Name: KEY Date: _____

Honors Physical Science
Impulse & Momentum Review

1. Review the use of these equations.

$F = ma$ $W = mg$ $g = 9.8\ m/s^2$ $p = mv$ $Ft = m\Delta v$

$F_f = \mu F_N$ $p_{\text{before collision}} = p_{\text{after collision}}$

2. Define the following key terms:

- Acceleration
- Force
- Impulse
- Momentum
- Law of Conservation of Momentum
- Universal Law of Gravitation
- Friction
- Coefficient of Friction
- G
- g
- Centripetal Force
- Centrifugal Force
- Inertia
- Newton's Laws of Motion

3. Fill in the blank.

a. All forces have two parts, a direction and a magnitude.

b. The unit of force in the metric system is the Newton.

c. When the forces acting on an object cancel out, we say the forces are balanced.

d. To cause changes in an object's motion, we need an unbalanced force.

e. If the forces on an object are balanced, it will not change its acceleration

f. The normal force acting on an object always acts perpendicular to the surface.

g. Gravity depends on masses of objects and the distance between objects.

4. Short Answer:

a. What is the weight of a 75 kg man on Earth?

$W = m \cdot g$ $75 \cdot 9.8$ $W = 735\ N$

$W = 740\ N$

b. Joe hits a stationary 0.12-kg hockey puck with a force that lasts for 0.01-s and makes the puck shoot across the ice with a speed of 20.0 m/s scoring a goal for the team. With what force did Joe hit the puck?

$m = 0.12\ kg$ $\Delta p = .12 \cdot 20$

$v = 20.0\ m/s$ $\Delta p = 2.4\ kg \cdot m/s$

$t = .01\ s$ $F = \frac{\Delta p}{t}$ $\frac{2.4}{.01}$

$F = 240\ N$

c. A tennis ball traveling at 10.0 m/s is returned by Maria Sharapova. It leaves her racket with a speed of 36.0 m/s in the opposite direction from which it came. What is the change in momentum of the tennis ball? If the 0.06-kg ball is in contact with the racket for 0.02-s, with what average force has Maria hit the ball?

$m = 0.06$ kg
$\Delta v = 26$ m/s
$t = .02$ s

$Ft = m\Delta p$

$F = \frac{m\Delta p}{t}$

$F = 78$ N

d. Mrs. Dora performs an experiment in which she shoots a pellet gun at a cantaloupe. The 1.0-g pellet travels at 98 m/s until it embeds itself into the cantaloupe. If the cantaloupe takes 0.37s to bring the pellet to a stop, what average force is exerted on the pellet?

Before

Pellet
.001 kg
$v = 98$ m/s

$p = mv$
$= .001 \cdot 98$
$p = 0.098$ kg·m/s

$F = \frac{\Delta p}{t} = \frac{.098}{.37}$

$F = 0.26$ N

e. Steve has a mass of 80-kg and is zooming along in a 100-kg amusement bumper car at 1.9 m/s. He bumps Michelle's car which is sitting still. Michelle has a mass of 65-kg and is also in a 100-kg bumper car. After the collision, Steve continues ahead with a speed of 0.4 m/s. What type of collision is this? How fast is Michelle's car bumped across the floor? inelastic

Before

S: $m = 180$, $v = 1.9$, $p = 342$
M: $m = 165$, $v = 0$, $p = 0$

$P_{total} = 342$ kg·m/s

$v_f = \frac{270}{165}$

After

S: $m = 180$, $v = .4$, $p = 72$
M: $m = 165$, **$v = 1.64$ m/s**, $p = 342 - 72 = 270$

f. An 800-kg sports car traveling at 13-m/s is rear ended by a 1200-kg pick-up truck traveling at 20 m/s. The bumpers lock and the two move together after the collision. What type of collision is this? How fast do they move after the collision? inelastic

Before

C: $m = 800$, $v = 13$, $p = 10400$
T: $m = 1200$, $v = 20$, $p_{truck} = 24{,}000$

$P_{Total} = 24000 + 10{,}400 = 34{,}400$

After

C + T: $m = 2000$, $p = 34{,}400$

$v = \frac{34{,}400}{2000}$

$v = 17.2$ m/s

g. Two ice skaters push off against one another starting from a stationary position. The 45-kg skater acquires a velocity of 0.875 m/s to the right. What velocity does the 60-kg skater acquire?

Skater 1

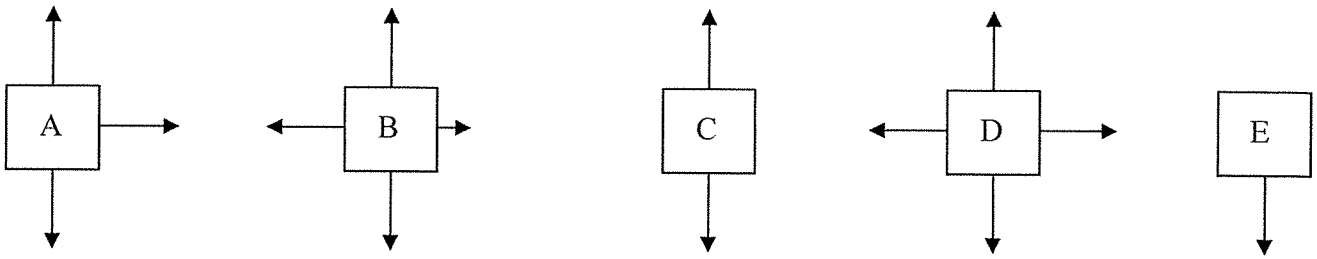
$m = 45$ kg
$v = .875$
$p = 39.375$

$v = \frac{-39.375}{60}$

Skater 2

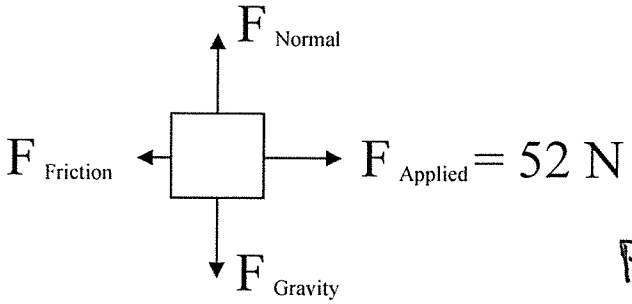
$m = 60$
$v = -.656$ m/s
$p = -39.375$

5. Match up the correct Free-body diagram with each description. Will any Free-body diagrams fit for more than one description?



- A skydiver who has reached terminal velocity. C
- A crate sliding to the left and being acted on by friction. B
- An object moving at constant velocity. C, D
- A feather "floating" to the ground. C
- An object that is accelerating horizontally. B, A
- An object that is accelerating vertically. E
- A crate with a net force of zero acting on it. D, C
- An object with some net force acting on it ($F_{net} \neq 0$). A, B, E

7. Several forces act on a 7 kg object as shown in the diagram below. What is the value of the frictional force when it experiences an acceleration of 0.8 m/s^2?



$F = 7(.8)$

$F_{net} = 5.6$

$F_F = 52 - 5.6$

$F_f = 46.4\ N$

9. Use an example to explain what a centripetal force is.

force pushing in to keep something in circular path

10. Compare & contrast centripetal force from centrifugal force.

Centripetal

real force
pulling object in

Centrifugal

apparent force
↳ what you feel
- pushing out