Name:	Index No:
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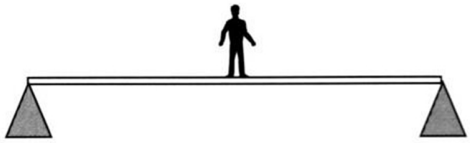
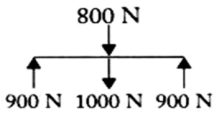
Assignment 06: Turning effect of forces

1. The diagram below shows a man of weight 800 N standing in the middle of a plank supported at the sides. The plank weighs 1000 N.

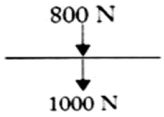


Which one of the following diagrams shows the forces acting on the plank?

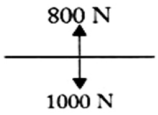
A



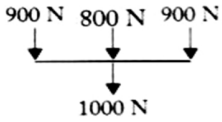
B



C

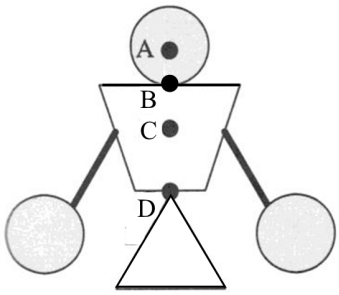


D



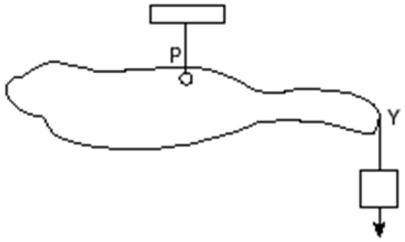
( )

2. The diagram shows a balancing toy **pivoted on a triangular stand**. When the toy is tilted slightly, it stays at the new position.



Where is the centre of gravity of the toy? ( )

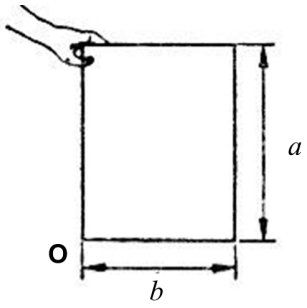
3. A thin uniform sheet of metal is cut into an irregular shape. It is 380 mm long, weighs 6.00 N and is freely suspended at point **P** which is halfway along its length. A 5.30 N weight hung at **Y** makes it balance and in equilibrium as shown in the diagram.



What is the perpendicular distance from the line of action of its weight to the point **P**?

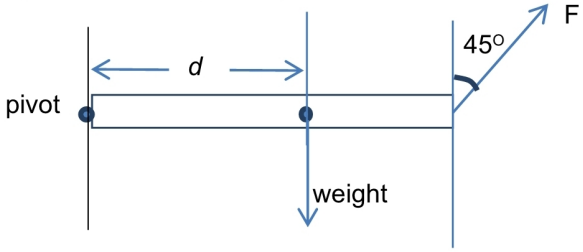
A. 3.7 mm B. 130 mm C. 170 mm D. 540 mm ( )

4. A person exerts a horizontal force on a rectangular book such that it is just tilted about point **O** as shown in the diagram below. If the book has a weight of *W*, what is the moment of the force that is produced by the person?



A. $W\frac{a}{2}$ B. $W\frac{b}{2}$ C. Wa D. Wb ( )

5. A force *F* of magnitude 8.20 N acts on a non-uniform rod of weight 10.0 N and length 1.00 m freely hinged to a wall at pivot P, such that the rod remains horizontal.

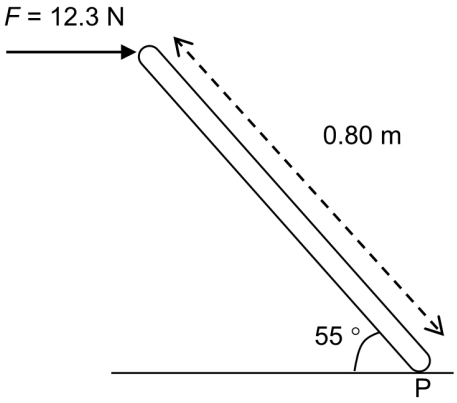


What is *d*, the distance of the centre of gravity of the rod from P?

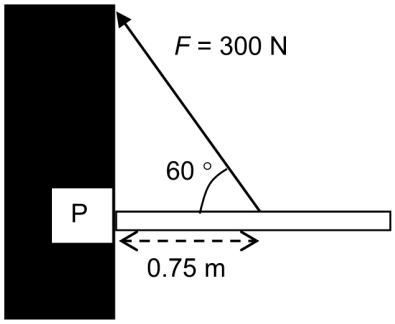
A. 0.18 m B. 0.42 m C. 0.58 m D. 0.82 m ( )

6. For each of the following cases, calculate the moment of the force, *F* about the pivot P. [4]

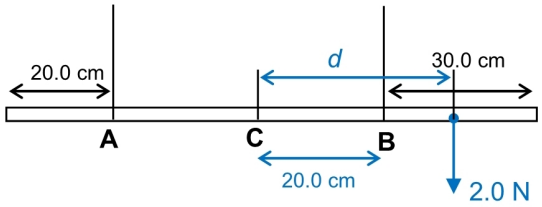
(a)



(b)



7. A uniform metre rule of weight 0.90 N is suspended horizontally by two vertical loops of threads **A** and **B** placed at 20.0 cm and 30.0 cm from its ends respectively as shown in the diagram below.



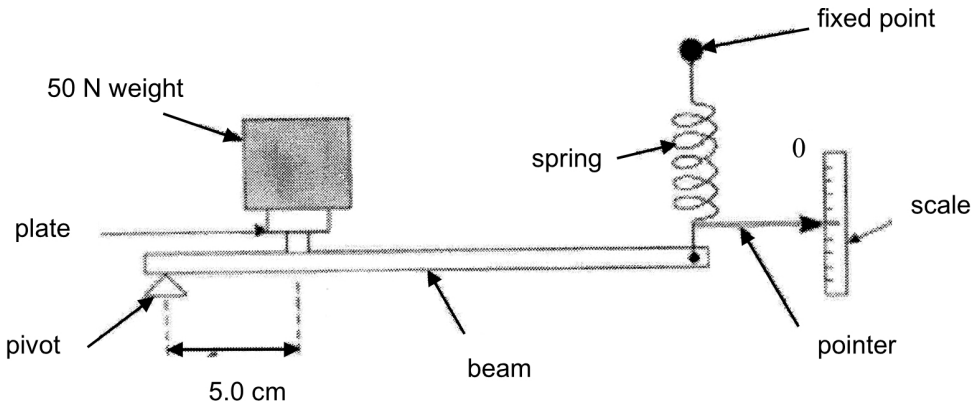
Calculate the distance *d* from the centre of the rule, **C,** at which a 2.0 N weight should be suspended to balance the metre rule and keep it in equilibrium while

(a) making loop **A** slack, [2]

(b) making loop **B** slack. [2]

State if the distance *d* is to be on the left side or the right side of **C**.

8. The diagram below shows the mechanism of a weighing machine.



When the 50 N weight is placed on the plate, the spring extends until the beam is horizontal. A pointer attached to the spring moves along the scale. When the weight is removed from the plate, the **spring returns to its original length (suggesting plate's and beam's weights are negligible)**.

(a) Determine the moment of the force about the pivot due to a 50 N weight placed on the plate. [2]

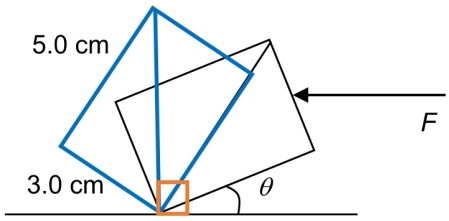
(b) What is the direction of the force acting on the beam due to the spring? [1]

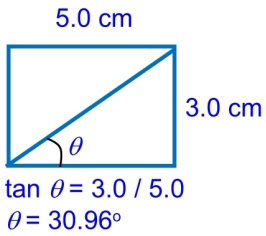
(c) What is the direction of the force acting on the spring due to the beam? [1]

(d) Is the magnitude of the force in the spring greater than, smaller than or equal to 50 N? (Ignore the weight of the beam and the plate.) Explain your answer. [2]

(e) The plate is now moved along the beam towards the spring. The rest of the weighing machine remains unchanged in design. Explain why the pointer reading obtained is higher than it should be when the 50 N weight is placed on the plate for weighing. [2]

9. The diagram shows a uniform rectangular block maintained at an angle θ by a horizontal force F.





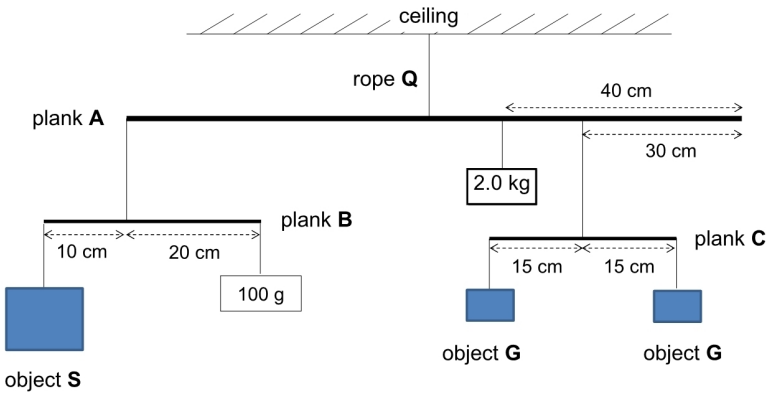
tan θ = 3.0 / 5.0

θ = 30.96°

(a) What is the maximum angle, θ_{max}, the block can rotate in the direction of F without toppling? Explain your answer. [2]

(b) From the position shown in the above diagram, describe and explain the motion of the block if F were to be removed suddenly. [2]

10. The diagram below shows an experimental set-up to determine the mass of object **G**.



Given that the mass of planks (of **uniform** cross-sectional area) **A**, **B** and **C** are 1.2 kg, 0.90 kg and 0.85 kg respectively, and that the length of plank **A** is 1.0 m, with rope **Q** being hung at the centre of plank **A**. The entire setup is in equilibrium. Take gravitational acceleration, g = 10 m s^{-2}.

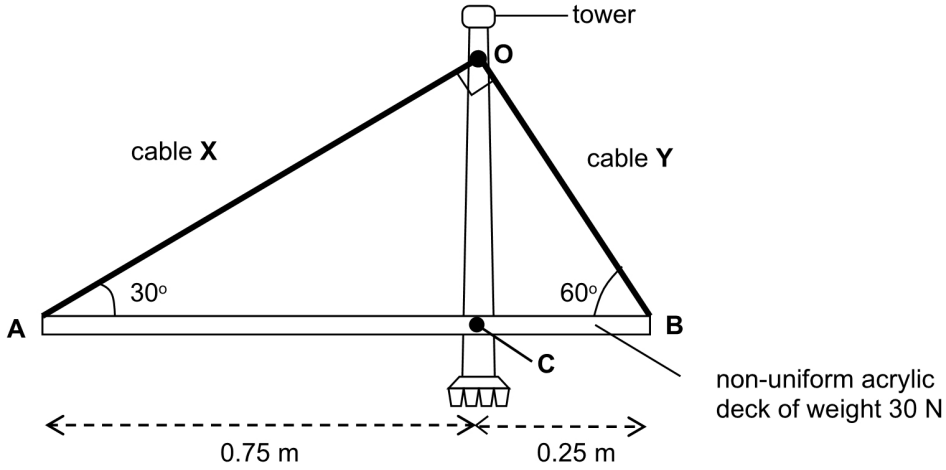
(a) Determine the mass of object **S**. [2]

(b) Determine the mass of object **G**. [2]

(c) For the calculation in (b), explain why it is not necessary to consider the weight of plank A. [1]

(d) Determine the magnitude of tension in rope **Q**. [2]

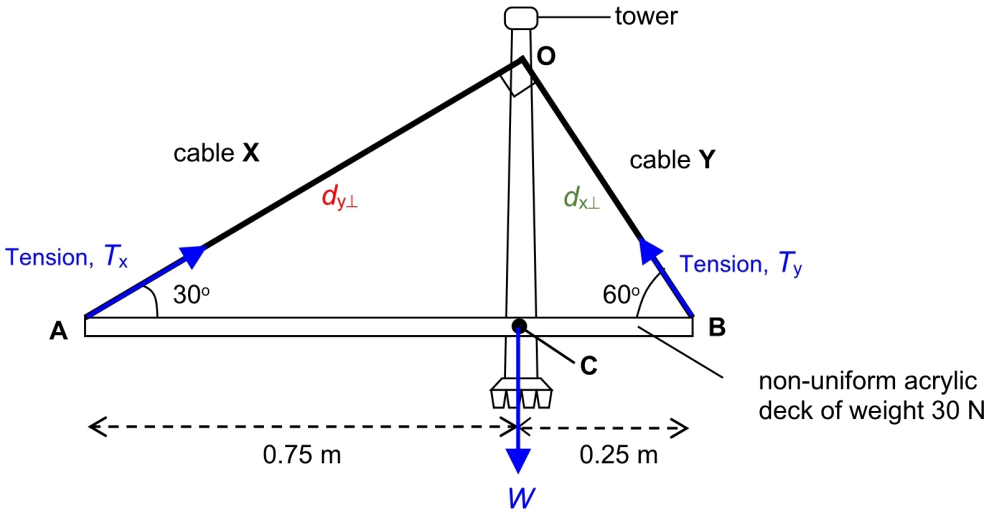
11. The diagram (not to scale) shows a model of a cabled bridge built by a student for a school project.



(a) A non-uniform, rectangular, acrylic deck, **AB**, of weight 30 N, is held at rest by the cables **X** and **Y** which are fixed to the tower at point **O**. The tower is upright and perpendicular to the deck. When in equilibrium, the deck rests on the tower at the point **C**, which is also the centre of gravity of the deck. **AOB** is a right-angle triangle.

Ignore the forces exerted by the tower on the deck.

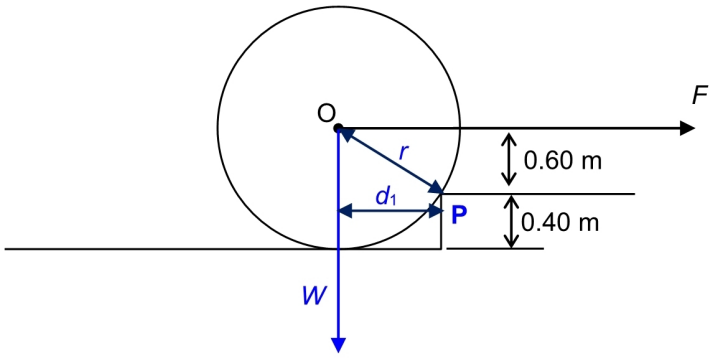
On the above diagram, draw and label, the weight *W* acting on the acrylic deck. [1]



(b) Determine the magnitude of the tension in the cable **X,** T_x. [2]

(c) Determine the magnitude of the tension in the cable **Y,** T_y. [2]

12. The diagram below shows a wheel of mass 15.0 kg and radius 1.00 m. The point O is the centre of the wheel. It is being pulled by a horizontal force, *F*, against a step of 0.40 m high. **Take gravitational acceleration, g = 10 m s^{-2}.**



(a) Indicate the weight *W* of the wheel with an arrow on the above diagram. [1]

(b) Calculate the magnitude of the initial force, *F*, which is just sufficient to turn the wheel so that it will rise over the step. [2]