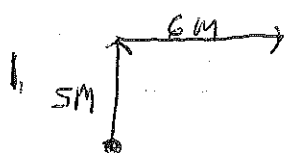
Monster Review 2015

1. 

	Mag	θ	i	j
	5m	90	0	5
	6m	0	6	0

$6mi + 5mj$

$Mag = \sqrt{i^2 + j^2} = \sqrt{6^2 + 5^2} = 7.81m$

$\theta = \tan^{-1}\frac{|5|}{|6|} = 39.80°$ N of E

The Dog is 7.81 m away from his home at 39.80° N of E

2. $P_i = P_f$

m	V	p	θ	i	j
1000	10	10000	30	8660.25	5000
2000	20	40000	270	0	-40000j

$P_i = \frac{8660.25i + -35000j}{3000} = \frac{3000V_f}{3000}$ ← P_f

$2.89 m/s i + -11.66 j = V_f$

$Mag = \sqrt{(2.891)^2 + (-11.66)^2} = 12.01 m/s$

$\theta = \tan^{-1}\frac{|-11.66|}{|2.891|} = 76.1°$ S of E or 13.9° E of S

The wreakage will be moving at 12.01 m/s at 13.9° E of S

3. $S = x_i + V_i t + \frac{1}{2}at^2$

$80 = 0 + 10t + \frac{1}{2}\frac{V_f - V_i}{t}t^2$

$80 = 0 + 10t + \frac{1}{2}\frac{0-10}{t}t^2$

$80 = 10t + -5t$

$80 = 5t$

$t = 16 sec.$

The car will take 16 sec to come to rest while traveling a distance of 80m. The rate of deceleration was -.625 m/s^2

4 $S_A = S_B$

$0 + 0t + \frac{1}{2}(2)t^2 = 2000 + -50t + \frac{1}{2}(.05)t^2$

$t^2 = 2000 + -50t + .025t^2$

$-.975t^2 + -50t + 2000 = 0$

$t = 26.40$ sec $S = 697.20$ m

$V_{fA} = V_i + at = 0 + 2(26.40) = 52.8$ m/s

$V_{fB} = V_i + at = -50 + .05(26.40) = -48.68$ m/s

		x	y		x	y
5.	S	25	35.85 m		74.47 m	0
	x_i	0	15		0	15
	V_i	$25\cos 30$	$25\sin 30 = 12.5$		21.65	12.5
	V_f	$= V_i = 21.65$				
	a	0	-9.8		0	-9.8
	t	1.15	1.15		3.44	3.44

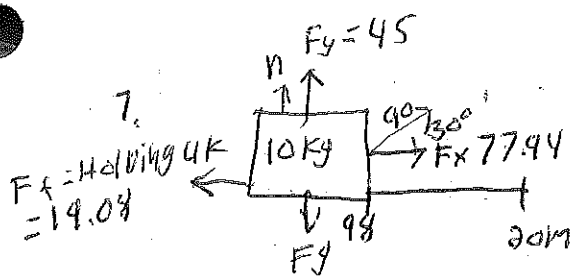
		x	y		x	y
6.	S	432.8 m	0		90.93	41.4
	x_i	$= 0$	0		0	0
	V_i	$70\cos 30$	$70\sin 30 = 35$ m/s		$70\cos 30$	$70\sin 30 = 35$
	V_f	$= V_i = 60.62$			60.62	
	a	0	-9.8		0	-9.8
	t	7.14	7.14		1.5	1.5

$KE = PE$

$\frac{1}{2}m(35)^2 = m(9.8)h$

$h = 62.5$ m

7.



$F_{net} = ma$

$(77.94 + -19.06) = 10a$

$\boxed{a = 5.88\ m/s^2}$

8. $P_i = P_f$

$1000(0) + (70)(0) + 70(0) = 70(150) + 1070V$

$0 = 10500 + 1070V$

$\boxed{V = -9.81\ m/s}$

KE = Work of Friction

$\frac{1}{2}mv^2 = mg\mu_k d$

$\frac{1}{2}(9.81)^2 = 9.8(.05)d$

$\boxed{d = 98.2m}$

9.

	m	V	P	θ	P_x	P_y
	.005	40	.2	270	0	-.2
P_f	.0124	6	.0744	56	.0416	.0617
	.0076				-.0416	.1383
			P_i		0	0

$\frac{P_f}{.0076} = \frac{-.0416\ \frac{kgm}{s}\ i}{.0076} + \frac{.1383\ \frac{kgm}{s}\ j}{.0076}$

$V_f = -5.47\ \frac{m}{s}\ i + 18.20\ \frac{m}{s}\ j$

$\boxed{19.0\ \frac{m}{s} \text{ at } 73.27° \text{ N of W or } 19 m/s \text{ at } 16.73 \text{ W of N}}$

10. $\text{Power} = \frac{\text{work}}{\text{time}} = \frac{F_g \cdot d}{t} = \frac{mgd}{t} = \frac{55(9.8)(50)}{3(60)}$

$= \boxed{149.72\ W}$

$PE = KE$

$mgh = \frac{1}{2}mv^2$

$9.8(50) = \frac{1}{2}v^2$

$\boxed{V = 31.30\ m/s}$

$PE = KE + \text{Work Friction}$

$mgh = \frac{1}{2}mv^2 + mguKd$

$9.8(50) = \frac{1}{2}v^2 + 9.8(.1)(85)$

$\boxed{V = 28.52\ m/s}$

11. A $PE = KE$

$mgh = \frac{1}{2}mv^2$

$9.8(70) = \frac{1}{2}(\text{[redacted}) v^2$

$V = 37.04\ m/s$

B) $PE = KE + PE$

$mgh = \frac{1}{2}mv^2 + mgh$

$9.8(70) = \frac{1}{2}v^2 + (9.8)(22)$

$V = 30.67$

C) $PE = PE$

$mgh = mgh$

$70 = 70$

12. KE = Work of Friction

$\frac{1}{2}mv^2 = mg\mu_k d$

$\frac{1}{2}(10)^2 = 9.8(.05)d$

$d = 102.04\,m$

KE = PE

$\frac{1}{2}mv^2 = mgh$

$\frac{1}{2}(10)^2 = 9.8h$

$h = 5.10\,m$

13. KE = PE

$\frac{1}{2}mv^2 = mgh$

~~$\frac{1}{2}(30)^2 = 9.8$~~

$\frac{1}{2}(30)^2 = 9.8h$

$h = 45.91\,m$

KE = KE + PE

$\frac{1}{2}(m)v^2 = \frac{1}{2}mv^2 + mgh$

$\frac{1}{2}(30)^2 = \frac{1}{2}v^2 + 9.8(5)$

$V = 28.31\,m/s$

14.

A) 1.475 N

B) $\frac{Kgm}{s^2} \cdot \frac{1}{m} = \frac{Kg}{s^2}$

C) .89 Kg/s^2

D) $\frac{Kgm}{s^2} \cdot \frac{m}{1} = \frac{Kgm^2}{s^2} = N \cdot m = Joules$

E) 33.82 Joules

15 $S_R = S_{coyote}$

$125 + 25t = 0 + 12t + \frac{1}{2}(.9)t^2 + \frac{1}{2}(-.05)t^2$

$125 + 25t + \frac{1}{2}(-.05)t^2 = 0 + 12t + \frac{1}{2}(.9)t^2$

$-.025t^2 + 25t + 125 = 12t + .45t^2$

$.475t^2 + 13t + 125 = 0$

$t = 34.91 \text{ sec}, 967.22 \text{ m}$

$V_{fc} = 12 + .9(34.91) = 43.42 \text{ m/s}$

$V_{fR} = 25 + -.05(34.91) = 23.25 \text{ m/s}$

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16. A

	x	y
	5324.81	423
x_i	0	400
V_i	$70\cos 25$	$70\sin 25 = 28.58$
V_f	$V_i = 63.44$	
a	0	-9.8
t	5.12	5.12

533.32 m at 52.48° above the horizon as seen from the Ground

or

325.62 m at 4.05° above the horizon as viewed from the top of the cliff.

16 B-C

	X	Y
S	795.53	0
V_i	$70\cos 25$	$70\sin 25 = 29.58$
V_f	$= V_i = 63.44$	-93.31 m/s
a	0	-9.8
t	12.54	12.54

$V_f = 63.44\hat{i} + -93.31\hat{j}$

112.83 m/s at 55.78 with the [redacted] Ground

17. $V = 331\sqrt{\frac{273 + -70}{273}} =$

18. A ($\frac{1}{4}\lambda$ N $\frac{1}{4}\lambda$) A .80m $\quad \frac{2}{4} = \frac{1}{2}\lambda$

$V = 331\sqrt{\frac{273 + 25}{273}}$

$V = 345.82$

$V = \lambda f$

$f_o = \frac{V}{\lambda} = \frac{V}{2L} = \frac{345.82}{(2)(.80)} = 216.14$ Hz

$f_{2nd} = f_o \times 2 = 432.27$ Hz

$f_{3rd} = f_o \times 3 = 648.41$ Hz

19 N 1/4λ A .60m $\quad \frac{1}{4}\lambda$ -

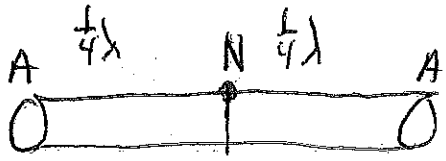
$V = \lambda f$

$f_o = \frac{V}{\lambda} = \frac{V}{4L} = \frac{345.82}{4(.60)} = 144.1$ Hz

There is no 2nd Harmonic

3rd $f_o \times 3 = 432.28$ Hz

20.



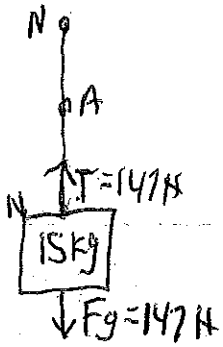
$V = \sqrt{\frac{4.1E10}{2.43E3}}$

$= 3740.7$

$V = \lambda f$

$f = \frac{V}{\lambda} = \frac{V}{2L} = \frac{3740.74}{2(.8)} = 2337.96 Hz$

21.



$V_{string} = \sqrt{\frac{T}{(m/L)}}$

$= \sqrt{\frac{147}{(.015/3)}} = 171.46$

$f = \frac{V}{\lambda} = \frac{V}{2(3)} = \frac{171.46}{6} = 28.57 Hz$

$f_{2nd} = f_0 \times 2 = 57.15 Hz$

$f_{3r} = f_0 \times 3 = 85.73 Hz$

22.

$V = \lambda f$

$3E8 = \lambda \ 6.56E14$

$\lambda = 4.57E^{-7}$

$\lambda = \frac{xd}{L}$

$4.57E^{-7} = \frac{.24\,d}{2}$

$d = 3.80E^{-6} M$

23.

$\lambda = \frac{xd}{L}$

$x = \lambda L / d$

$X = \lambda (.8) / 3.8E^{-6}$

R	13.66 cm
O	12.42 cm
Y	12.00 cm
G	10.74 cm
B	10.00 cm
I	9.36 cm
V	8.42 cm

24. Speed of Light $= \frac{3E8}{n} = \frac{3E8}{1.92} =$ 1.5625E8 m/s

25. $n_1 \sin\theta_I = n_2 \sin\theta_2$

$n_1 \sin 10 = 1.0003 \sin 16$

$n_1 = 1.59$

26. $I = \frac{L_4 m^2 n}{4\pi r^2}$

$25 = \frac{2.81E28}{4\pi r^2}$

$r =$ 9.45E12 m $=$ 63 A.U.

$S = X_i + V_i t + \frac{1}{2} a t^2$

$9.45E12 = 0 + 3E8t + \frac{1}{2}0t^2$

$S =$ 31525 sec $=$ 8.75 hr.

26, cont. C $-\log(25) = .4(VM + 14.2)$

$VM = -17.69$

D)

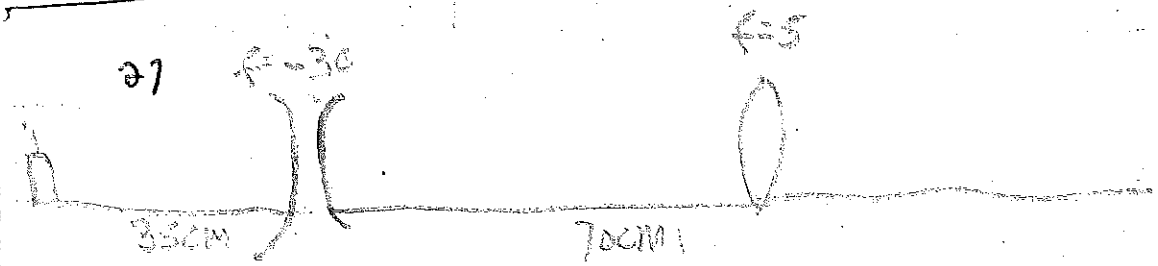
$I = \frac{2.81E28}{4\pi(7E26)^2} = \underline{4.56E^{-27}}$ $\frac{\text{lumen}}{m^2}$

$= \underline{4.56E^{-27}}$ LUX

$-\log(4.56E^{-27}) = .4(VM + 14.2)$

$VM = 51.65$

27



$\frac{1}{-30} = \frac{1}{35} + \frac{1}{di}$

$di = -16.15$

$M = \frac{-di}{do} = \frac{16.15}{35}$

$= .46$

$\frac{1}{5} = \frac{1}{86.15} + \frac{1}{di}$

$di = 5.31$

$M = \frac{-di}{do} = \frac{-5.31}{86.15}$

$= -.06$

5.31 cm to Right of converging lens it will be Inverted and smaller by a factor of -.126.

28. A) $n_1 \sin\theta_I = n_2 \sin\theta_R$

$1.92 \sin(20.8) = 1.36 \sin\theta_R$

$\theta_R = 30.08°$

B) $1.92 \sin\theta = 1.36 \sin 90$

$\theta_c = 45.09°$

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29. $dB = 10 \log \frac{I}{I_0}$

$210 = 10 \log \frac{I}{1E^{-12}}$

$21 = \log I/1E^{-12}$

$10^{21} = I/1E^{-12}$

$I = 1E9\ W/m^2$

$I = \frac{\text{Power}}{4\pi(76.2)^2}$ A) Power = 7.29E13 Watts

$\frac{250ft}{1} \cdot \frac{12.in}{1ft} \cdot \frac{2.54cm}{1in} \cdot \frac{1m}{100cm}$

$= 76.2m$

B) $\frac{7.29E13\ J}{s} \cdot \frac{30s}{1} = 2.187E15\ J$

C) $I = \frac{7.29E13}{4\pi(5000)^2} = 232047\ W/m^2$

$dB = 10 \log \frac{232047}{1E^{-12}} = 173.65\ dB$

29 cont. $dB = 10 \log I/I_0$

$150 = 10 \log I/1E^{-12}$

$I = 1000 \quad W/m^2$

$1000 = \frac{power}{4\pi(1)^2}$

power = 12,566 W per Jackhammer

$\frac{7.29E13\ W}{1\ bomb} \cdot \frac{1\ Jackhammer}{12,566\ W} = 5.80E9$ Jackhammers Per Bomb.

30.

A) $f = 5.08E14\left(\frac{3E8 + 1.5E7}{3E8 \mp 0}\right) = 5.33E14$ Orange

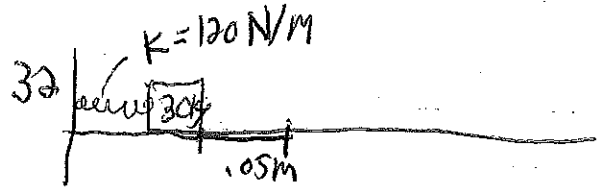
B) $f = 5.08E14\left(\frac{3E8 - 2.1E7}{3E8 \mp 0}\right) = 4.55E14$ Red

C) $f = 4.61E14\left(\frac{3E8 - 2.1E7}{3E8 - 9E7}\right) = 4.61E14\left(\frac{2.79E8}{2.1E8}\right)$

$= 6.12E14$ Greenish Blue

31. 1. Oscilitory motion
2. Force directed toward equilibrium point
3. Obey Hook's Law Linear Force or Approx Linear

32



$\omega = \sqrt{\frac{K}{M}} = \sqrt{\frac{120}{30}} = 2$

$\omega = 2\pi f$

$x = A\cos(\omega t)$

$= .05\cos(2t)$

$V = -A\omega\sin(\omega t) = -.1\sin\omega t$

$a = -A\omega^2\cos(\omega t) = -.2\cos\omega t$

A) $a_{max} = \frac{F}{m} = \frac{-kx}{m} = \frac{-120(.05)}{30} = -.2\ \frac{m}{s^2}$

B) $U_{spring} = KE$

$\frac{1}{2}kx^2 = \frac{1}{2}mv^2$

$\frac{1}{2}(120)(.05)^2 = \frac{1}{2}(30)v^2$

$v = \underline{.1\ m/s}$

C) $\omega = 2\pi f$

$2 = 2\pi f$

$f = \frac{1}{\pi}$

$T = \frac{1}{f} = \pi$

D) $x = .05\cos(2(3.1)) = +.0497\ m$

E) $a = -.2\cos(2t) \overset{t=3.0}{=} +.167\ m/s$

F) $V = -.1\sin(2(2.1)) = +.087\ \frac{m}{s}$

33.

(30 uC) A) $E_{@.75\ cm} = \frac{Kq}{r^2} = \frac{9E9\,(30E^{-6})}{(.75)^2} = 480{,}000\ \frac{N}{C}$

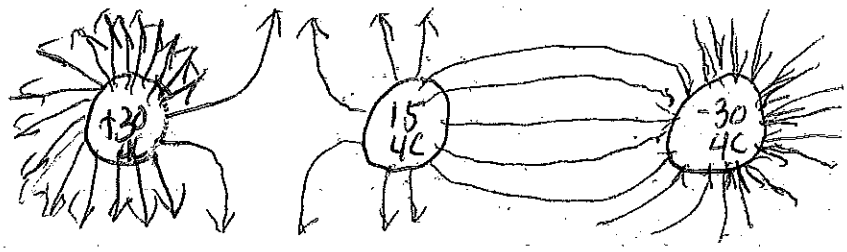
B) $E_{@50m} = \frac{9E9\,(30E^{-6})}{(50)^2} = 108\ \frac{N}{C}$

C) $F = Eq = 108(1.60E^{-19}) = 1.728E^{-17}\ N$

d) $a = \frac{F}{m}$

$a = \frac{1.728E^{-17}}{1.67E^{-27}} = 1.03E10\ m/s^2$

34.



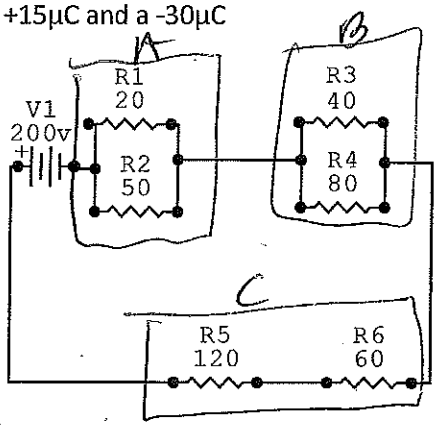
31. State the three conditions that must be met for simple harmonic motion to occur.

32. A 30kg box on a frictionless surface is attached to spring with a k=120 N/m. The box is displaced +5.0 cm from its equilibrium position. A) What is the boxes maximum acceleration? B) What is the boxes maximum velocity? C) What is the period of the boxes oscillation? D) What is the position of the box at 3.1 sec.? E) What is the boxes acceleration at 5.0 sec? F) What is the boxes velocity at 2.1 sec?

33. An object with a charge of 30μC is in open space. A) What is the electric field at 75cm from the charge? B) What is the electric field at 50m away from the charge? C) At a distance of 50m what force would a proton feel? D) At 50m what would be the protons acceleration.

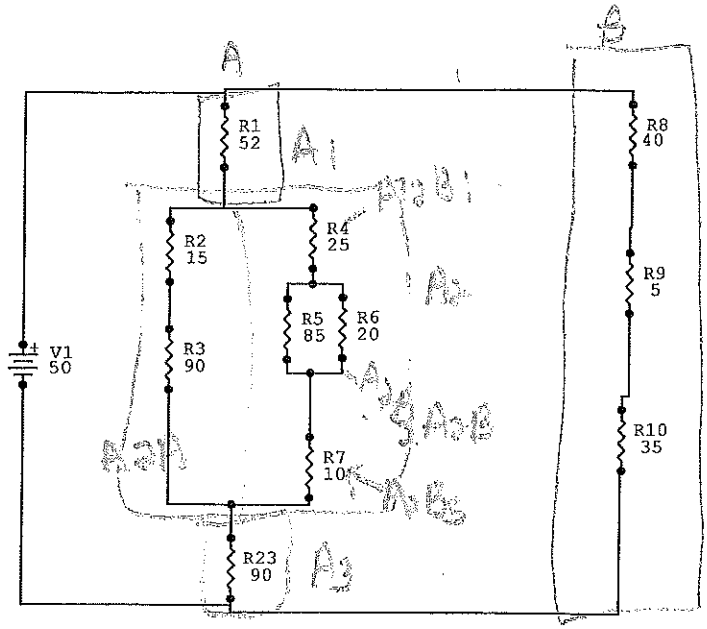
34. Draw the field lines for the following charges assuming they are in a straight line from left to right. +30μC, +15μC and a -30μC

35.



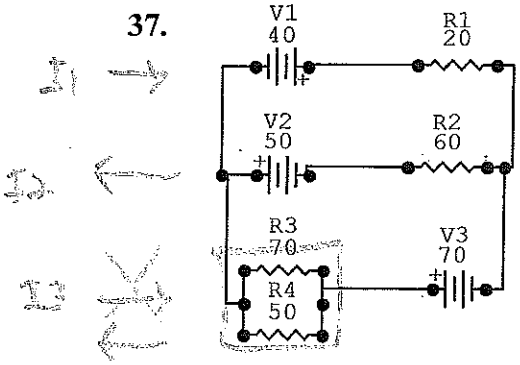
	Total	R1	R2	R3	R4	R5	R6	A	B	C
E	200	12.92	12.92	24.13	24.13	108.6	54.3	12.92	24.13	162.81
I	.905	.65	.36	.61	.30	.905	.905	.905	.905	.905
R	220.95	20	50	40	80	120	60	14.28	26.67	180
P	181	8.40	3.36	14.66	7.24	98.28	49.19	11.69	21.84	147.36

36.



	Total	R1	R2	R3	R4	R5	R6	R7	R8
E	50	19.53	11.25	8.1	9.75	3.08	3.08	1.9	25.2
I	.91	.38	.09	.09	.39	.04	.15	.19	.63
R	55.04	52	125	90	25	85	20	10	40
P	45.5	4.08	.18	.73	.90	.12	.96	.36	15.87
	R9	R10	A	A1	A2	A3	A2&A	A2B	A2&B
E	3.15	31.5	50	14.56	9.63	25.2	9.63	9.63	9.75
I	.63	.63	.26	.28	.26	.28	.09	.19	.19
R	5	35	176.41	52	37.41	90	105	51.19	35
P	1.98	13.89	14.7	4.8	2.41	7.05	.87	1.63	.90

37.



$-20I_1 + 60I_2 + 0I_3 = -90$

$0I_1 + 60I_2 + -30.73I_3 = 50$

$1I_1 + 1I_2 + 1I_3 = 0$

$I_1 = 3.61$

$I_2 = .63$

$I_3 = 1.96$

	V1	V2	V3	R1	R2	R3	R4	A	
E	40	50	70	58.3	37.8	57.06	53.16	57.38	
I	3.61	.63	1.96	3.61	.63	.80	1.15	1.96	
R	—	—	—	20	60	70	50	29.17	
P	144.4	31.5	138.6	136.24	23.81	91.36	66.42	115.56	

$P_{in}: 374.5$

$P_{out}: 276.83$