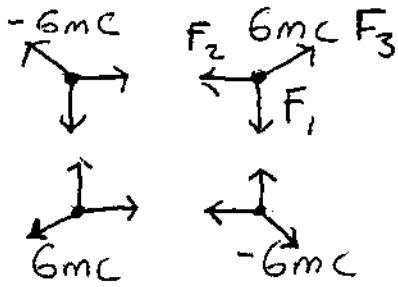
Ch 21 7, 13, 27, 35, 39, 45, 55

7. $F = \frac{KQ_1Q_2}{r^2}$ $\quad F' = 3F = \frac{3KQ_1Q_2}{r^2} = \frac{KQ_1Q_2}{\left(\frac{r}{\sqrt{3}}\right)^2}$

so $\frac{15cm}{\sqrt{3}}$ is the new distance

13. 

all charges have 3 forces

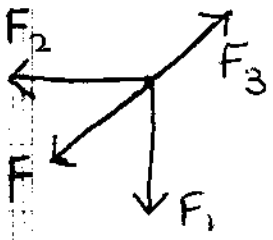
$F_1 = F_2 = \frac{K(6\times10^{-3}C)^2}{(.1m)^2} = 3.2\times10^7\ N$

$F_3 = \frac{K(6\times10^{-3}C)^2}{(\sqrt{2}\cdot1m)^2} = \frac{1}{2}F_2 = \frac{1}{2}F_1$

$= 1.6\times10^7\ N$

$F_x = -3.2\times10^7\ N + 1.6\times10^7\ N \cos 45^\circ = -2.1\times10^7 N$

$F_y = -3.2\times10^7 N + 1.6\times10^7 N \sin 45^\circ = -2.1\times10^7 N$



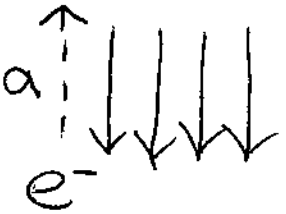
$\vec{F} = \vec{F_1} + \vec{F_2} + \vec{F_3}$

27. $E = \frac{KQ}{r^2} = \frac{K(33\times10^{-6}C)}{(.20m)^2} = 7.4\times10^6\ N/C$

Ch 21

35. $F = qE = ma$

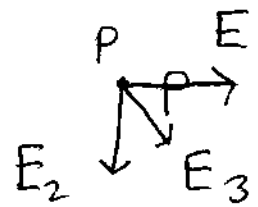
$E = \frac{ma}{q}$



$= \frac{m_e}{q_e}(145 m/s^2)$

$= 8.25 \times 10^{-10} N/C$

39.



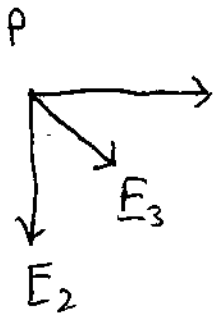
$\vec{E} = \vec{E}_1 + \vec{E}_2 + \vec{E}_3$

$E_1 = E_2 = \frac{KQ}{r^2} = 2.9 \times 10^4 \frac{N}{C}$

$E_3 = \frac{KQ}{(\sqrt{2}r)^2} = 1.45 \times 10^4 N/C$

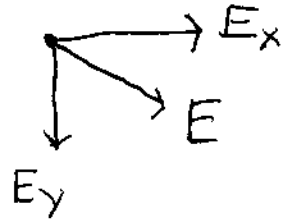
$E_x = 2.9 \times 10^4 \frac{N}{C} + 1.45 \times 10^4 \frac{N}{C} \cos 45^\circ = 3.9 \times 10^4 N/C$

$E_y = -2.9 \times 10^4 \frac{N}{C} - 1.45 \times 10^4 \frac{N}{C} \sin 45^\circ = -3.9 \times 10^4 N/C$



$\vec{E} = \left(3.9 \times 10^4 \frac{N}{C}\right)\hat{i} - \left(3.9 \times 10^4 \frac{N}{C}\right)\hat{j}$

45)



$E = E_x + E_y$

$$E_x = k\lambda' \int \frac{dl}{r^2} \cos\theta$$ (see page 559 Not 2)

$$= \frac{\lambda'}{4\pi\varepsilon_0} \frac{x}{(x^2+a^2)^{3/2}} \int_0^{\pi a} dl = \frac{1}{4\pi\varepsilon_0} \frac{\lambda' x \pi a}{(x^2+a^2)^{3/2}}$$

where $\lambda' = \frac{Q}{\pi a}$ so $E_x = \frac{1}{4\pi\varepsilon_0} \frac{Qx}{(x^2+a^2)^{3/2}}$

(same as example!)

Now $E_y \neq 0$

$$E_y = k\lambda' \int_0^{\pi a} \frac{dl}{r^2} \sin\theta$$

$$= \frac{\lambda'}{4\pi\varepsilon_0} \frac{a}{(x^2+a^2)^{3/2}} \int_0^{\pi a} dl = \frac{1}{4\pi\varepsilon_0} \frac{\lambda' a^2 \pi}{(x^2+a^2)^{3/2}}$$

$\lambda' = \frac{Q}{\pi a}$ so $E_y = \frac{1}{4\pi\varepsilon_0} \frac{Qa}{(x^2+a^2)^{3/2}}$

Ch 21 55.

$ma = qE$ so $\vec{a} = \frac{q}{m}\vec{E} = \left(3.5\times10^{15}\hat{i} + 1.4\times10^{16}\hat{j}\right)$

$\vec{V} = \vec{V}_0 + \vec{a}t$

$\vec{V} = 8\times10^{4}\ m/s + \left(3.5\times10^{15}\hat{i} + 1.4\times10^{16}\hat{j}\right)1\times10^{-9}\ s$

$= \left(3.58\times10^{6}\ m/s\right)\hat{i} + \left(1.4\times10^{7}\ m/s\right)\hat{j}$

22: 7, 13, 19, 29

7) $E\cdot A = \left(410\frac{N}{C}\right)(30m)^2 - \left(560\frac{N}{C}\right)(30m)^2$

$= -135000\ \frac{Nm^2}{C} = \frac{Q_{enc}}{\varepsilon_0}$

so $Q_{enc} = -1.19\times10^{-6}C$

13) outside  , $E\,4\pi r^2 = \frac{12\times10^{-6}C}{\varepsilon_0}$

so $E = \frac{12\times10^{-6}C}{4\pi\varepsilon_0 r^2}$ $r > 15cm$

inside $Q_{enc} = \frac{4/3\,\pi r^3}{4/3\,\pi R^3}(12\times10^{-6}C) = \frac{r^3}{R^3}(12\times10^{-6}C)$

$\Rightarrow$

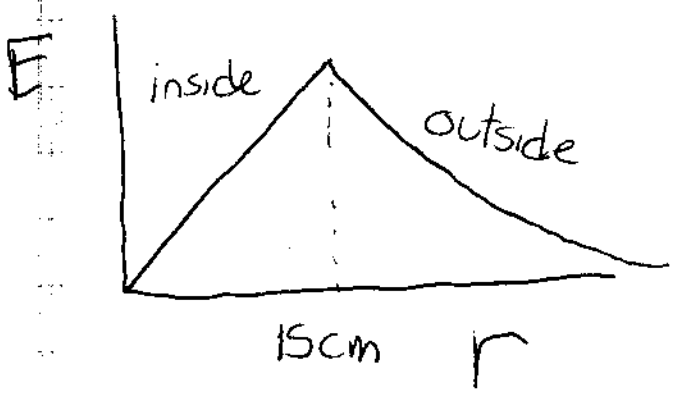
13) cont

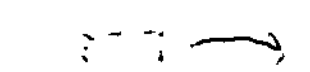
$R = .15\,cm$

$$\text{so } E 4\pi r^2 = \frac{12\times10^{-6}\,C}{\varepsilon_0}\frac{r^3}{R^3}$$

$$\text{so } E = \frac{12\times10^{-6}\,C\,r}{4\pi\varepsilon_0 R^3}$$ (in Numerator.)

E grows



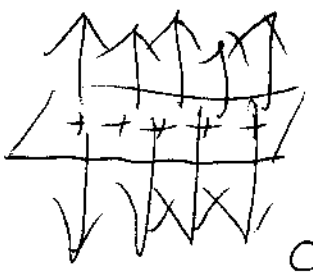


19. $2E\ell w = \frac{\sigma \ell w}{\varepsilon_0}$

in Between destructive

so $E = \sigma/2\varepsilon_0$ for one plate

$E = 0$, outside constructive $E = \sigma/\varepsilon_0$



destructive

29) inside Both $Q_{enc}=0$ so $E=0$

outside both $Q_{enc}=0$ so $E=0$

in the middle $E 2\pi r L = {}^{+}Q/\varepsilon_0$

$$E = \frac{Q}{2\pi\varepsilon_0 r L}$$

$$F = qE = \frac{mv^2}{r}$$

so $qEr = mv^2$

so $\frac{qEr}{2} = \frac{1}{2}mv^2 = KE$

$$\frac{qEr}{2} = \frac{q\frac{Q}{2\pi\varepsilon_0 r L}}{2} r = \boxed{\frac{qQ}{4\pi\varepsilon_0 L}}$$

ch 23

3) $\Delta U = qV = 3.36 \times 10^{-15}\ J$

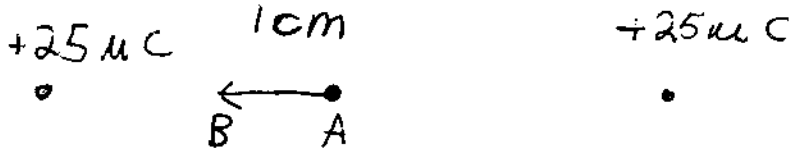
11. $V = \int E \cdot dl = El$ (where l is paralk l to E)

so $V_{BA} = 0$

$$V_{CB} = V_{CA} = \left(-300\frac{N}{C}\right)\hat{i} \cdot (9m)\hat{i}$$

$$= -2100\ V$$

23



$qV_{AB} = W_{AB}$ $\qquad V = \frac{KQ}{r}$

$$V_A = \left(\left(8.98 \times 10^9 \frac{Vm}{C}\right)\frac{25 \times 10^{-6}\ C}{.03\ m}\right) * 2$$

$$= 1.5 \times 10^7\ V$$

$$V_B = \left(8.98 \times 10^9 \frac{Vm}{C}\right)\left(\frac{25 \times 10^{-6}\ C}{.02m} + \frac{25 \times 10^{-6}\ C}{.04m}\right)$$

$$= 1.7 \times 10^7\ V \qquad \text{so } V_{AB} = 2 \times 10^6\ V$$

$q = .1\mu C$

$W = qV =$ [redacted] $.20\ J$

j22.2 D and C are opposite signs
D and B are same sign
D and A are same sign
so D, B, A are same sign
BUT B and A are attracted..??

j22.7 green is positive (repulsed by 5)
(2) is positive (green is repulsed)
(3) is neutral
(4) is negative (green is attracted

23.3) (I) c
(II) b
(III) d
(IV) a
(V) e