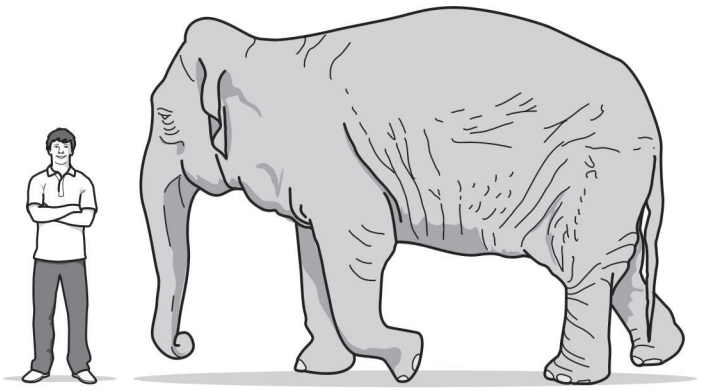
Calculate the value of force X and the value of force Y.

X .....

Y ..... [4]

[Total: 4]

21 A student is studying elephants.The diagram shows an elephant.



(a) The student measures the elephant and records the values, as shown in the table.

Complete the table by adding a suitable unit for each measurement. Choose the units from those shown in the box.

m^2	kg	cm	mm^2	g	m	cm^2	mg	mm

measurements	value	unit
mass of elephant	4000	
height of elephant	3.0	
average area of an elephant's foot	0.125	

[2]

(b) Using information from the table in **(a)**:

(i) calculate the weight of the elephant

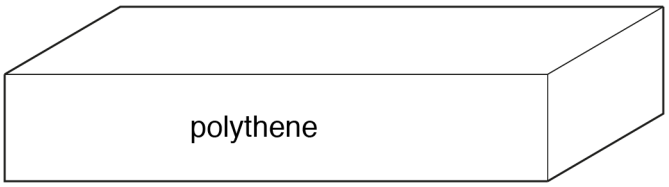
weight = ... N [3]

(ii) calculate the pressure the elephant exerts on the ground when it is standing on four feet. Include a unit.

pressure = ... [4]

[Total: 9]

22 The diagram shows a block of polythene.



The weight of the polythene block is 0.84 N.

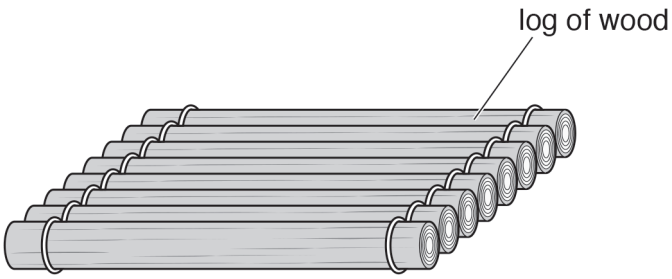
Calculate the mass of the block.

mass = ... kg [3]

[Total: 3]

23 The diagram shows a wooden raft. The raft is made from 8 logs.

The logs are all of the same type of wood.



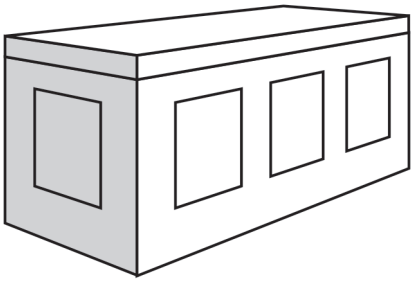
The average mass of each log is 65.0 kg.

Calculate the total weight of the raft.

total weight of the raft = ...N [3]

[Total: 3]

24 The diagram shows a large box with a heavy lid.

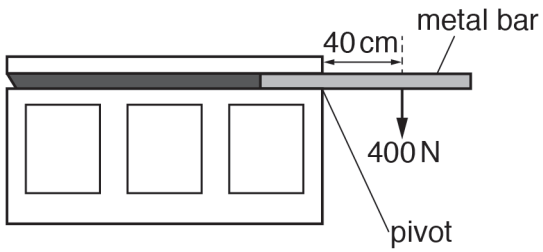


(a) The weight of the box is 2250 N.

Calculate the mass of the box.

mass = ... kg [3]

(b) A man wants to lift the lid of the box. He puts a strong metal bar between the box and the lid. He applies a force to the bar as shown in the diagram.



(i) Calculate the moment of his force about the pivot. State the unit.

moment = ... [4]

(ii) The moment in **(b)(i)** is not sufficient to lift the lid. Describe how the man can increase the moment, using the same force.

.....

..... [1]

[Total: 8]

25 The diagram shows a glass vase used for displaying flowers.

(a) The mass of the glass is 450 g. The volume of glass in the vase is 145 cm^3.

(i) Calculate the density of the glass.

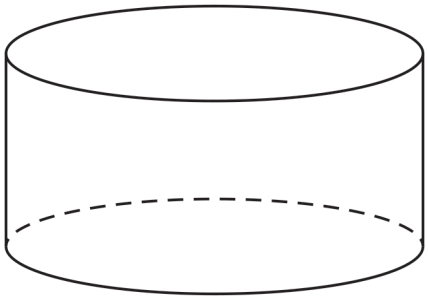
density = ... g / cm^3 [3]

(ii) Calculate the weight of the glass.

weight = ... N [3]

[Total: 6]

26 The diagram shows a cylinder made from copper of density 9000 kg / m^3.



The volume of the cylinder is 75 cm^3.

(a) Calculate the mass of the cylinder.

mass = ... [2]

(b) The gravitational field strength is 10 N / kg.

(i) Calculate the weight of the cylinder.

weight = ... [2]

(ii) State **one** way in which weight differs from mass.

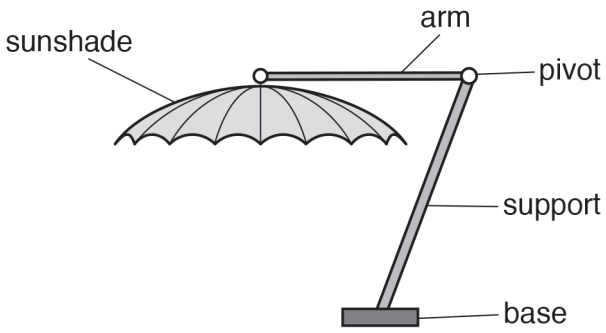
.....

.....

..... [1]

[Total: 5]

27 The diagram shows a large sunshade.



The arm holding the sunshade pivots about the end of a support.

(a) The sunshade has a mass of 20.0 kg.

Calculate the weight of the sunshade.

weight = ... N [3]

[Total: 3]

28 **(a)** The walls of a room are to be painted.

A tin of paint has a total mass of 7000 g and a volume of 5000 cm^3.

The empty tin has a mass of 500 g.

(i) Determine the mass of the paint.

mass of paint = ... g [1]

(ii) Calculate the density of the paint. Include the unit.

density = ... [3]

(b) The painter drops a brush into the tin of paint. The brush floats.

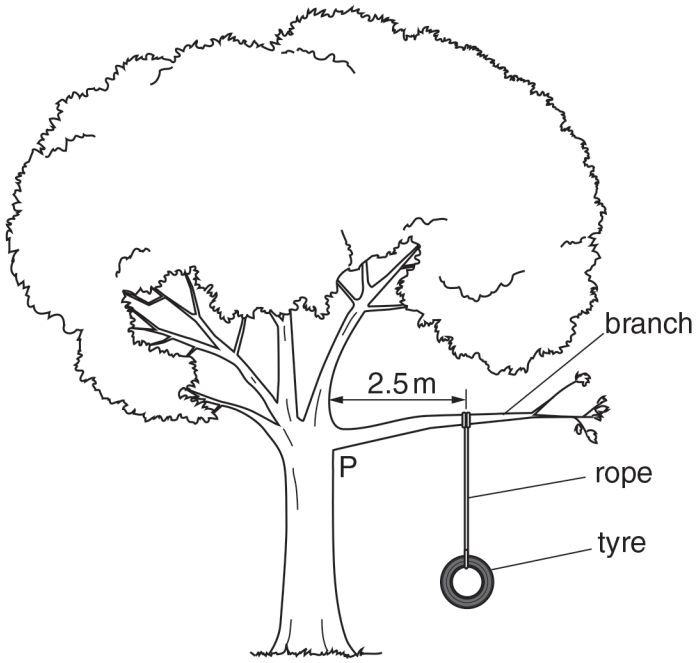
Suggest why the brush floats.

.....

..... [1]

[Total: 5]

29 The diagram shows a tyre hanging from the branch of a tree.



(a) The mass of the tyre is 15 kg.

Calculate its weight.

weight of tyre = ... N [2]

(b) The weight of the tyre exerts a moment on the branch, about point P where the branch joins the tree.

(i) Explain what is meant by the term *moment*.

..... [1]

(ii) A child sits on the tyre. The weight of the child and tyre together is 425 N. Calculate the moment of this force about point P. Use information given in the diagram. Include the unit.

moment = ... [4]

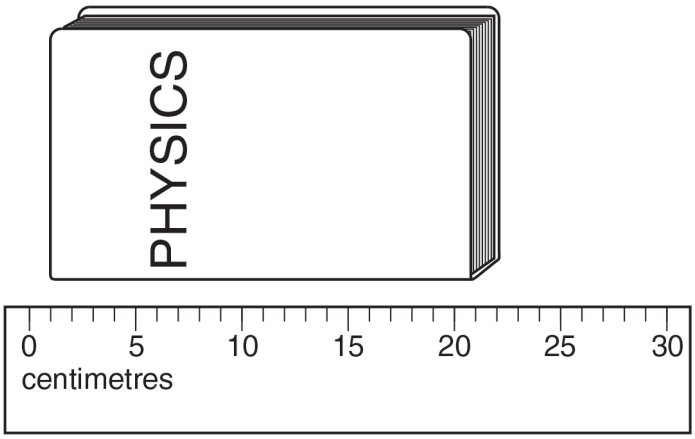
(iii) A heavier child wants to sit on the tyre. Describe how the tyre position should be adjusted so that the moment is the same as in **(b)(ii)**.

..... [1]

[Total: 8]

30 A student measures a book.

(a) He measures the length of the book, as shown in the diagram.



The student records his measurements.

length of book = 19.9 cm

His measurement is not accurate.

Describe **two** ways that the student can improve the accuracy of his measurement.

1. .....

.....

2. .....

..... [2]

(b) The book contains 200 thin sheets of paper.
The student wants to find the average (mean) thickness of a sheet of paper in the book.

Describe how he can determine such a small distance using only a ruler.

.....

.....

.....

.....

..... [3]

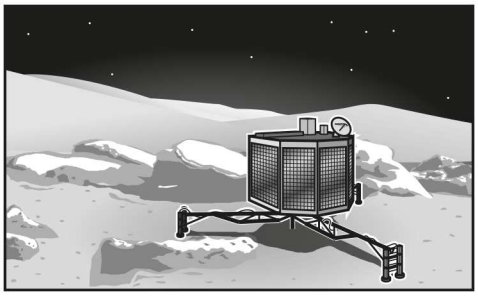
(c) The book has a mass of 400 g.

Calculate the weight of the book. Include the unit.

weight = ... [4]

[Total: 9]

31 The diagram shows remote sensing equipment on the surface of a distant planet.



(a) The mass of the equipment is 350 kg. The acceleration of free fall on the surface of this planet is $7.5\,m/s^2$.

(i) State what is meant by the term *weight*.

.....

..... [1]

(ii) Calculate the weight of the equipment on the planet.

weight = ... [2]

(b) The equipment releases a balloon from a point that is a small distance above the surface of the planet. The atmosphere at the surface of this planet has a density of 0.35 kg / m^3. The inflated balloon has a mass of 80 g and a volume of 0.30 m^3.

Make an appropriate calculation and then predict and explain the direction of any motion of the balloon. Show your working.

prediction .....

explanation .....

..... [4]

[Total: 7]

32 The mass of an object is measured on Earth. The mass is 5.0 kg.

The object is taken to the Moon. The mass of the object is measured on the Moon.

What is the mass of the object on the Moon?

A 0 kg

B more than 0 kg, but less than 5.0 kg

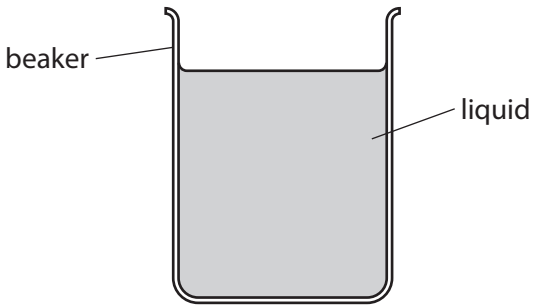
C 5.0 kg

D more than 5.0 kg

[1]

[Total: 1]

33 A student has a beaker of liquid as shown in the figure.



The student makes some measurements. His results are shown in the table.

mass of beaker and liquid	280 g

mass of empty beaker	120 g
volume of liquid	200 cm^3

(a) Calculate the mass of the liquid in the beaker.

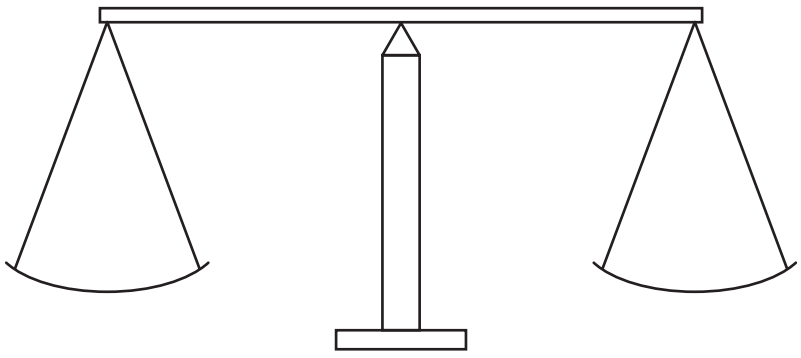
mass of liquid = ... g [1]

(b) Calculate the density of the liquid.

density = ... g/cm^3 [3]

[Total: 4]

34 The figure below is a simplified diagram of a balance with equal arms.



A copper block of unknown mass is placed on the left-hand pan. Six standard masses, placed on the right-hand pan, cause the balance to be in equilibrium, with the beam horizontal.

The six standard masses on the right-hand pan are:

100 g, 100 g, 50 g, 10 g, 5 g, 2 g

(a) What is the mass of the copper block?

mass = ... g [1]

(b) What will be seen to happen if the 2 g mass is removed from the right-hand pan?

.....

..... [1]

(c) The volume of the copper block is 30 cm^3.

Calculate the density of copper. State the unit in your answer.

density = ... [4]

[Total: 6]

35 A student has been told to find the density of some liquid paraffin by measuring its mass and its volume.

(a) Which piece of laboratory equipment should she use to measure the volume of the liquid paraffin?

..... [1]

(b) Which piece of laboratory equipment should she use to find the mass of the liquid paraffin?

..... [1]

(c) Describe the procedure she would follow in order to find the mass.

.....

.....

.....

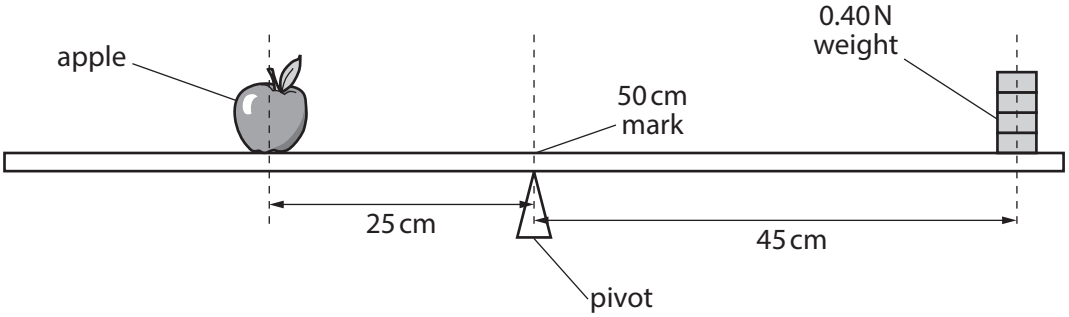
.....

..... [3]

[Total: 5]

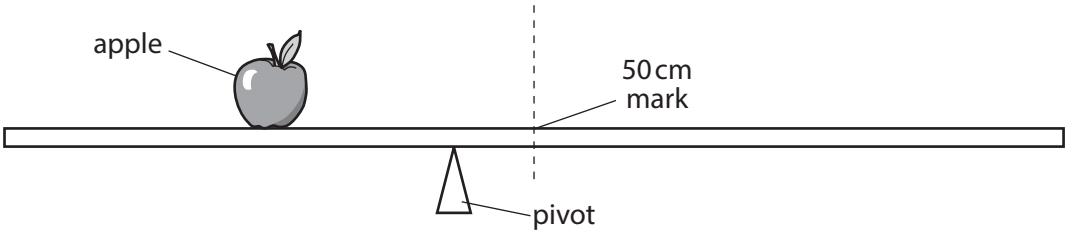
36 A metre rule balances when the 50 cm mark is directly above a pivot.

The figure (not to scale) shows an apple and a 0.40 N weight placed on the rule so that the rule remains balanced at the 50 cm mark.



The centre of mass of the apple is 25 cm from the pivot and the centre of mass of the weight is 45 cm from the pivot.

The apple is not moved. The weight is removed from the rule and the pivot is moved to the left until the rule balances as shown in the figure below.



The pivot in the figure above is closer to the 50 cm mark than to the centre of mass of the apple.

Compare the weight of the rule to the weight of the apple.

.....

..... [1]

[Total: 1]

37 Which statement about the weight of an object is correct?

A Weight is equal to mass.

B Weight is a force.

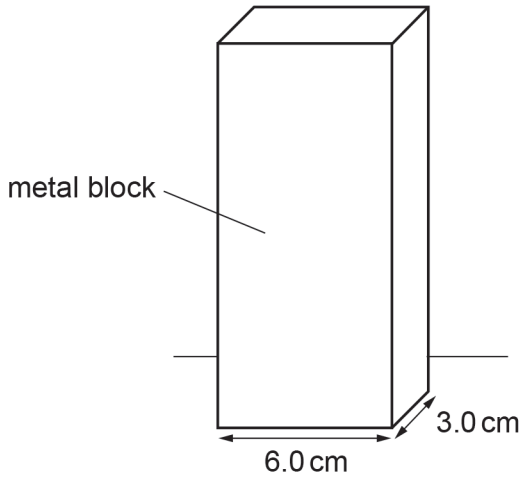
C Weight is found using a measuring cylinder.

D Weight is measured in kilograms.

[1]

[Total: 1]

38 The diagram shows a metal block on a flat surface.



The mass of the metal block is 1.6 kg.

Calculate the weight of the metal block.

weight = ... N [2]

[Total: 2]

39 The mass of an empty beaker is 400 g.

Calculate the weight of the empty beaker.

weight = ... N [4]

[Total: 4]

40 A student collects 0.21 kg of water.

Calculate the weight of this water.

weight of water = ... N [3]

[Total: 3]