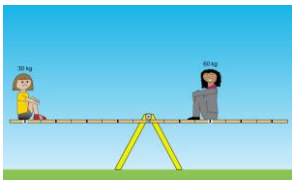
How can motion be described and explained?

Virtual Practical Activity

Torque and Rotational Equilibrium

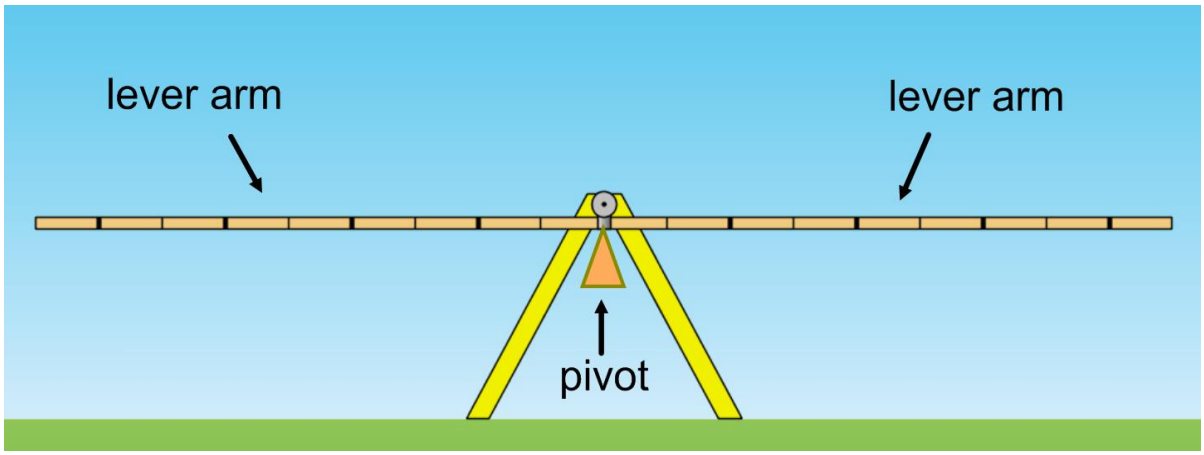


Name.....

*Open up the **Balancing Act** simulation under **lesson 14** of **How can motion be described and explained?***

Begin by having a play to familiarise yourself with all the controls on the simulation. Then press **Reset All**

The simulation is all about balancing a see saw. The see saw can be considered as two lever arms joined together and pivoted in the centre as shown below.



Relevant Theory

For an object to be in **rotational equilibrium**, the sum of the **clockwise** torques must be equal to the sum of the **anticlockwise** torques. This can be written:

$$\Sigma\tau_{clockwise} = \Sigma\tau_{anticlockwise}$$

Clockwise torques can be considered as **positive** and anticlockwise torques can be considered as being **negative**, so the condition for rotational equilibrium can also be expressed as:

$$\Sigma\tau = 0$$

Tick all the boxes under **Show** and then click on **Add Supports.**

Pick up the **rubbish bin** and place it at a position on the beam that is 1.5m to the right of the central pivot point.

What is the size of this torque (in Nm)? Use g = 10ms^{-2} .....

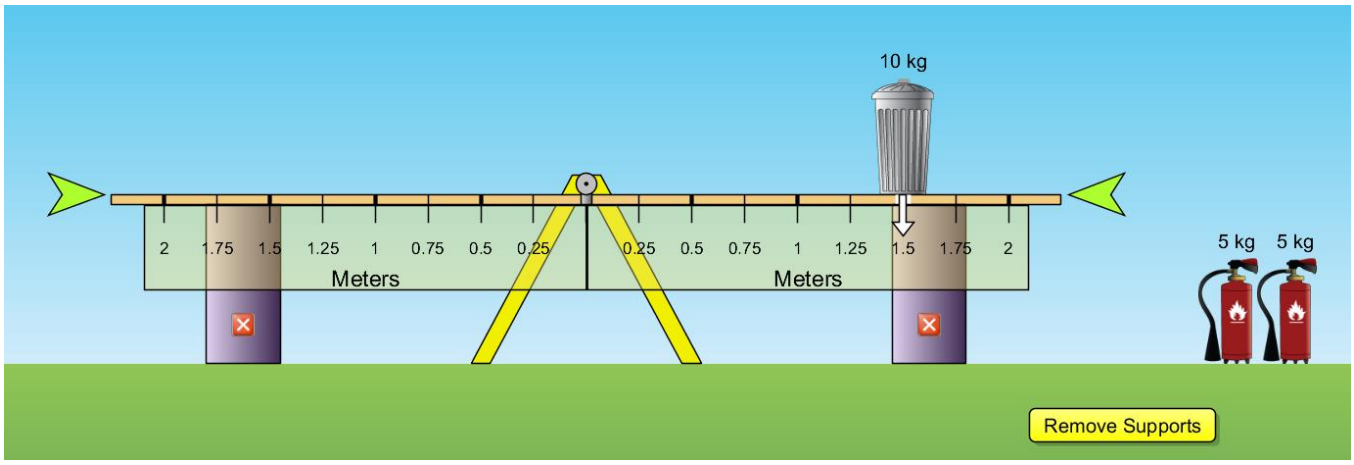
Is this a clockwise or anticlockwise torque?.....

Can you balance this torque by placing a single fire hydrant to the left of the pivot? Click on remove supports to test each of your trials. Explain your answer

.....

.....

Referring to the previous situation with the rubbish bin at 1.5m from the central pivot shown below



By using a trial and error approach or by calculation of torques, place the **two fire hydrants** at positions the left of the pivot so that the see saw is **balanced**. Draw them in on the above diagram.

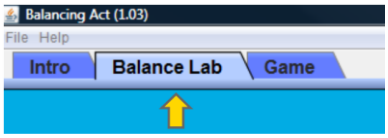
Complete the following for your solution:

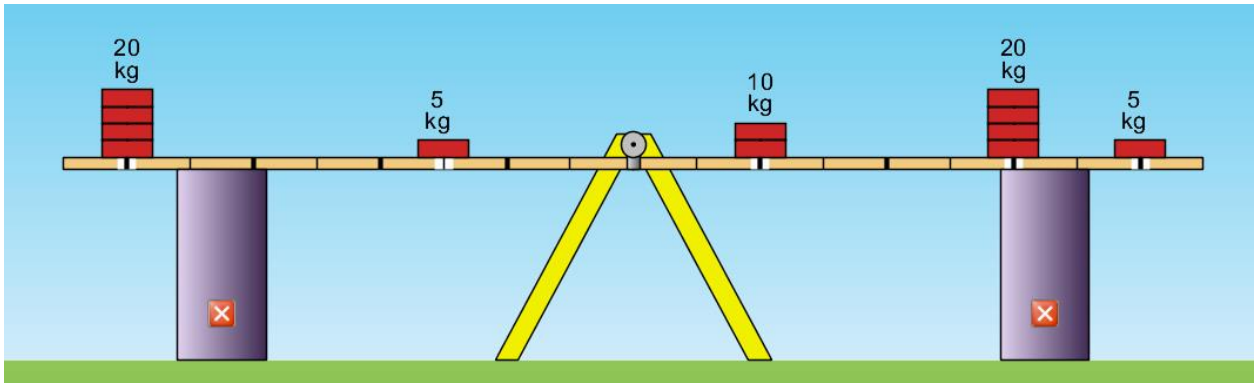
$\Sigma\tau_{clockwise}$ = ... = ...Nm

$\Sigma\tau_{anticlockwise}$ = ... + ... = ...Nm

$\Sigma\tau$ = ...

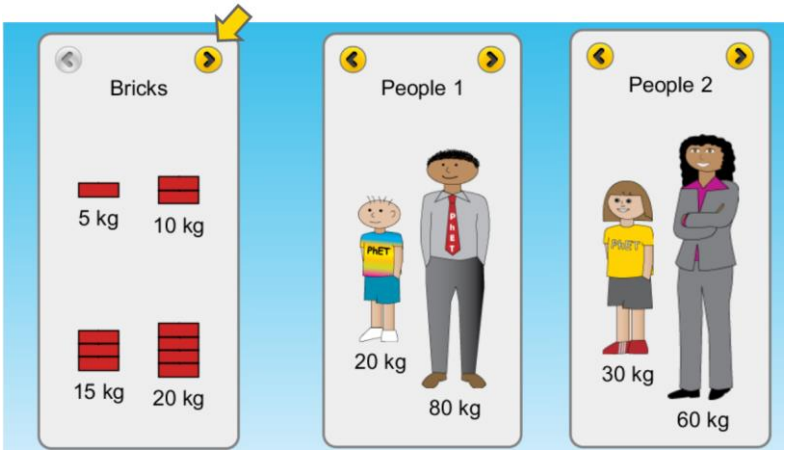
Now select the **Balance Lab** tab and place **bricks** as shown below.



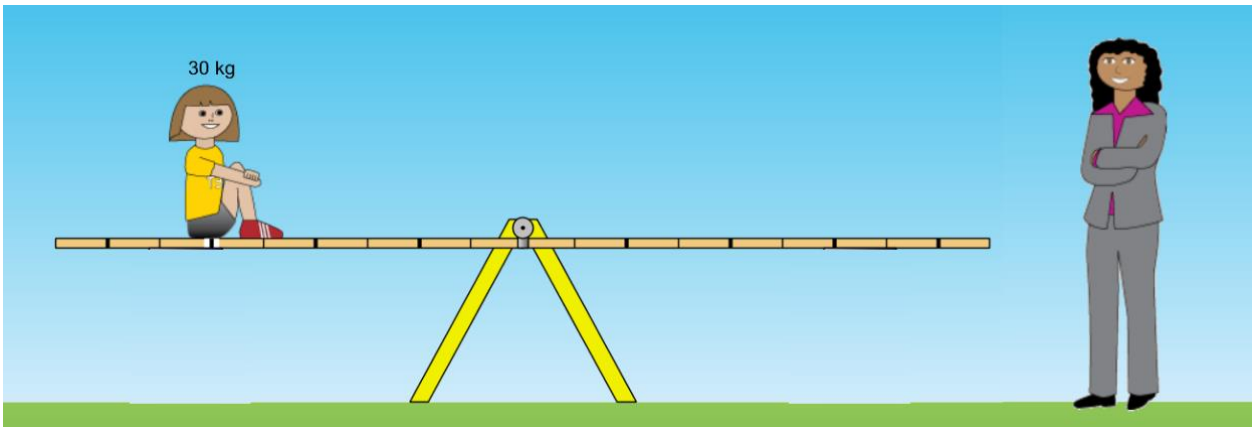


Calculate the sum of the torques acting (with supports removed) and hence decide if this structure is **stable** or balanced. Hint: tick the ruler box to help with distances.

Select **people** by clicking on the arrow as shown.



Where does the **adult** need to sit to keep the see saw balanced if the child sits in the position below?



Show your working out here:

To finish, click on the **Game** tab and work your way through a number of questions designed to test your understanding of torque and rotational equilibrium.