

Unit 7 Momentum Comprehensive Quiz

Name Solutions Period _____ Date _____

1. Select the type of collision in which momentum is conserved

- | | |
|---------------------------|----------------------------|
| i. Elastic Collisions | a. i only |
| ii. Inelastic Collisions | b. ii only |
| iii. Explosive Collisions | c. i and ii |
| | d. i and iii |
| | <u>e. i and ii and iii</u> |

all collisions

2. Select the type of collision in which kinetic energy is conserved

- | | |
|---------------------------|---------------------|
| i. Elastic Collisions | <u>a. i only</u> |
| ii. Inelastic Collisions | b. ii only |
| iii. Explosive Collisions | c. i and ii |
| | d. i and iii |
| | e. i and ii and iii |

only elastic

3. Select the type of collision both objects have the same final velocity

- | | |
|---------------------------------|---------------------|
| i. Elastic Collisions | a. i only |
| <u>ii. Inelastic Collisions</u> | <u>b. ii only</u> |
| iii. Explosive Collisions | c. i and ii |
| | d. i and iii |
| | e. i and ii and iii |

*moving together
inelastic*

4. What must all moving objects have?

- a. Kinetic energy but no momentum
- b. Momentum but not kinetic energy
- c. Both kinetic energy and momentum
- d. Neither kinetic energy or momentum

KE = moving
 $P = mv$
 stationary
 if $v = 0$ then $p = 0$
 must move to have p

5. Of the following, which object has a greater momentum?

- a. .3kg object traveling at 400m/s
- b. 30kg object traveling at 40m/s
- c. 300kg object traveling at 40m/s
- d. 30,000kg object traveling at 4m/s

$P = mv$

Elastic
 $O \rightarrow \leftarrow O$
 $\leftarrow O O \rightarrow$ or $O \rightarrow O \rightarrow$
 dif final v

Inelastic
 $O \rightarrow \leftarrow O$
 together $O O \rightarrow$ $v_{1f} = v_{2f}$
 same final v

Explosion
 $\leftarrow O O \rightarrow$

6. Calculate the velocity of a tractor that is 3200kg and utilizes 4200 kgm/s of momentum?

- a. .76m/s
- b. 1.3m/s
- c. 7,400m/s
- d. 13,440,000m/s

$P = m v$
 $\frac{4200}{3200} = \frac{3200 v}{3200}$

7. Find the mass of a bowling ball that has a momentum of 61.2 kgm/s when thrown at 8.5m/s?

- a. .14kg
- b. 7.2kg
- c. 52.7kg
- d. 520.2kg

$P = m v$
 $\frac{61.2}{8.5} = \frac{m \cdot 8.5}{8.5}$

8. As a 2,300kg truck speeds up from 46m/s to 68m/s, what is the impulse on the truck?

- a. 22kgm/s
- b. 104.5kgm/s
- c. 50,600kgm/s
- d. 7,194,400kgm/s

$J = \Delta p = m \Delta v$
 $J = 2300(68 - 46)$
 $J = 2300(22)$

9. How much force is exerted on a skater when a 102kg hockey player misses a check and hits the boards at 12m/s taking 0.2seconds to stop?

- a. 1.7kgm/s
- b. 244kgm/s
- c. 1440kgm/s
- d. 6120kgm/s

$F t = \Delta p = m \Delta v$
 $F \cdot 0.2 = 102 \cdot 12$
 $F \cdot 0.2 = 1224$
 $F = \frac{1224}{0.2}$

An 86kg student is sitting on a high tech rolling chair whose bearings and wheels are so well manufactured that friction is almost non-existent. She has been challenged by her friends to move towards the white board without using her feet. The only thing she has is her 27kg backpack that she is able to throw at 6 m/s.

10. What will be her velocity after she throws the backpack?

- a. 0.05m/s
- b. 1.9 m/s
- c. 76 m/s
- d. 248 m/s

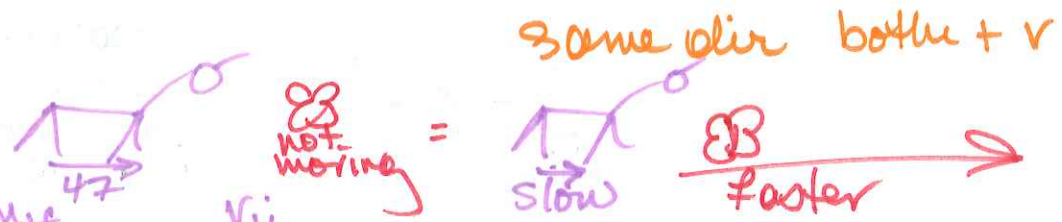
$m_1 v_{1i} + m_2 v_{2i} = m_1 v_{1f} + m_2 v_{2f}$
 $(86 \cdot 0) + (27 \cdot 0) = 86 v_{1f} + (27 \cdot 6)$
 $0 + 0 = 86 v_{1f} + 162$
 $+162 = 86 v_{1f} + 162$
 $\frac{162}{86} = \frac{86 v_{1f}}{86} = 1.88$

11. What direction should she throw her backpack?

- a. Toward the board
- b. Away from the board
- c. At a right angle to the board
- d. It doesn't matter which direction as long as she throws it

Explosion
 $v_{1i} = 0$
 $v_{2i} = 0$
 $m_1 v_{1f} + m_2 v_{2f}$
 $+v -v$

not together
diff final v
P is transf
KE is consrv



12. A 304kg unicorn is running at 47m/s in the Enchanted Forest when he runs into a stationary .7kg fairy in an elastic collision. They both fall in the same directions and the unicorn notices he now has a velocity of 12m/s. What is the speed of the fairy after the collision?

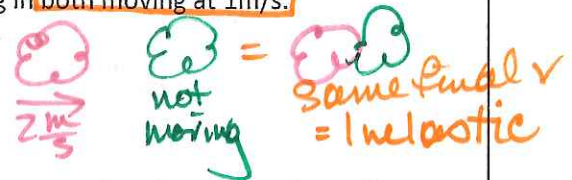
- a. 15,200 m/s
- b. 15,212 m/s
- c. 15,247 m/s
- d. 15,153 m/s

$$\begin{aligned}
 m_1 v_{1i} + m_2 v_{2i} &= m_1 v_{1f} + m_2 v_{2f} \\
 (304 \times 47) + (.7 \times 0) &= (304 \times 12) + (.7 v_{2f}) \\
 14288 + 0 &= 3648 + .7 v_{2f} \\
 10640 &= .7 v_{2f} \\
 v_{2f} &= 15200 \text{ m/s}
 \end{aligned}$$

A clump of pink algae and a clump of green algae are floating underwater in a still pond. The 5kg pink algae was pushed by a fish until it is moving freely at 2m/s. The 5kg green algae is stationary and not attached to anything. The two clumps of algae collide resulting in both moving at 1m/s.

13. What is the relationship of momentum in this scenario?

- a. Momentum is conserved
- b. Momentum is not conserved
- c. There is not enough information to determine whether momentum is conserved or not.



14. What is the relationship of Kinetic Energy in this scenario?

- a. Kinetic Energy is conserved
- b. Kinetic Energy is not conserved
- c. There is not enough information to determine whether kinetic energy is conserved or not.

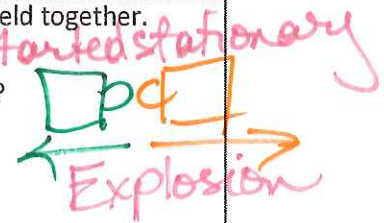
Elastic only

The following questions refer to the Collisions Labette in which the spring carts are held together. Consider after the carts are released and move away.

15. Do both carts have the same kinetic energy as the carts move away from each other?

- a. Yes kinetic energy is equal
- b. No kinetic energy is not equal
- c. There is not enough data for a meaningful answer
- d. This is an irrelevant question

Elastic only



16. Do both carts have the same momentum as the carts move away from each other?

- a. Yes momentum is equal
- b. No momentum is not equal
- c. There is not enough data for a meaningful answer
- d. This is an irrelevant question

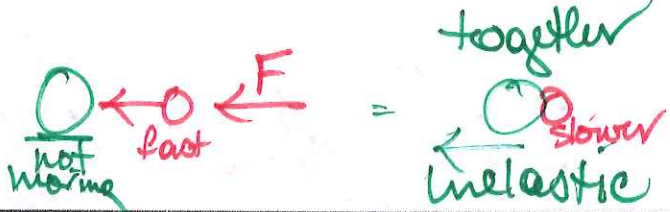
all collision

17. Do both carts have the same velocity as the carts move away from each other?

- a. Yes velocity is equal
- b. No velocity is not equal
- c. There is not enough data for a meaningful answer
- d. This is an irrelevant question.

inelastic

need know mass + p



The following questions refer to the demo in which a student is sitting on a stationary cart that rolls with very little effort. A heavy backpack is thrown at the student.

18. What direction does the student roll?
- a. In the same direction of the force that propelled the backpack
 - b. Opposite the direction of the force that propelled the backpack
 - c. There is not enough data for a meaningful answer
 - d. This is an irrelevant question.
19. Is the kinetic energy conserved before and after the backpack is caught?
- a. Yes kinetic energy is conserved
 - b. No kinetic energy is not conserved
 - c. There is not enough data for a meaningful answer
 - d. This is an irrelevant question
20. Is the momentum conserved before and after the backpack is caught?
- a. Yes momentum is conserved
 - b. No momentum not conserved
 - c. There is not enough data for a meaningful answer
 - d. This is an irrelevant question
21. Did the velocity of the backpack change?
- a. Yes velocity is increased
 - b. Yes velocity is decreased
 - c. No there is no change in the backpacks velocity
 - d. There is not enough data for a meaningful answer

22. What is the impulse experienced on a ball by a bat with 23N of force for .008 seconds?

- a. .00034kgm/s
- b. .184kgm/s
- c. 22.99kgm/s
- d. 2875kgm/s

$J = Ft = \Delta p = m\Delta v$

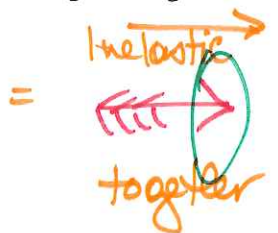
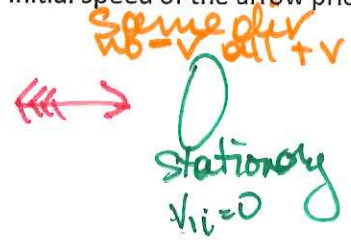
23. Using the physics of motion, explain why are seat belts required by law.

make time to hit windshield longer $t \uparrow$

$J = \int F dt$

less harm

24. A 0.08kg arrow is shot, without any arc in its trajectory, from a high force bow at a 2.1kg target. The forces of the arrow pushes the target back at 4.1m/s. Assuming there is no friction, what is the initial speed of the arrow prior to hitting the target.



$m_1 v_{1i} + m_2 v_{2i} = (m_1 + m_2) v_f$

$(.08 v_{ii}) + (2.1 \times 0) = (.08 \times 4.1) + (2.1 \times 4.1)$

$.08 v_{ii} + 0 = .328 + 8.601$

$.08 v_{ii} = 8.929$

$v_{ii} = 111.7 \text{ m/s}$