Edexcel Physics GCSE

Topic 2.19: Motion and Forces

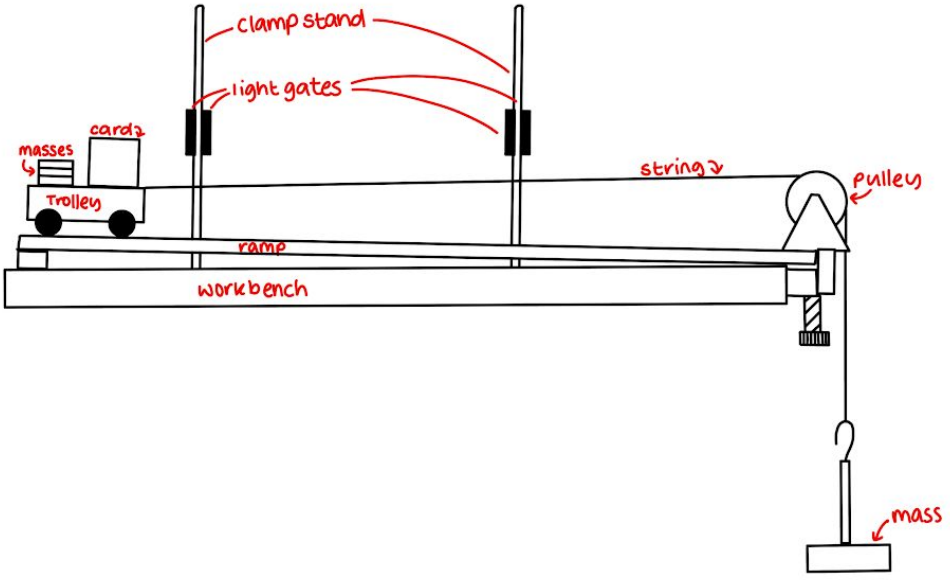
Practical notes

Core Practical 1: Investigate the relationship between force, mass and acceleration by varying the masses added to trolleys

Equipment:

- Trolley
- 10 x 0.1kg masses
- String
- Pulley
- Ramp
- Light gates
- Clamps and clamp stands to hold the light gates
- Data Logger
- Balance to measure the mass of the trolley
- Piece of card to put on top of the trolley

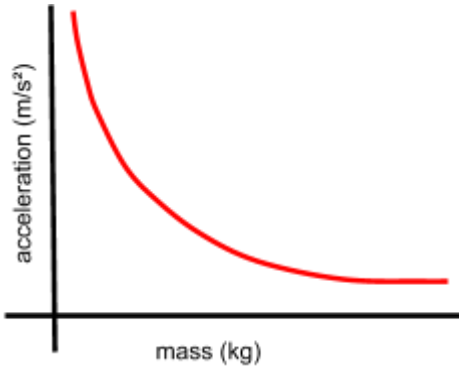
Diagram

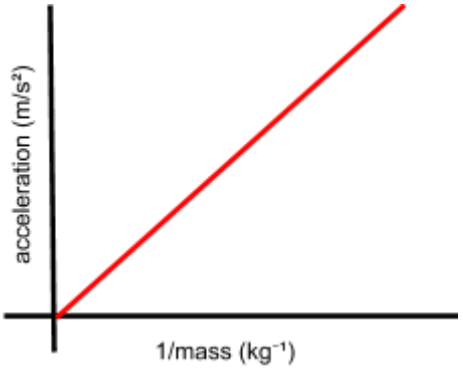


Method

1. Set up the equipment as shown in the diagram below
2. Use the balance to measure the mass of the trolley (with no extra masses added)
3. Start with one 0.1kg mass hanging on the end of the string and no masses on the trolley
4. Release the trolley from rest and record the time it takes to travel between the light gates (which will be shown on the data logger) as well as the velocity of the trolley at each light gate (also on data logger)

5. Add one 0.1kg mass to the trolley and repeat
6. Continue adding masses to the trolley until all of the masses are used up (or a reasonable number have been used in order to get comprehensive results), recording the time taken and the velocity at both gates each time
7. Calculate the acceleration for each recorded value using $a = \frac{v-u}{t}$
8. Plot a graph of acceleration against mass, which should give a smooth curve showing an inverse relationship between the two variables
9. Plot a graph of acceleration against $\frac{1}{mass}$, which should give a straight line





Tips

- Counteract friction by raising the ramp slightly so that, when pushed, the trolley will roll to the end of the ramp without stopping.
- You must also measure the length of the card attached to the trolley and input that into the data logger so that it can calculate the velocity of the trolley as it passes through the light gates.
- The force in the string must be kept constant, so the mass at the end of the string must remain the same.
- You may need two sets of light gates: one on each stand to measure the velocity of the trolley at each point, and a set of two to measure the time taken to travel between them.

Safety Precautions

- Place something soft below the falling mass at the end of the string to break the fall.
- Do not stand next to the end of the ramp so as to ensure that you do not get hit by the falling mass or the trolley.
- Attach the masses to the trolley using something that will keep them in place such as tape or sticky tack so that they do not fall off and cause injury.