Mechanics

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Work, energy and power

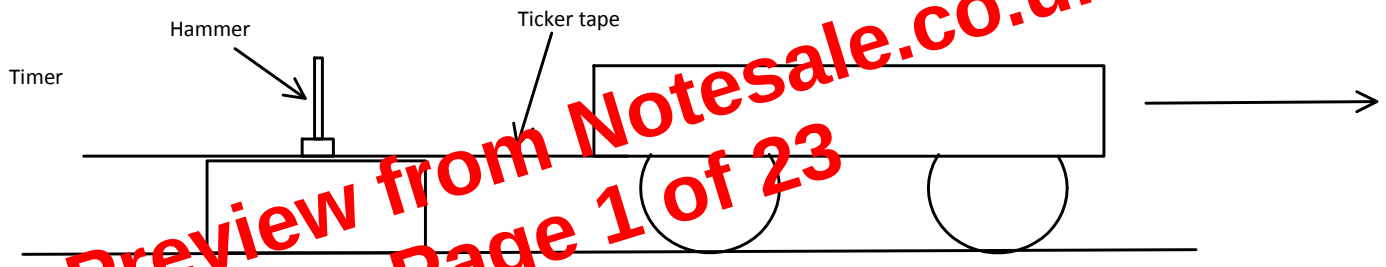
- Work = force x distance
  - W = Fd
- Forms of energy
  - Kinetic energy (E_k)
    - Due to motion
  - Potential energy (E_p)
    - Due to height/ position
- Mass
  - Form of energy
  - Energy contained
    - $E = mc^2$

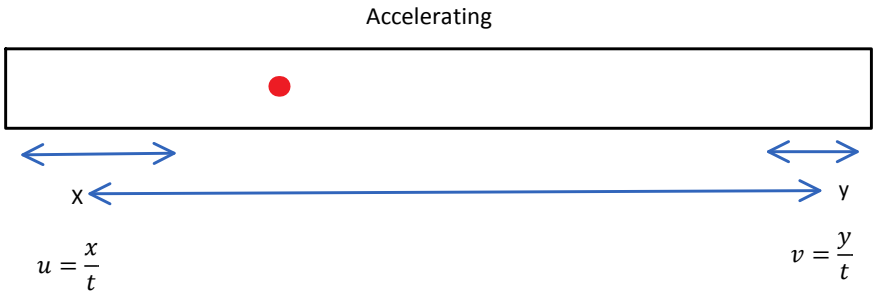
Linear motion

- Acceleration is the rate of change of velocity

Vectors and scalars

- Measurement of velocity and acceleration
  - Ticker tape timer
    - Trolley moves along track
    - Tape pulled through time r
    - 0.02 seconds mark made





$u = \frac{x}{t}$ $v = \frac{y}{t}$

- Find value of t
  - Number of spaces between dots x 0.02
- Find acceleration
  - $a^2 = \frac{v^2 - u^2}{2s}$
- Distance time graphs
  - Content speed
    - Speed = slope

Mandatory Experiments

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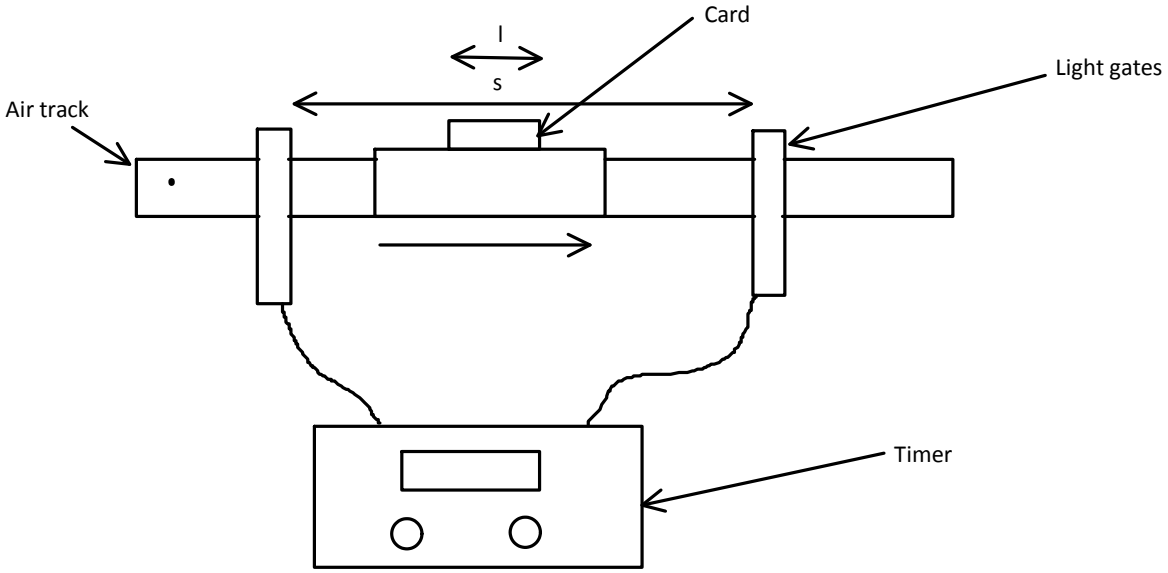
To measure velocity and acceleration

Apparatus



Method

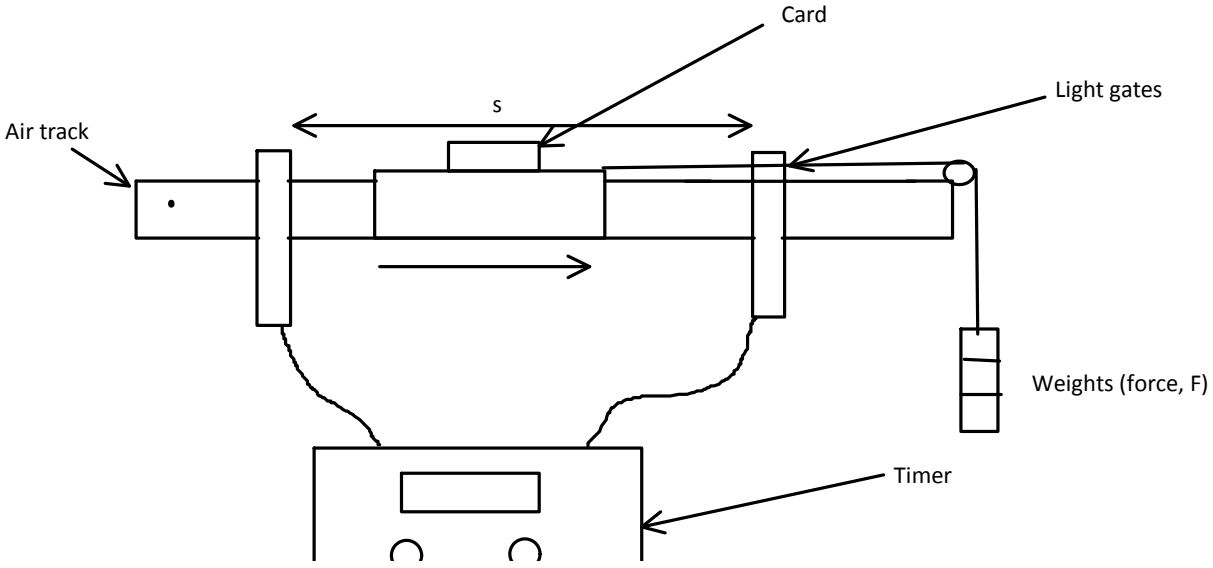
1. The rider can be pushed along so that it passes through each of the light gates.
2. As it passes through one the light is blocked by the card. The time that is taken to pass is recorded electronically by the timer.
3. As we know the length of the card and the time it takes to pass the light gate, we can calculate the velocity, u, using the formula: $u = \frac{l}{t_1}$
4. This procedure can be repeated to measure the velocity at the second gate, v.
5. The acceleration can be calculated using the formula: $a = \frac{v^2 - u^2}{2s}$

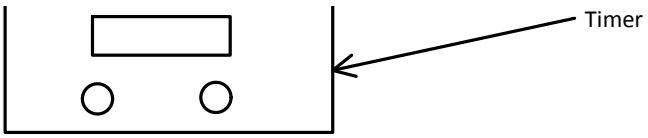
Conclusion

The velocity and acceleration have been measured.

To show that acceleration is proportional to force ($a \propto F$)

Apparatus



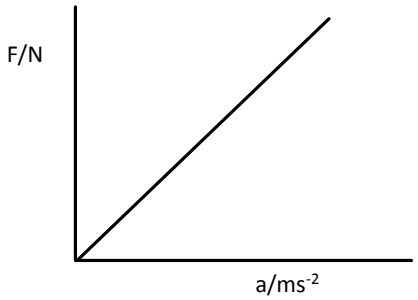


Method

1. Set up the apparatus as shown in the diagram.
2. Set the weights (F). Release the card from rest.
3. Calculate the initial velocity, u, and the final velocity, v.
4. Find the acceleration using the equation: $a = \frac{v^2 - u^2}{2s}$
5. Remove 1N disc from the pan, attach this to the vehicle, and repeat.
6. Continue for a number of values of F. Record the results.
7. Draw a graph of a against F.

Conclusion

A straight line through the origin shows, that for a constant mass, the acceleration is proportional to the applied force.

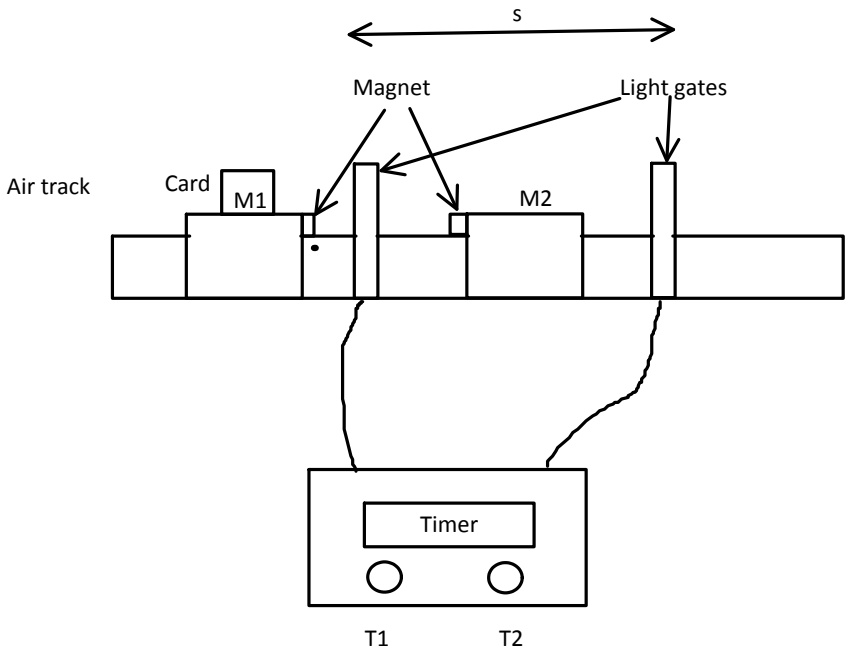


Accuracy

- The weights are transferred between the string and the trolley to keep the total mass constant.
- The air track reduces friction, improving accuracy.

To verify the principle of conservation of momentum

Apparatus



Method

1. Set up the apparatus as in the diagram.