# Act 1.1 Hand in Assignment - Key - 00P

## Kinematics Review

a) $-8 \xrightarrow{\vec{d} = 6\,km} -2$

b) $-8 \xleftarrow[\vec{d} = -10\,km]{} 0 \quad +2$

c) $0 \xrightarrow{\vec{d} = 8\,km} 8$

d) $-8 \quad 0 \xrightarrow[\vec{d} = 28\,km]{} 20$

e) $-8 \quad 0 \quad +8$
$\hookleftarrow \vec{d} = -16\,km$

3. $\therefore v_{AV} = \dfrac{d_{total}}{t_{total}} = \dfrac{(10 + 18 + 9.8)\,km}{(7.50 + 14.40 + 5.80)\,min} = \dfrac{37.8\,km}{27.7\,min} = 1.4\,\dfrac{km}{min}$

5. $v_i = 40\,m/s$
$v_f = 0$ at max height
$t = 4.0\,s$
$a = ?$

$$a = \frac{v_f - v_i}{t} = \frac{0 - (40)}{4.0\,s} = -10\,m/s^2$$

7. $v_i = 0$
$v_f = 2.0 \times 10^7\,m/s$
$d = 0.10\,m$
$a = ?$
$t = ?$

$$v_f^2 = v_i^2 + 2ad$$
$$(2.0 \times 10^7)^2 = 0 + 2a(.10)$$
$$\frac{4.0 \times 10^{14}}{0.20} = a$$
$$2.0 \times 10^{15}\,m/s^2 = a$$

$$a = \frac{v_f - v_i}{t}$$
$$2.0 \times 10^{15} = \frac{2.0 \times 10^7 - 0}{t}$$
$$t = 1.0 \times 10^{-8}\,s$$

9. $v_i = 500\ m/s$

$v_f = 0$ at max height

$a = -9.81\ m/s^2$

$t = ?$

$d = ?$

$$a = \frac{v_f - v_i}{t}$$

$$-9.81 = \frac{0 - 500}{t}$$

$$t = \frac{-500}{-9.81}$$

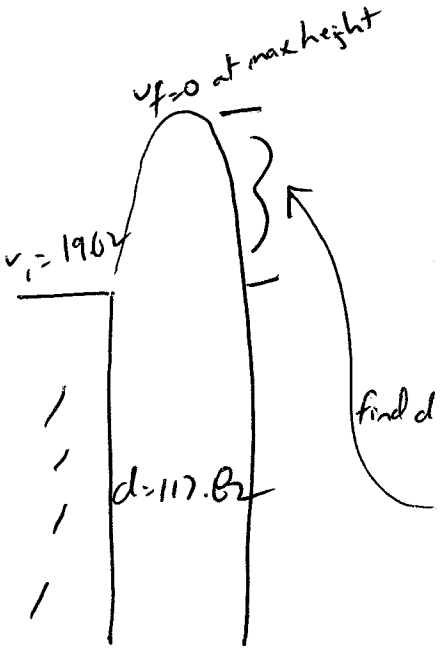
$$t = 51s$$

$$d = v_f t - \frac{1}{2} a t^2$$

$$d = 0 - \frac{1}{2}(-9.81)(50.96..)^2$$

$$d = 1.3 \times 10^4 m$$

11.




i) find time to reach max height

$$a = \frac{v_f - v_i}{t}$$

$$-9.81 = \frac{0 - 19.62}{t}$$

$$t = 2.0s$$

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

$$d = 19.62(2) + \frac{1}{2}(-9.81)(2)^2$$

$$d = 19.62m$$

iii) total d falls is $19.62 + 117.72 = 137.44\ m$

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

$$-137.44 = \frac{1}{2}(-9.81)(t^2)$$

$$5.29s = t$$

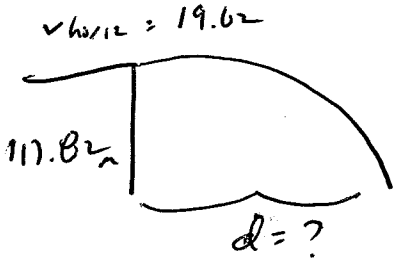
total time

up + down

$2.0s + 5.29s = 7.29s$

13)

i) 2D motion - x (uniform) y (accel by gravity)




find time to fall 117.82m

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

$$-117.82 = 0 + \frac{1}{2}(-9.81)(t^2)$$

$$4.90\text{s} = t$$

ii) stone moves horizontally for the same time!

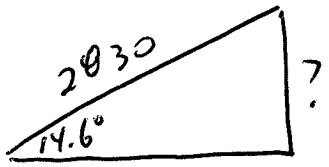
$$d = vt$$

$$= 19.62\text{m/s} \times 4.90\ldots\text{s}$$

$$= 96.2\text{m}$$

## Vectors Review

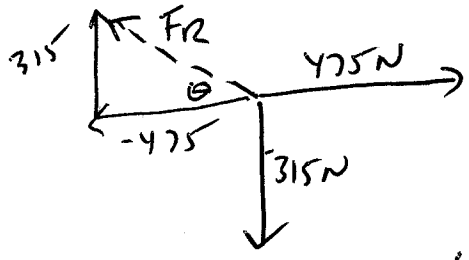
1.)




$$\sin 14.6 = \frac{?}{2830}$$

$$? = 713\text{m}$$

3)




$$F_R = \sqrt{(-475)^2 + (315)^2}$$

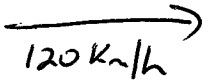
$$= 570\text{N}$$

$$\tan\theta = \frac{315}{475}$$

$$= 33.6^\circ \text{ N of W}$$

5) i) Resolve each vector into its x and y components

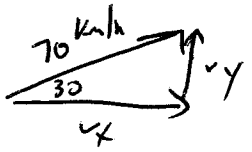
plane




$v_x = 120\ km/h$

$v_y = \phi$

wind




$v_x = \cos 30 \times 70$

$= 60.62\ km/h$

$v_y = \sin 30 \times 70$

$= 35\ km/h$

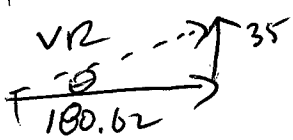
ii) add the x and y components

$Resultat_x = 120\ km/h + 60.62\ km/h = 180.02\ km/h\ [E]$

$Resultat_y = \phi + 35\ km/h = 35\ km/h\ [N]$

iii) add perpendicular components tip to tail

North




$v_R = \sqrt{(180.62)^2 + (35)^2}$

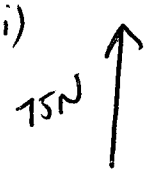
$= 184\ km/h$

$\tan\theta = \frac{35}{180.62} = 11°\ N\ of\ E$

↖ typo says S of E

7.) similar process to #5

i)




$F_x = 0$

$F_y = 75N$


$\cos 30 \times 45 = F_x$

$38.97 N = F_x$

$\sin 30 \times 45 = F_y$

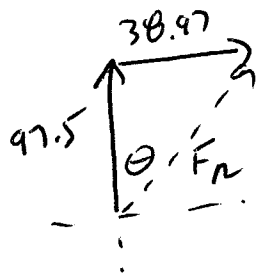
$22.5N = F_y$

ii) Resultant x = $\emptyset + 38.97N$

$= 38.97N[E]$

Resultant y = $75N + 22.5N = 97.5N[N]$

iii)




$F_R = \sqrt{(97.5)^2 + (38.97)^2}$

$F_R = 105N$

$\tan\theta = \frac{38.97}{97.5} = 22°[E \text{ of } N]$

Circular Motion Review

1.) a) $v = \frac{d}{t}$ since d = circumference $v = \frac{2\pi r}{T} = \frac{2\pi(2.8)}{.98s}$

T = time for one rotation

$= 18 m/s$

b) $F_T = F_C = \frac{mv^2}{R} = \frac{(1.0)(17.94..)^2}{2.8} = 114.98N$

$= 1.1 \times 10^2 N$

↑ typo says $1.2 \times 10^2 N$

3) $F_c = \frac{4\pi^2 r_m}{T^2} = \frac{4\pi^2 (.60)(1.7)}{(1.1)^2} = 33\ N$

Dynamics Review

1). can at rest - 1st law - the can will remain at rest until and external unbalanced force acts upon it.

press on gas - 3rd law and 2nd law

2nd - an unbalanced force causes the can to accelerate in the direction of the unbalanced force. ($F_{net} = ma$)

3rd - forces come in pars - tires push back on road (action) road pushes forward on tires (reaction)

reaches constant speed - 1st law an object in motion will stay in motion

At this point $F_{friction} = F_{applied}$

3) $a = \frac{v_f - v_i}{t}$

$a = \frac{2.5 - \phi}{8.7}$

$= 0.2873\ m/s^2 [W]$

$F_{net} = ma$

$= (22)(0.2873..)$

$= 6.3N [W]$

# Dynamics Review (cont)

5) $F_g = mg$

$g = \frac{F_g}{m} = \frac{36.0\,N}{22.0\,kg}$ ($F_g$ is weight!)

$= 1.64\ m/s^2$ [down]

7) Draw FBD's! - object accel in direction of stronger force.

a)


$F_g$ is stronger

$F_{net} = F_g - F_T$

$ma = mg - F_T$

$(1200)(1.05) = (1200 \times 9.81) - F_T$

$1260 = 11772 - F_T$

$-1.05 \times 10^4\,N = -F_T$

$1.05 \times 10^4\,N = F_T$

b)


$F_{net} = F_T - F_g$

$ma = F_T - mg$

$1260 = F_T - 11772$

$1.30 \times 10^4\,N = F_T$

c)


no accel so forces are balanced

$F_T = F_g$

$= mg$

$= 1.18 \times 10^4\,N$