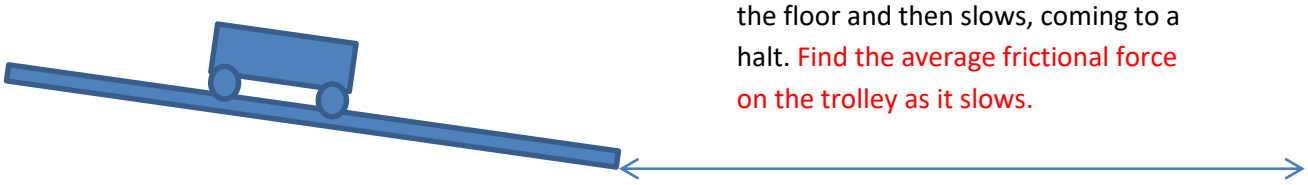
L3.1 Finding the average frictional force on a dynamics trolley moving across the floor

Overall concept



A trolley runs down the ramp onto the floor and then slows, coming to a halt. Find the average frictional force on the trolley as it slows.

The only MEASURING apparatus available is:

Metre rules

Mass balance

Stopwatch

No measurements are to be undertaken whilst the trolley is on the ramp.

To decide on a strategy use these prompts:

What is the final speed?

If the average speed across the floor whilst slowing down was 2 m/s, what would the speed at the bottom of the ramp have been?

So what is the link between the speed at the bottom of the ramp and the average speed whilst slowing?

So how can you calculate the acceleration (although in this case the acceleration will be negative)?

So how can you find the average frictional force?

Write a bullet point plan for what you would do to perform the experiment, including:

- A neat labelled diagram – at least 1/3 of a page
- A list of apparatus
- A method explaining what you will do with the apparatus

- An explanation of what you will measure and precisely how this will be measured.
- An explanation of how the average frictional force will be calculated.

Now use the data below to calculate the average frictional force (which is a little less than 0.2 N).

time to come to a halt = 4.32 s

distance travelled along the floor = 2.46m

mass of trolley = 714g

Calculating the average frictional force on a dynamics trolley

Mark Scheme

Allow trolley to run down a ramp	Fully met = 1	Part met = 0	Not met = 0
Use a **stopwatch** to **time** from the moment it **starts to leave** the ramp until it comes to a halt *(allow the moment it fully leaves the ramp if measuring to the back of the trolley in the point below)*			
Use **metre rules** to measure the **distance** from the **end of the ramp** to the **front of the trolley** when static *(or to back of trolley if using the alternative method)*			
Measure the **mass** of the **trolley** with a **mass balance**			
Average speed = distance travelled / time			
Speed at bottom of ramp = 2 x average speed			
Acceleration = change in speed / time			
Average frictional force = mass x acceleration			
Correct calculation (0.188 or 0.19 N)			
Total = /8			