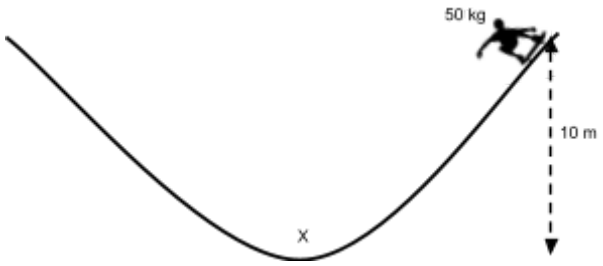
Our Dynamic Universe

Conservation of Energy

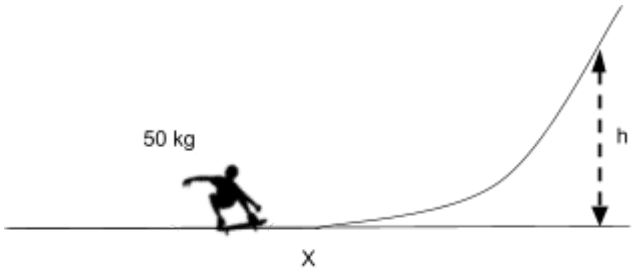
1) A 50 kg skateboarder starts from rest 10 m high up a ramp. He then rides down the ramp as shown.



a) Calculate the potential energy of the skateboarder at the top.
b) Assuming the frictional force of the track is 20 N and the length travelled to position X is 8 m, then find the work done against friction.
c) Determine the skateboarder's kinetic energy at position X.
d) Calculate the speed of the skateboarder at position X.

[a) 4,900 J, b) 160 J, c) 4,740 J, d) 13.8 ms^{-1}]

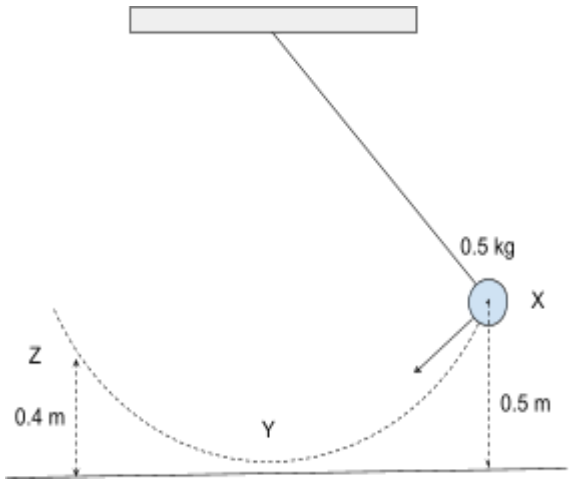
2) A 50 kg skateboarder reaches a speed of 6 ms^{-1} at point X. The frictional force of the ramp is 10 N and the skateboarder travels a distance of 8 m ***on the ramp***.



a) Calculate the kinetic energy of the skateboarder at position X.
b) Find the work done against friction by the skateboarder
c) Determine the vertical height reached up the ramp by the skateboarder.

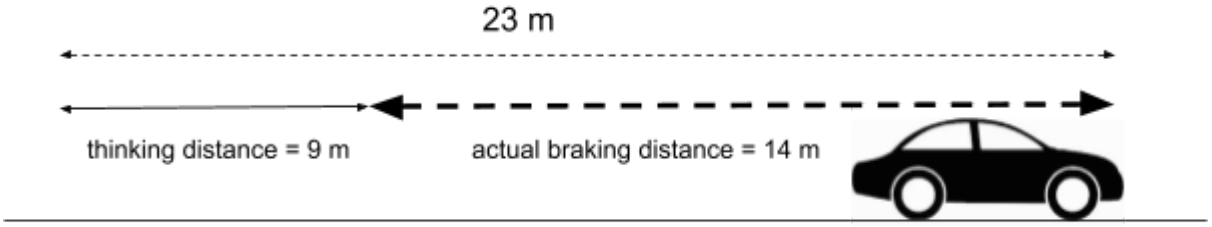
[a) 900 J, b) 80 J, c) 1.7 m]

3) A pendulum of mass 0.5 kg is lifted up to a height of 0.5 m and let go. The pendulum reaches to a height of 0.4 m at the other side.



a) Calculate the potential energy of the pendulum at position X
b) When the pendulum reaches point Z determine the energy lost overcoming friction.

4) A car of mass 2000 kg travelling at 13 ms^{-1} brakes and comes to a stop in a distance of 23 m, 9 m are actual `*thinking distance*' the remaining distance is the stopping distance caused by the total braking force acting on the car.

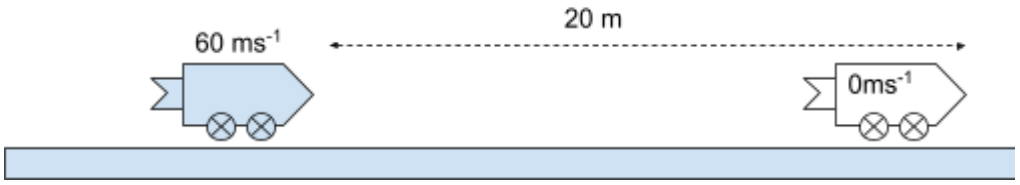


a) Find the kinetic energy of the car during the thinking distance
b) Determine the breaking force of the car.

5) A 2 kg metal ball falls from a height of 5 m. Assuming that there is no air resistance;

a) Calculate the potential energy of the ball when it is 5 m high. [98 J]
b) State the kinetic energy of the ball just before it lands.
c) Using conservation of energy determine the speed of the ball just before it strikes the ground. [9.9 ms^{-1}]

6) A 200 kg experimental rocket traveling at 60 ms^{-1} is brought to a halt on a section of track of length 20 metres.



a) Calculate the work done by the frictional force of the track to bring the rocket to a stop.
b) State the energy transfer that has taken place.

7) A small rocket, mass 100 kg, is launched with a velocity of 25 ms^{-1}. It is calculated that the work done by the rocket overcoming the frictional force of the air is 19,490 J.

a) Calculate the kinetic energy of the rocket at launch. [31,250J]
b) Using conservation of energy determine the height the rocket reached. [12 m]

8) A 2000 kg car travelling at 18 ms^{-1} is brought to a stop in a distance of 0.5 m.

a) Calculate the kinetic energy of the car before it stops.

b) Determine using conservation of energy the average stopping force from the wall.