REVISION: MOMENTUM & VERTICAL PROJECTILE MOTION

18 MARCH 2014

Lesson Description

In this lesson we revise:

- Momentum & Impulse
- Vertical Projectile Motion
- Graphs of Motion

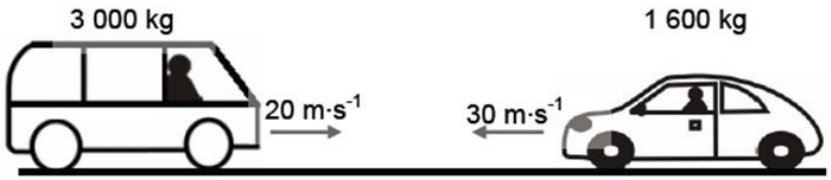
Improve your Skills

Momentum & Impulse

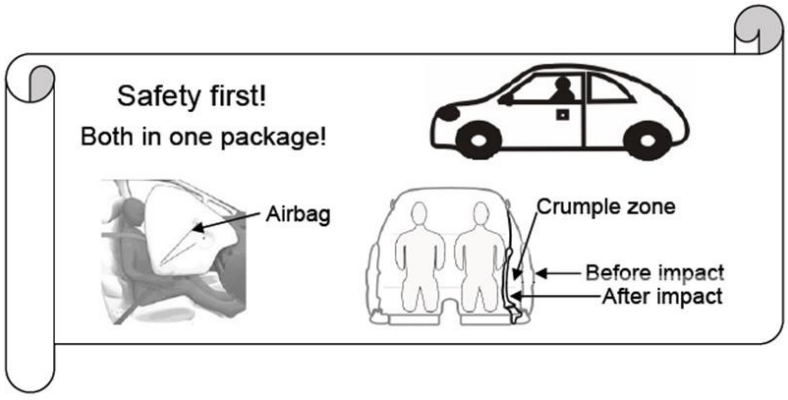
Question 1

(Adapted from Exemplar 2008 Paper 1)

Collisions happen on the roads in our country daily. In one of these collisions, a car of mass 1 600 kg, travelling at a speed of 30 m.s^{-1} to the left, collides head-on with a minibus of mass 3 000 kg, travelling at 20 m.s^{-1} to the right. The two vehicles move together as a unit in a straight line after the collision.



1.1. Calculate the velocity of the two vehicles after the collision.
1.2. Do the necessary calculations to show that the collision was inelastic.
1.3. The billboard below advertises a car from a certain manufacturer.



Use your knowledge of momentum and impulse to justify how the safety features mentioned in the advertisement contribute to the safety of passengers.

Question 2

(Adapted from Final Exam 2009 (1) – Paper 1)

A man of mass 87 kg on roller skates, moving horizontally at constant speed in a straight line, sees a boy of mass 22 kg standing directly in his path. The man grabs the boy and they boy continue in a straight line at 2,4 $m.s^{-1}$.

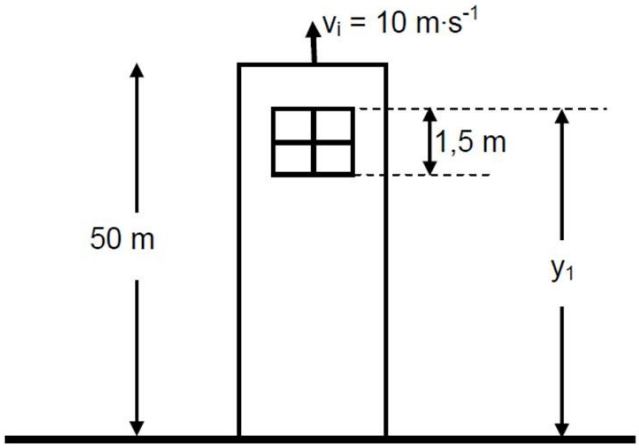
2.1. Calculate the man's speed just before he grabs the boy. Ignore the effects of friction.
2.2. Is the collision elastic? Use a calculation to support your answer.

Vertical Projectile Motion

Question 1

(Adapted from Feb-March 2012 Paper 1)

A stone is thrown vertically upward at a velocity of 10 $m.s^{-1}$ from the top of a tower of height 50 m. After some time the stone passes the edge of the tower and strikes the ground below the tower. Ignore the effects of friction.



1.4. Draw a labelled free-body diagram showing the force(s) acting on the stone during its motion
1.5. Calculate the
  1.5.1. Time taken by the stone to reach its maximum height about the ground
  1.5.2. Maximum height that the stone reaches above the ground
1.6. Using the ground as reference (zero position), sketch a position-time graph for the entire motion of the stone.
1.7. On its way down, the stone takes 0,1 s to pass a window of length 1,5 m, as shown in the diagram above. Calculate the distance (y_1) from the top of the window to the ground.

Graphs of Motion

Question 1

*(Adapted from KZN June 2013 Paper 1 posted by **Stylour Mano Nzamour**)*

An object is projected vertically upwards at 8,70 $m.s^{-1}$ from the roof of a building of unknown height. On its way down the object passes a point P, located 34,80m above the ground. It takes the object 1,25s to strike the ground from point P. Take upward motion as positive.

1.1. Show that the magnitude of the velocity at point P is 21,72 $m.s^{-1}$
1.2. Calculate the height of the building
1.3. Draw a velocity versus time graph to represent the motion of this object