

AP Physics 1

Name: _____ Score: _____

1. What is the momentum of a 1500 kg car moving at $20 \frac{\text{m}}{\text{s}}$, in $\text{kg} \cdot \frac{\text{m}}{\text{s}}$?
_____ $\text{kg} \cdot \text{m/s}$
2. The impulse–momentum theorem says impulse equals the change in _____.

3. A 2 kg trolley at $3 \frac{\text{m}}{\text{s}}$ hits a stationary 1 kg trolley and they stick. What is their common speed after, in $\frac{\text{m}}{\text{s}}$?
_____ m/s
4. In an **elastic** collision, which quantity is conserved besides momentum?
☐ kinetic energy
☐ nothing else
☐ temperature
☐ mass only
5. Momentum is a vector, so its direction matters.
☐ True ☐ False
6. A force of 20 N acts for 0.5 s. What is the impulse, in $\text{N} \cdot \text{s}$?
_____ $\text{N} \cdot \text{s}$
7. Momentum is conserved only when the system is:
☐ moving fast
☐ at rest
☐ isolated (no external net force)
☐ made of identical objects
8. Momentum is conserved in both elastic and inelastic collisions (for an isolated system).
☐ True ☐ False
9. Momentum equals mass times _____.

10. How does an airbag reduce the force on a passenger in a crash?
☐ by removing all the energy

- ☐ by adding momentum
- ☐ by reducing the change in momentum
- ☐ by making the stop take longer

AP Physics 11. **30000 kg · m/s**

$$p = mv = 1500 \times 20 = 30\,000 \text{ kg} \cdot \frac{\text{m}}{\text{s}}.$$

2. **momentum**

$$\vec{J} = \Delta\vec{p} - \text{impulse equals the change in momentum.}$$

3. **2 m/s**

$$\text{Before: } p = 2(3) = 6. \text{ After: } 3v = 6, \text{ so } v = 2 \frac{\text{m}}{\text{s}}.$$

4. **kinetic energy**

An elastic collision conserves **kinetic energy** as well as momentum.

5. **True**

$$\vec{p} = m\vec{v} \text{ points along the velocity; opposite directions give opposite signs.}$$

6. **10 N · s**

$$J = F\Delta t = 20 \times 0.5 = 10 \text{ N} \cdot \text{s}.$$

7. **isolated (no external net force)**

With no external net force, the internal forces cancel and total momentum stays constant.

8. **True**

Momentum is always conserved in an isolated collision. Kinetic energy is the quantity that distinguishes the two types.

9. **velocity**

$$\vec{p} = m\vec{v} - \text{mass times velocity.}$$

10. **by making the stop take longer**

The change in momentum is fixed. A longer stopping time Δt makes $F = \Delta p / \Delta t$ smaller.