Impulse and Momentum Worksheet

With Just a Hint of Cocoa butter

1. A 165g ball strikes a wall at 12.0m/s and bounces straight back at 11.0m/s. The ball is in contact with the wall for 0.166s.

a. Find the change in momentum of the ball.

b. Find the Impulse on the ball.

c. Find the average force the wall applies to the ball.

2. A 325g pool (billiards) ball strikes the bumper of a pool (billiards) table as shown below.

34o 34o

1.4m/s 1.4m/s

a. Find the change in momentum of the ball.

b. Find the impulse imparted to the ball.

c. What force provided the impulse?

d. If the ball contacts the bumper for 0.014s, what is the average force on the ball?

3. An open top 12kg cart rolls along a frictionless sidewalk in a serious rain storm. When I say serious, I mean serious. Get out the sand bags, floods shall ensue. Water collects in the cart at a rate of 74.0kg/hour. If the empty cart starts at 2.6m/s find its speed after 2.0 minutes.

4. Fill in the blanks with Greater Than, Less Than or Equal To.

A 12kg mass (Mass A) collides with a 156kg mass (Mass B). Consider magnitudes only.

a. The force on Mass A is \_\_\_\_\_\_\_\_\_\_\_\_\_ the force on Mass B.

b. The impulse on Mass A is \_\_\_\_\_\_\_\_\_\_\_\_ the impulse on Mass B.

c. The change in momentum of Mass A is \_\_\_\_\_\_\_\_\_\_\_\_\_\_ the change in momentum of Mass B.

d. The change in velocity of Mass A is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the change in velocity of Mass B.

e. The acceleration of Mass A is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the acceleration of Mass B.

5. A 7.0g bullet is fired horizontally, at 1400m/s, into a stationary, 3.2kg block. The block is resting on a frictionless horizontal surface. The bullet passes through the block and exits at 850m/s. What is the final speed of the block?

6. Consider the collision below.

m=1.50kg

vI=22m/s

56o

v=34m/s

81o

m=3.0kg

v=35m/s

Find the following: a. The final velocity of the 1.50kg mass.

b. The impulse on the 1.50kg mass.

c. The impulse on the 3.0kg mass.

7. a. Is it possible for a closed system to gain momentum in a collision?

b. Is it possible for a closed system to lose momentum in a collision?

c. Is it possible for a single object to gain momentum in a collision?

d. Is it possible for a single object to lose momentum in a collision?

8. A. Two identical cars have the same speed. Do they have the same momentum? (Yes, No or It depends upon…..)

B. Two identical cars have the same velocity. Do they have the same momentum? (Yes, No or It depends upon…..)

9. Mass 1 is 2.2kg, and collides completely with a stationary Mass 2, which is 1.2kg. The two masses stick together in the collision. The surface is frictionless. How far from the base of the drop (x) will the blocks land?

3.0m/s

M1 M2

1.6m

x

10. Use the same diagram and values as question 6 except now the coefficient of friction between the blocks and the table, after the collision, is 0.100. Again, find x.

3.0m/s

M1 M2

μ=0 μ=0.100

1.6m

0.78m x

11. A 7.0g bullet is fired horizontally, at 1400m/s, into a stationary, 3.2kg block. The block is resting on a frictionless horizontal surface. The bullet becomes lodged within the block. What is the final speed of the bullet/block?

12. A 7.0g bullet is fired horizontally, at 1400m/s, into a stationary, 3.2kg block. The block is resting on a frictionless horizontal surface. The bullet passes completely through the block and emerges travelling at 610m/s. What is the final speed of the bullet/block?

13. A 7.0g bullet is fired horizontally, at 1400m/s, into a stationary, 3.2kg block. The block is resting on a frictionless horizontal surface. The bullet bounces off of the block and travels straight back at 610m/s. What is the final speed of the block?

14. For how long must a 25N act on a 4.0kg mass to change it’s velocity from 16m/s south to 14m/s north? What direction is the force?

15. What average net force must a 1600kg car experience to accelerate from 6.0m/s west to 8.0m/s north in 2.00s?

16. A 260 kg object moving east at 12 m/s explodes into three unequal fragments, as shown below. After the explosion, a 75 kg

fragment moves north at 25 m/s, a 125kg moves off at 14.0m/s east.

v1 = 25 m/s

m1 = 75 kg

14.0m/s

m2=125kg

N

S

W

E

v = 12 m/s

260 kg

m3

v2

What is the velocity m3?

17. A 1.8kg bag of sea-salt soaked with feta cheese brine free falls from rest for 2.0s. What is the impulse experienced by the bag?

18. A 1.8kg bag of sea-salt soaked with feta cheese brine free falls from rest for 2.0m. What is the impulse experienced by the bag?