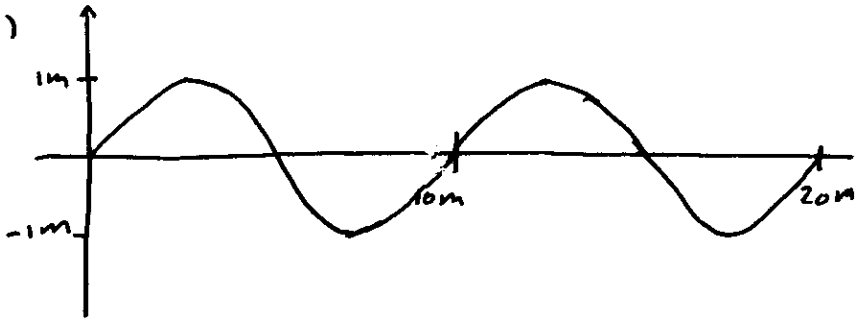
Problem 1 $A(x,t) = A_0 \sin\left(\frac{2\pi}{\lambda}(x - vt)\right)$

(a) $A_0 = 1\,m \qquad \lambda = 10\,m$

(b)



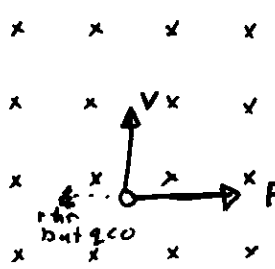
(c) The wave is moving to the right $A(x,t) = A(x - vt)$

(d) $T = 4\,sec, \quad f = \frac{1}{T} = .25\,sec$

(e) $V = \lambda f = 10/4 = \boxed{2.5\,m/s = V}$

Problem 2 $B = 0.2\,T, \quad q = -1.0\,C, \quad |v| = 10\,m/s$

(a)

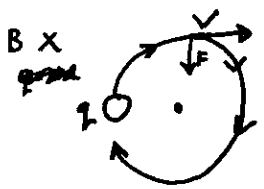


$F = qv \times B \Rightarrow |F| = (1\,C)(10\,m/s)(.2\,T)$

$\Rightarrow \boxed{F = 2N \text{ to the right}}$

(b) From lecture $R = \left|\frac{mv}{qB}\right| = \left|\frac{(2kg)(10m/s)}{1C\,(.2T)}\right| = \boxed{100\,m = R}$

or $|F| = |qv \cdot B| = ma = mv^2/R \Rightarrow R = \left|\frac{mv}{qB}\right| = 100\,m = R$

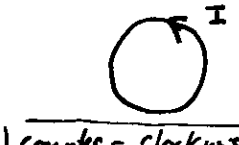


Clockwise

(c) $C = 2\pi R = vT \Rightarrow T = \frac{2\pi R}{v} = \frac{2\pi(100m)}{10m/s} = 20\pi\,s = \boxed{62.8\,s = T}$

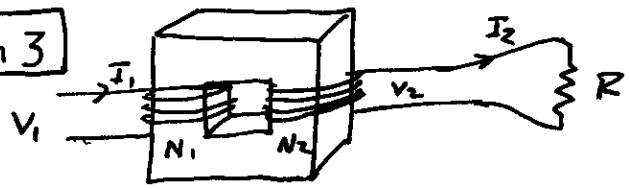
$f = \frac{1}{T} = \frac{1}{20\pi s} = \boxed{.016Hz = f}$

(d) $I = \frac{\#\,Coulombs}{time} = \frac{(1\,Coulomb)}{20\pi\,s} = \boxed{.016\,Amps = I}$



counter-clockwise

Problem 3



$V_1 = 120\,V$

$R = 6\,\Omega$

(a) $V_1/N_1 = V_2/N_2 \Rightarrow V_2 = \frac{N_2}{N_1} V_1 = \left(\frac{10}{100}\right)(120) = \boxed{12V = V_2}$

(b) $V_2 = I_2 R \Rightarrow I_2 = V_2/R = \frac{12V}{6amps} = \boxed{2amps = I_2}$

(c) $P = IV = I^2R = (2amps)(12V) = \boxed{24\,watts = P}$

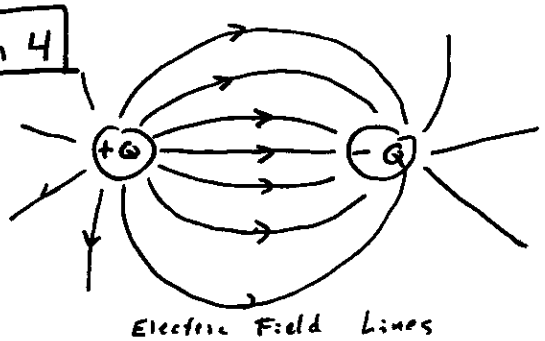
(d) $P_1 = P_2 \Rightarrow I_1 V_1 = I_2 V_2 \Rightarrow I_1 = I_2 \left(\frac{V_2}{V_1}\right) = (12amps)\left(\frac{12V}{120V}\right)$

$\Rightarrow \boxed{I_2 = 0.2\,amps}$

(e) $\boxed{I_2 = 0}$ For DC I_1 = constant $\Rightarrow$ the magnetic flux Φ through the coil N_2 = constant $\Rightarrow$ No emf $\Rightarrow$ no I_2

Problem 4

(a)



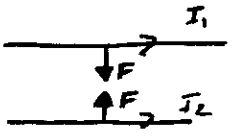
Electric Field Lines

Forces

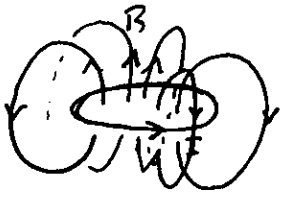
(b) $F = k\frac{q_1 q_2}{d^2} = (9\times10^9)\frac{(1C)(-1C)}{(1)^2} = \boxed{-9\times10^9\,N = F}$

Problem 5

(a)

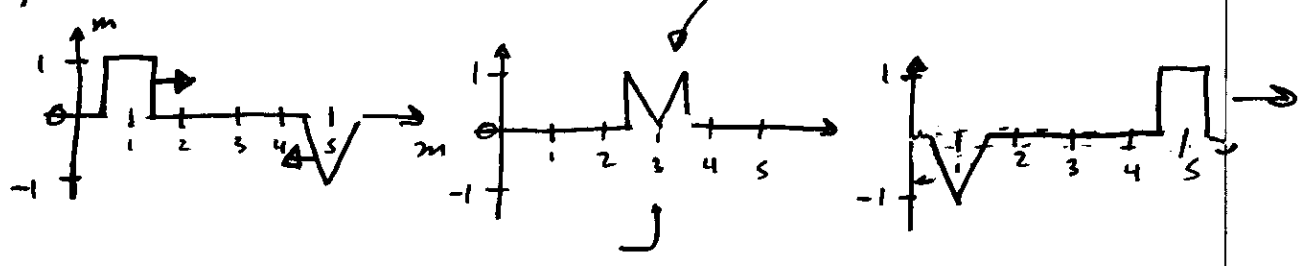


(b)



(c)

This shape = ⊓ + V



Note the center

Amplitude = 1m - 1m = 0