Long form answer key

Momentum – Unit 4, Ch. 10

PART A – MOMENTUM

1. A steel ball whose mass is 2.0 kg is rolling at a rate of 2.8 m/s. What is its momentum?

GIVEN	WORK
P=m*v m= 2.0kg v= 2.8m/s p= ???	P= 2.0kg * 2.8m/s = 5.6kg*m/s
ANSWER: 5.6kg*m/s	

2. A marble is rolling at a velocity of 1.5 m/s with a momentum of 0.10 kg·m/s. What is its mass?

GIVEN	WORK
P=m*v v= 1.5m/s p= 0.10kg*m/s m= ????	P=m*v If we divide both sides by 'v' we can solve for mass. **p/v = m*~~v/v~~** **p/v= m** **Therefore, we can solve by dividing the momentum by the velocity.** **0.10kg*m/s = mass of marble** **1.5 m/s**
ANSWER: 0.067kg or 0.07kg	

PART B – CONSERVATION OF MOMENTUM

3. Suppose you are playing ice hockey in the middle of a totally frictionless frozen pond. How can you move yourself to the edge of the pond? Remember that without friction, you won't be able to push against the ice. Explain what you would do and why it would work.

See short form for answer.

4. A 4.5-kg ham is thrown into a stationary 15-kg shopping cart. At what speed will the cart travel if the ham had an initial speed of 2.2 m/s?

BEFORE	AFTER
P_{ham}: 4.5kg * 2.2m/s = 9.9 kg*m/s **P_{cart}: 15kg*0m/s = 0kg*m/s** **$p_{Total} = p_{ham} + p_{cart}$** **$p_{Total}$ = 9.9kg*m/s + 0kg*m/s= 9.9kg*m/s** **p_{Total} =9.9kg*m/s**	-**We** know that the total p before has to equal the total p after. From the before calculations we know the total p is 9.9*m/s. -**We** also know that **Mass of ham + cart = 19.5kg** Therefore we know that … **$P_{ham+cart}$: 19.5kg * ?m/s = 19.5kg*m/s** We need to solve this equation to find the speed of cart (with the ham inside). We know now that p=m*v so, Solve for velocity by dividing both sides by 19.5kg and we get…
ANSWER: 0.51m/s	

5. A 6-kg bowling ball rolling at 5 m/s strikes a stationary 4-kg bowling ball. If Ball #1 is moving **forward** at 2 m/s after the collision, what is the speed and direction of Ball #2?

BEF	AFTER
$p_{Ball\ 1}$: 6kg * 5m/s = 30 kg*m/s **$p_{Ball\ 2}$: 4kg*0m/s = 0kg*m/s** **p_{Total} = $p_{Ball\ 1}$ + $p_{Ball\ 2}$** **p_{Total} = 30kg*m/s + 0kg*m/s= 30kg*m/s** **p_{Total} =30kg*m/s**	**$p_{Ball\ 1}$: 6kg * 2m/s = 12 kg*m/s** We know that the total p before has to equal the total p after. From the before calculations we know the total p is 30kg*m/s. We also know that Ball 1 has a 'p' of 12kg*m/s after. Therefore, **p_{Total} MINUS $p_{Ball\ 1}$ EQUALS $p_{Ball\ 2}$** **30kg*m/s - 12kg*m/s= 18kg*m/s** We still need to find the speed of ball #2. We know now that p=m*v so, **$p_{Ball\ 2}$: 4kg * $velocity_{after}$ = 18kg*m/s** Solve for velocity by dividing both sides by 4kg and we get…
ANSWER: 4.5m/s forward	

6. Make two event chains showing what happens when a rolling ball (Ball 1) hits a resting ball (Ball 2). Use the phrases: *gains momentum, hits Ball 2, is hit by Ball 1, loses momentum, rests, rolls, slows down, starts rolling.*