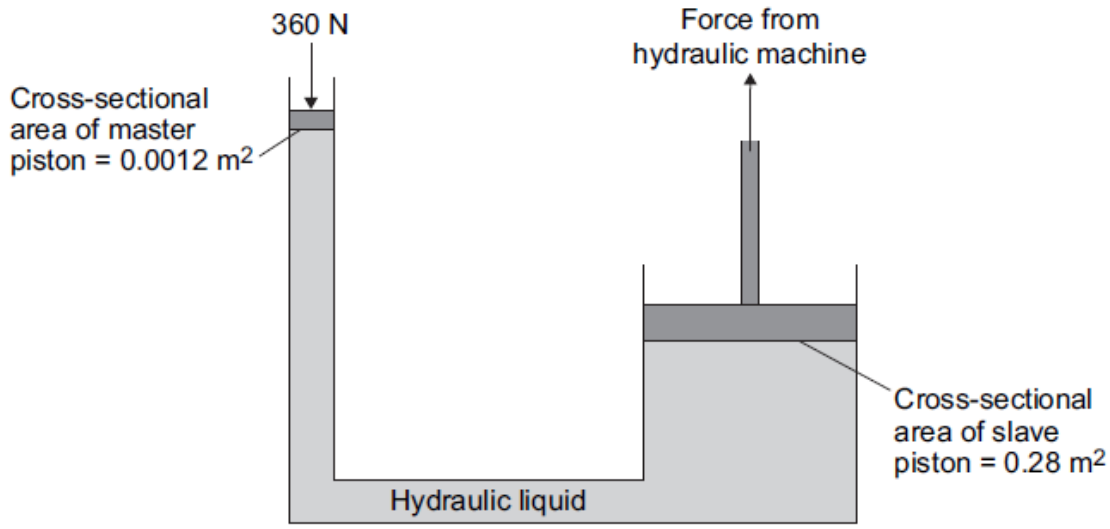
Mixed Topics Questions

1.

Figure 14 shows the hydraulic machine that is used to make the ramp tilt.

Figure 14



The pressure applied to the hydraulic liquid at the master piston is the same as the pressure applied by the hydraulic liquid to the slave piston.

(i) State the property of the liquid that keeps the pressure at both pistons the same.

[1 mark]

.....

(ii) A 360 N force acts on the master piston.

Use information from **Figure 14** to calculate the force applied by the hydraulic liquid to the slave piston.

Use the correct equation from the Physics Equations Sheet.

[3 marks]

.....

.....

.....

.....

Force = ... N

2.

Figure 13 shows a diagram of a device for lifting heavy loads.

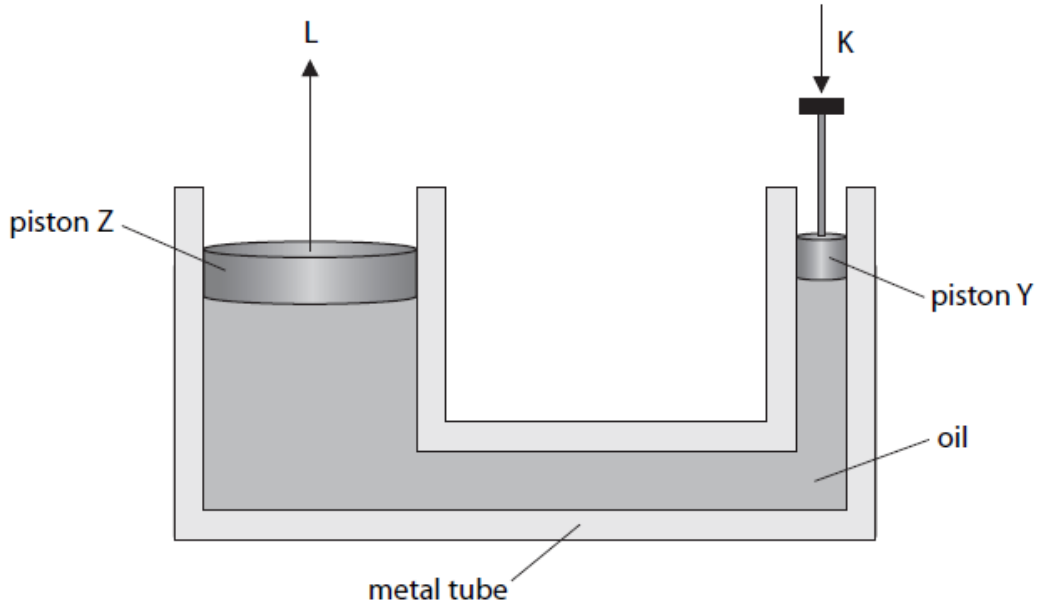


Figure 13

The metal tube is filled with oil.

The piston Y is pushed down with a force K.

This produces a force L on piston Z.

The pressure exerted on the oil by piston Y is the same as the pressure exerted by the oil on piston Z.

Explain the difference between the size of force K and the size of force L.

(3)

3.

(i) Figure 14 shows the vertical forces on an aeroplane.

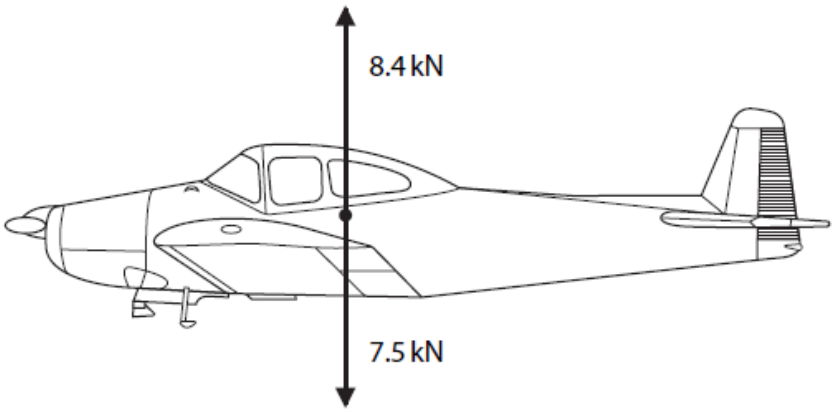


Figure 14

Use information from the diagram to determine the size and direction of the resultant vertical force on the aeroplane.

(2)

size = ... kN, direction is .....

(ii) The aeroplane is descending.

Figure 15 shows a diagram of the resultant vertical and horizontal forces on the aeroplane as it is descending.

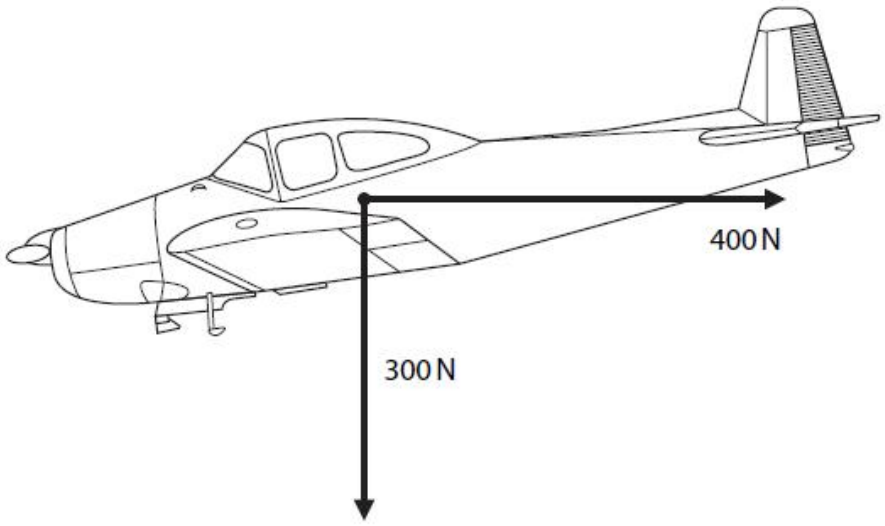


Figure 15

Complete the diagram to show the resultant of these two forces.

(1)

(iii) Calculate the size of the resultant force and the angle the resultant force makes with the 400N force.

4.

Figure 19 shows two forces, P and Q, acting at point X.

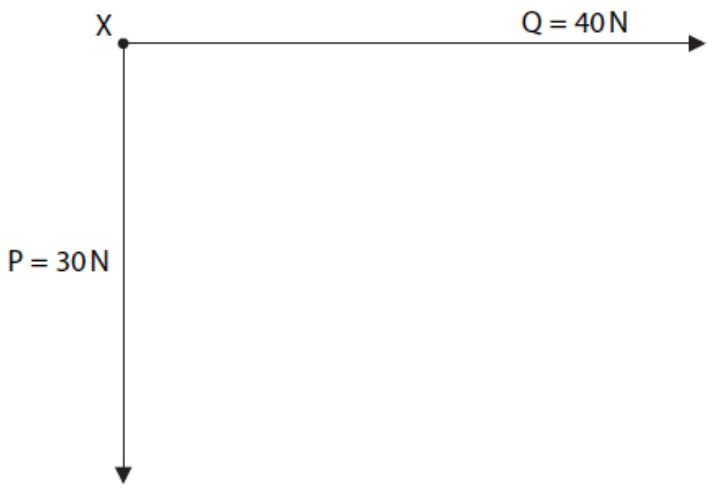


diagram is drawn to scale

Figure 19

(a)

Complete the diagram in Figure 19 to show the size and direction of the resultant force, R, on point X.

(2)

(b)

Calculate the size of the resultant force and the angle it makes with the 40N force.

5.

Figure 7 shows a person trying to lift a large rock using a metal bar.

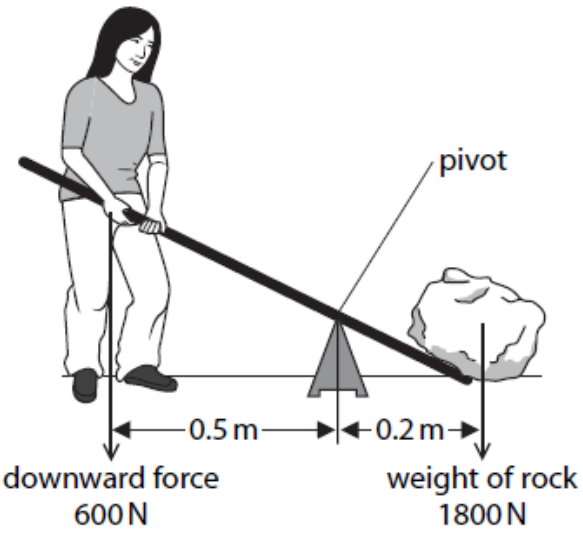


Figure 7

The rock weighs 1800 N.

The person can only produce a downwards force of 600 N.

The person cannot lift the rock.

(i) Explain, using calculations, why the person cannot lift the rock.

(3)

(ii) Explain **one** change to the arrangement that will make it possible for this person to lift the rock.

(2)

6.

Figure 12 shows some of the bones and muscles in an arm.

The arrows show the forces on the forearm when the arm is bent.

The hand is empty.

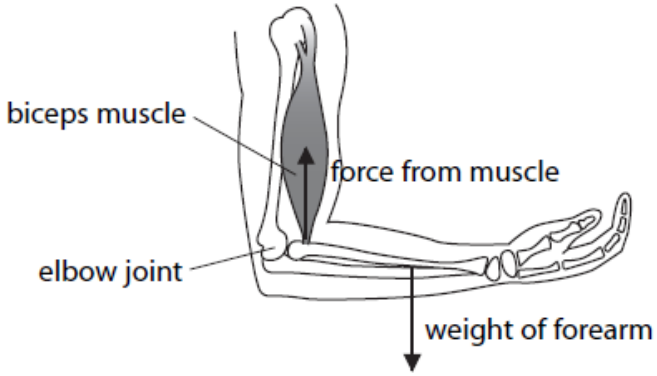


Figure 12

The biceps muscle provides a force to balance the weight of the forearm.

The weight of the forearm can be represented as a single force.

Figure 13 shows a diagram representing the forces and distances involved.

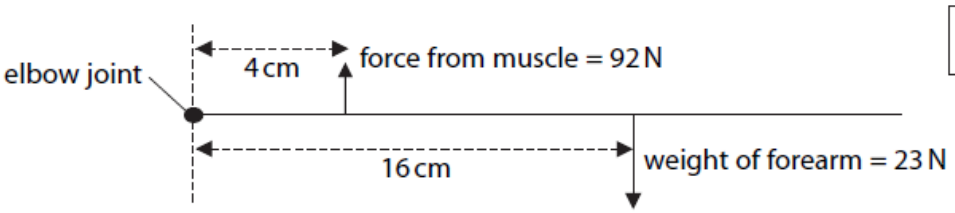


Figure 13

(i) Use the principle of moments to show that the system shown in Figure 13 is in equilibrium.

(2)

(ii) The person then holds a ball weighing 15 N in their hand.

Figure 14 shows the forces on the forearm and their distances from the elbow joint.

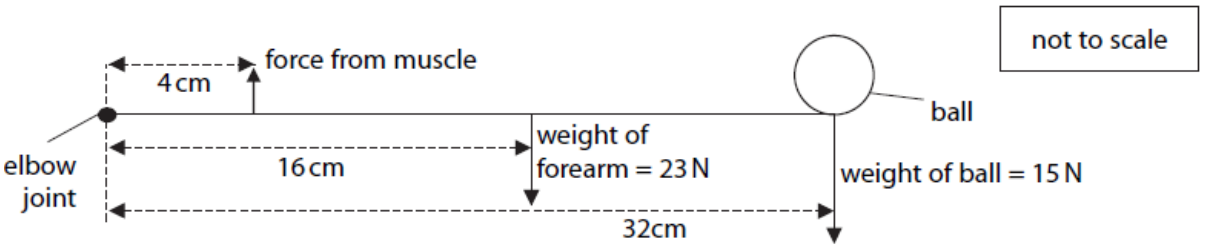


Figure 14

Calculate the force from the muscle that is needed to keep the system in Figure 14 in equilibrium.

(3)

force = ... N

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7. A cube with sides 2 m floats in water.

   The bottom face of the cube is 1.5 m below the surface of the water.

   Density of water is 1000 kg/m^3.

   Calculate the buoyany force acting on the cube.

8.

Figure 28 shows a cross-section of a boat floating in water and the same boat with a load inside.

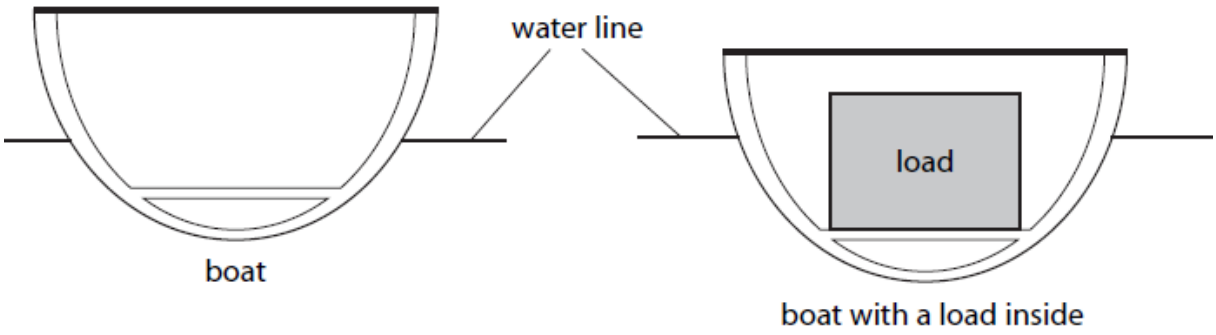

Figure 28

The boat floats lower in the water when there is a load inside the boat.

Explain why the boat floats in water and why the boat floats lower in the water when there is a load inside the boat.

You may add to the diagram to help with your answer.

(6)