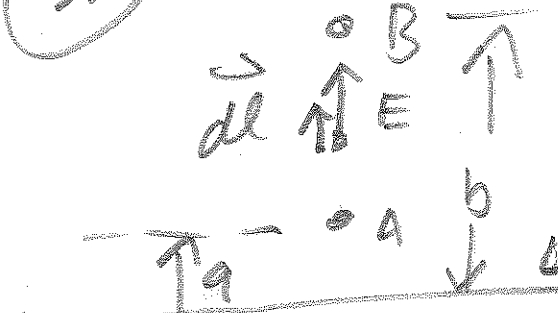
CH 23 Quiz 3 hints

(31.) → see also #63, 64




NOTE: $\vec{dl} = (dx, dy, dz) = dx\hat{i} + dy\hat{j} + dz\hat{k}$

$$\Delta V = -\int_A^B \vec{E}\cdot\vec{dl} = V_B - V_A$$

NOTE: $\vec{E} = \left(-\frac{\partial V}{\partial x}, -\frac{\partial V}{\partial y}, -\frac{\partial V}{\partial z}\right)$

$$-\vec{E}\cdot\vec{dl} = \frac{\partial V}{\partial x}dx + \frac{\partial V}{\partial y}dy + \frac{\partial V}{\partial z}dz$$

Ch 22: $E = \dfrac{\lambda}{2\pi\varepsilon_0 r}$

(a.) $\Delta V = -\int_a^b \dfrac{\lambda\, dr}{2\pi\varepsilon_0 r} = -\dfrac{\lambda}{2\pi\varepsilon_0}\ln\dfrac{b}{a} = V_B - V_A$

$\Delta V = -\int_a^b \vec{E}\cdot\vec{dl}$

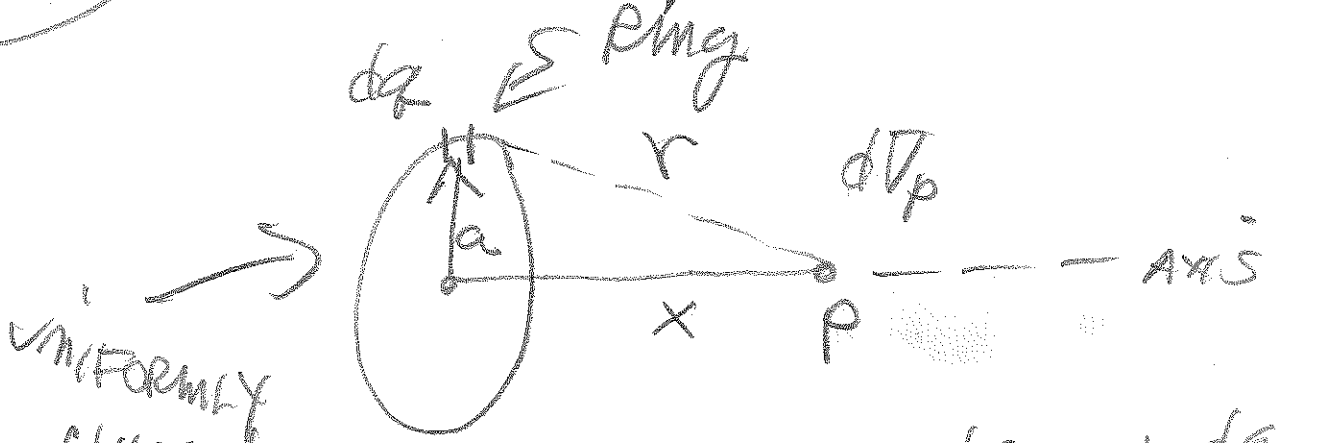
$a = 2.50\text{ cm}$

$b = 3.50\text{ cm}$

IF $\lambda > 0$: $V_B - V_A = -575\text{ (V)}$

IF $\lambda < 0$: $V_B - V_A = +575\text{ (V)}$

(54.) see example 23.11




$$dV_p = \frac{k\,dq}{r} = \frac{k\,dq}{\sqrt{x^2+a^2}}$$

SUMMARY:

(i) FIND $V_p$

(ii) FIND ANSWER TO (a)

$W_{ON} = \Delta U$

$\Delta U = q \cdot \Delta V$

EASY WAY:

$$V_p = \int_{ring} dV_p = \frac{k}{\sqrt{x^2+a^2}} \int_{ring} dq$$

$$= \frac{k \cdot Q}{\sqrt{x^2+a^2}}$$

34.

(a)

$$V = \frac{kQ}{\sqrt{x^2+a^2}}$$

$$W_{you} = \Delta U$$

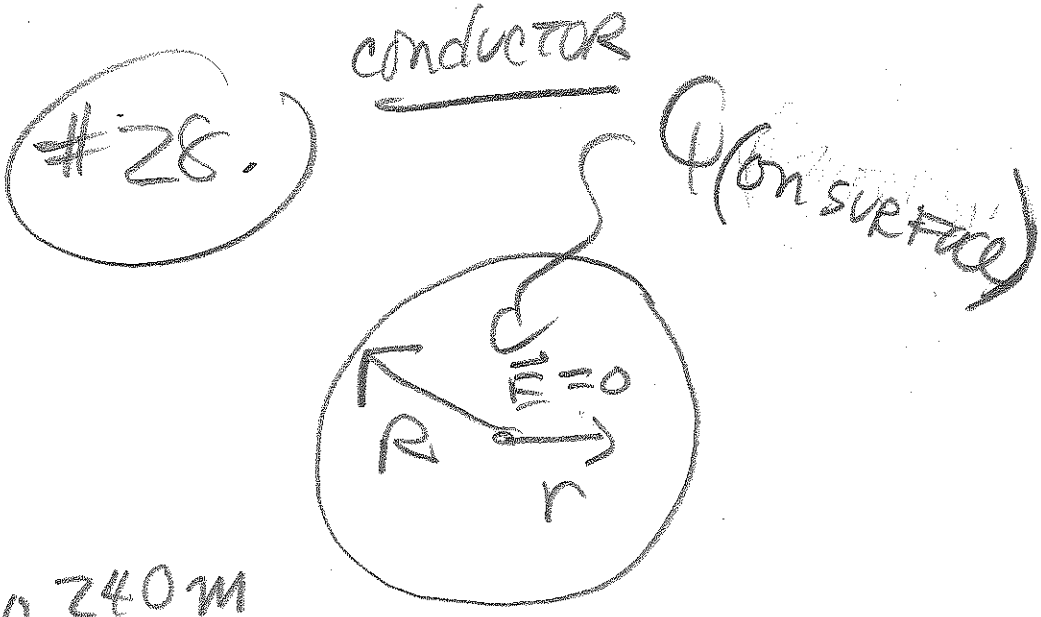
$$\Delta U = q \cdot \Delta V$$

$$= q \cdot (V_{center} - V_\infty)$$

$$W_{you} = q \cdot \left( \frac{kQ}{\sqrt{0^2+a^2}} - \frac{kQ}{\sqrt{\infty^2+a^2}} \right)$$

$$\frac{kQ}{\sqrt{0^2+a^2}} \qquad \frac{kQ}{\sqrt{\infty^2+a^2}} \to 0$$

#28.




$R = 0.240\ m$

(a) $V = ?$ $r = 0.48\ m > R$

(b) $V = ?$ $r = 0.24\ m = R$

(c) $V = ?$ $r = 0.12\ m < R$

methodology

Let $r \geq R$ and TREAT system as a point charge:

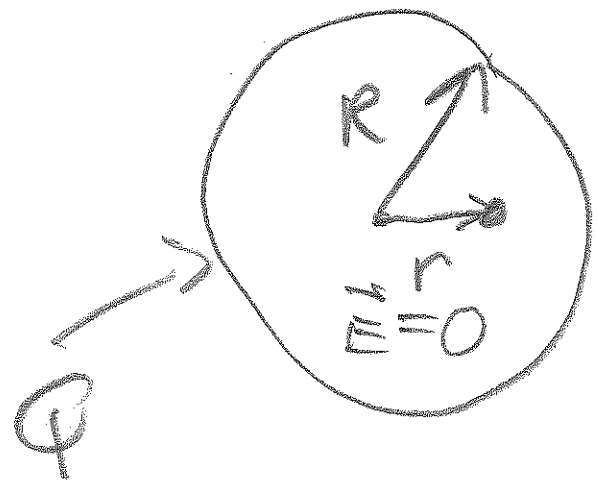
$E_p = kQ/r^2 \Rightarrow V = kQ/r$

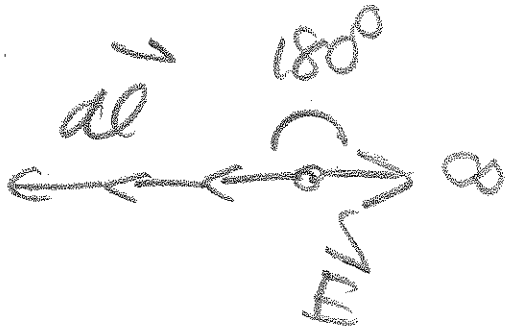

(a) $V = kQ/r = \frac{kQ}{2R}$

(b) $V = kQ/r = kQ/R$

(28) (C)

$V = V_r = ?$, $r < R$



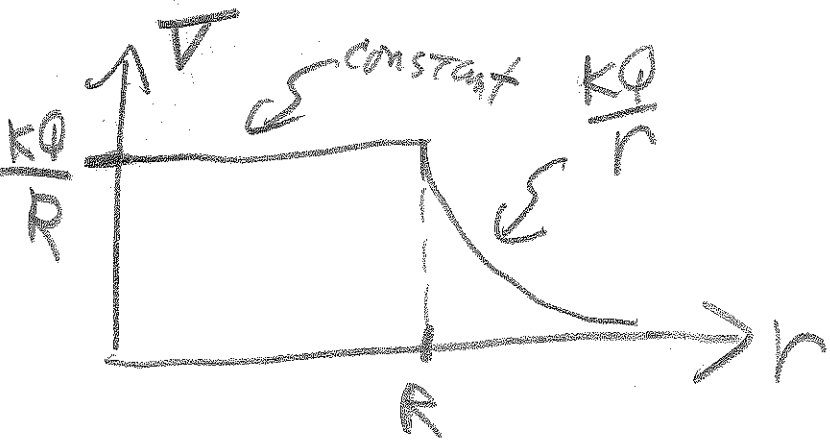

$\varphi$

$$V_r - V_\infty = -\int_\infty^r \vec{E}\cdot d\vec{l} = -\int_\infty^R \vec{E}\cdot d\vec{l} - \int_R^r \vec{E}\cdot d\vec{l}$$

$$= \frac{kQ}{R} - 0$$

**NOTE:**

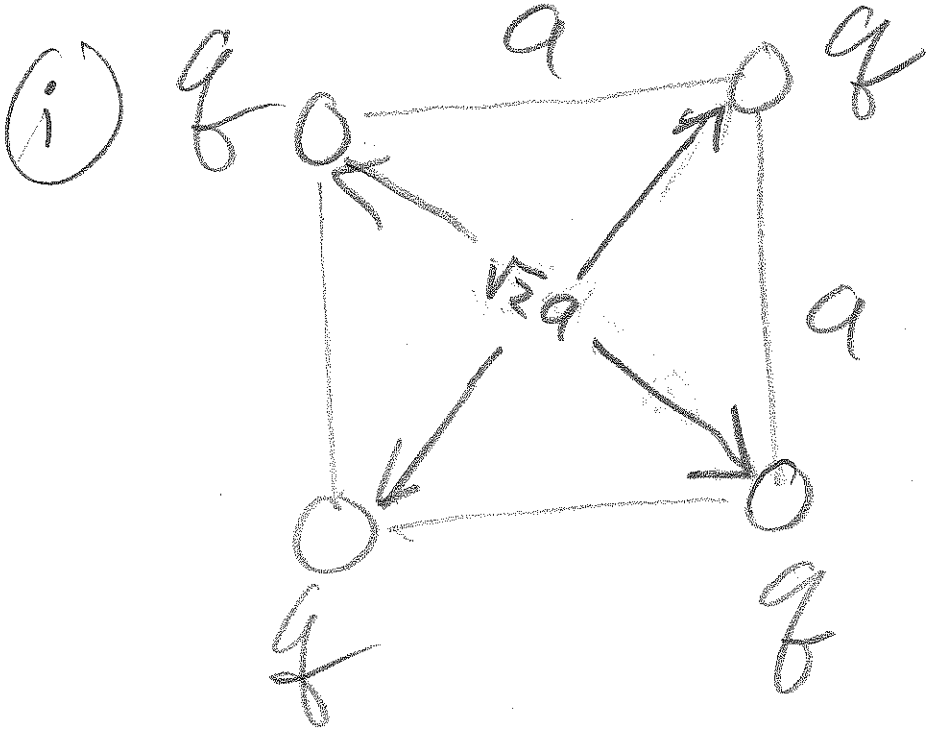
$r \geq R$, $E = \frac{kQ}{r^2}$




$$V_r - V_\infty = (V_R - V_\infty) + \underbrace{(V_r - V_R)}_{0 \Rightarrow V_r = V_R}$$

Sq. 1 Warm up:

(i)




N = 4;

# of PAIRS

$$\frac{N\cdot(N-1)}{2}$$

$$= \frac{4(4-1)}{2}$$

$$= 6 \text{ PAIRS}$$

$U_{total} = ?$

$$U = k\left[4\frac{q^2}{a} + 2\cdot\frac{q^2}{\sqrt{2}a}\right]$$

(4 SIDES; 2 DIAGONALS)

note: 4 + 2 = 6

$$4.7\frac{kq^2}{a} = U = \frac{kq^2}{a}\cdot\left[4+\frac{2}{\sqrt{2}}\right] = \frac{kq^2}{a}\cdot\left[4+\frac{2\sqrt{2}}{2}\right]$$

(ii) follow up to warm up:

suppose all charges are released from rest. Find speeds at $\infty$.

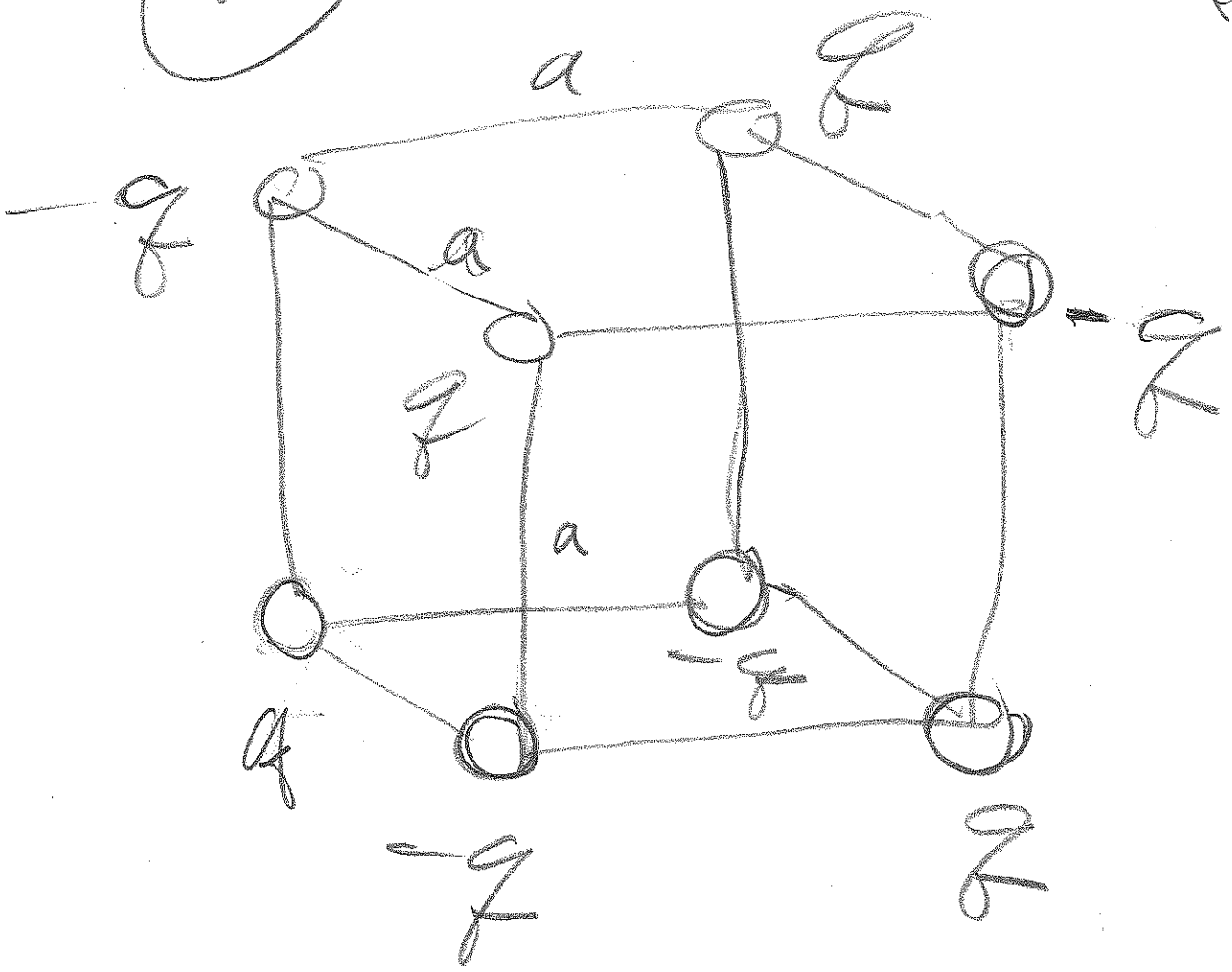
$$4.7\frac{kq^2}{a} = 4\cdot\left(\frac{1}{2}mv_\infty^2\right)$$

$$v_\infty = \sqrt{\frac{k\cdot 4.7}{2\cdot a\cdot m}}\cdot q$$

$$v_\infty = \sqrt{\frac{2.35\cdot k}{a\cdot m}}\cdot q$$

(59.)

(8



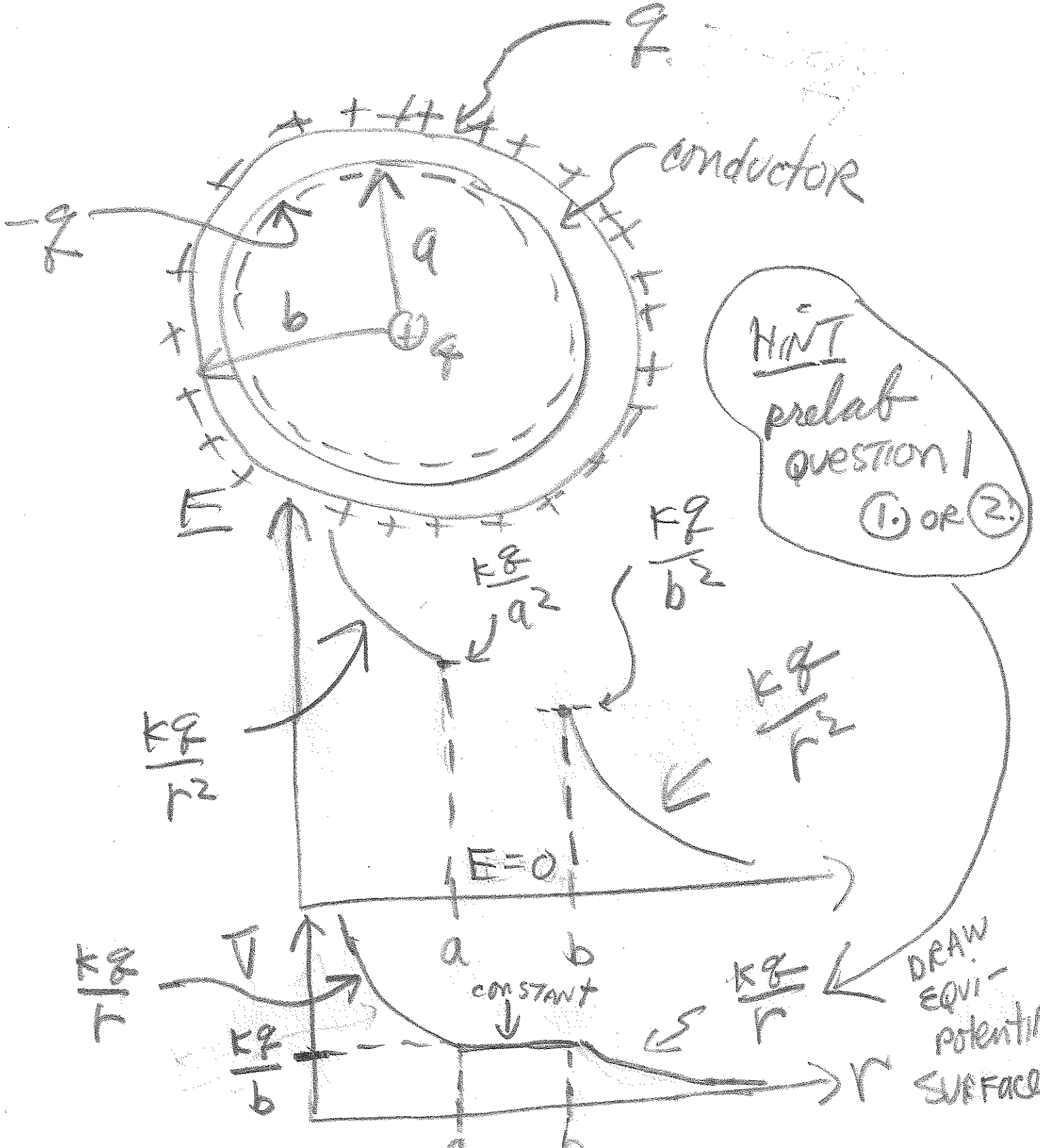

$N = 8$

$\#$ of pairs $= \frac{8 \cdot (8-1)}{2}$

$= \frac{(8)(7)}{2} = 28$ pairs

# prelab question 2 — lab 3

#3



Assume $\Delta V$ = same difference between equipotential surfaces

# Ohm's Law Lab

formal report
(group report)

(A) cover sheet
names, roles, etc

(B) Abstract is
concise if NOT short.

(1) purpose: a LAW you are trying to PROVE or test.

mention basic procedure: (1 sentence)

"VERIFY" is OK to use.

(C) Data:

Filled data sheet that came with handout.

(D) analysis:

Show calculations of $\bar{x}$, error and range determination

Example:

51.1561 ± 0.0051 (RMSE) = 51.156 ± 0.005

SHOW graph of V vs I with slope and RMSE.

ROUND TO same place

ROUND TO once place

(B)

Include results:

(1.) reference a linear graph

(2) % error was small

BUT ALSO RESISTORS

were within

tolerance range,

indicating accurate

equipment.

(E) Possible source of error

if necessary.

(Only mention parts of detailed procedure if they caused a large error.)

(F) Talk about importance of your range calculation, your percent error and your straight line as it pertains to your purpose.

Explain calculations NOT just "show" as in (D).