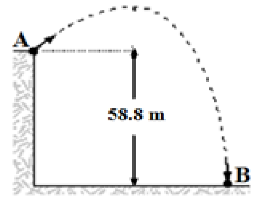
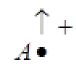
Q4. A stone is thrown outward from point A at the top of a 58.8 m high cliff with an upward velocity component of 19.6 m/s (see **Figure 2**). Assume that it lands on the ground, at point B, below the cliff, and that the ground below the cliff is flat. How long was the stone in the air? [Neglect the air resistance].

Figure 2



A) 6.00 s
B) 5.00 s
C) 4.00 s
D) 7.00 s
E) 8.00 s

Ans: Take A is origin of the coordinates and the upward direction is positive 

. Then

$$v_{yo} = 19.6 \text{ m/s}, \; y_B = -58.8 \text{ m}, \; g = -9.8 \text{ m/s}^2$$

Use the equation

$y_B = v_{yo}t + \frac{1}{2}gt^2$ to have $-58.8 = 19.6t + \frac{1}{2}(-9.8)t^2$,which has the solutions:

$t = 6\text{s}, \; -2\text{s}$

Q5. Figure 3 illustrates the motion of a particle starting from rest and moving along an x-axis with a constant acceleration. The figure's vertical scaling is set by x_s = 12 m. The particle's acceleration is

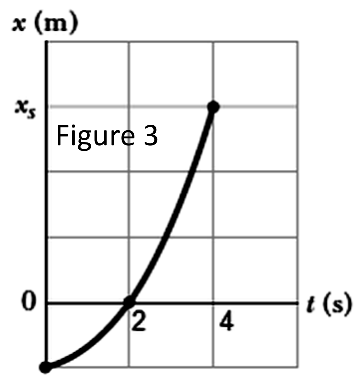
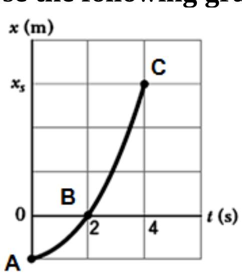


Figure 3

A) 2.0 m/s^2
B) 0.50 m/s^2
C) – 6.0 m/s^2
D) 6.0 m/s^2
E) –3.0 m/s^2

Ans:

First method	**Second method**
Use the following graph:  $x_A = -4$ m, $\quad t_A = 0,$ $x_B = 0$ m, $\quad t_A = 2,$ Then, use the equation $x_B - x_A = v_{iA}t + \frac{1}{2}at^2$ $0 - (-4) = 0 \times 2 + \frac{1}{2}a(2)^2 \Rightarrow a = 2m/s^2$	**with** v_0 as unknown: $x - x_0 = v_0 t + 1/2\,(a)t^2$ From the figure x_0 =– 4 at t= 2 0– (–4)=2v_0+2a v_0+a= 2 (1) $at\ t = 4$ 12– (– 4)) = $4v_0 + 8a$ $v_0 + 2a = 4$ (2) *From* (1) *and* (2) $\quad a$ $= 2\,m/s^2$ #

Q15. A particle is moving along an x-axis with a constant acceleration of –3.0 m/s^2. The velocity of the particle is given by the equation *v* (t) = 4.0 – 3.0t, where *v* is in m/s and t is in seconds. Find the displacement of the particle during the time interval t = 0 to t = 2.0 s.

A) 2.0 m
B) 2.8 m
C) 1.4 m
D) 3.1 m
E) 7.7 m

Ans:

First method	**Second method**
$displacement = x_2 - x_o = v_o t + \frac{1}{2}at^2$ $= (4)(2) + \frac{1}{2}\left(-3\frac{m}{s^2}\right)(2s)^2 = 2\,m$	$v_f^2 = v_i^2 + 2a\Delta x \Rightarrow \Delta x = \frac{v_f^2 - v_i^2}{2a};\ v_f = v(t = 2.0\ s);\ v_i = v(t = 0\ s)$ $v_f(t = 2.0) = 4.0 - 3t = 4 - 6 = -2m/s$ $v_i(t = 0) = 4$ $\Delta x = \frac{(-2)^2 - (4)^2}{2 \times (-3.0)} = \frac{-12}{-6.0} = 2.0\ m$