

# Momentum Review & Practice

(Answer on separate sheet of paper. Show ALL work on problems.)

1. If a huge truck and a motorcycle have a head-on collision, which will experience the greater force of impact?
2. If a huge truck and a motorcycle have a head-on collision, which will experience the greater impulse?
3. If a huge truck and a motorcycle have a head-on collision, which will experience the greater change in momentum?
4. If a huge truck and a motorcycle have a head-on collision, which will experience the greater acceleration?
5. If a huge truck and a motorcycle have a head-on collision, which will experience the greater damage? (You'd better get this one right!)
6. A fully dress person is at rest in the middle of a pond on perfectly smooth ice and must get to shore. How can this be accomplished? (Use your knowledge of momentum.)
7. In a fireworks display a 3 kg body moving at 4 km/h due north explodes into 3 equal pieces: A moves east at 4 km/h; B moves  $37^\circ$  south of west at 5 km/h; and C moves due north at 15 km/h. After the explosion, what is the total momentum of all the pieces?
8. In 1994, a tower 22.13 m tall was built of Lego blocks. Suppose a block with a mass of 2.00 g is dropped from the top of this tower. Neglecting the air resistance, calculate the block's momentum at the instant it hits the ground. ( $4.17 \times 10^{-2} \text{ kg}\cdot\text{m/s}$  downward)
9. The "human cannonball" has long been a popular - and extremely dangerous- circus stunt. The record speed at which a person has been shot from a circus cannon is about 24 m/s. Calculate the magnitude of the impulse that the cannon must impart to a human cannonball with a mass of 45.0 kg. What is the magnitude of the force if it accelerates the human cannonball in 0.70 s? (1500 N)
10. Steel Phantom is a roller coaster in Pennsylvania that, like the Desperado in Nevada, has a vertical drop of 68.6 m. Suppose a roller coaster car with a mass of  $1.00 \times 10^3 \text{ kg}$  travels from the top of that drop without friction. The car then decelerates along a horizontal stretch of track. If the car travels a distance of 30.0 m along this horizontal track before the car comes to rest, what is the magnitude of the average force acting on the car during its deceleration? ( $-2.24 \times 10^4 \text{ N}$ )
11. Sumo wrestlers must be very heavy to be successful in their sport, which involves pushing the rival out of the ring. One of the greatest sumo champions, Akebono, had a mass of 227 kg. The heaviest sumo wrestler ever, Konishiki, at one point had a mass of 267 kg. Suppose these two wrestlers are opponents in a match. Akebono moves left with a speed of 4.00 m/s while Konishiki moves toward Akebono with an unknown speed. After the wrestlers undergo an inelastic collision, both have a velocity of zero. From this information, calculate Konishiki's velocity before colliding with Akebono. ( $3.40 \text{ m/s}$  toward Akebono)
12. The heaviest wild lion ever measured had a mass of 313 kg. Suppose this lion is walking by a lake when it sees an empty boat floating at rest near the shore. The curious lion jumps into the boat with a speed of 6.00 m/s, causing the boat with the lion in it to move away from the shore with a speed of 2.50 m/s. Find the amount of kinetic energy dissipated in this inelastic collision. (-3280 J)
13. The largest beet root on record had a mass of 18.40 kg. The largest cabbage on record had a mass of 56.20 kg. Imagine these two vegetables traveling in opposite directions with a speed of 5.00 m/s relative to the ground. The two collide head-on with each other, so that the cabbage continues in its original direction (left), but with a speed of  $6.60 \times 10^{-2} \text{ m/s}$ . What velocity does the beet root have after the collision? ( $10.1 \text{ m/s}$ , left)