

## **PHYS 1200 Physics of Everyday Experience**

### **Review questions and exercises for Lecture 3 (M-2)**

1. Define acceleration
  2. What do we mean when we say that gravity is a non-contact force?
  3. What is the difference between mass and weight?
  4. What conclusions did Galileo reach concerning free fall?
  5. What is the weight of an object of mass 150 kg on earth?
  6. What is the mass of an object that weighs 2000 N on earth?
  7. An object is dropped from rest from the top of a tall building. Make a table showing the velocity of the object for each second that it falls up to 10 seconds.
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**Answers and Solutions** (Try to answer the questions before reading the solutions.)

1. Acceleration ( $a$ ) is the rate at which the velocity of an object changes with time; it is the time rate of change of velocity. If an object has a velocity  $v_1$  at time  $t_1$ , and its velocity changes to  $v_2$  at time  $t_2$  then over this time interval its acceleration is  $a = \frac{v_2 - v_1}{t_2 - t_1}$ .

Acceleration is measured in units of velocity divided by time, or (m/s) per sec. or  $\text{m/s}^2$ .

As an example, suppose an object starting from rest, accelerates to 20 m/s in 5 s. Its

acceleration is then  $a = \frac{20 \text{ m/s} - 0}{5 \text{ s} - 0} = \frac{20 \text{ m/s}}{5 \text{ s}} = 4 \text{ m/s}^2$ .

2. Non-contact forces are forces exerted by one body on another even though the bodies are not in physical (touching) contact. The force of gravity of the earth acts on every object near it even if the object is not on the ground.
3. Mass ( $m$ ) is the measure of the inertia of an object; weight ( $w$ ) is the force of gravity on an object. Mass and weight are related by  $w = mg$ , where  $g$  is the acceleration due to gravity.
4. Galileo observed that, in the absence of air resistance, all objects, regardless of their mass, fall to earth with the same acceleration.
5.  $w = mg = 150 \text{ kg} \times 10 \text{ m/s}^2 = 1500 \text{ N}$  ( $1 \text{ kg m/s}^2 = 1 \text{ N}$ ).
6. Since  $w = mg \rightarrow m = w/g$ , so  $m = 2000 \text{ N} / (10 \text{ m/s}^2) = 200 \text{ kg}$ .
7. If the velocity at  $t = 0 \text{ s}$  is 0 m/s, then at any later time,  $t$  its velocity is  $v = gt$ . You can make the table on your own.