Name: _____ Date: _____

Momentum & Collisions
Impulse—Changes in Momentum #1

Part 1: Calculate impulse using force and contact time. The units for impulse are the same as units for momentum: kg·m/s. Show your work in the boxes.

$$J = \Delta p = F \cdot t$$

1. Ralph hit the tennis ball with a force of 12 N. The contact time between the racquet and the tennis ball was 0.40 seconds. Calculate the impulse by the tennis ball.

2. The car accidentally crashed into wall. (No one was inside the car). It took the car 0.8 seconds to come to a complete stop when it hit the wall. The pushback force of the wall on the car was -16,000 N. Calculate the impulse of the car.

3. Shandra kicked the soccer ball with a force of 25 N. The contact time between her shoe and the soccer ball was 0.32 seconds. Calculate the impulse of the soccer ball.

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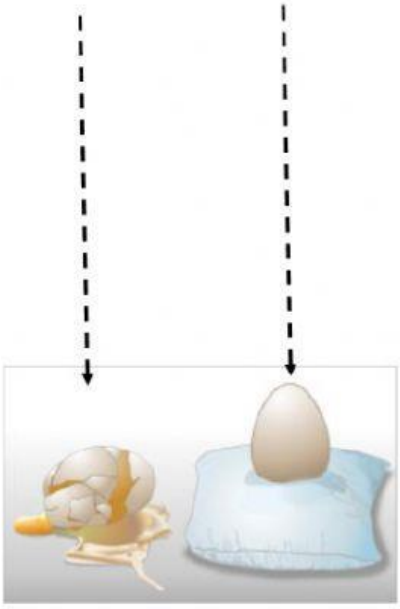
Part 2: Calculate the force acting upon the body. Force is reported in units of Newtons (N). Calculate force as the impulse divided by the contact time.

$$F = \frac{J}{t} = \frac{\Delta p}{t}$$



4. Two identical eggs were dropped from 3 meters above the floor at the same time.

- Egg #1 impacted a tile floor.
- Egg #2 fell into a pillow.

Both eggs impacted the floor and pillow moving at the same downward speed and came to rest. The impulse of both eggs was the same at 2.4 kg·m/s, but the stop times were different.

Egg #1 came to rest in 0.10 second (splat).
Egg #2 came to rest in 0.80 second (no splat).

Calculate the force of impact on Egg #1.

Calculate the force of impact on Egg #2.

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5. At the safety lab, crash tests are done on new automobiles to evaluate airbag effectiveness. During a test crash, the crash test dummy's upper body was cushioned by the inflatable airbag and came to rest in 0.90 seconds. The dummy's impulse was 630 kg·m/s. Calculate the force of the dummy's body on the airbag.

6. The safety lab did the same crash test on the same dummy, but the car did not have an airbag. The upper body of the dummy hit the steering wheel and came to rest in 0.15 seconds. The dummy's impulse was the same at 630 kg·m/s. Calculate the force of the dummy's body on the steering wheel.

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