ABRHS PHYSICS (CP) NAME: KEY

1D Motion Problems Review

Equations

$\bar{v} = \frac{d}{t}$ $a = \frac{v_f - v_i}{t}$ $\bar{v} = \frac{v_f + v_i}{2}$ $d = v_i t + \frac{1}{2} a t^2$ $v_f = v_i + at$

Constant Velocity

1. A car has a constant velocity of 25 m/s for 30 seconds. How far does it travel?

$V = \frac{d}{t}$ $25 = \frac{d}{30}$ $d = (25)(30) = 750 \text{ m}$

2. A person walking with a constant velocity travels 300 meters in 7 minutes. What was their velocity?

$(7 \text{ min})\left(\frac{60 \text{ s}}{1 \text{ min}}\right)$ $\rightarrow t = 420 \text{ s}$

$V = \frac{d}{t}$ So $V = \frac{d}{t} = \frac{300}{420} = 0.71 \text{ m/s}$

3. A bird flies 50 meters at a constant speed of 2 m/s. How long did it take?

$V = \frac{d}{t}$ $2 = \frac{50}{t}$ $2t = 50$ $t = 25 \text{ s}$

Constant Acceleration (Vertical Motion)

4. A ball is dropped from a height of 2 meters.
   a. How long does it take to fall?

$y = \frac{1}{2} a t^2 + v_i t$ $y = -2$, $a = -10$, $v_i = 0$

$-2 = \frac{1}{2}(-10)t^2 + (0)t$

$-2 = -5t^2$

$t^2 = .4$

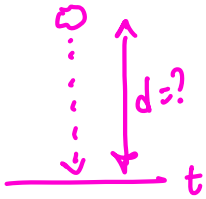
$t = 0.63 \text{ s}$

   b. How fast is it going just as it hits the ground?

$V = at + v_i$ $V = (-10)(.63) + 0$ $V = -6.3 \text{ m/s}$

5. A rock is dropped and falls for 2.5 seconds.
   a. How far does it fall?

$t = 2.5$ seconds, $v_i = 0$ m/s, $a = -10 \text{ m/s}^2$



$d = \frac{1}{2} a t^2 + v_i t$ most general

$y = \frac{1}{2} a t^2 + v_i t$ v_{y_i}

$y = \frac{1}{2}(-10)(2.5)^2 + (0)(2.5)$

$y = (-5)(6.25)$

$y = -31.25 \text{ m}$

   b. How fast is it going just as it hits the ground?

$V = at + v_i$

$V_y = at + v_{y_i}$

$V_y = (-10)(2.5) + 0$

-25 m/s

$+\uparrow$ $-\downarrow$

1D Motion Problems Review

6. A ball is dropped from a height of 0.75 meters.
   a. How long does it take to fall?

$y = \frac{1}{2}at^2 + v_i t$ $\quad y = -.75\ m$, $a = -10\ m/s^2$, $v_i = 0\ m/s$

$-.75 = \frac{1}{2}(-10)t^2$

$-.75 = -5t^2$

$t^2 = 0.15$

$t = 0.39\ s$

   b. How fast is it going just as it hits the ground?

$v = at + v_i = (-10)(.39) + 0$

$v = -3.9\ m/s$

7. A ball is launched straight up with an intial velocity of 15 m/s.
   a. How long does it take to reach its maximum height?

$v_i = 15\ m/s$, $a = -10\ m/s^2$ $\quad v = 0$ (@ Max Height) $\quad \therefore v = at + v_i$

$0 = -10t + 15$

$10t = 15$

$t = 1.5\ s$

   b. How long does it take to reach the ground?

Since $t_{up} = t_{down}$ (↑ ↓)

$1.5 + 1.5 =$ 3 s

   b. What was its maximum height?

$y = \frac{1}{2}at^2 + v_i t$ $\quad v_i = 15\ m/s$, $t = 1.5\ s$, $a = -10\ m/s^2$

$y = \frac{1}{2}(-10)(1.5)^2 + (15)(1.5)$

$y = -11.25 + 22.5$

$y = 11.25\ m$

8. Another ball is launched straight up in the air and takes 3 seconds to reach its maximum height.
   a. What was its initial velocity?

To max height $v_f = 0\ m/s$, $t = 3\ s$

$v = at + v_i$

$0 = -10(3) + v_i$

$0 = -30 + v_i$

$v_i = 30\ m/s$

   b. How long does it take to reach the ground?

3 seconds up, so 3 seconds down

so 6 s

   b. What was its maximum height?

$y = \frac{1}{2}at^2 + v_i t$

$v_i = 30\ m/s$, $a = -10\ m/s^2$, $t = 3\ s$

$y = \frac{1}{2}(-10)(3)^2 + (30)(3)$

$= -45 + 90$

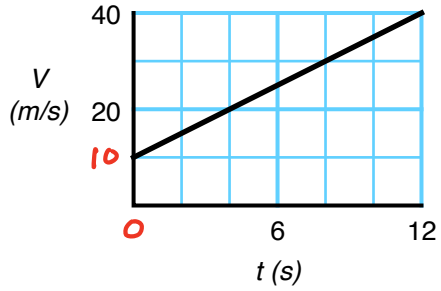
$= 45\ m$

1D Motion Problems Review

Motion Graphs

When you see a graph that has a straight line, you know that something has to be constant. In each of the following graphs, determine what is constant (position, velocity or acceleration) and its value.

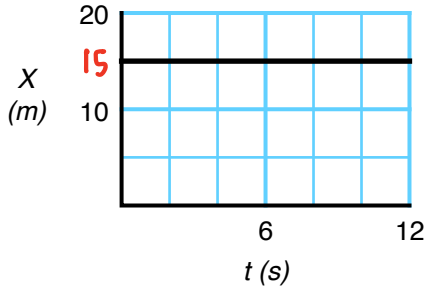
9.



acceleration is constant

$a = \text{slope} = \frac{40-10}{12-0} = \frac{30}{12} = 2.5\ m/s^2$

10.

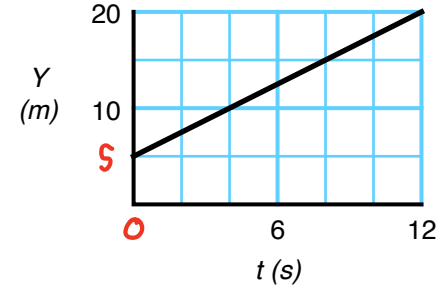


position is constant

(so velocity is constant 0 m/s)

$X = 15\ m$

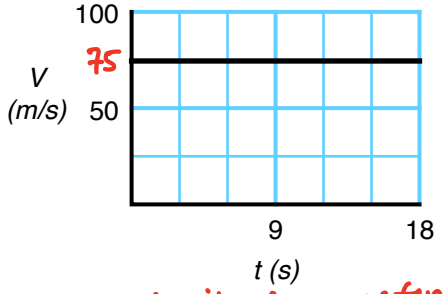
11.



velocity is constant

$v = \text{slope} = \frac{20-5}{12-0} = \frac{15}{12} = 1.25\ m/s$

12.

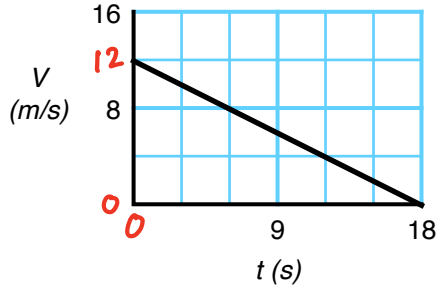


velocity is constant

(so acceleration is constant 0 m/s^2)

$v = 75\ m/s$

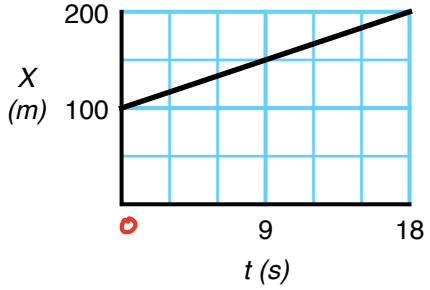
13.



acceleration is constant

$a = \text{slope} = \frac{0-12}{18-0} = -0.75\ m/s^2$

14.

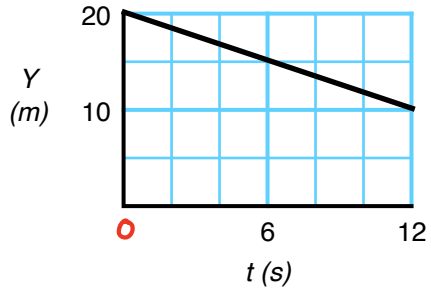


velocity is constant

$v = \text{slope} = \frac{200-100}{18-0} = 5.56\ m/s$

1D Motion Problems Review

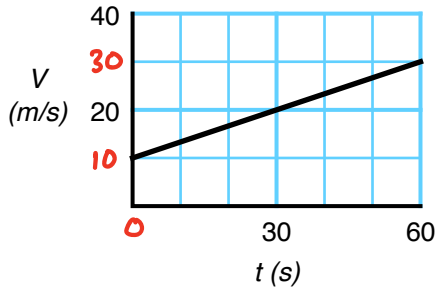
15.



velocity is constant

$v = \text{slope} = \frac{10-20}{12-0} = -0.83\ m/s$

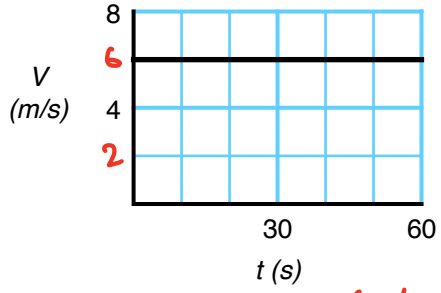
16.



acceleration is constant

$a = \text{slope} = \frac{30-10}{60-0} = 0.33\ m/s^2$

17.

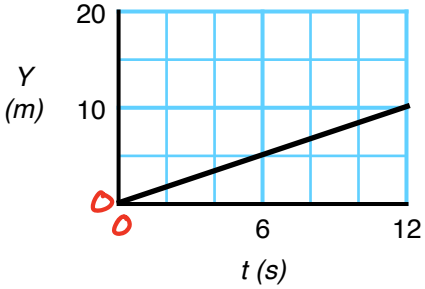


velocity is constant

(so acceleration is constant $0\ m/s^2$)

$v = 6\ m/s$

18.



velocity is constant

$v = \text{slope} = \frac{10-0}{12-0} = 0.83\ m/s$

Answers:

1) 750 m *2) 0.71 m/s* *3) 25 s*

4. a) 0.63 s b) -6.3 m/s *5. a) 31.3 m b) -25 m/s*

6. a) 0.39 s b) -3.9 m/s *7. a) 1.5 s b) 3 s c) 11.25 m*

8. a) 30 m/s b) 6 s c) 45 m *9) acceleration, 2.5 m/s²*

10) position, 15 m *11) velocity, 1.25 m/s* *12) velocity, 75 m/s*

13) acceleration, –0.75 m/s² *14) velocity, 5.56 m/s* *15) velocity, –0.83 m/s*

16) acceleration, 0.33 m/s² *17) velocity, 12 m/s* *18) velocity, 0.83 m/s*