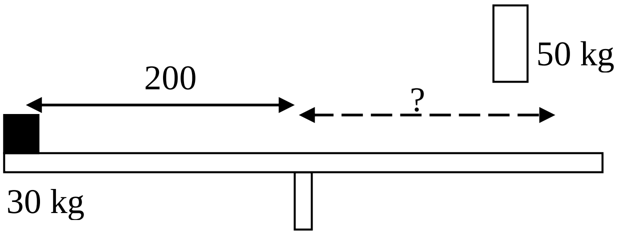
**First-Class Levers** Name:___________________________

Levers use the principle of "torque". A torque is like a force that creates a turning motion. The size of the torque is dependant on the size of the force AND the distance from the pivot point.

For example, on a see-saw, a small child sitting at one end will cause the see-saw to rotate. If a larger child sits at the other end at the same distance from the middle (the pivot point), the see-saw will rotate the other way.
So how can you balance a small child with a large child? To balance, the torques on either side of the see-saw's pivot point have to be the same.




Torque = force x distance from pivot: T = F d
On the left, the torque is 30kg x 200cm = 6000kg-cm.
To balance the torque on the right also has to be 6000kg-cm.
So, $\text{Torque}_{(left)} = F_{(left)} \times d_{(left)} = \text{Torque}_{(right)} = F_{(right)} \times d_{(right)}$

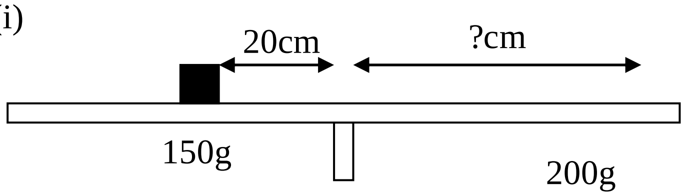
Therefore,

| |
|---|
| 30kg x 200cm = 50 x $d_{(right)}$. |
| 6000 = 50 x $d_{(right)}$ |
| $d_{(right)}$ = 6000/50 = 120cm. |

The larger child therefore needs to sit 120 cm from the middle to balance the smaller child who is sitting 200 cm from the middle.

AIM: To examine the characteristics of a first class lever.
EQUIPMENT: Meter ruler, 50g weights, small wooden block.
METHOD: Set up the ruler as if it was a see-saw on the wooden block. Place the weights as instructed below. Do the prac, and then calculate the values mathematically.
RESULTS:
A. Where do these weights need to be put to balance the lever?

(i)

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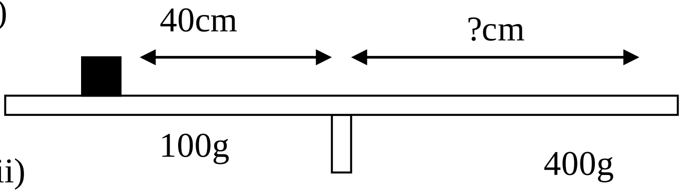


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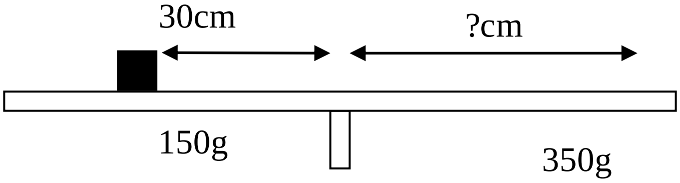


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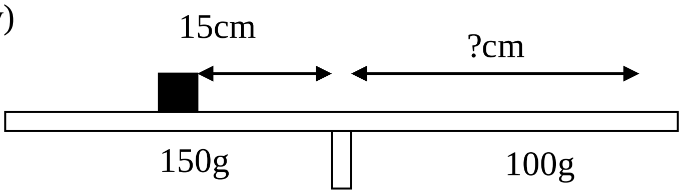
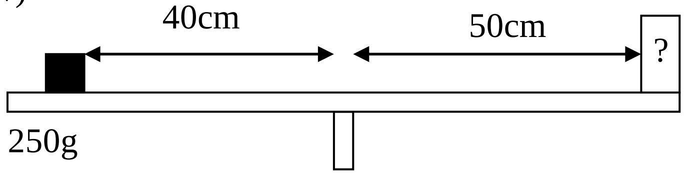
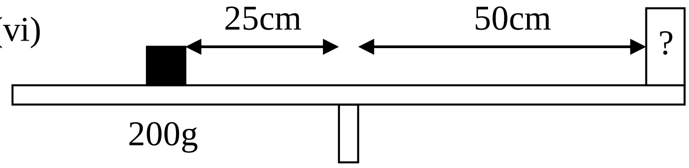


B. What <u>mass (m)</u> will balance the left-hand mass in the positions shown? Do the prac, and calculate the values mathematically.

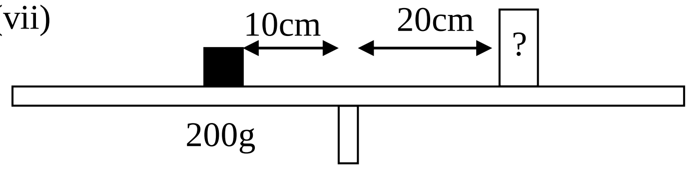
(v)



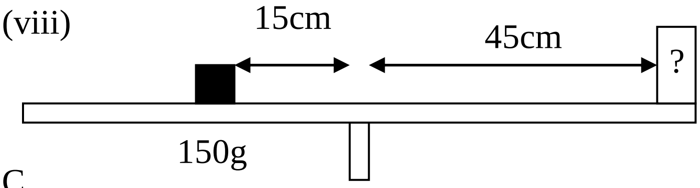

(vi)




(vii)




(viii)



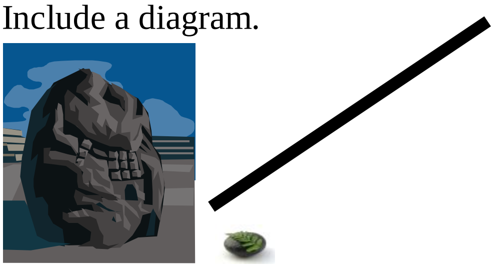

C.

1. Suzie, who has a mass of 50kg sits on a see-saw 1.8 metres from the pivot. Where should John, who has a mass of 70kg, sit to balance the see-saw?

2. A 75 kg man sits 2.5 from the pivot of a see-saw. Where should the 60kg woman sit to balance?

3. A girl of mass 35 kg sits exactly 1.5 metres from the pivot of a see-saw. Another girl sits exactly 1 metre from the see-saw. What is the second girl's mass?

4. Describe, mentioning distances, how you would set up a lever to move the large rock. Include a diagram.



D. Archimedes' first determined the principle of the lever, saying, "**bodies on a lever will be in equilibrium if their distances to the pivot point are inversely as their weight.**" Describe what he meant <u>AND</u> give an example.