

### Newton's 2nd Law Worksheet

**Objectives:**

- Understand acceleration in terms of a changing velocity.
- Understand acceleration in terms of a constant net force.
- Understand the motion of an object rolling down a varying slope in terms of velocity and acceleration.

1. Use the following definitions to answer the questions below:

$$\text{acceleration} = \frac{\text{change in velocity}}{\text{time}}$$

$$\text{acceleration} = \frac{\text{net force}}{\text{mass}}$$

Two people with the same mass of 50 kg are riding in a pickup truck at 20 m/s. They are brought to an abrupt stop in a head-on collision with a drunk driver who has crossed the divider line. One person wears a seat belt and is brought to a stop in 0.10 seconds. The other is not wearing a seat belt and is brought to a halt by the dashboard in 0.01 seconds.

- a. What is the deceleration of the person who comes to a stop wearing the seatbelt?
- b. How much average force is exerted by the seatbelt to bring the first person to a stop?
- c. What is the deceleration of the person who comes to a stop by hitting the dashboard?
- d. How much average force is exerted by the dashboard on the second person?

2. A ball rolls down a constant slope ramp. Describe the force that acts on the ball causing it to accelerate down the ramp.



3. (Circle the correct answer) The acceleration of the ball rolling down the constant sloped ramp is

(decreasing)                      (constant)                      (increasing)

If the ramp is made to be steeper, the acceleration is

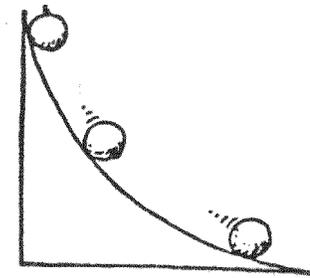
(more)                      (the same)                      (less)

When the ball reaches the bottom and rolls along a smooth level frictionless surface it

(continues to accelerate)                      (does not accelerate)

4. When a ball rolls down this ramp of varying slope, the ball's acceleration is greater

(at the top)                      (at the middle)  
(at the bottom)                      (same everywhere)



In this special case, the speed is greatest when the acceleration is

(greatest)                      (least)

5. In the box at the right, sketch a ramp on which the acceleration of the ball will be very little at the top and progressively greater as it moves down the ramp.

