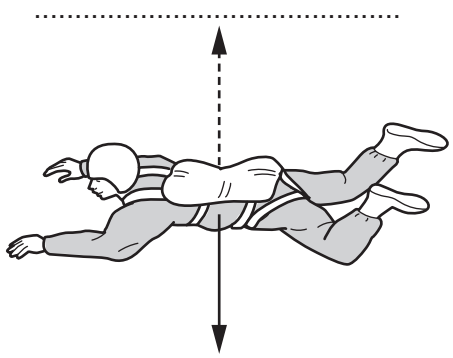
1 The weight of a skydiver is 750 N.

The weight of the skydiver acts downwards, as shown in the diagram.

While the skydiver is falling, another force acts upwards.

The upward force varies as the skydiver falls.



weight = 750 N

(not to scale)

The skydiver is accelerating between time = 0 and time = 20 s of the fall.

Between time = 20 s and time = 40 s the skydiver is falling at a constant speed.

(a) On the diagram, write the name of the upward force on the dotted line above the upward force.

[1]

(b) Suggest a value for the upward force on the skydiver at time = 10 s.

..... N [1]

(c) Determine the value of the upward force on the skydiver at time = 30 s.

..... N [1]

[Total: 3]

2 A sailor uses a winch to raise a sail on a boat. Diagram A shows the sailor turning the winch.

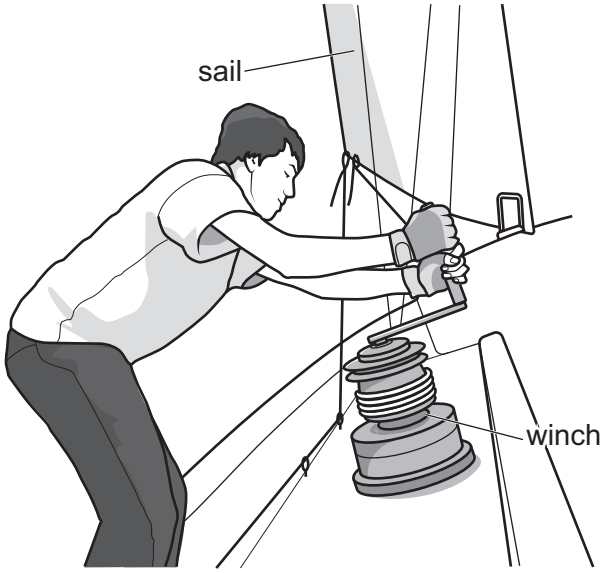


Diagram A

The sailor applies a force of 200 N at a distance of 30 cm from the pivot in the winch, as shown in diagram B.

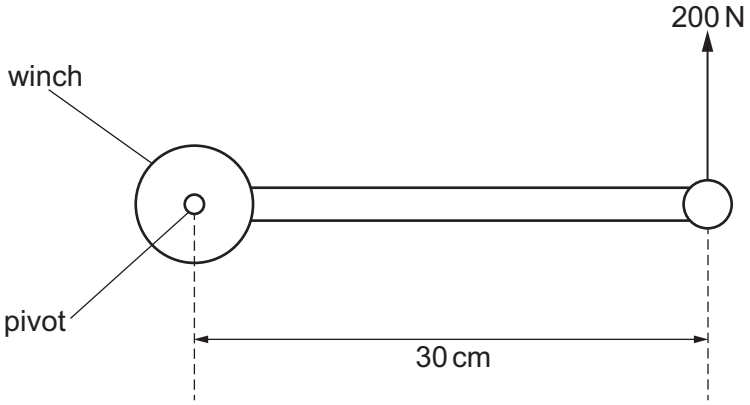


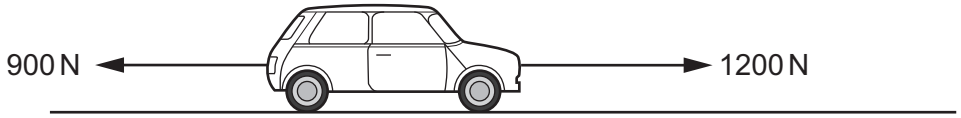
Diagram B

Calculate the moment of this force about the pivot.

moment of force = ... N cm [3]

[Total: 3]

3 The diagram shows the horizontal forces acting on a car.



(not to scale)

Calculate the resultant horizontal force on the car.

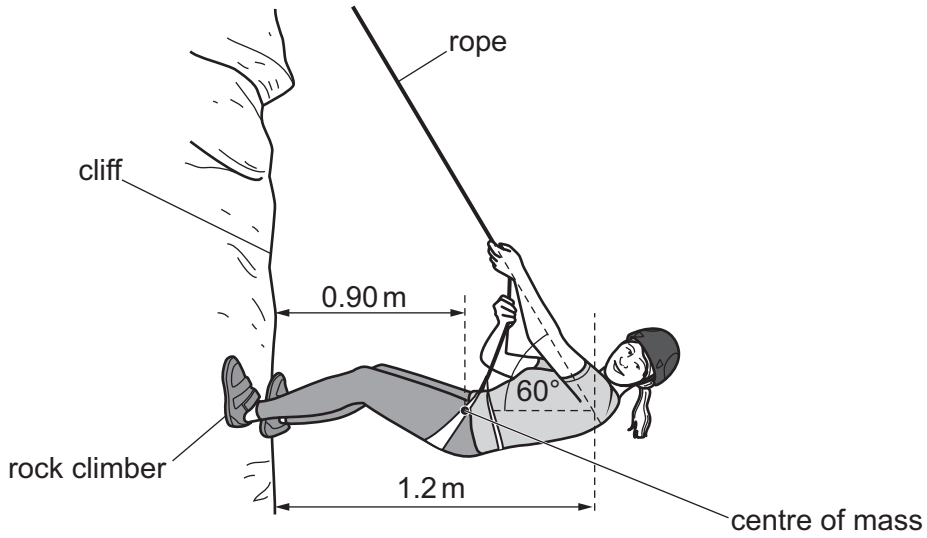
size of force = ... N

direction ..... [3]

[Total: 3]

4 A rock climber, of total mass 62 kg, holds herself in horizontal equilibrium against a vertical cliff. She pulls on a rope that is fixed at the top of the cliff and presses her feet against the cliff.

The diagram shows her position.



(not to scale)

State the **two** conditions needed for equilibrium.

1. .....

2. ..... [2]

[Total: 2]

5 A force is a vector quantity.

State the names of **two** other quantities that are vectors.

1. .....

2. ..... [2]

[Total: 2]

6 A force is a vector quantity.

State **two** features of a vector quantity.

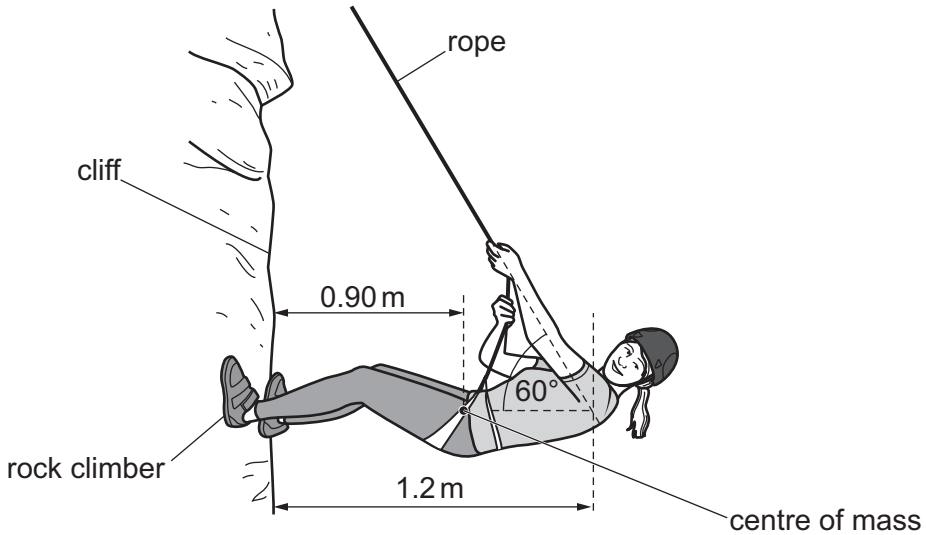
1. .....

2. ..... [2]

[Total: 2]

7 A rock climber, of total mass 62 kg, holds herself in horizontal equilibrium against a vertical cliff. She pulls on a rope that is fixed at the top of the cliff and presses her feet against the cliff.

The diagram shows her position.



(not to scale)

(a) The climber's centre of mass is 0.90 m from the cliff.

Calculate the moment about her feet due to her weight.

moment = ... [2]

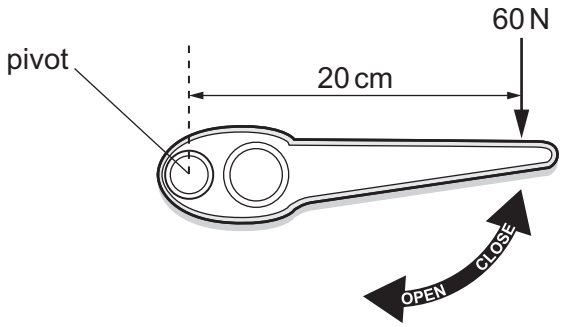
(b) The line of the rope meets the horizontal line through her centre of mass at a distance of 1.2 m from the cliff, as shown in the diagram. The rope is at an angle of 60° to the horizontal.

Determine the tension in the rope.

tension = ... [3]

[Total: 5]

8 The diagram shows the handle used to open and close a cupboard door on an aeroplane.



(not to scale)

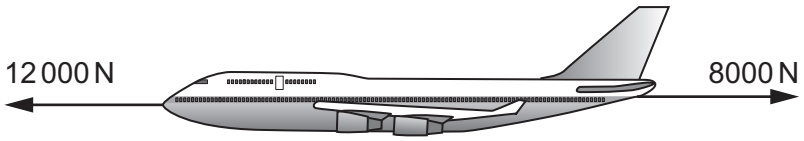
A force of 60 N acts at a distance of 20 cm from the pivot of the handle.

Calculate the moment of the 60 N force about the pivot.

moment = ... N cm [3]

[Total: 3]

9 The diagram shows an aeroplane flying. There are horizontal forces acting on the aeroplane, as shown in the diagram.



(not to scale)

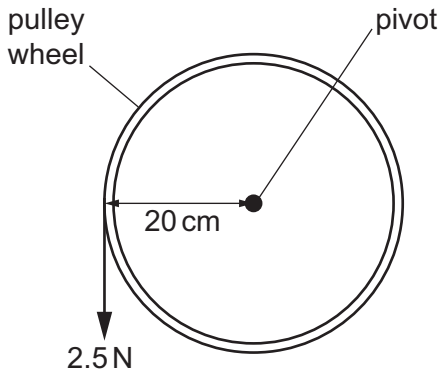
State the name of the effect producing the 8000 N force on the aeroplane.

..... [1]

[Total: 1]

10 A pulley wheel is used to raise a load.

The diagram shows the force on the pulley from the load.



The weight of the load is 2.5 N and the weight acts at a distance of 20 cm from the pivot of the pulley wheel.

Calculate the moment of the weight of the load about the pivot.

moment = ... N cm [3]

[Total: 3]

11 Force is a vector.

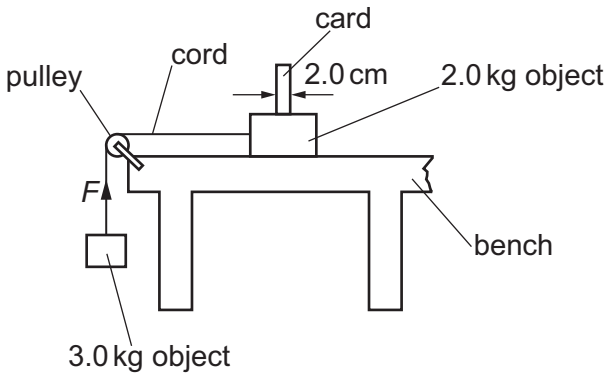
Draw a circle around **two** other quantities in the list which are vectors.

acceleration	**density**	**energy**	**mass**
momentum	**power**	**refractive index**	

[2]

[Total: 2]

12 The diagram shows an object of mass 2.0 kg on a bench. This object is connected by a cord, passing over a pulley, to an object of mass 3.0 kg.



The 2.0 kg object is released from rest and accelerates at 4.0 m / s^2.

Calculate the resultant force acting on the 2.0 kg object.

force = ... [2]

[Total: 2]

13 A battery provides energy to an electric car.

The electric car has an acceleration of $2.9\,m/s^2$ when it moves from rest. The combined mass of the car and its driver is 1600 kg.

Calculate the force required to produce this acceleration.

force = ... [2]

[Total: 2]

14 A battery provides energy to an electric car.

Under ideal conditions, the car can travel a maximum distance of 390 km when the battery is fully charged.

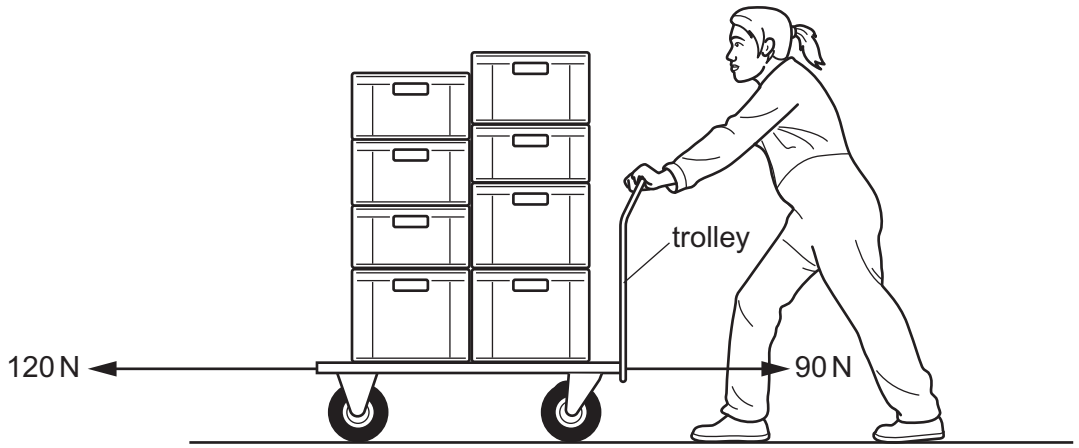
Suggest why, in normal use, the car needs to be recharged after travelling less than 390 km.

.....

..... [1]

[Total: 1]

15 A woman starts to push a trolley across the floor. The diagram shows the horizontal forces acting on the trolley.



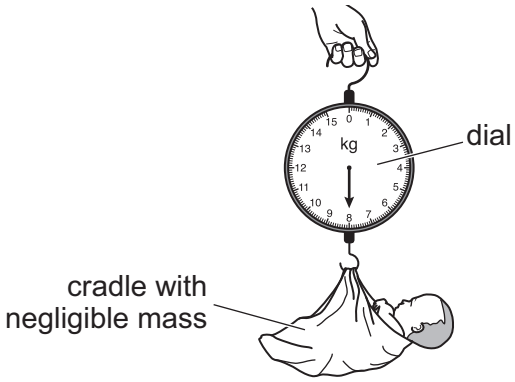
Determine the resultant horizontal force on the trolley.

resultant force = ... N

direction of resultant force = ... [3]

[Total: 3]

16 The diagram shows a spring balance used to measure the weight of a baby. The spring inside the balance extends when a mass is suspended from it. The dial shows the extension of spring as a value of mass in kg.



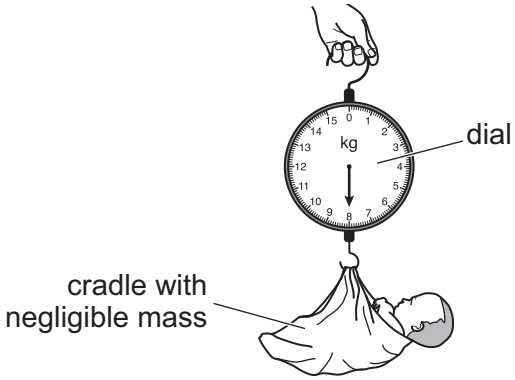
The reading on the spring balance is 8.0 kg.

Determine the force exerted on the spring due to the baby.

force = ... [1]

[Total: 1]

17 The diagram shows a spring balance used to measure the weight of a baby. The spring inside the balance extends when a mass is suspended from it. The dial shows the extension of spring as a value of mass in kg.



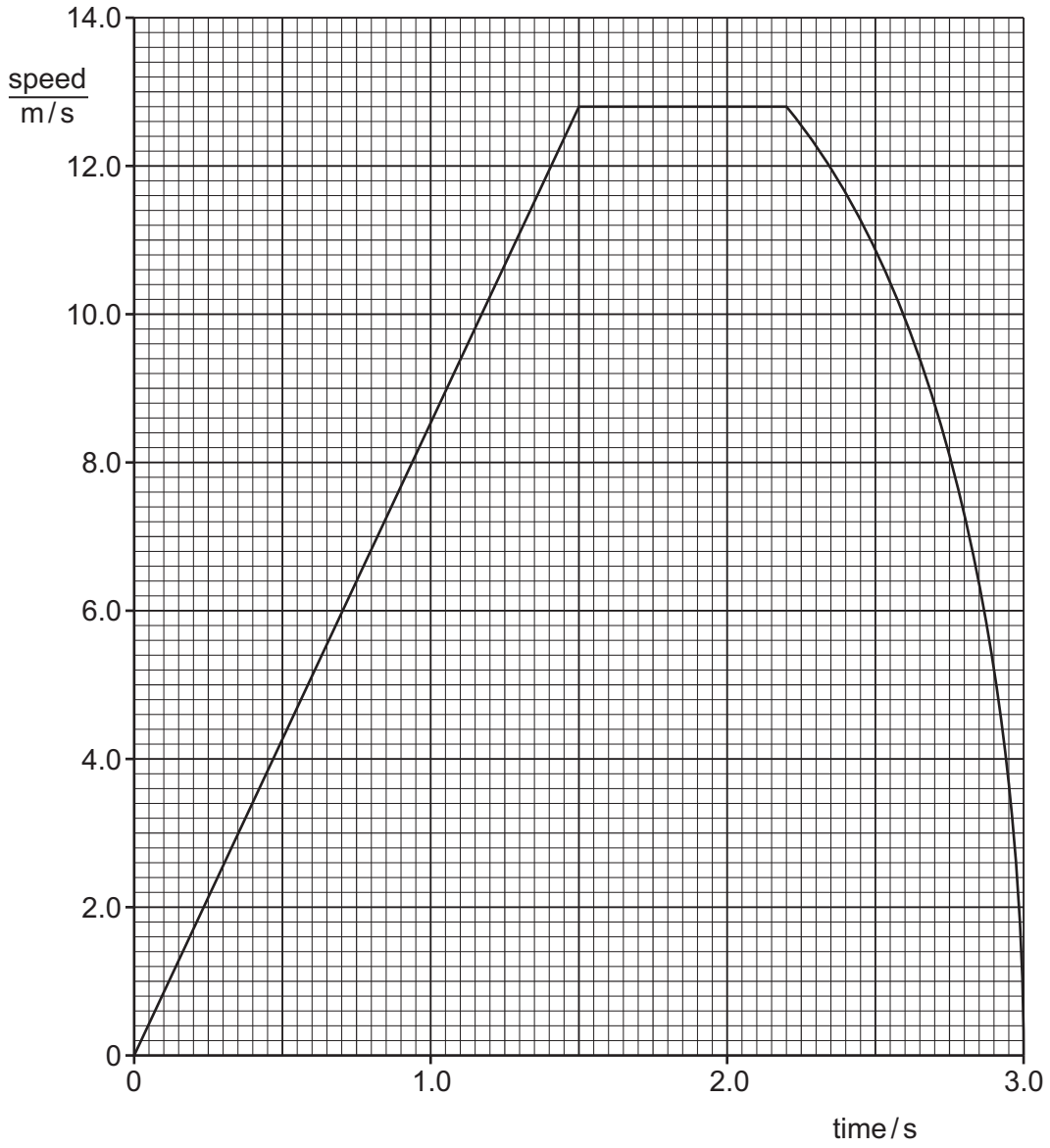
State the relationship between the mass of the baby and the force exerted on the spring due to the baby.

.....

..... [1]

[Total: 1]

18 A ball rolls down a ramp and onto a horizontal surface. The first section of the horizontal surface is smooth. The second section of the horizontal surface is rough. A speed-time graph for the ball is shown below.



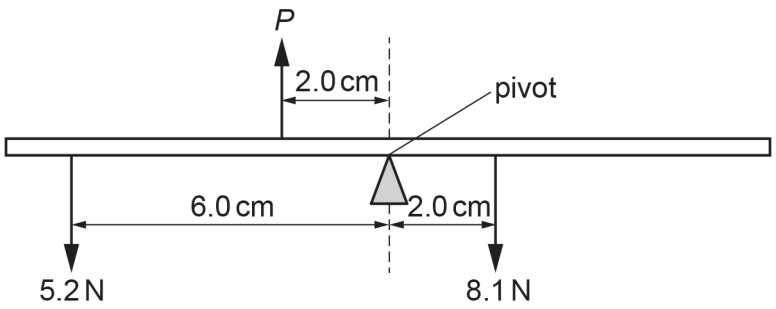
Explain how the graph shows that there is **no** resultant force on the ball when it rolls along the smooth section of the horizontal surface.

.....

..... [2]

[Total: 2]

19 The diagram shows the forces acting on a uniform balanced beam. The beam is pivoted at its centre.



(a) Calculate the moment of the 5.2 N force about the pivot and show that its value is close to 30 Ncm.

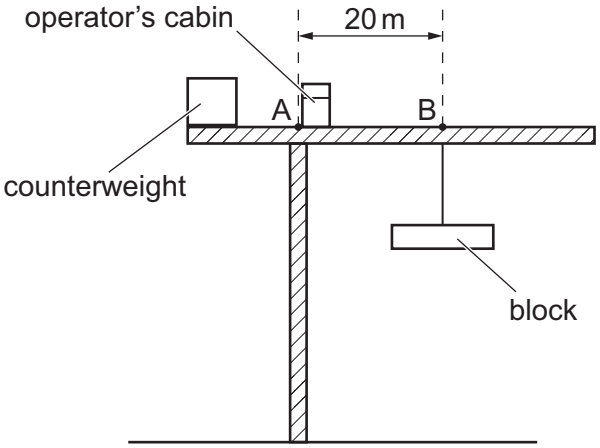
[3]

(b) The beam is balanced. Calculate force *P*.

force *P* = ... N [4]

[Total: 7]

20 The diagram shows a large crane on a construction site lifting a block of mass 14 000 kg.



Calculate the moment about A due to the 14 000 kg block suspended from B.

moment = ... [2]

[Total: 2]