Ans Review Test 2 Kin

1- $v_i = 0$
$v_f = 60\ km/h = 16.67$
$t = 4.20\ s$

$a = \frac{v_f - v_i}{t} = \frac{16.67 - 0}{4.20} = 3.968\ m/s^2$ $4.0\ m/s^2$

$d = v_i t + \frac{1}{2} a t^2$
$d = \frac{1}{2}(3.968)(4.20)^2$ $d = 34,998\ m$
$= 30\ m$

2- $a = 70000\ m/s^2$
$v_f = 500\ m/s$
$v_i = 0$
$d =$
$t =$

$v_f^2 = v_i^2 + 2ad$
$\frac{500^2}{2(70000)} = \frac{0^2}{2(70000)} + \frac{2(70000)d}{2(70000)}$
$d = 1.785\ m$
$1.79\ m$

$a = \frac{v_f - v_i}{t}$
$t = \frac{500 - 0}{70000}$
$t = 0.00714$

3-

I
$d = 25\ m$
$v = 0.101\ m/s$
$t = ?$
$t = \frac{d}{v}$
$t = \frac{25}{0.101} = 247.52\ s$
$248\ s$

h
$d = 25\ m$
$v_i = 0$
$a = 0.500\ m/s^2$
$t = ?$
$d = \cancel{v_i t} + \frac{1}{2} a t^2$
$25 = \frac{1}{2}(0.500) t^2$
$\sqrt{t^2} = \sqrt{100}$
$t = 10\ s + 240 = 250\ s$

The tortoise wins he finishes 2.00 s before the hare

4- $v_i = 20.0\ km/h = 5.56\ m/s$
$v_f = 230\ km/h = 63.89\ m/s$
$t = 7.50\ s$
$d = ?$
$a = ?$

$a = \frac{v_f - v_i}{t}$
$a = \frac{63.89 - 5.56}{7.50}$
$a = 7.8\ m/s^2$

$v_f^2 = v_i^2 + 2ad$
$(63.89)^2 = 5.56^2 + 2(7.78)d$
$d = 259.68$
$d = 260\ m$

5- $d = 40\ cm = 0.40\ m$
$t = 30\ ms = 0.03\ s$
$v_i = 0$
$a = ?$

$d = \cancel{v_i t} + \frac{1}{2} a t^2$
$0.40 = \frac{1}{2} a (0.03)^2$
$a = 888.88\ m/s^2$
$890\ m/s^2$

$$\frac{-30 \pm \sqrt{30^2 - 4(1)(-120}}{2(1)} \qquad \frac{-30 + 37.148}{2}$$

6 $a = 0.20 m/s^2$ $\quad d = v_i t + \frac{1}{2} a t^2 \quad t = 3.57 s$

$v_i = 3.0 m/s$ $\quad 12 = 3t + \frac{1}{2}(0.20) t^2$

$d = 12 m$ $\quad 12 = 3t + 0.1 t^2 \quad 3.6 s$

$t = ?$ $\quad 0.1 t^2 + 3t - 12 = 0$

$t^2 + 30t - 120 = 0$

7 J

$v = 9.0 m/s$

$d = 20 + d$

$d + 20 = vt$

$d = 9t - 20$

B

$a = 2.0 m/s^2$

$v_i = 0$

$t = t$

$d = d$

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

$d = \frac{1}{2}(2) t^2$

$d = t^2$

$9t - 20 = t^2$

$t^2 - 9t + 20 = 0$

$(t - 5)(t - 4)$

$t = 5, \; t = 4$

$\frac{+9 \pm \sqrt{9^2 - 4(1)(20)}}{2(1)}$

$\frac{9 \pm 1}{2}$

Yes he will overtake the bus at 4s if he cannot stop the bus to get on it will pass him again at 5s

8 $a = -9.8 m/s^2$ $\quad v_F^2 = v_i^2 + 2ad$

$v_i = 0$ $\quad v_F^2 = 0^2 + 2(-9.8)(-3.5)$

$v_F = ?$ $\quad \sqrt{v_F^2} = \pm\sqrt{68.6}$

$d = -3.5 m$ $\quad v_F = \pm 8.28$

$v_F = -8.3 m/s$

9.

Given: Find:

$a = +3.2\ m/s^2$ $t = 32.8\ s$ $v_i = 0\ m/s$ $d = ??$

$d = v_i*t + 0.5*a*t^2$

$d = (0\ m/s)*(32.8\ s)+ 0.5*(3.20\ m/s^2)*(32.8\ s)^2$

$d = 1720\ m$

10.

Given: Find:

$d = 110\ m$ $t = 5.21\ s$ $v_i = 0\ m/s$ $a = ??$

$d = v_i*t + 0.5*a*t^2$

$110\ m = (0\ m/s)*(5.21\ s)+ 0.5*(a)*(5.21\ s)^2$

$110\ m = (13.57\ s^2)*a$

$a = (110\ m)/(13.57\ s^2)$

$a = 8.1\ m/s^2$

11.

Given: Find:

$a = -9.8\ m$ $t = 2.6\ s$ $v_i = 0\ m/s$ $d = ??$

$v_f = ??$

$d = v_i*t + 0.5*a*t^2$

$d = (0\ m/s)*(2.6\ s)+ 0.5*(-9.8\ m/s^2)*(2.6\ s)^2$

$d = 33\ m$

$v_f = v_i + a*t$

$v_f = 0 + (-9.8\ m/s^2)*(2.6\ s)$ $= -26\ m/s$

$v_f = -25.5\ m/s$ (- indicates direction)

12.

Given: Find:

$v_i = 18.5$ m/s $v_f = 46.1$ m/s $t = 2.47$ s $d = ??$

$a = ??$

$a = (\Delta v)/t$

$a = (46.1 \text{ m/s} - 18.5 \text{ m/s})/(2.47 \text{ s})$

$a = 11.2 \text{ m/s}^2$

$d = v_i*t + 0.5*a*t^2$

$d = (18.5 \text{ m/s})*(2.47 \text{ s}) + 0.5*(11.2 \text{ m/s}^2)*(2.47 \text{ s})^2$

$d = 45.7 \text{ m} + 34.1 \text{ m}$

$d = 79.8$ m

(Note: the d can also be calculated using the equation $v_f^2 = v_i^2 + 2*a*d$)

13.

Given: Find:

$v_i = 0$ m/s $d = -1.40$ m $a = -1.67 \text{ m/s}^2$ $t = ??$

$d = v_i*t + 0.5*a*t^2$

$-1.40 \text{ m} = (0 \text{ m/s})*(t) + 0.5*(-1.67 \text{ m/s}^2)*(t)^2$

$-1.40 \text{ m} = 0 + (-0.835 \text{ m/s}^2)*(t)^2$

$(-1.40 \text{ m})/(-0.835 \text{ m/s}^2) = t^2$

$1.68 \text{ s}^2 = t^2$ $t = 1.29$ s

14.

Given: Find:

$v_i = 0$ m/s $v_f = 44$ m/s $t = 1.80$ s $a = ??$

$d = ??$

$a = (\Delta v)/t$

$a = (444 \text{ m/s} - 0 \text{ m/s})/(1.80 \text{ s})$

$a = 247 \text{ m/s}^2$ $a = 250 \text{ m/s}^2$

$d = v_i*t + 0.5*a*t^2$

$d = (0 \text{ m/s})*(1.80 \text{ s}) + 0.5*(247 \text{ m/s}^2)*(1.80 \text{ s})^2$

$d = 0 \text{ m} + 400 \text{ m}$

$d = 400 \text{ m}$ $d = 4.0 \times 10^2 \text{ m}$

(Note: the d can also be calculated using the equation $v_f^2 = v_i^2 + 2*a*d$)

15.

Given: Find:

$v_i = 0 \text{ m/s}$ $v_f = 7.10 \text{ m/s}$ $d = 35.4 \text{ m}$ $a = ??$

$v_f^2 = v_i^2 + 2*a*d$

$(7.10 \text{ m/s})^2 = (0 \text{ m/s})^2 + 2*(a)*(35.4 \text{ m})$

$50.4 \text{ m}^2/\text{s}^2 = (0 \text{ m/s})^2 + (70.8 \text{ m})*a$

$(50.4 \text{ m}^2/\text{s}^2)/(70.8 \text{ m}) = a$

$a = 0.712 \text{ m/s}^2$

16.

Given: Find:

$v_i = 0 \text{ m/s}$ $v_f = 65 \text{ m/s}$ $a = 3 \text{ m/s}^2$ $d = ??$

$v_f^2 = v_i^2 + 2*a*d$

$(65 \text{ m/s})^2 = (0 \text{ m/s})^2 + 2*(3 \text{ m/s}^2)*d$

$4225 \text{ m}^2/\text{s}^2 = (0 \text{ m/s})^2 + (6 \text{ m/s}^2)*d$

$(4225 \text{ m}^2/\text{s}^2)/(6 \text{ m/s}^2) = d$

$d = 704 \text{ m}$ $d = 700 \text{ m}$ or $7.0 \times 10^2 \text{ m}$

17.

Given: Find:

$v_i = 22.4$ m/s $v_f = 0$ m/s $t = 2.55$ s $d = ??$

$d = (v_i + v_f)/2 * t$

$d = (22.4 \text{ m/s} + 0 \text{ m/s})/2 * 2.55 \text{ s}$

$d = (11.2 \text{ m/s}) * 2.55 \text{ s}$

$d = 28.6$ m

18.

Given: Find:

$a = -9.8 \text{ m/s}^2$ $v_f = 0$ m/s $d = 2.62$ m $v_i = ??$

$v_f^2 = v_i^2 + 2*a*d$

$(0 \text{ m/s})^2 = v_i^2 + 2*(-9.8 \text{ m/s}^2)*(2.62 \text{ m})$

$0 \text{ m}^2/\text{s}^2 = v_i^2 - 51.35 \text{ m}^2/\text{s}^2$

$51.35 \text{ m}^2/\text{s}^2 = v_i^2$

$v_i = 7.17$ m/s

19.

Given: Find:

$a = -9.8 \text{ m/s}^2$ $v_f = 0$ m/s $d = 1.29$ m $v_i = ??$

$t = ??$

$v_f^2 = v_i^2 + 2*a*d$

$(0 \text{ m/s})^2 = v_i^2 + 2*(-9.8 \text{ m/s}^2)*(1.29 \text{ m})$

$0 \text{ m}^2/\text{s}^2 = v_i^2 - 25.28 \text{ m}^2/\text{s}^2$

$25.28 \text{ m}^2/\text{s}^2 = v_i^2$

$v_i = 5.03$ m/s

To find hang time, find the time to the peak and then double it.

$v_f = v_i + a*t$

$0 \text{ m/s} = 5.03 \text{ m/s} + (-9.8 \text{ m/s}^2)*t_{up}$

$-5.03 \text{ m/s} = (-9.8 \text{ m/s}^2)*t_{up}$

$(-5.03 \text{ m/s})/(-9.8 \text{ m/s}^2) = t_{up}$

$t_{up} = 0.513$ s hang time = 1.03 s

20.

Given: Find:

$v_i = 0$ m/s $v_f = 521$ m/s d = 0.840 m a = ??

$v_f^2 = v_i^2 + 2*a*d$

$(521 \text{ m/s})^2 = (0 \text{ m/s})^2 + 2*(a)*(0.840 \text{ m})$

$271441 \text{ m}^2/\text{s}^2 = (0 \text{ m/s})^2 + (1.68 \text{ m})*a$

$(271441 \text{ m}^2/\text{s}^2)/(1.68 \text{ m}) = a$ $a = 1.62*10^5 \text{ m/s}^2$

21.

Given: Find:

$a = -9.8 \text{ m/s}^2$ $v_f = 0$ m/s t = 3.13 s d = ??

(NOTE: the time required to move to the peak of the trajectory is one-half the total hang time.)

First use: $v_f = v_i + a*t$

$0 \text{ m/s} = v_i + (-9.8 \text{ m/s}^2)*(3.13 \text{ s})$

$0 \text{ m/s} = v_i - 30.6 \text{ m/s}$

$v_i = 30.6$ m/s

Now use: $v_f^2 = v_i^2 + 2*a*d$

$(0 \text{ m/s})^2 = (30.6 \text{ m/s})^2 + 2*(-9.8 \text{ m/s}^2)*(d)$

$0 \text{ m}^2/\text{s}^2 = (938 \text{ m/s}) + (-19.6 \text{ m/s}^2)*d$

$-938 \text{ m/s} = (-19.6 \text{ m/s}^2)*d$

$(-938 \text{ m/s})/(-19.6 \text{ m/s}^2) = d$ d = 47.9 m

22.

Given: Find:

$v_i = 0$ m/s d = -370 m $a = -9.8 \text{ m/s}^2$ t = ??

$d = v_i*t + 0.5*a*t^2$

$-370 \text{ m} = (0 \text{ m/s})*(t) + 0.5*(-9.8 \text{ m/s}^2)*(t)^2$

$-370 \text{ m} = 0 + (-4.9 \text{ m/s}^2)*(t)^2$

$(-370 \text{ m})/(-4.9 \text{ m/s}^2) = t^2$

$75.5 \text{ s}^2 = t^2$ t = 8.69 s t = 8.7s

23.

Given: Find:

$v_i = 367$ m/s $v_f = 0$ m/s $d = 0.0621$ m $a = ??$

$v_f^2 = v_i^2 + 2*a*d$

$(0 \text{ m/s})^2 = (367 \text{ m/s})^2 + 2*(a)*(0.0621 \text{ m})$

$0 \text{ m}^2/\text{s}^2 = (134689 \text{ m}^2/\text{s}^2) + (0.1242 \text{ m})*a$

$-134689 \text{ m}^2/\text{s}^2 = (0.1242 \text{ m})*a$

$(-134689 \text{ m}^2/\text{s}^2)/(0.1242 \text{ m}) = a$

$a = -1.08*10^6 \text{ m/s}^2$

(The - sign indicates that the bullet slowed down.)

24.

Given: Find:

$a = -9.8 \text{ m/s}^2$ $t = 3.41$ s $v_i = 0$ m/s $d = ??$

$d = v_i*t + 0.5*a*t^2$

$d = (0 \text{ m/s})*(2.6 \text{ s}) + 0.5*(-9.8 \text{ m/s}^2)*(3.41 \text{ s})^2$

$d = 0 \text{ m} + 0.5*(-9.8 \text{ m/s}^2)*(11.63 \text{ s}^2)$

$d = -57.0$ m (NOTE: the - sign indicates direction)

25.

Given: Find:

$a = -3.90 \text{ m/s}^2$ $v_f = 0$ m/s $d = 290$ m $v_i = ??$

$v_f^2 = v_i^2 + 2*a*d$

$(0 \text{ m/s})^2 = v_i^2 + 2*(-3.90 \text{ m/s}^2)*(290 \text{ m})$

$0 \text{ m}^2/\text{s}^2 = v_i^2 - 2262 \text{ m}^2/\text{s}^2$

$2262 \text{ m}^2/\text{s}^2 = v_i^2$ $v_i = 47.6$ m/s $V_i = 48 \text{ m/s}$

26.

Given:

$v_i = 0$ m/s $\quad v_f = 88.3$ m/s $\quad d = 1365$ m

Find:

a = ??

t = ??

$v_f^2 = v_i^2 + 2*a*d$

$(88.3 \text{ m/s})^2 = (0 \text{ m/s})^2 + 2*(a)*(1365 \text{ m})$

$7797 \text{ m}^2/\text{s}^2 = (0 \text{ m}^2/\text{s}^2) + (2730 \text{ m})*a$

$7797 \text{ m}^2/\text{s}^2 = (2730 \text{ m})*a$

$(7797 \text{ m}^2/\text{s}^2)/(2730 \text{ m}) = a$

$a = 2.86 \text{ m/s}^2$

$v_f = v_i + a*t$

$88.3 \text{ m/s} = 0 \text{ m/s} + (2.86 \text{ m/s}^2)*t$

$(88.3 \text{ m/s})/(2.86 \text{ m/s}^2) = t$

$t = 30.8$ s

27.

Given:

$v_i = 0$ m/s $\quad v_f = 112$ m/s $\quad d = 398$ m

Find:

a = ??

$v_f^2 = v_i^2 + 2*a*d$

$(112 \text{ m/s})^2 = (0 \text{ m/s})^2 + 2*(a)*(398 \text{ m})$

$12544 \text{ m}^2/\text{s}^2 = 0 \text{ m}^2/\text{s}^2 + (796 \text{ m})*a$

$12544 \text{ m}^2/\text{s}^2 = (796 \text{ m})*a$

$(12544 \text{ m}^2/\text{s}^2)/(796 \text{ m}) = a$

$a = 15.8 \text{ m/s}^2$

28.

Given:

$a = -9.8 \text{ m/s}^2$ $\quad v_f = 0$ m/s $\quad d = 91.5$ m

Find:

v_i = ??

t = ??

First, find speed in units of m/s:

$v_f^2 = v_i^2 + 2*a*d$

$(0 \text{ m/s})^2 = v_i^2 + 2*(-9.8 \text{ m/s}^2)*(91.5 \text{ m})$

$0 \text{ m}^2/\text{s}^2 = v_i^2 - 1793 \text{ m}^2/\text{s}^2$

$1793 \text{ m}^2/\text{s}^2 = v_i^2$

$v_i = 42.3$ m/s

Now convert from m/s to mi/hr:

$v_i = 42.3 \text{ m/s} * (2.23 \text{ mi/hr})/(1 \text{ m/s})$

$v_i = 94.4$ mi/hr