Review for Momentum & Impulse Test

1) Momentum - the quantity of motion that an object has "mass in motion"

2) $p = mv$ momentum = mass x velocity $kg \cdot m/s = (kg) \times (\frac{m}{s})$

3) $J = Ft$ impulse = Force x time

4) If the mass stays the same and you increase the velocity the momentum increases.

5) An elastic collision is where two objects collide and bounce off of each other. ex) billiard balls colliding & a car crash where the cars bounce off of each other.

6) $m_1v_1 + m_2v_2 = m_1v_1' + m_2v_2'$

7) An inelastic collision is where two objects collide & stick together
ex) two train cars colliding & hooking together
getting rear ended at a stoplight where the bumpers of both cars get stuck together.
a bug hitting your windshield

8) $m_1v_1 + m_2v_2 = (m_1 + m_2)v$

9) To increase momentum you could increase the mass or increase the velocity.

10) If the momentum is increased and the mass remains constant the velocity has to increase.

11) The change in momentum is equal to the impulse.

12) In order for there to be momentum the object must be moving.

13) $m = 21$
$V = 13$
$p = mv$
$p = (21)(13)$
$\boxed{p = 273 \text{ kg m/s}}$

14) $m = 14$
$p = 2$
$p = mv$
$\frac{2}{14} = \frac{(14)(v)}{14}$
$\boxed{v = .14 \text{ m/s}}$

15) $v = 34$
$p = 148$
$p = mv$
$\frac{148}{34} = \frac{m(34)}{34}$
$\boxed{4.35 \text{kg} = m}$

16) $p = ?$
$m = 32$
$d = 1000$
$t = 120$
$p = mv$
$p = (32)(8.33)$
$\boxed{p = 266.67 \text{ kg m/s}}$
$v = \frac{d}{t}$
$v = \frac{1000}{120}$
$v = 8.33$

17) $m = 12$
$v = 3.1$
$t = 0.8$
$F = ?$

$mv = Ft$
$(12)(3.1) = (F)(.8)$
$\frac{37.2}{.8} = \frac{F(.8)}{.8}$
$\boxed{F = 46.5\ N}$

18) $m_g = 15$
$m_b = 22$
$v_g = ?$
$v_b = 1.3$

$m_1 v_1 = -(m_2 v_2)$
$(15)(v_g) = -(22)(1.3)$
$\frac{(15)(v_g)}{15} = \frac{-28.6}{15}$
$\boxed{v_g = -1.9\ m/s}$

19) $m_c = 16$
$m_b = 6.2$
$v = 4.6$
$p = ?$

$p = (m_c + m_b)v$
$p = (16 + 6.2)(4.6)$
$p = (22.2)(4.6)$
$\boxed{p = 102.12\ kg\,m/s}$

20) If you decrease the time you increase the Force.
If you increase the time you decrease the Force.

21) $m = 0.35$
$v = 15$
$v' = -19\ m/s$

a) $J = Ft = mv$
$J = (19)(.35)$
$\boxed{J = 6.65\ kg\,m/s}$

b) $\Delta p = J$
$\Delta p = m(v_f - v_i)$
$\Delta p = (0.35)(-19 - 15)$
$\Delta p = (0.35)(-34)$
$\boxed{\Delta p = 11.9\ kg\,m/s}$

22) $m = 0.9$
$v = 22$
$t = 0.06$
$v_f = 0$
$F = ?$

$\Delta p = J$
$\Delta p = m(v_f - v_i)$
$m(v_f - v_i) = Ft$
$(0.9)(0 - 22) = F(0.06)$
$(0.9)(-22) = F(0.06)$
$-19.8 = F(0.06)$
$\boxed{-330\,N = F}$

23) $m_1 = 5$
$v_1 = 3$
$m_2 = 3.2$
$v_2 = 0$
inelastic

$m_1v_1 + m_2v_2 = (m_1 + m_2)v$
$(5)(3) + (3.2)(0) = (5 + 3.2)v$
$15 + 0 = 8.2(v)$
$\frac{15}{8.2} = \frac{8.2v}{8.2}$
$\boxed{1.8\,m/s = v}$

Worksheet: Conservation of Momentum Name_____

1. A 1250 kg car is stopped at a traffic light. A 3550 kg truck moving at 8.33 m/s hits the car from behind. If bumpers lock, how fast will the two vehicles move?

$m_1v_1 + m_2v_2 = (m_1+m_2)v$

$(1250)(0) + (3550)(8.33) = (1250+3550)v$

$0 + 29571.5 = 4800v$

$29571.5 = 4800v$

$\frac{29571.5}{4800} = v$

$6.16\ m/s = v$

2. The muzzle velocity of a 50.0 g shell leaving a 3.00 kg rifle is 400. m/s. What is the recoil velocity of the rifle?

$0 = m_bv_b + m_rv_r$

$0 = (.05)(400) + (3)(v_r)$

$0 = 20 + 3(v_r)$

$-20 = 3v_r$

$-6.67\ m/s = v_r$

3. Imagine that you are hovering next to a space shuttle and your buddy of equal mass who is moving a 4 km/h with respect to the ship bumps into you. If he holds onto you, how fast do you both move with respect to the ship? → Pick a number

[Y] + [B] = [Y B]

$m_1v_1 + m_2v_2 = (m_1+m_2)(v)$

$(2)(0) + (2)(4) = (2+2)(v)$

$0 + 8 = 4(v)$

$\frac{8}{4} = \frac{4v}{4}$

$v = 2\ m/s$

4. Joe and his brother Bo have a combined mass of 200.0 kg and are zooming along in a 100.0 kg amusement park bumper car at 10.0 m/s. They bump into Melinda's car, which is sitting still. Melinda has a mass of 25.0 kg. After the collision, the twins continue ahead with a speed of 4.12 m/s. How fast is Melinda's car bumped across the floor?

[J+B+car] + [M car] = [J+B car] + [M car]

$m_1v_1 + m_2v_2 = m_1v_1' + m_2v_2'$

$(100+200)(10) + (25+100)(0) = (300)(4.12) + (125)(v)$

$3000 + 0 = 1236 + 125(v)$

$-1236 \quad -1236$

$\frac{1764}{125} = \frac{125v}{125}$

$14.1\ m/s = v$

5. If an 800. kg sports car slows to 13.0 m/s to check out an accident scene and the 1200. kg pick-up truck behind him continues traveling at 25.0 m/s, with what velocity will the two move if they lock bumpers after a rear-end collision?

[SC] + [truck] = [SC Truck]

$m_1v_1 + m_2v_2 = (m_1+m_2)(v)$

$(800)(13) + (1200)(25) = (800+1200)(v)$

$10400 + 30000 = 2000(v)$

$\frac{40400}{2000} = \frac{2000v}{2000}$

$v = 20.2\ m/s$