

Question 1 [5 marks]

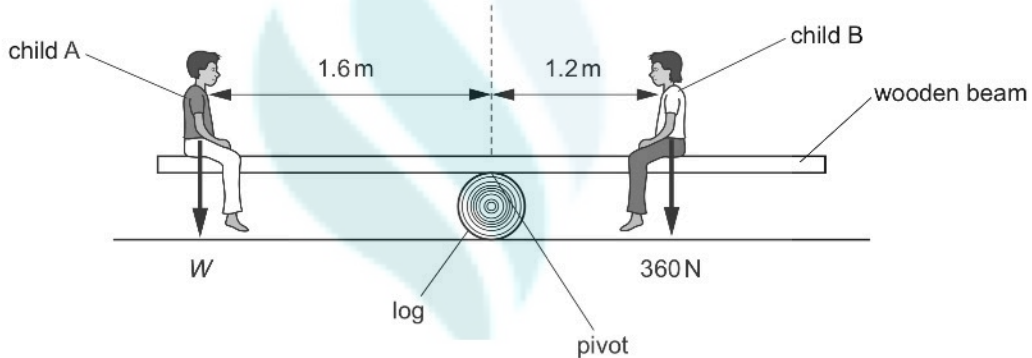
A wooden beam is used in a see-saw.

A. The mass of the wooden beam is 40 kg.

Calculate the weight of the wooden beam. [2]

B. Two children balance the wooden beam horizontally on a log. The wooden beam pivots on the log to make the see-saw.

Fig. below shows the children on the see-saw.



The see-saw balances horizontally, as shown in Fig. The weight of child B is 360 N.

Calculate the weight W of child A.

State and use the principle of moments in your answer. [3]

Question 2 [4 marks]

Describe how a uniform metre ruler, a pivot and a selection of masses can be used to demonstrate that there is no resultant moment on an object in equilibrium.

You may include a labelled diagram in your answer. [4]

Question 3 [6 marks]

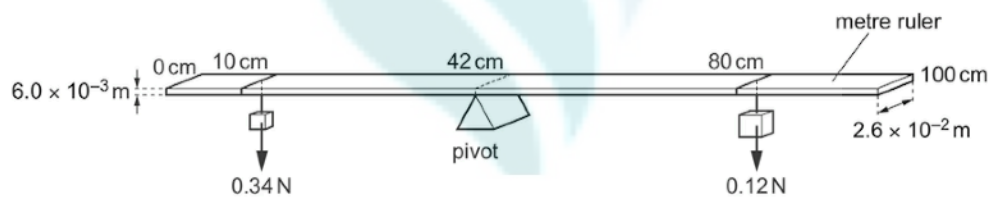
Fig. below shows a balanced, uniform metre ruler made of wood.

The width of the metre ruler is 2.6×10^{-2} m and the thickness of the ruler is 6.0×10^{-3} m.

A. Define the 'moment' of a force in words. [1]

On Fig. below mark the position of the centre of gravity of the metre ruler with a point labelled X.

B. Label the distance of X from the 0 cm end of the ruler. [1]



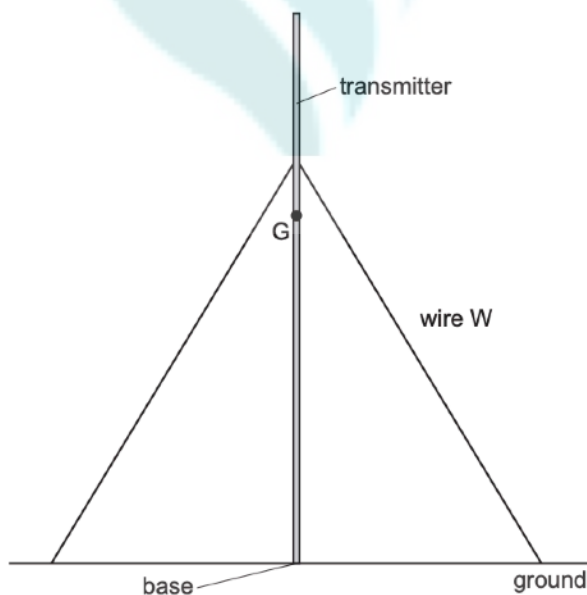
C. Show that the mass of the metre ruler is 0.081 kg. [3]

D. Calculate the density of the wood in kg / m^3 [1]

Question 4 [6 marks]

A radio transmitter is a very tall, thin cylinder. It is prevented from falling over by wires which have one end fixed to the transmitter and the other end fixed in the ground. The ends of the wires in the ground are a long distance from the transmitter. Fig. below shows the transmitter and two of the wires.

The centre of gravity G is shown on Fig.



A. State what is meant by centre of gravity. [1]

B. Explain why the radio transmitter without the wires is a very unstable structure. [1]

C. Wire W is under tension and it exerts a force T on the transmitter.

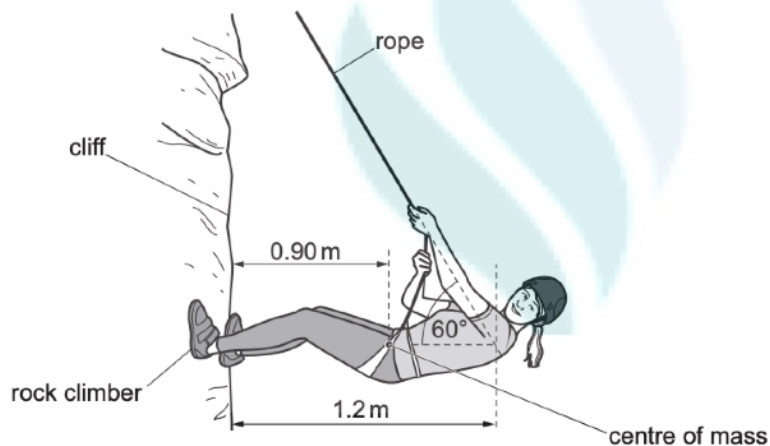
(i) On Fig. mark an arrow to show the force T exerted by wire W on the transmitter. [1]

(ii) The force T produces a moment on the transmitter about its base. Describe how the moment produced by T is calculated and indicate on Fig. what is meant by any other terms in the description. [3]

Question 5 [8 marks]

A rock climber, of total mass 62kg, 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.

Fig. shows her position.



- A. Calculate the total weight of the climber. [1]
- B. State the two conditions needed for equilibrium. [2]
- C. The climber's centre of mass is 0.90m from the cliff.
- (i) Calculate the moment about her feet due to her weight. [2]
- (ii) The line of the rope meets the horizontal line through her centre of mass at a distance of 1.2m from the cliff, as shown in Fig. [2]
- The rope is at an angle of 60° to the horizontal. Determine the tension in the rope. [3]

Reference

IGCSE past papers - year 2025 to 2021