Physics 01-04 Acceleration and Graphs **Name: _______________**

More about Acceleration

- Acceleration is how quickly __________ is changing.

$$a = \frac{\Delta v}{\Delta t} = \frac{v - v_0}{t - t_0}$$

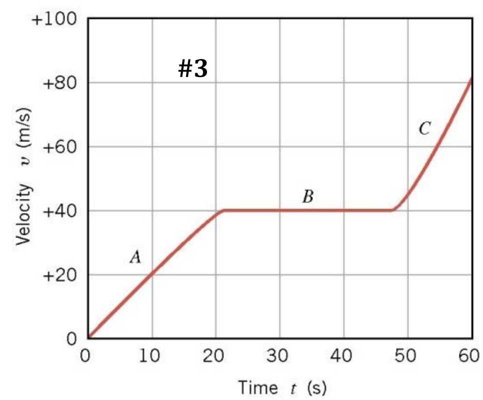
$$v = at + v_0$$

- Acceleration is the __________ of a ___________ vs time graph.
- Acceleration is a ___________ (has direction).
- If the velocity and acceleration are the same direction, then the object ____________________ speed.
- If the velocity and acceleration are in opposite directions, then the object _____________________ speed.
- If there is constant acceleration
    - The graph of position–time is __________________ ($x = \frac{1}{2}at^2 + v_0 t + x_0$ is quadratic)
    - The graph of velocity–time is _______________ ($v = at + v_0$ is linear)

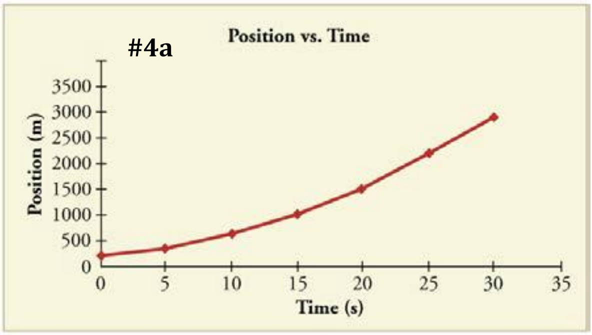
A dropped object near the earth will accelerate downward at 9.8 m/s². (Use -9.8 m/s².) If the initial velocity is 1 m/s downward, what will be its velocity at the end of 3 s? Is it speeding up or slowing down?

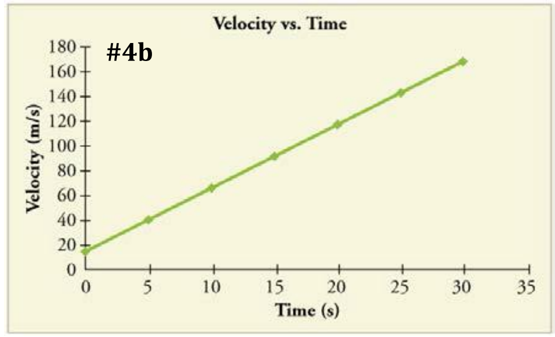
Homework

1. (a)Draw a quick sketch of velocity–time graph of a ball being thrown up so that it goes up, then comes back down. (b) Describe the graph using mathematical terms.
2. One way to find the acceleration due to gravity is to graph the position–time of a dropped object. How could you use the position–time graph to find constant acceleration?
3. A snowmobile moves according to the velocity–time graph shown in the drawing. What is the snowmobile's average acceleration during each of the segments A, B, and C? (Cutnell 2.59) **2 m/s², 0 m/s², 3.8 m/s²**

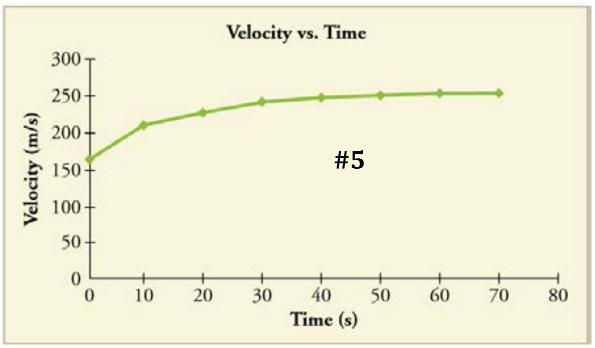


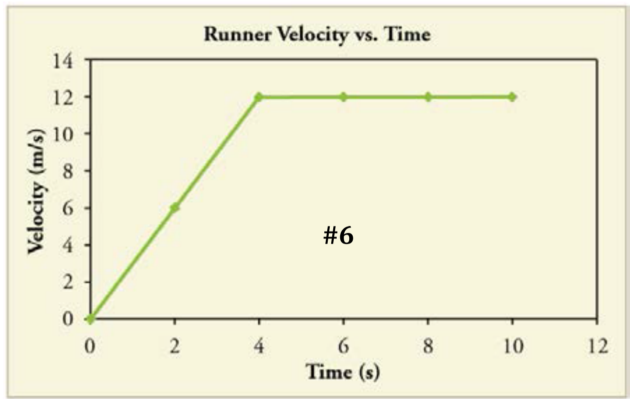
4. (a) By taking the slope of the curve in the position–time graph, verify that the velocity of the jet car is 115 m/s at t=20 s. (b) By taking the slope of the curve at any point in the velocity–time graph, verify that the jet car's acceleration is 5.0 m/s^2. (OpenStax 2.59)





5. By taking the slope of the curve in graph, verify that the acceleration is 3.2 m/s^2 at t=10 s. (OpenStax 2.62)





6. A graph of v(t) is shown for a world-class track sprinter in a 100-m race. (a) What is his average velocity for the first 4 s? (b) What is his instantaneous velocity at t=5 s? (c) What is his average acceleration between 0 and 4 s? (d) What is his time for the race? (OpenStax 2.65) **6 m/s, 12 m/s, 3 m/s^2, 10 s**

7. If a car is accelerating in the positive direction and is currently moving in the negative direction, (a) is it speeding up or slowing down? (b) How about if the acceleration is positive and the velocity is positive?

8. A cheetah can accelerate from rest to a speed of 30.0 m/s in 7.00 s. What is its acceleration? (OpenStax 2.16) **4.29 m/s^2**

9. Dr. John Paul Stapp was U.S. Air Force officer who studied the effects of extreme deceleration on the human body. On December 10, 1954, Stapp rode a rocket sled, accelerating from rest to a top speed of 282 m/s (1015 km/h) in 5.00 s, and was brought jarringly back to rest in only 1.40 s! Calculate his (a) acceleration and (b) deceleration. Express each in multiples of g (9.80 m/s^2) by taking its ratio to the acceleration of gravity. (OpenStax 2.17) **56.4 m/s^2, 5.76 g, -201 m/s^2, 20.6 g**

10. A motorcycle has a constant acceleration of 2.5 m/s^2. Both the velocity and acceleration of the motorcycle point in the same direction. How much time is required for the motorcycle to change its speed from (a) 21 to 31 m/s, and (b) 51 to 61 m/s? (Cutnell 2.13) **4.0 s, 4.0 s**

11. A runner accelerates to a velocity of 5.36 m/s due west in 3.00 s. His average acceleration is 0.640 m/s^2, also directed due west. What was his velocity when he began accelerating? (Cutnell 2.15) **3.44 m/s W**