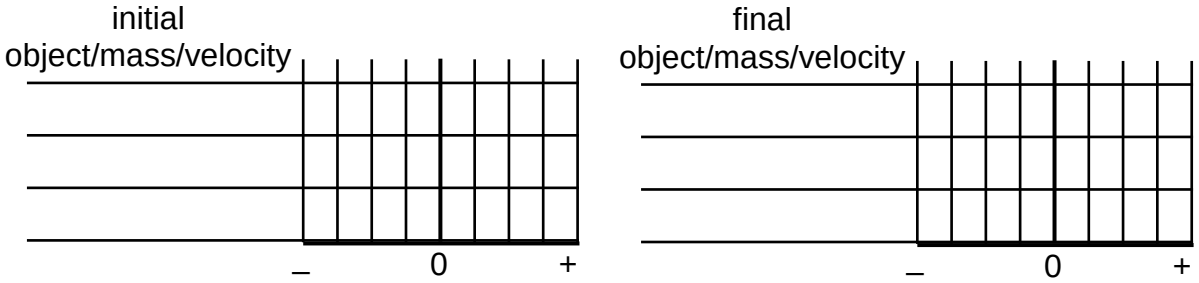
Name_____

Date_____ **Pd**____

IB Physics Unit 10 Review

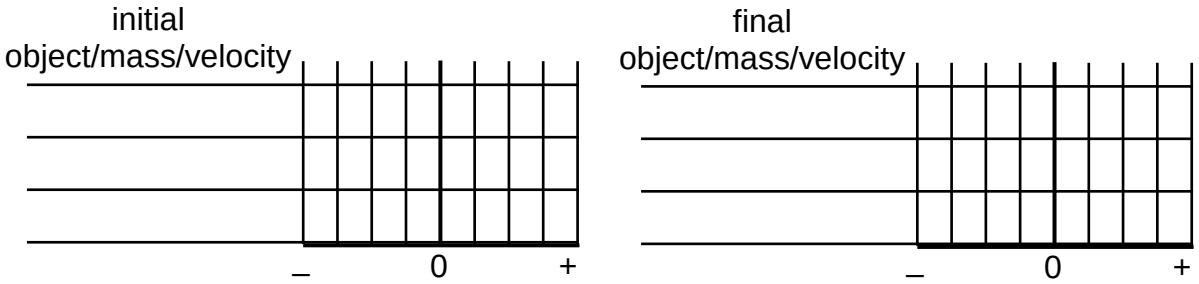
1. A ball of mass 3.0 kg, moving at 2.0 m/s eastward, strikes head-on a ball of mass 1.0 kg that is moving at 2.0 m/s westward. The balls stick together after the impact. Complete the momentum conservation diagram. What is the magnitude and direction of the velocity of the combined mass after the collision?

event:



2. One way of measuring the muzzle velocity of a bullet is to fire it horizontally into a massive block of wood placed on a cart. Assuming no friction, we then measure the velocity with which the wood containing the bullet and cart begin to move. In one experiment the bullet had a mass of 7.5 g and the wood and its cart had a mass of 5.0 kg. After the shot, the cart, wood, and bullet moved at a constant speed, traveling 2.4 m in 4.0 s. From these data, complete a momentum conservation diagram and determine the original speed of the bullet.

event:



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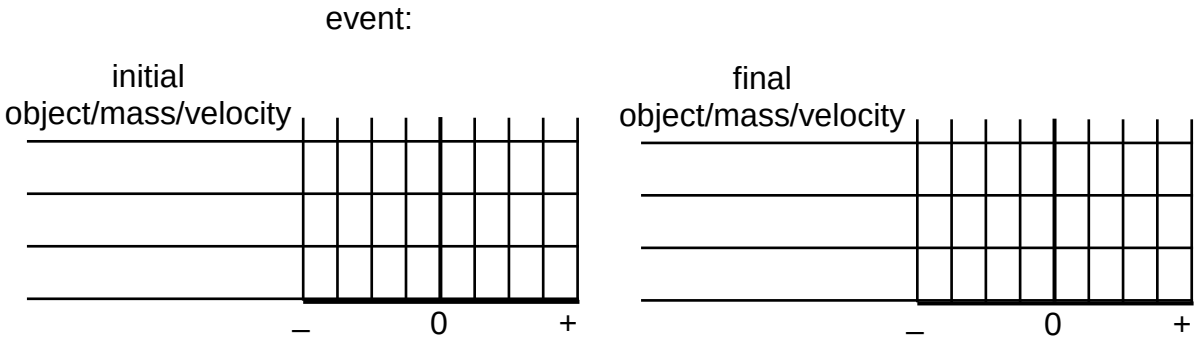
3. A raft of mass 180 kg carries two swimmers of mass 50. kg and 80. kg. The raft is initially floating at rest. The two swimmers simultaneously dive off opposite ends of the raft, each with a horizontal velocity of 3.0 m/s. Complete the momentum conservation diagram and determine the final velocity and direction the raft.

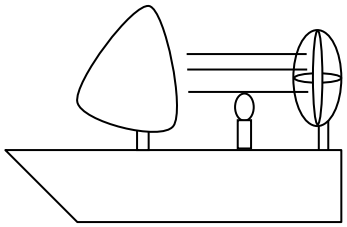


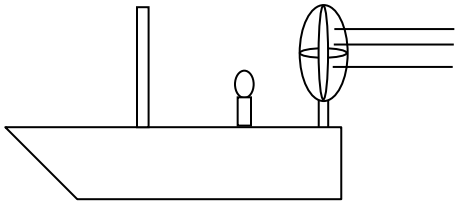
4. Comment on the advisability of attempting to jump from a rowboat to a dock that seems just within jumping distance.

5. a. Why is it difficult for a fire-fighter to hold a hose that ejects large amounts of high-speed water?

   b. Calculate the force needed to hold a 6.0 cm diameter fire hose in place when the water flow rate is 110 m^3/hour. (density of water: 1000 kg/m^3)

6. A sailboat is stalled on a lake on a windless day. The skipper's only piece of auxiliary equipment is a large fan, which can either be set up to blow air into the sail or the fan can be pointed the off of the back of the boat with the sail taken down. Will either technique get the boat to shore? Which technique would work best? Explain your answer in terms of impulse and momentum.



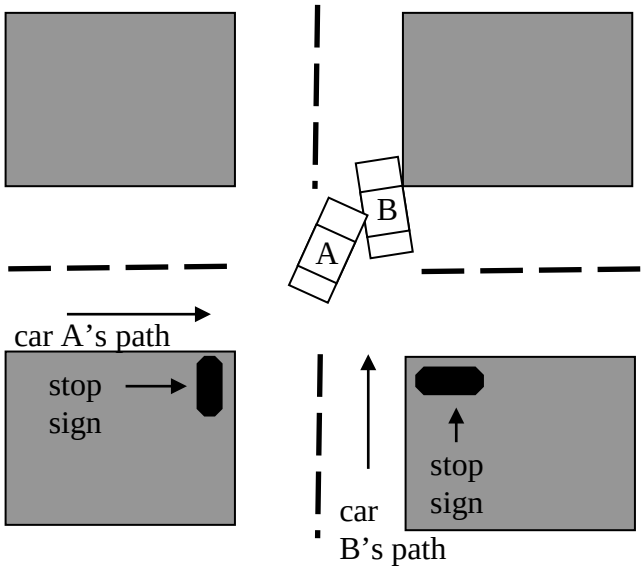


7. a. When a bug smacks into your windshield, which gets hit harder, the bug or the windshield? Justify your answer.

b. Which will experience the greatest change in momentum? Justify your answer.

c. Which will experience the greatest acceleration? Justify your answer.

8. Accident investigators come upon the following scene involving a collision between two cars of similar mass. Both drivers had intended to travel through the intersection without turning.



Driver A says that after stopping at the stop sign and then proceeding, car B ran the stop sign so there was no time to stop before hitting the side of car B.

Driver B says that after stopping at the stop sign and then proceeding, car A came out of nowhere, evidently running the stop sign and T-boning car B.

a. Which car ran the stop sign? Explain your answer in terms of our momentum studies.

b. Sketch a picture of how the cars would have come to rest had the driver's story that ran the stoplight been true.

c. Briefly explain why the cars end up where you drew them.