Week 2

Detailed learning goals

By completing this topic, you should be able to:

- Calculate displacement of an object that is not accelerating, given initial position and velocity.
- Calculate final velocity of an accelerating object, given initial velocity, acceleration, and time.
- Calculate displacement and final position of an accelerating object, given initial position, initial velocity, time, and acceleration.
- Apply problem-solving steps and strategies to solve problems of one-dimensional motion.
- Apply strategies to determine whether or not the result of a problem is reasonable, and if not, determine the cause.
- Explain the concepts of free fall and free-fall acceleration.
- Solve free fall problems using the kinetic equations.

Prescribed readings for SLE123 content

Please read the following sections from Giambattista Physics (5th ed.). New York: McGraw-Hill:

- Section 2.5 Kinematic Equations for Motion Along a Line with Constant Acceleration.
- Section 1.7 Problem-Solving Techniques.
- Section 2.6 Free Fall.

SLE123 – Week 2 – practice questions :

1) A rock falls from a 30 m cliff. (Assume g = 9.8 m/s^2)
   a) How long will it take to fall?
   b) At what speed will it hit the ground?

2) A cross-country skier is skiing along at 8.0 m/s. She stops pushing and simply glides along, slowing to a reduced speed of 6.0 m/s after gliding for 5.0 m. What is the magnitude of her acceleration as she slows?

3) Formula One racers speed up much more quickly than normal passenger vehicles, and they also can stop in a much shorter distance. A Formula One racer travelling at 100 m/s can stop in a distance of 150 m. What is the magnitude of the car's acceleration as it slows during breaking?

4) An eagle accelerates at 5 m/s^2 from rest for 90 m. How fast is it going after 90 m? What is this in km/h?

5) A gannet is a seabird that fishes by diving from a great height. If a gannet hits the water at 32 m/s (which they do), what height did it dive from? Assume that the gannet was motionless before starting its dive?

More questions for practice: **(Assume g = 10 m/s^2)**

1.1 A dog chasing a ball starts at rest and accelerates uniformly over a distance of 5 meters. It takes the dog 1 s to cover that first 5 m. What is the dog's acceleration, and what speed is the dog travelling when it reaches the 5 m point? Answer: a = 10ms^{-2}, *speed* = 10ms^{-1}

1.2 During a particular car crash, it takes just 0.18 s for the car to come to a complete stop from 50 kmh^{-1}.
(a) At what rate is the car accelerating during the crash?
(b) How many times larger than the acceleration due to gravity is this?
Answer: (a) 77ms^{-2} (b) 7.7×g

1.3 A jogger starting their morning run accelerates from a standstill to their steady jogging pace of 8.0 kmh^{-1}. They reach a speed of 8.0 kmh^{-1}, 5 s after starting. How long does it take the jogger to reach the end of their 20 m driveway? Answer: 12 s

1.4 A driver in a blue car travelling at 50 km h^{-1} sees a red car approaching in his rear-view mirror. The red car is travelling at 60 kmh^{-1} and is 30 m behind the blue car when first spotted.
(a) How many seconds from the time the driver of the blue car first noticed it until the red car passes the blue car?
(b) How much farther down the road will the blue car travel in this time?
Answer: t = 11 s, d = 150m