

Momentum Quiz  
momentum

Impulse

Name: \_\_\_\_\_ Per: \_\_\_\_\_

Formulas:  $p = mv$

$Ft = m\Delta v$

$KE = \frac{1}{2} mv^2$

$PE = mgh$

$v = gt$

$d = \frac{1}{2} gt^2$

1. If a smart car has a mass of 820 kg (1807.79 lbs), what is its momentum at a velocity of 30 m/s?

$p = mv = (820 \text{ kg})(30 \text{ m/s}) = 24,600 \text{ kg}\cdot\text{m/s}$

2. An offensive lineman with a mass of 140 kg has a momentum of 250 kg m/s, what is his velocity?

$p = mv \Rightarrow v = \frac{p}{m} = \frac{250 \text{ kg}\cdot\text{m/s}}{140 \text{ kg}} = 1.8 \text{ m/s}$

3. A beach ball is rolling in a straight line towards you at a speed of 0.5 m/s. Its momentum is 0.25 kg m/s. What is the mass of the beach ball?

$p = mv \Rightarrow m = \frac{p}{v} = \frac{0.25 \text{ kg}\cdot\text{m/s}}{0.5 \text{ m/s}} = 0.5 \text{ kg}$

You are given the following data about a baseball hitting a stationary baseball on a tee.

Mass of baseball	= .350 kg	Speed of bat before collision	= 38 m/s
Mass of Baseball	= .046 kg	Speed of bat after collision	= 29 m/s

$P_i = P_f$

Calculate the following and SHOW YOUR WORK! Remember UNITS!

4. Momentum of the bat before the collision.

$p = mv = .35 \text{ kg} \times 38 \text{ m/s}$

Answer = 13.3 kg·m/s  
 $P_i(\text{bat})$

5. Momentum of the bat after the collision.

$p = mv = .35 \text{ kg} \times 29 \text{ m/s}$

Answer = 10.2 kg·m/s  
 $P_f(\text{bat})$

6. Momentum of the baseball before the collision.

$p = mv = .046 \text{ kg} \times 0 \text{ m/s}$

Answer = 0 kg·m/s  
 $P_i(\text{ball})$

7. Momentum of the baseball ~~before~~ after the collision.

$P_i = P_f$   
 $P_i = 13.3 \text{ kg}\cdot\text{m/s}$   
 $P_f = 10.2 \text{ kg}\cdot\text{m/s} + P_f(\text{ball})$

Answer = 3.1 kg·m/s  
 $P_f(\text{ball})$   
 $13.3 \text{ kg}\cdot\text{m/s} = 10.2 \text{ kg}\cdot\text{m/s} + P_f$   
 $-10.2$   
 $3.1$

8. Identify the Impulse for the baseball after the collision.

$p = mv$     $Ft = m\Delta v$

Answer = 3.1 kg·m/s  
 $3.1 \text{ N}\cdot\text{s}$

9. What is the average force exerted by the ball after 2 seconds?

$Ft = m\Delta v \Rightarrow F(2 \text{ sec}) = 3.1 \text{ N}\cdot\text{s}$   
 $\frac{3.1 \text{ N}\cdot\text{s}}{2 \text{ sec}} = 1.55 \text{ N}$

Answer = 1.55 N

10. Velocity of the baseball right after it was hit by the bat.

$p = mv \Rightarrow v = \frac{p}{m} = \frac{3.1 \text{ kg}\cdot\text{m/s}}{.046 \text{ kg}} = 67 \text{ m/s}$

Answer = 67 m/s

11. Define the period of a pendulum.

time it takes to complete a full swing (oscillation)

12. Identify the most significant variable that affects the period of a pendulum.

13. Explain why this variable affects the pendulum period.

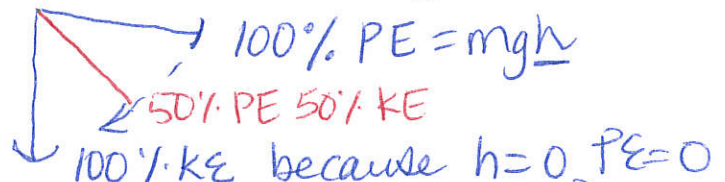
↑ length ↑ trajectory ↑ Period

$$d = r \cdot t$$



14. Draw a diagram of yourself swinging. Label where there is all kinetic energy and where there is all potential energy and where PE = KE.

as ↓ PE when fall  
↑ KE



15. Calculate the kinetic energy of an 8 kg bowling ball moving at 2 m/s.

$$KE = \frac{1}{2}mv^2 = \frac{1}{2}(8\text{kg})(2\text{m/s})^2 = \frac{1}{2}(8\text{kg})(4\frac{\text{m}^2}{\text{s}^2}) = 16\text{J}$$

16. Calculate the gravitational potential energy of Mrs. Chamberlain if she has a mass of 63.5 kg in a plane 4000 m above the ground?

$$gPE = mgh = (63.5\text{kg})(10\text{m/s}^2)(4000\text{m}) = 2,540,000\text{J}$$

17. Calculate Mrs. Chamberlain's velocity after falling for 4 sec.

$$v = gt = (10\text{m/s}^2)(4\text{s}) = 40\text{m/s}$$

18. What is Mrs. Chamberlain's momentum at 4 sec?

$$p = mv = (63.5\text{kg})(40\text{m/s}) = 2,540\text{kg}\cdot\text{m/s}$$

19. Explain why Mrs. Chamberlain prepares to land, by falling into a mattress with her parachute open instead of the concrete.

concrete  
↓ ↑ F

mattress  
↑ ↓ F

Ft = Impulse  
Inverse

20. A moving car has momentum, if it moves twice as fast, its momentum is twice as much.

21. Two cars, one twice as heavy as the other, move down a hill at the same speed. Compared to the lighter car, the momentum of the heavier car is twice as much.

22. Wiley Coyote runs into a speeding train and makes a big umpfh when he gets flattened on the front window. For the following questions answer True or False by writing out the entire word.

a. True The train and Coyote experience the same force during the collision.

b. False The time of impact is the same for both the train and Coyote, the impulse is less than the impulse on the train.

c. True The Coyote experiences a greater acceleration than the train.

$$Ft = \text{impulse}$$

↘ change in velocity