PY 202

- Midterm

midterm 4) b) $E = ?$

$r < a: E = 0$

$b < r < c: E = 0$

$3Q - Q = 2Q$

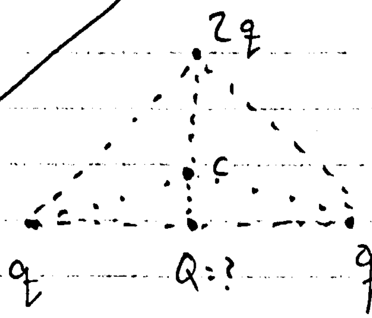
other two regions:

Gauss: $\oint \vec{E} \cdot \hat{n} dA = E 4\pi r^2$

$\rightarrow \frac{Q_{enc}}{\varepsilon_0} = \frac{3Q}{\varepsilon_0}$

$\rightarrow E = \frac{2Q}{\varepsilon_0}$

1)



at C $\vec{E} = 0$

$h = \frac{\sqrt{3}}{2} L$ → superfluous

$C(x, y) = \left(0, \frac{h}{3}\right)$

→ C divs height into $\frac{2}{3}$ and $\frac{1}{3}$ pieces

midterm 4c

$V = -\int_\infty^{r<a} \vec{E} \cdot d\vec{l} = -\int_\infty^{c} \frac{2Q}{4\pi\varepsilon_0 r^2} dr - \int_c^b 0 - \int_b^a \frac{3Q}{4\pi\varepsilon_0 r^2} dr$

$kQ\left(\frac{3}{a} - \frac{3}{b} + \frac{2}{c}\right)$ ... $= 0$, so ignore

from $V = -\int_0^c \vec{E} \cdot d\vec{l}$

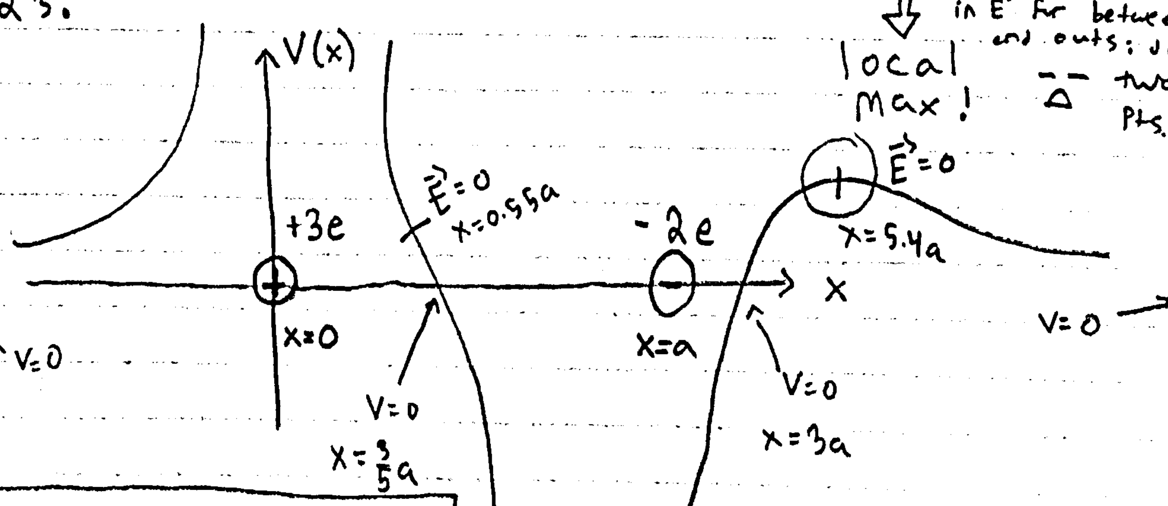
y-components:

$$-\frac{k(2q)}{\left(\frac{2h}{3}\right)^2} + \frac{kQ}{\left(\frac{h}{3}\right)^2} + 2\left(\frac{kq}{\left(\frac{2h}{3}\right)^2}\right) \sin 30^\circ = 0$$

$$\frac{-kq}{\left(\frac{2h}{3}\right)^2} + \frac{kQ}{\left(\frac{h}{3}\right)^2} = 0$$

$$\boxed{Q = \frac{q}{4}}$$

2) HW Q3.



Your intuition should have told you to search for 0 (max) in $\vec{E}$ for between and outside — two pts.

Δ pt of and infln

Readings 24.1-3, for Wed

24.4-5, for Fri

$x_0 + C \Rightarrow$ Coupled analog $\rightarrow x_0 \rightarrow$ decode $\rightarrow fe(x_0) \rightarrow x_0 + C$

$\Rightarrow$ Coupled analog $\rightarrow x_0 \rightarrow$ decode $\rightarrow$

① immutable analog CML; observe digital behavior

② mutable analog CML; initial state is modified post-map by a function of previous state and decoded previous state

or (2.1) x_0 from $dec(x_{0-1})$ and $dec(x_{0-1})$ of neighbor

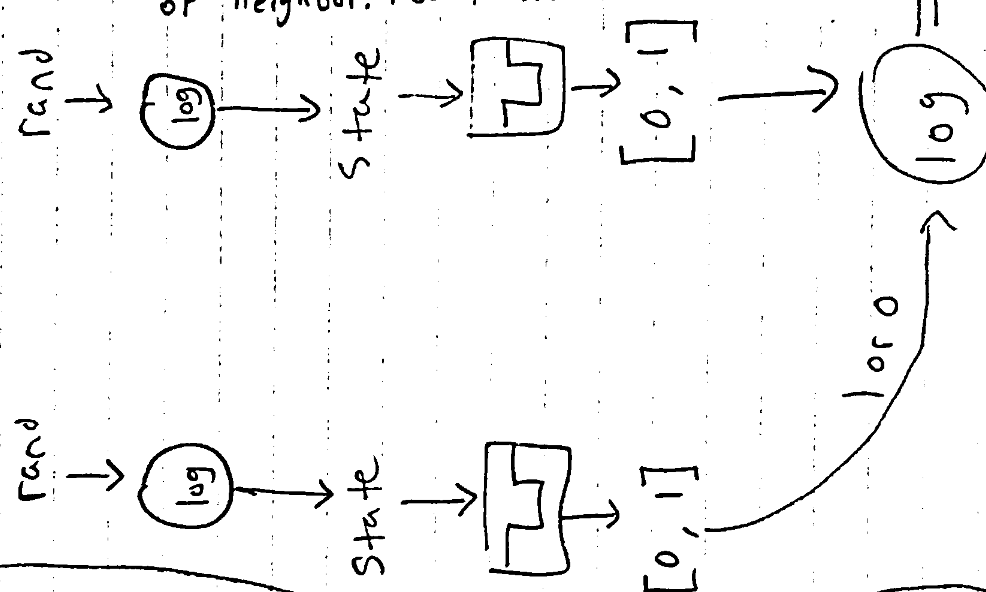
③ initial state is generated entirely from current decoded state and that of neighbor. Few possible states

(A) $\left\{ \begin{array}{l} \text{diffuse} \\ \text{Map} \end{array} \right\}$

$$\left\{ \begin{array}{l} \text{diffuse} \\ \text{Map} \\ \text{or} \\ \text{not} \end{array} \right\}$$

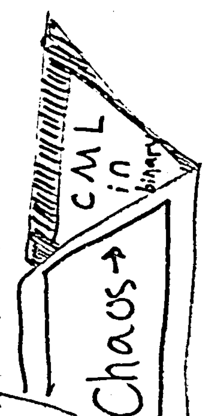
$$V(x) = \frac{k(3e)}{|x|} + k\frac{(-2e)}{|x-a|}$$

$$E(x) = \frac{k(3e)}{x^2} + \frac{k(-2e)}{(x-a)^2}$$



$$\log = \left[\epsilon(f(1 \text{ or } 0)) + (1-\epsilon(f(1 \text{ or } 0))) \right]$$

$= \boxed{1}$ always if same bit,
otherwise
$1 + \epsilon(f(1) - f(0)) \rightarrow 1$
or $1 + \epsilon(F(0) - f(1)) \rightarrow 1$



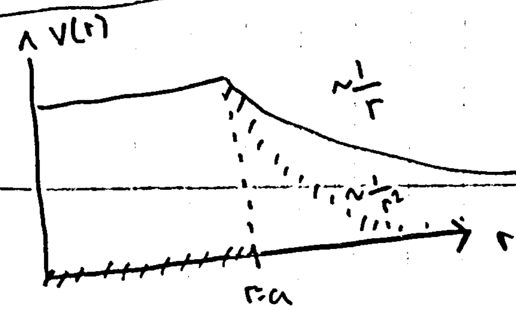
3.9 (1)(0)

3

ALWAYS 1

if Kaneko s-n coupling for decoding before each evolution

3)



$$\boxed{Q_{tot} = Q_A + Q_B} = Q - \frac{Q}{2} : \frac{Q}{2}$$

$\boxed{V_A : V_B}$

$$\frac{kQ_A}{a} = \frac{kQ_B}{b} = \frac{kQ_B}{a/2} \Rightarrow Q_B = \frac{Q}{6}, \quad Q_A = \frac{Q}{3}$$

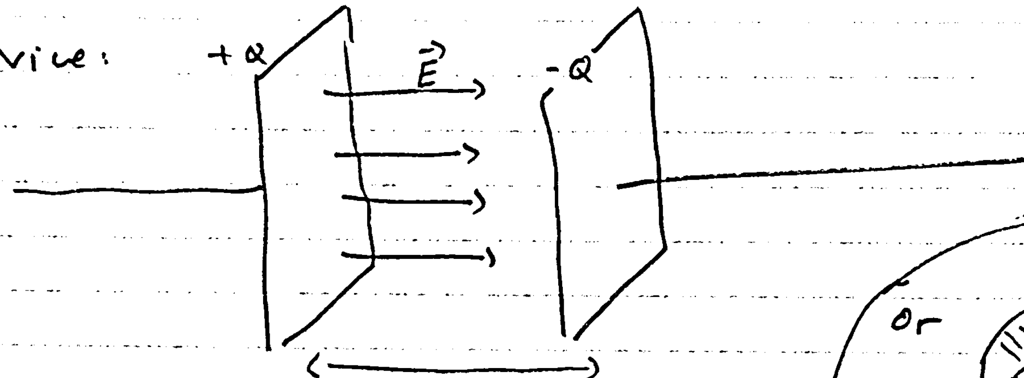
d) $\boxed{V_A = V_B = \frac{kQ}{3a}}$

24 Capacitors

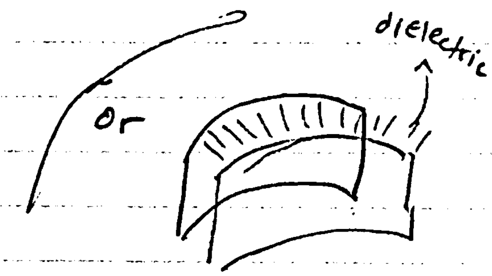
Capacitance: Means of storing energy

Capacitance: $\frac{Q}{V} = \frac{\text{charge}}{\text{potential difference}} = \frac{\text{charge}}{\text{potential}} = \frac{\text{charge}}{\text{voltage (drop)}}$

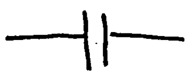
device:



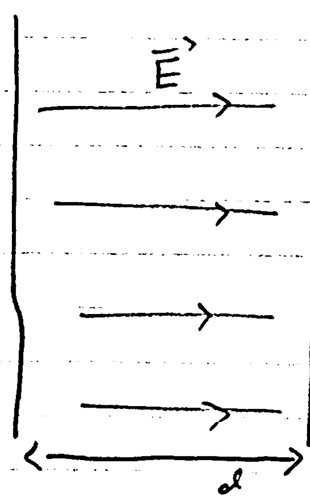
or



Symbol:



$$\boxed{C = \frac{Q}{V}}$$



$$\boxed{C = \frac{\varepsilon_0 A}{d}}$$

V = higher potential − lower potential
(so that $V \geq 0$)

$$V = -\int \vec{E} \cdot d\vec{l} = E d$$

$$= \frac{\sigma}{\varepsilon_0} d \quad , \quad \sigma = \frac{Q}{A}$$

$$= \frac{Q d}{\varepsilon_0 A} = V$$

$$\boxed{V = \frac{Q d}{\varepsilon_0 A}}$$

→ Capacitance does <u>not</u> depend on Q or V.

- depends on dielectric, area, and distance between