

Momentum Quiz 1 Answer Key

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MOMENTUM QUIZ #1 (/15)

1. How much momentum (magnitude and direction) does an 80.0 kg mass have if it is traveling at 22 m/s North? (1 mark)

$$\vec{p} = m\vec{v} = (80)(22) = 1760 \text{ kg m/s @ North}$$

2. A motor bike has a mass of 220.0 kg. A constant force acts upon it for 58.0 s. The bike's initial velocity is 23 m/s South and its final velocity is 52 m/s South.

(a) What change in momentum (magnitude and direction) does it undergo? (1 mark)

$$\Delta\vec{p} = m\vec{v} - m\vec{v}_0 = (220)(52) - (220)(23) = 6380 \text{ kg m/s @ South}$$

(b) What is the magnitude of the force which acts upon it? (1 mark)

$$\Delta\vec{p} = \vec{F}at \rightarrow \vec{F} = \frac{\Delta\vec{p}}{t} = \frac{6380}{58} = 110 \text{ N}$$

3. (a) An 80.0 kg water skier moving forward at 18.0 m/s lets go of a towline. What is the magnitude of the impulse is needed to bring him to rest? (1 mark)

$$\Delta\vec{p} = m\vec{v}_f - m\vec{v}_0 = 0 - 80(18) = -1440 \text{ kg m/s}$$

(b) The impulse is provided by the water, exerting an average backwards force of 270 N on the skier. How long will it take for the skier to come to rest? (1 mark)

$$\Delta\vec{p} = \vec{F}t \rightarrow t = \frac{\Delta\vec{p}}{F} = \frac{-1440}{-270} = 5.33 \text{ s}$$

4. A ~~20~~^{.17 kg} g hockey puck is moving East at 22 m/s, when it is struck by a hockey stick. After the impact, the puck is moving West at 43 m/s.
- a) What impulse (magnitude and direction) did the stick give to the puck? (2 marks)

$$\Delta \vec{p} = m\vec{v}_f - m\vec{v}_i = (.17)(-43) - (.17)(22)$$

$$\Delta \vec{p} = -11.05 = 11.05 \text{ kg m/s @ W}$$

- b) If the stick is in contact with the puck for 0.025 s, what is the average force (magnitude and direction) applied by the stick? (2 marks)

$$\Delta \vec{p} = \vec{F}t \rightarrow \vec{F} = \frac{\Delta \vec{p}}{t} = \frac{-11.05}{.025} = -442$$

$$= 442 \text{ N @ West}$$

5. A 150 g baseball is thrown due east with an initial velocity of 39 m/s. It is struck by a bat, and rebounds due west. If the bat is in contact with the ball for 7.5×10^{-3} s, and the average force applied by the bat is 20400 N, find
- a) the impulse (magnitude and direction) given to the ball (2 marks)

$$\Delta \vec{p} = \vec{F}t = (-20400)(.0075) = -153$$

$$\Delta \vec{p} = 153 \text{ N}\cdot\text{s @ West}$$

- b) the final velocity (magnitude and direction) (3 marks)

$$\Delta \vec{p} = m\vec{v}_f - m\vec{v}_i$$

$$\vec{v}_f = \frac{\Delta \vec{p} + m\vec{v}_i}{m} = \frac{-153 + (.15)(39)}{.15} = -981 \text{ m/s} \dots$$

$$= 981 \text{ m/s @ West}$$

bad answer!
Unrealistic!

6. What is the impulse (magnitude and direction) of a 2500 kg truck traveling West with a constant velocity of 34 m/s? (1 mark)

$$\Delta \vec{p} = 0 \text{ kg m/s}$$