M.7.7 Power

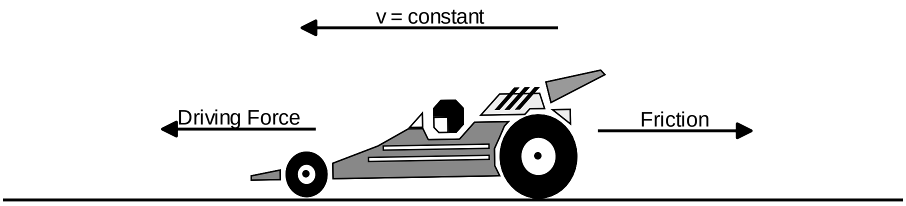
The rate at which work is done on, or by a body is called power.

$$\text{Power} = \frac{\text{Work done}}{\text{Time taken}}$$

or $$P = \frac{w}{t} = \frac{\Delta E}{t}$$

Units of power are joule per second = Watts (W)

For an object moving at constant velocity, the drag/friction forces balance the driving force.



In this case the net force is zero. Work is still being done, against the friction force. The power is

$$P = \frac{w}{t} = \frac{F \times x}{t} = F\,\frac{x}{t}$$

but $$\frac{x}{t} = v$$

$\Rightarrow$ $$P = F\,v$$

M.7.8 Collisions

There are two types of collision, they are elastic and inelastic.

For **Elastic** collisions, kinetic energy is conserved. This means that the amount of kinetic energy after the collision is the same as the amount of kinetic energy before the collision. Momentum is also conserved.

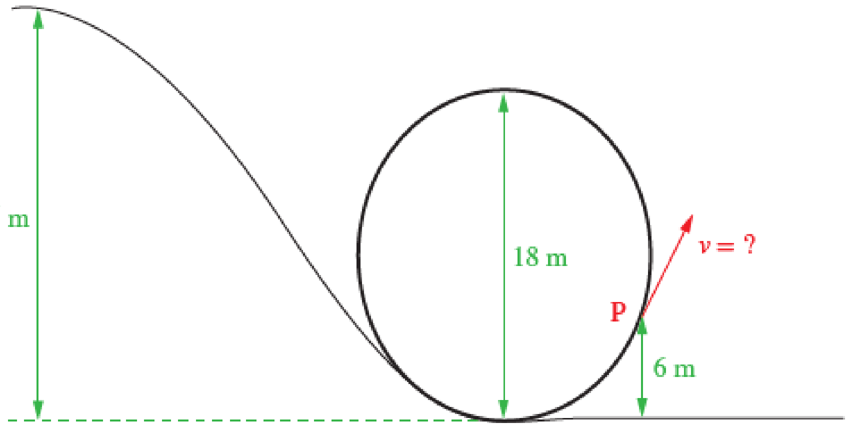
$\therefore E_{final} = E_{initial}$ and $p_{final} = p_{initial}$

With **inelastic** collisions, the total kinetic energy is not conserved. This means that the amount of kinetic energy after the collision is less than the amount of kinetic energy before the collision. Some of the kinetic energy has been lost, and this has been transformed into other types, typically heat and sound, or transferred to another object. However momentum is still conserved.

$\therefore p_{final} = p_{initial}$ but $E_{initial} > E_{final}$

Example

Consider a rollercoaster with a lift hill of height 25.0 m and a loop height of 18.0 m as shown in the figure below. At the top of the lift hill, the rollercoaster car has zero velocity; then it begins to roll down the hill. Calculate the speed of the car at point P on the loop, when the car is 6 m above the ground. Assume friction is negligible.



Text Questions: Page 196 Questions 9, 10, 11