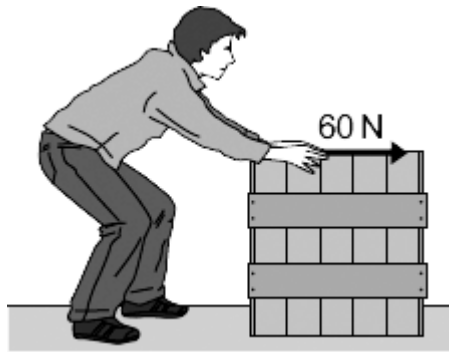


P8 Forces – In balance, task 1

Foundation Questions

Q1.

The diagram shows a worker using a constant force of 60 N to push a crate across the floor.



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- (a) The crate moves at a constant speed in a straight line
- (i) Draw an arrow on the diagram to show the direction of the friction force acting on the moving crate.
- (ii) State the size of the friction force acting on the moving crate.

_____ N

Give the reason for your answer.

- (b) Calculate the work done by the worker to push the crate 28 metres.

Show clearly how you work out your answer and give the unit.

Choose the unit from the list below.

joule

newton

watt

Work done = _____

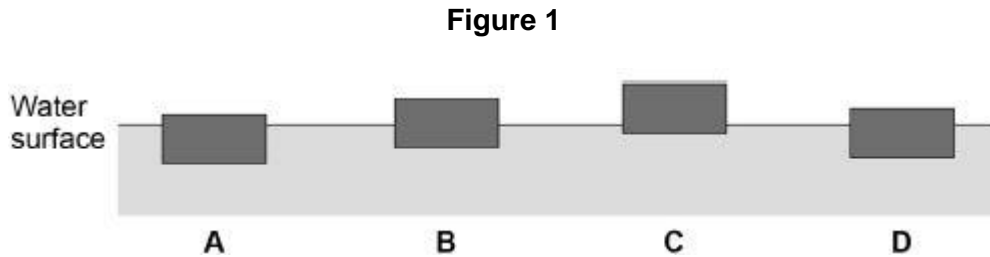
P8 Forces – In balance, task 1

(3)
(Total 6 marks)

Q2.

Figure 1 shows four blocks of different materials floating on water.

The four blocks are the same volume.



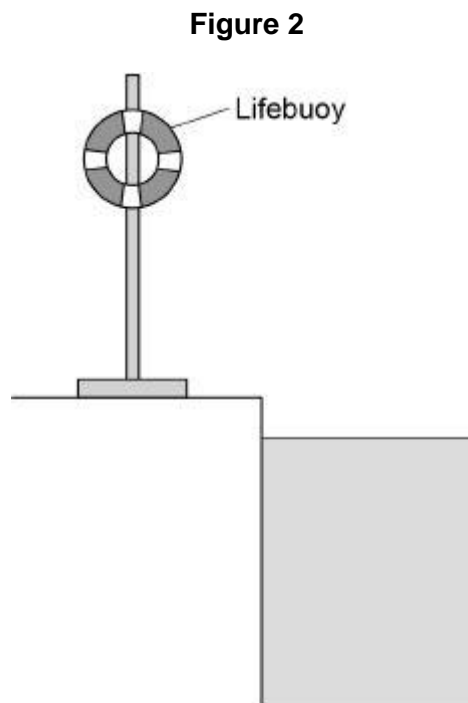
(a) Which of the blocks has the smallest weight?

Tick **one** box.

A B C D

(1)

Figure 2 shows a lifebuoy next to a deep swimming pool.



(b) The lifebuoy has a mass of 2.5 kg.
gravitational field strength = 9.8 N/kg

P8 Forces – In balance, task 1

Calculate the weight of the lifebuoy.

Use the equation:

$$\text{weight} = \text{mass} \times \text{gravitational field strength}$$

$$\text{Weight} = \text{_____} \text{ N}$$

(2)

- (c) When thrown into the water the lifebuoy floats. The two forces acting on the lifebuoy are the weight of the lifebuoy downwards and upthrust upwards.

How big is the upthrust on the lifebuoy compared to the weight of the lifebuoy?

Tick **one** box.

The upthrust is greater than the weight.

The upthrust is less than the weight.

The upthrust is the same as the weight.

(1)

- (d) Write down the equation which links acceleration, mass and resultant force.

(1)

- (e) A rope is used to pull the lifebuoy to the side of the swimming pool.

A resultant force of 4.0 N acts on the lifebuoy.

The mass of the lifebuoy is 2.5 kg.

Calculate the acceleration of the lifebuoy.

$$\text{Acceleration} = \text{_____} \text{ m/s}^2 [3]$$

(Total 8 marks)

P8 Forces – In balance, task 1

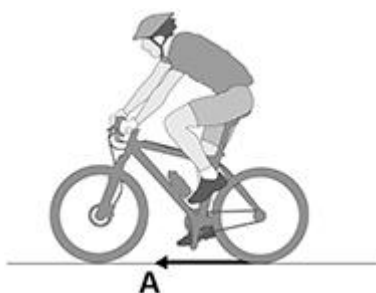
Higher Questions

Q3.

Figure 1 shows a cyclist riding a bicycle.

Force **A** causes the bicycle to accelerate forwards.

Figure 1

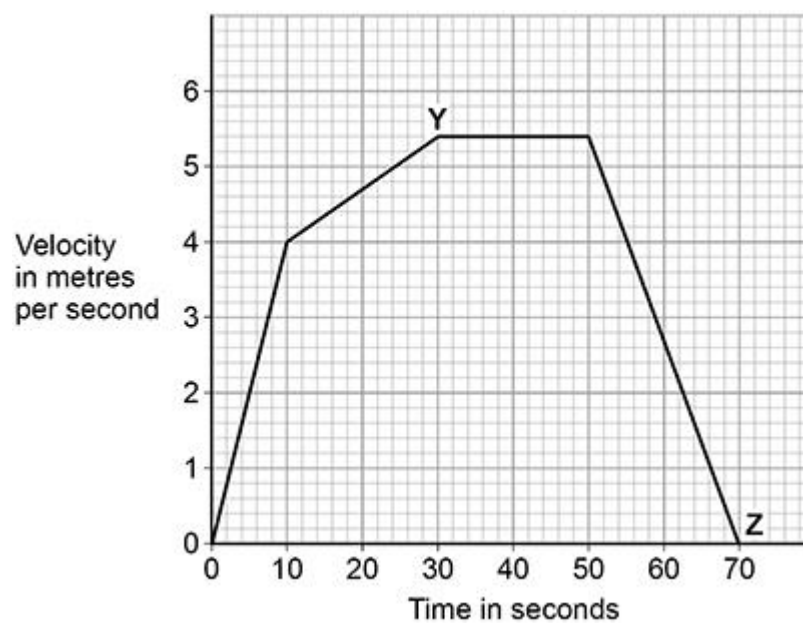


(a) What name is given to force **A**?

(1)

Figure 2 shows how the velocity of the cyclist changes during a short journey.

Figure 2



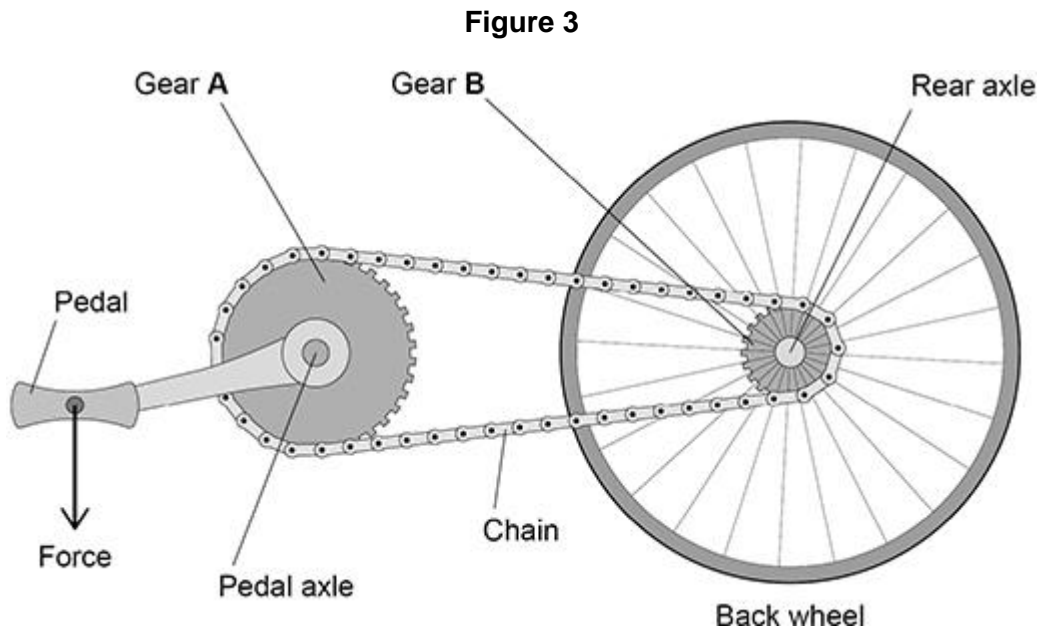
(b) Determine the distance travelled by the cyclist between **Y** and **Z**.

P8 Forces – In balance, task 1

Distance travelled by the cyclist between **Y** and **Z** = _____ m

(3)

(c) **Figure 3** shows the gears on the bicycle.



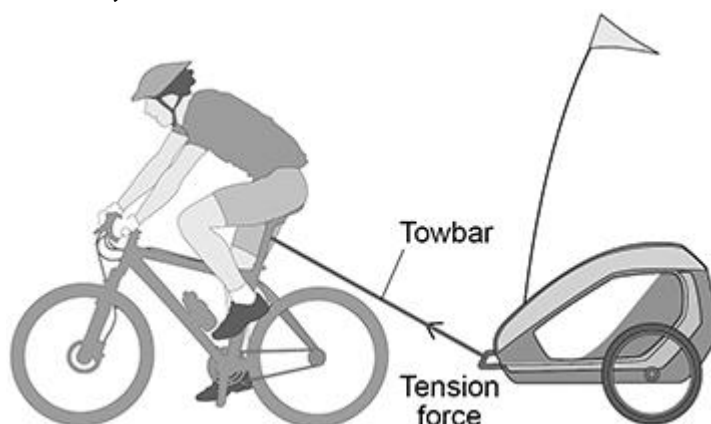
Describe how the force on the pedal causes a moment about the rear axle.

(2)

Figure 4 shows a different cyclist towing a trailer.

Figure 4

P8 Forces – In balance, task 1



- (d) The speed of the cyclist and trailer increased uniformly from 0 m/s to 2.4 m/s.
The cyclist travelled 0.018 km while accelerating.
Calculate the initial acceleration of the cyclist.

Acceleration = _____ m/s²

(3)

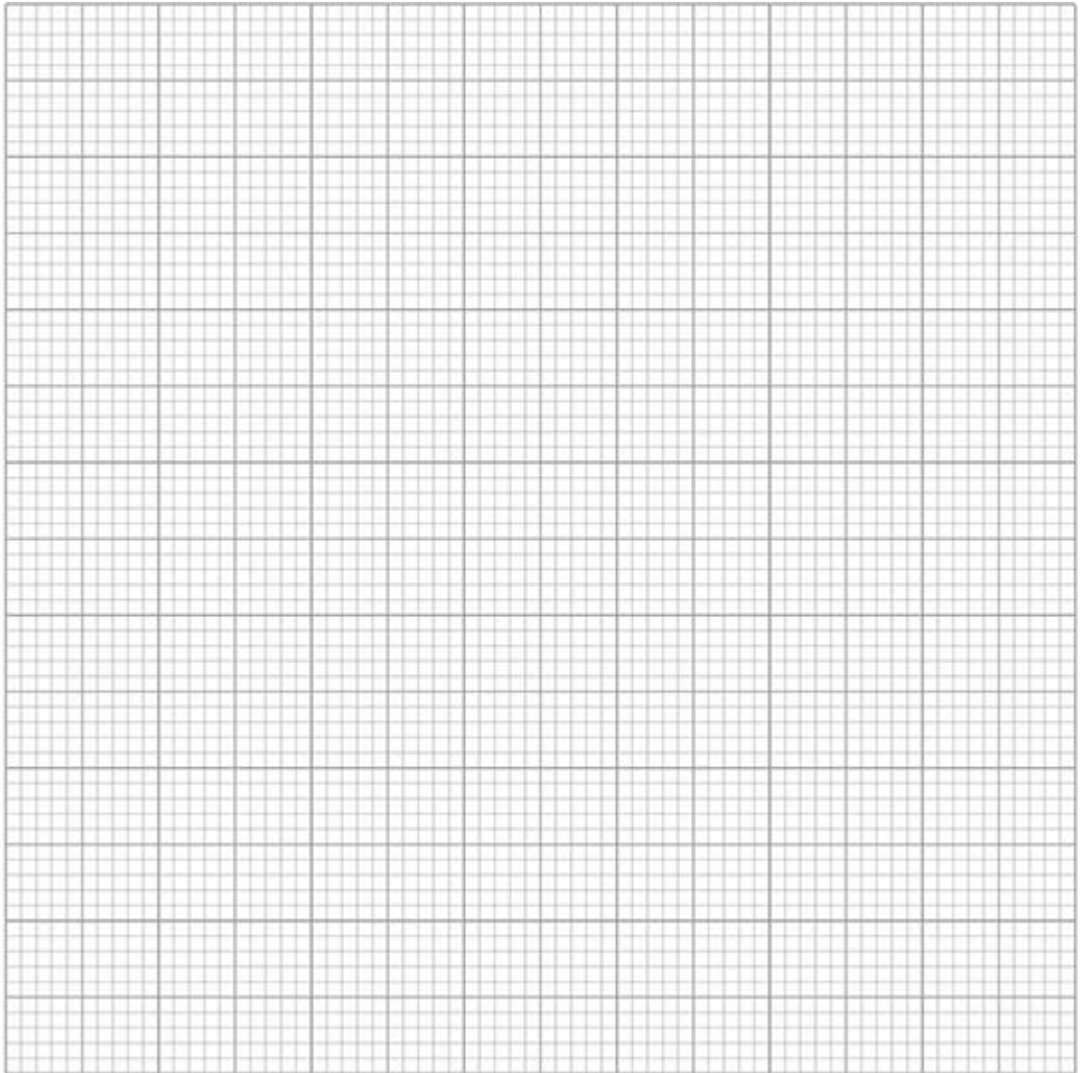
- (e) The resultant force of the towbar on the trailer has a horizontal component and a vertical component.

horizontal force = 200 N

vertical force = 75 N

Determine the magnitude and direction of the resultant force of the towbar on the trailer by drawing a vector diagram.

P8 Forces – In balance, task 1



Magnitude of force = _____ N

Direction of force = _____ degrees

(4)

(Total 13 marks)

Q4.

- (a) **Figure 1** shows an aircraft flying at a constant velocity and at a constant height above the ground.

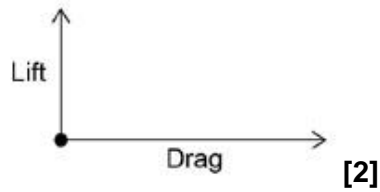
Figure 1



Complete the free body diagram in **Figure 2** to show the other two forces acting on the aircraft.

P8 Forces – In balance, task 1

Figure 2



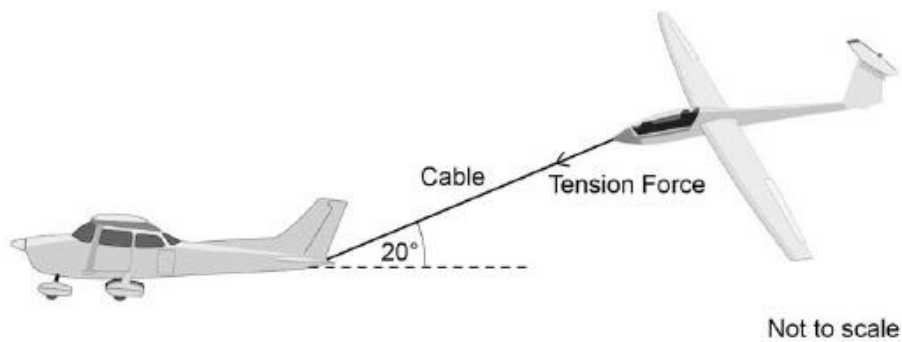
- (b) A small aircraft accelerated down a runway at 4.0 m/s^2 . The aircraft started from rest and reached a speed of 34 m/s just before take-off. Calculate the distance the aircraft travelled while accelerating. Give your answer to 2 significant figures.

Distance = _____ m

(4)

- (c) **Figure 3** shows the small aircraft being used to tow a glider.

Figure 3



The tension force in the cable can be resolved into a horizontal component and a vertical component. The tension in the cable is 2000 N . The cable makes an angle of 20° with the horizontal.

Draw a vector diagram to determine the magnitude of the two components of the tension force in the cable.

Magnitude of the horizontal component = _____ N

Magnitude of the vertical component = _____ N

(1)

(Total 10 marks)