College Physics 1

Uniform Accelerated Motion Worksheet

Please write your answer in the corresponding blank for each assigned problem. When a problem requires work to solve, please show all work next to that corresponding problem. In order to gain proper credit, all corresponding work (if applicable) must be shown to the right of and/or below the corresponding answer blank. ***All responses should ALWAYS take into account significant figures and proper applicable units.***

3SF

K.m.S

1. A race car starting from rest accelerates at a constant rate of 4.00 m/s^2. **(a)** What is the velocity (in m/s) of the car after it has traveled 3.00 x 10^2 ft? **(b)** How much time has elapsed (in seconds)? Calculate the average velocity (in m/s) using **(c)** equation 2.2 and **(d)** equation 2.7

(a) 27.0 m/s

(b) 6.75 s

(c) 13.5 m/s

(d) 13.5 m/s

3SF

2. A car traveling at a constant speed of 23.5 m/s passes a trooper hidden behind a billboard (*as in lecture Figure 2.17*). One second after the speeding car passes the billboard, the trooper sets off in chase with a constant acceleration of 3.10 m/s^2. **(a)** How long (in seconds) does it take the trooper to overtake the speeding car? **(b)** How fast (in m/s) is the trooper going at that time?

(a) t=16.1 s

(b) V=49.4 m/s

3. A jetliner lands at a speed of 1.56×10^2 mi/h and decelerates at the rate of 4.75 m/s^2. If the plane travels at a constant speed of 1.56×10^2 mi/h for 1.30 s after landing before applying the brakes, what is the **(a)** total displacement (in meters) of the aircraft between touchdown on the runway and coming to rest?

3SF

(a) 602m

4. A ball is thrown from the top edge of a building with an initial velocity of 15.8 m/s straight upward, at an initial height of 65.0 m above the ground. The ball just misses the edge of the roof on its way down (*as shown similarly in lecture Figure 2.20, but with different measurements*). Determine **(a)** the time needed for the ball to reach its maximum height (m), **(b)** the maximum height (m), **(c)** the time (s) needed for the ball to return to the height from which it was thrown and the **(d)** the velocity (m/s) of the ball at this point, **(e)** the time (s) needed for the ball to reach the ground, and **(f)** the velocity (m/s) and **(g)** position (m) of the ball after a total of 4.68 seconds (Σt = 4.68 s) have elapsed since the initial release.

3SF

(a) $t = 1.61s$

(b) $\Delta y = 12.7m$

(c) $t = 3.22s$

(d) $V = -15.8$ m/s

(e) $t = 5.59s$

(f) $V = -39.0$ m/s

(g) $\Delta y = -33.4$ m

1.

35F

kg · m · s

$x = \cancel{300ft}$ 91.4m

$a = 4.00 m/s^2$

$t = 6.75$ s

$V = 27.0$ m/s

$V_0 = 0$ m/s

$\bar{V} =$

$\frac{300 ft}{1} \cdot \frac{.3048 m}{1 ft} = 91.44 m$ 91.4m

A) $V^2 = V_0^2 + 2ax$

$V = \sqrt{0^2 + 2(4.00 m/s^2)(91.4m)}$

$8 \cdot 91.4$

$V = 27.04 = 27.0$ m/s

B) ~~$x = V_0 t + \frac{1}{2} a t^2$~~

$V_x = V_{0x} + a_x t$

$-V_{0x}$

$\frac{V_x - V_{0x}}{a_x} = \frac{a_x t}{a_x}$

$t = \frac{V_x - V_{0x}}{a_x}$

$t = \frac{27 m/s - 0 m/s}{4 m/s^2}$ $t = 6.75$ s

C.

$\bar{V} = \frac{V_0 + V}{2} = \bar{V} = \frac{0 m/s + 27 m/s}{2}$

$\bar{V} = 13.5$

$D = \bar{V} = \frac{X_f - X_i}{t_f - t_i}$ $\frac{91.4m - 0}{6.75s - 0} =$

$\frac{27 - 0}{6.75s - 0} = \frac{27 m/s}{6.75 s}$ 13.5 m/s

35F

2. car

$x_0 = 23.5$ m/s
$a = 0$ m/s^2
$t = 16.1$ s
$v =$
$v_0 = 23.5$ m/s
$\bar{v} = 23.5$ m/s

trooper

$x_0 = 0$ m (at 1s)
$a = 3.10$ m/s^2
$t = 16.1$ s
$v =$
$v_0 = 0$ m/s
$\bar{v} =$

A p1 $\Delta x_{car} = \Delta x_{car} - x_{0\,car} = v_0 t + \frac{1}{2} a t^2$

$$\Delta x - 23.5 \text{ m/s} = 23.5 \text{ m/s } t + \cancel{\tfrac{1}{2}(0)t^2}$$
$$+23.5 \text{ m/s} \quad +23.5 \text{ m/s}$$
$$\Delta x = 23.5 \text{ m/s } t + 23.5 \text{ m/s}$$

Ap2

$$\Delta x_{trooper} = \Delta x_{trooper} - \Delta x_{0\,trooper} = v_0 t + \tfrac{1}{2} a t^2$$
$$\Delta x - 0 = (0 \text{ m/s})t + \tfrac{1}{2}(3.10)t^2$$
$$\cancel{\Delta x = \tfrac{1}{2}(3.10)t^2}$$
$$\Delta x = \tfrac{1}{2}(3.10 \text{ m/s}^2)t^2$$

We want to find when $x_{car} = x_{trooper}$

$$23.5 \text{ m/s } t + 23.5 \text{ m/s} = \tfrac{1}{2}(3.10 \text{ m/s}^2)t^2$$
$$-23.5 \text{ m/s } t - 23.5 \text{ m/s} = 1.55 \text{ m/s}^2 t^2 - 23.5 \text{ m } t - 23.5 \text{ m/s}$$
$$0 = 1.55 \text{ m/s}^2 t^2 - 23.5 \text{ m/s } t - 23.5 \text{ m/s}$$
$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-(-23.5) \pm \sqrt{(-23.5)^2 - 4(1.55)(-23.5)}}{2(1.55)}$$
$$\frac{23.5 \pm 26.42}{3.1} = 16.1 \text{ s}$$

(2.b) $V = V_0 + at$

$V = 0 m/s + 3.10 m/s^2 (16.1 s)$

$V = 49.9$ m/s

(3.)

35F a.

$\frac{156 \text{ mi}}{\text{hr}} \cdot \frac{1609 m}{1 mi} \cdot \frac{1 hr}{3600 s} = 69.7$ m/s

$\Delta X_c = 90.6 m$ $\Delta x_{braking} =$

$a = -4.75 m/s^2$ $a_{coasting} = 0 m/s^2$

$t = 1.30 s$

$V_0 = 69.7 m/s$

$V_f = 0 m/s$

$\overline{V} =$

~~$\Delta x_{coasting} = V_0 t + \frac{1}{2}at^2$~~

~~$\Delta x = (0 m/s)(1.3 s) + \frac{1}{2}(-4.75 m/s^2)(1.30)^2$~~

~~$0 + \frac{1}{2}(-4.75 m/s^2)(1.69 s)$~~

~~$+ 2.38 m/s^2 (1.69 s)$~~

~~$\Delta x = -4.02 m/s$~~

~~$\Delta x_{coasting} = V_0 t + \frac{1}{2}at^2$~~

~~$69.7 m/s (1.3 s) + \frac{1}{2}(0)(1.3)^2$~~

~~$69.7(1.3 s)$~~

~~90.6 m/s~~

we use that because we know the info like t

$\Delta x_{coasting} = V_0 t + \frac{1}{2}at^2$

$69.7 m/s (1.3 s) + \cancel{\frac{1}{2}(0)(1.3)^2}$ cancels out

$90.6 \frac{m \cdot \cancel{s}}{\cancel{s}}$

90.6 m

(b) $\Delta X = \frac{v^2 - V_0^2}{2a}$ $\frac{0 m/s - (69.7 m/s)^2}{2(-4.75 m/s^2)} = \frac{-4858.09}{-9.5 m/s^2} =$

$\Delta x = 511.38$

$\Delta x = 511$

$\Delta x_c + \Delta x_B = 90.6 m + 511$

$= 602$ m

(4.)

$\cancel{y} = 0$

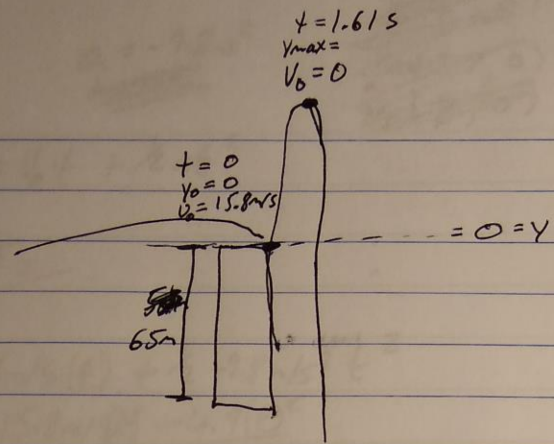
$a = -9.80 m/s^2$

$t_{max} = 1.61 s$

$V_0 = 15.8 m/s$

$V_f = 0 m/s$

$\overline{V} =$



a. $V = V_0 + at = 15.8 m/s + -9.80 m/s^2 (t)$

$0 m/s = 15.8 m/s - 9.8 m/s^2 t$

$\frac{-15.8 m/s \; -15.8 m/s}{-9.8 m/s^2} \quad -9.8 m/s^2$

$t = 1.61 s$

B. $\Delta y = y_f - y_0 = V_0 t + \frac{1}{2} a t^2$

$y - 0m = 15.8 m/s (1.61) s + \frac{1}{2} -9.8)$

$y = 15.8 (1.61)$

$25.4m \; + -4.9 m/s^2 (1.61)^2$

$-12.7 m$

-12.7

$25.4m - 12.7$

$y = 12.7 m$

V_0

$a = -9.8 m/s^2$

~~t = 1.61~~

~~$V_0(0,0)$~~
~~$V_{max}(12.7, 0)$~~
~~$V_f(0, 0)$~~

(C) $\Delta y = y_f - y_0 = V_0 t + \frac{1}{2} a t^2$

$\Delta y = 0 - 0 =$

$0m = 15.8 m/s(t) + \frac{1}{2} -9.8 m/s^2 t^2$

$\frac{0m}{t} = \frac{15.8 m/s(t) - 4.9(t)^2}{t}$

$0m = 15.8 m/s - 4.9t$

$-15.8 m/s$

$\frac{-15.8 m/s}{-4.9 m/s^2} = \frac{-4.9 m/s^2 t}{-4.9 m/s^2}$

$t = 3.22 s$

(D.) $V = V_0 + at$

$15.8 m/s + (-9.8 m/s^2)(3.22 s) =$

$15.8 m/s + -31.6 \frac{m}{s}$

$V = -15.8 m/s$

(E) $\Delta y = -65 = V_0 t + \frac{1}{2} a t^2$

$+65 = (15.8)t + \frac{1}{2}(-9.8) m/s^2 t^2 + 65$

$0 = 15.8t + -4.9 m/s^2 + 65$

$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $\quad \frac{-(15.8) \pm \sqrt{(15.8)^2 - 4(-4.9)(65)}}{2(-4.9)}$

$\frac{-15.8 \pm 39.0}{-9.8}$ $\quad \frac{-54.8}{-9.8} = 5.59 s$

F $v = V_0 + at$

$15.8 m/s + (-9.8 m/s^2)(5.59 s)$

$15.8 m/s - 54.8 m/s$

$-39.0\ m/s$

G

$\Delta y = y - y_0 = V_0 t + \frac{1}{2} a t^2$

$(15.8 m/s)(4.68 s) + \frac{1}{2}(-9.8 m/s^2)(4.68 s)^2$

$73.944 + (-4.9 m/s^2)(21.9 s)$

$-107.3 \frac{m\,s^2}{s^2}$

$73.944 - 107.3 = -33.4\ m$