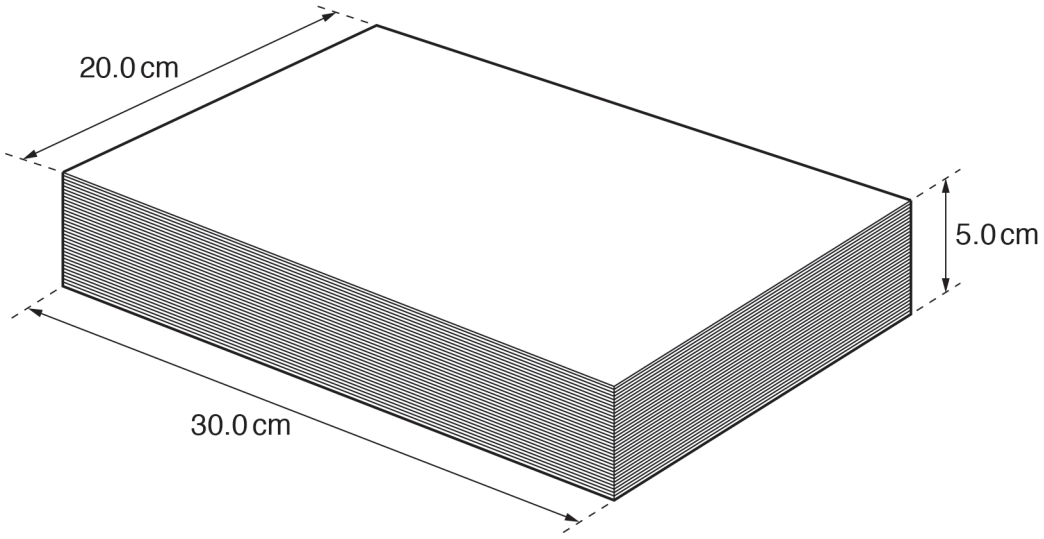
1 A student has a pile of A4 paper for his computer printer.

The diagram shows the dimensions of the pile of paper.



(a) Show that the pile of paper has a volume of 3000 cm^3. Use the information shown in the diagram.

[1]

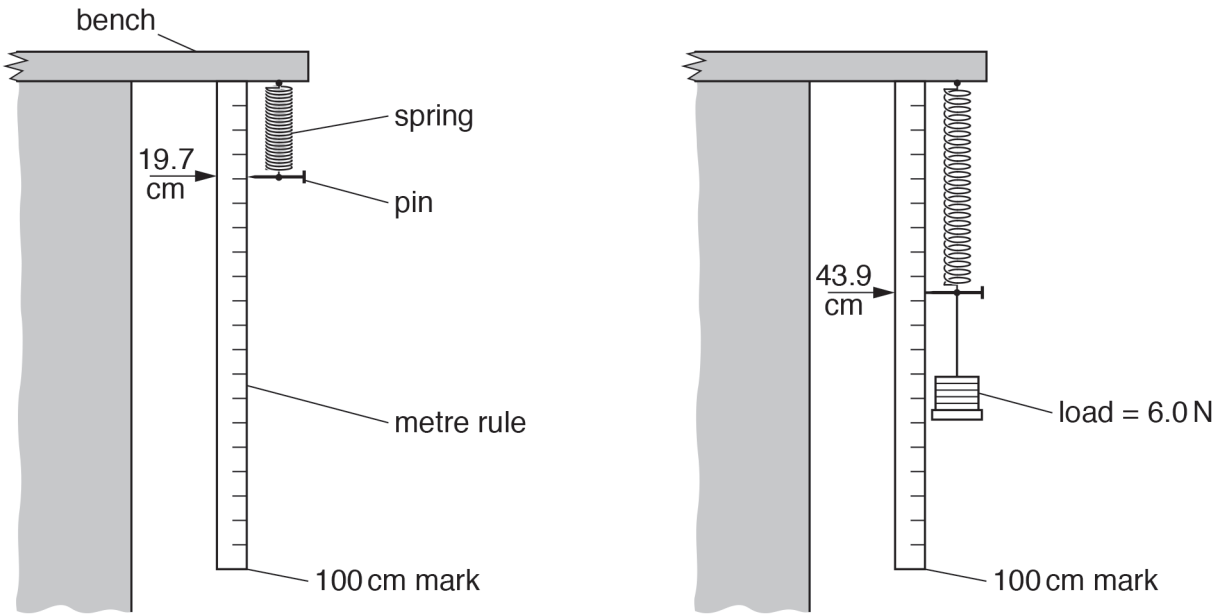
(b) The mass of the paper in the pile is 2400 g.

Calculate the density of the paper.

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

[Total: 4]

2 A spring is suspended from the edge of a bench, as shown in diagram **A**.



A **B**

With no load on the spring, the pin points to 19.7 cm on the metre rule, as shown in diagram **A**. When a load of 6.0 N is attached to the spring, the pin points to 43.9 cm, as shown in diagram **B**.

(a) Calculate the extension of this spring for a load of 6.0 N.

extension = ... cm [1]

(b) Describe how a student could use the equipment in diagram **A** to obtain accurate readings for a load-extension graph for this spring.

.....

.....

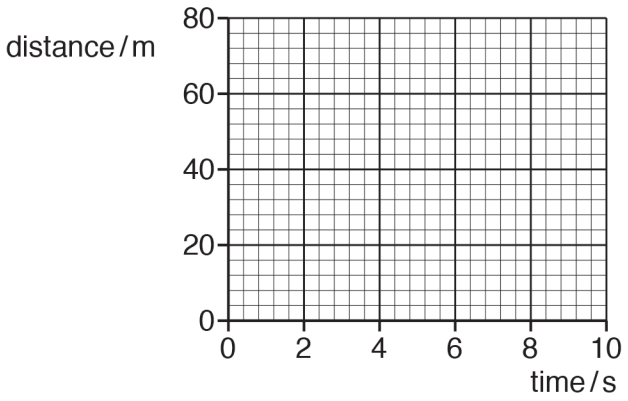
.....

.....

..... [2]

[Total: 3]

3 The diagram shows the axes of a distance-time graph for an object moving in a straight line.



(a) **1.** On the diagram, draw between time = 0 and time = 10 s, the graph for an object moving with a constant speed of 5.0 m / s. Start your graph at distance = 0 m.

2. State the property of the graph that represents speed.

..... [2]

(b) Between time = 10 s and time = 20 s the object accelerates. The speed at time = 20 s is 9.0 m / s.

Calculate the average acceleration between time = 10 s and time = 20 s.

acceleration = ... [2]

[Total: 4]

4 The mass of a car is 1400 kg. The car, initially at rest, is moved along a level road by a resultant force of 3500 N. The car reaches a speed of 30 m / s.

(a) Calculate the average acceleration of the car.

acceleration = ... [2]

(b) Calculate the time for which the force is applied.

time = ... [2]

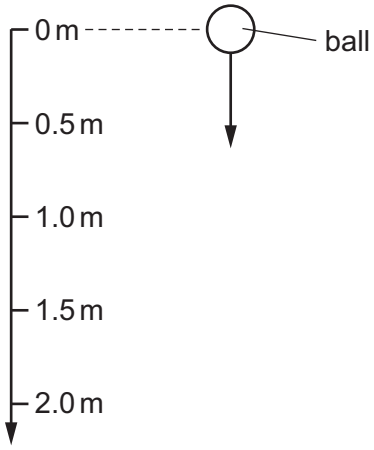
(c) State the name of a force which opposes the motion of the car.

..... [1]

[Total: 5]

5 On Earth, a ball is dropped and falls 2.0 m in a vacuum.

The acceleration of the ball at 1.0 m is 10 m / s^2.



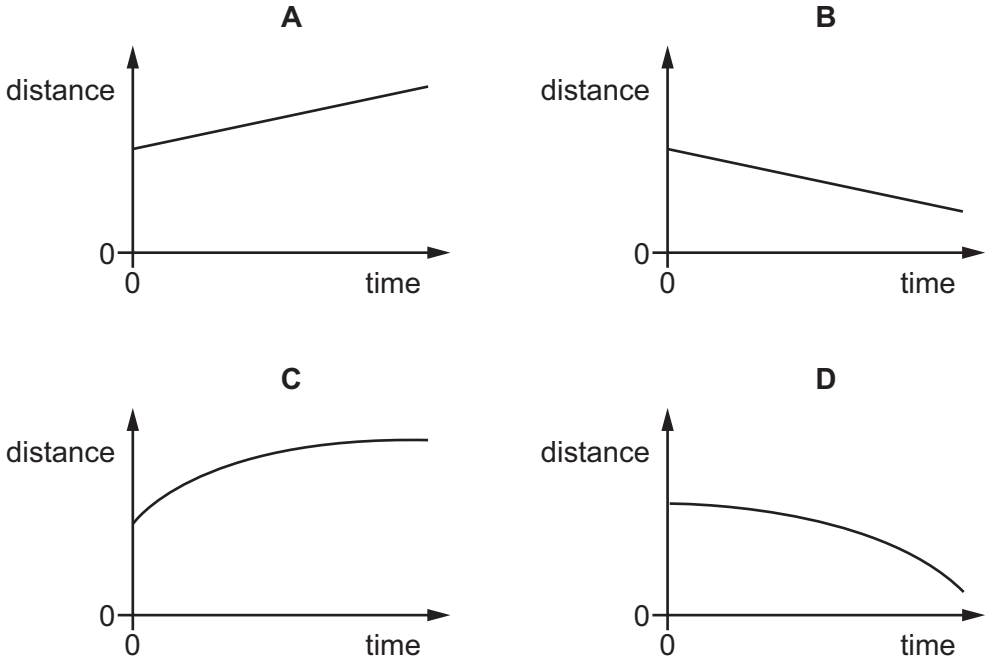
What is the acceleration of the ball at 0.5 m?

A 5.0 m / s^2 **B** 10 m / s^2 **C** 15 m / s^2 **D** 20 m / s^2

[1]

[Total: 1]

6 Which distance-time graph represents a body whose speed is decreasing?



[1]

[Total: 1]

7 At night, bats emit pulses of sound to detect obstacles and prey. The speed of sound in air is 340 m / s.

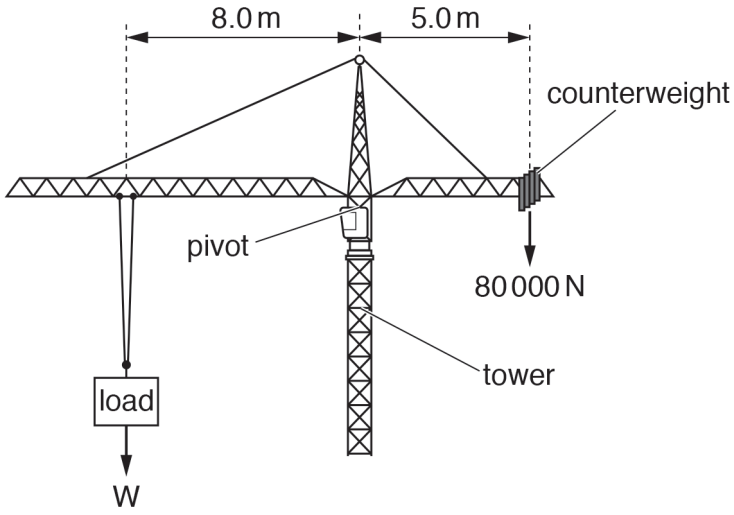
The pulse of sound hits a stationary object and is reflected back to the bat. The pulse is received by the bat 0.12 s after it was emitted.

Calculate the distance travelled by the pulse of sound during this time.

distance = ... [2]

[Total: 2]

8 A tower crane has a load W, as shown in the diagram.



(a) The counterweight has a weight of 80 000 N. This acts at a distance of 5.0 m from the pivot, as shown in the diagram.

Calculate the moment of the counterweight about the pivot. Give the unit.

moment = ... [3]

(b) The tower crane in the diagram balances horizontally when holding the load W.

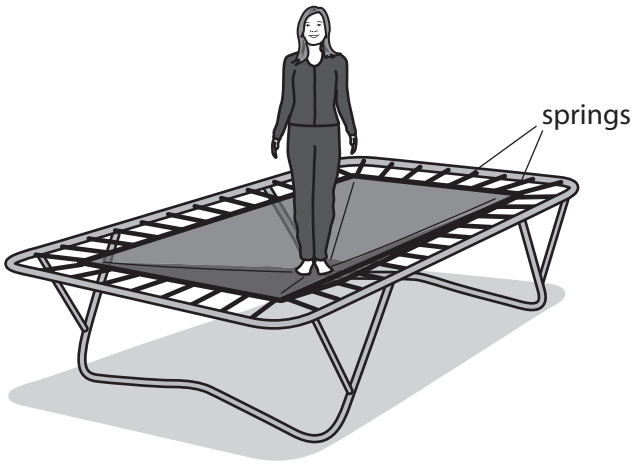
Calculate the weight of load W.

weight = ... N [3]

[Total: 6]

9 An athlete of mass 64 kg is bouncing up and down on a trampoline.

At one moment, the athlete is stationary on the stretched surface of the trampoline.The figure shows the athlete at this moment.



The stretched surface of the trampoline begins to contract. The athlete is pushed vertically upwards and she accelerates. At time *t*, when her upwards velocity is 6.0 m / s, she loses contact with the surface.

(a) Calculate her kinetic energy at time *t*.

kinetic energy = ... [2]

(b) Calculate the maximum possible distance she can travel upwards after time *t*.

maximum distance = ... [3]

(c) In practice, she travels upwards through a slightly smaller distance than the distance calculated in **(b)**.

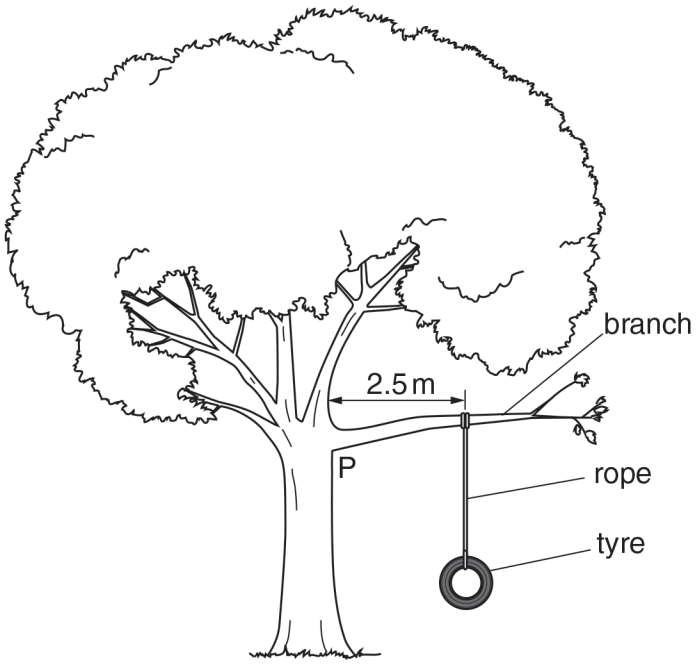
Suggest why this is so.

.....

..... [1]

[Total: 6]

10 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]

11 In a game of tennis, a player hits a stationary ball with his racquet.

(a) The racquet is in contact with the ball for 6.0 ms. The average force on the ball during this time is 400 N.

Calculate the impulse on the tennis ball.

impulse = ... [2]

(b) The mass of the ball is 0.056 kg.

Calculate the speed with which the ball leaves the racquet.

speed = ... [2]

[Total: 4]

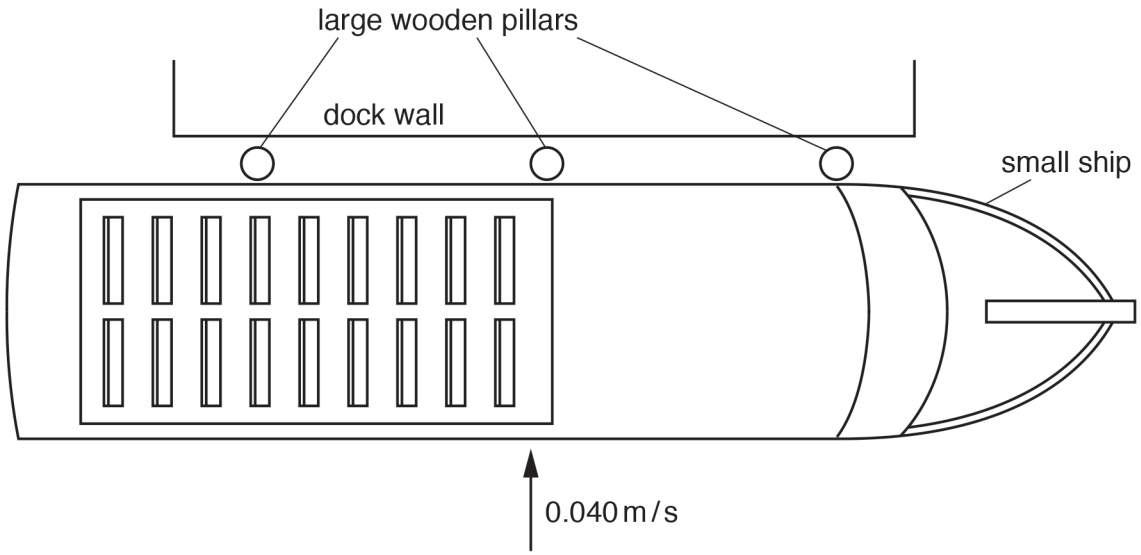
12 State the principle of conservation of energy.

.....

..... [2]

[Total: 2]

13 The diagram is the top view of a small ship of mass 1.2×10^6 kg. The ship is moving slowly sideways at 0.040 m / s as it comes in to dock.



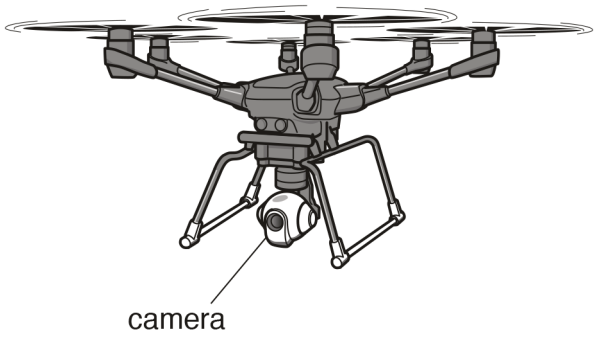
The ship hits the wooden pillars which move towards the dock wall.

Calculate the kinetic energy of the ship before it hits the pillars.

kinetic energy = ... [2]

[Total: 2]

14 A drone is a machine that can fly. The diagram shows a drone rising into the air, lifting a camera.



The drone obtains energy from a battery of cells.

When the drone moves, it wastes some energy. State the form of wasted energy and describe what happens to this energy.

form of energy .....

description .....

..... [2]

[Total: 2]

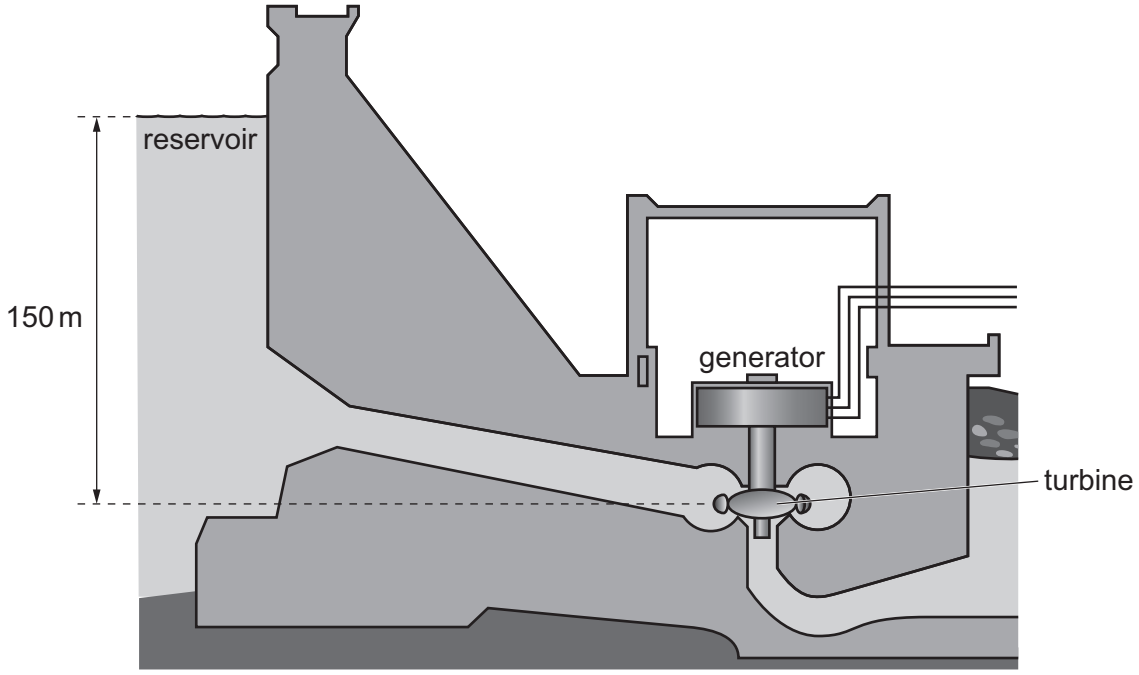
15 The weight of a table is 280 N. The table has four legs. The area of each table leg in contact with the floor is 18 cm^2.

Calculate the pressure of the table on the floor. Give the correct unit.

pressure on the floor = ... unit ..... [5]

[Total: 5]

16 The diagram shows water stored in a reservoir behind a hydroelectric dam.



(not to scale)

The turbine is 150 m below the level of the water in the reservoir.

Atmospheric pressure is 1.0×10^5 Pa. The density of water is 1000 kg / m^3.

(a) Calculate the total pressure in the water at the turbine.

pressure = ... [3]

(b) The turbine has a cross-sectional area of 3.5 m^2.

Calculate the force exerted on the turbine by the water.

force = ... [2]

[Total: 5]