

Module 07

Momentum

QUESTIONS

Question 1 (LV1): A large rock has a mass of 50 kg and is rolling downhill at 3 m/s. What is its momentum?

Question 2 (LV2): What is the impulse of a force of 10 N acting on a 2-kg box for 2 seconds?

Question 3 (LV3): A force is given by the expression $F(t) = b(t - c)$ where $b = 6.0$ N/s and $c = 1.2$ s. What is the impulse that this force exerts from $t = 0$ to $t = 3$ s?

Question 4 (LV4): A 24-g squash ball hits a wall with a speed of 10 m/s. The wall applies 3000 N force to the ball making it turn straight back moving with a speed of 8 m/s ~~velocity~~. For how long was the ball in contact with the wall?

Question 5 (LV5): A 1000-kg car travels forward with a speed of 4 m/s. Suddenly, a force F_x acting on the car for 0.2 s causes the car to reverse its motion with a speed of 3 m/s. Find the ~~force applied to this object~~.

Question 6 (LV6): A 40.0-kg boy, riding a skateboard of mass 2.0 kg, is travelling at 3.0 m/s along the positive x -direction when he attempts to jump forward from his skateboard. If his velocity immediately after leaving the skateboard is 3.1 m/s, how fast and in what direction is the skateboard moving?

PROBLEMS

Problem 1 (LV1, LV6): Three small clay balls of mass 200 g each have initial velocities as shown in the top view represented in Fig. 1. The three balls hit a big chunk of clay of mass 1.0 kg, which is initially at rest. If the three balls attach themselves to the larger piece after hitting it, what is the velocity and direction of the piece of clay after the collision?

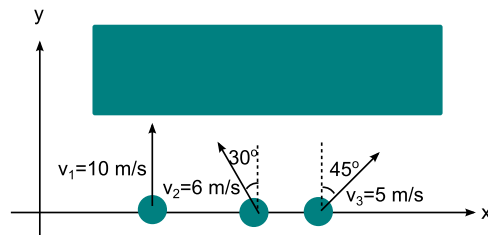


FIG. 1: Clay collision.

Problem 2 (LV4, LV6): An 80.0-kg super hero must fly head on against a train of mass 19537 kg, which is travelling at 65.0 km/h, in order to stop it. (a) Find the speed at which the super hero must fly against the train. (b) Calculate the time the super hero must take to stop the train, if the passengers experience an average horizontal force of 0.550 their own weight.

Problem 3 (LV6): A firecracker, initially at rest, explodes into two fragments. The first, of mass 20 g, moves in the $+x$ -direction at 48 m/s. The second moves at 20 m/s. Find the mass of the second fragment and the direction of its motion.