

$$\textcircled{1} a) \quad \frac{2 \times 10^{-3}}{1 + 2} = \frac{(9 \times 10^9) q (2.22 \times 10^{-19})}{(10^{-3})^2}$$

$$q = \frac{2 \times 10^{-3} \times (10^{-3})^2}{9 \times 10^9}$$

$$q = 2.22 \times 10^{-19}$$

$$\rightarrow \frac{(9 \times 10^9) (2.22 \times 10^{-19})}{(5 \times 10^{-3})^2} = \boxed{8 \times 10^{-5} \text{ V/m}}$$

@ 5 mm

$$\textcircled{1} b) \quad r^2 = \frac{(9 \times 10^9) (1 \times 10^{-6})}{8 \times 10^{-3}} = 1066.66 \text{ m}$$

$$\rightarrow \frac{(9 \times 10^9) (3 \times 10^{-6})}{(1066.66)^2} = \boxed{24 \times 10^{-3} \text{ V/m}}$$

2) a $qE = mg$

$$q = \frac{mg}{E} \rightarrow \frac{4 \times 10^{-16} \times 9.8}{6131.25} = 6.39 \times 10^{-19}$$

$$n = \frac{6.39 \times 10^{-19}}{1.60 \times 10^{-19}} = 3.99 \approx \text{4 electrons}$$

2b) $(6.39 \times 10^{-19}) - (1.60 \times 10^{-19}) = 4.79 \times 10^{-19}$

one e^- is removed

$$Fe = 2.93 \times 10^{-15} \text{ N}$$

$$q = \frac{(3.92 \times 10^{-15}) - (2.93 \times 10^{-15})}{4.0 \times 10^{-16}}$$

$$= 2.45 \text{ m/s}^2$$

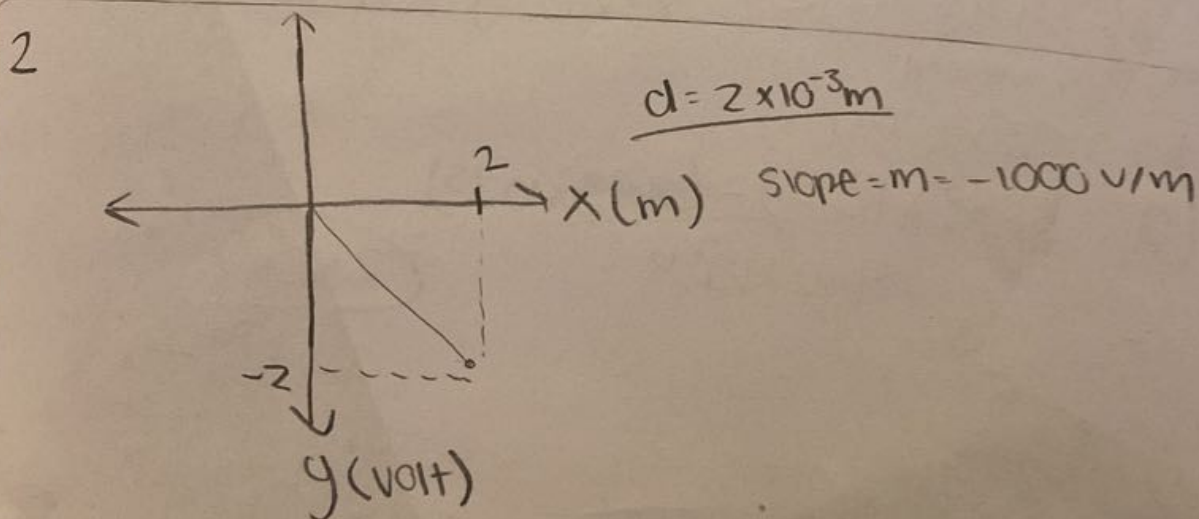
3) Potential energy & voltage, capacitors

1a) $W = qV$

$$H^+ = (1.6 \times 10^{-19})(4 \times 10^3) = 6.4 \times 10^{-16} \text{ J}$$

$$He = (2 \times 10^{-19})(4 \times 10^3) = 12.8 \times 10^{-16} \text{ J}$$

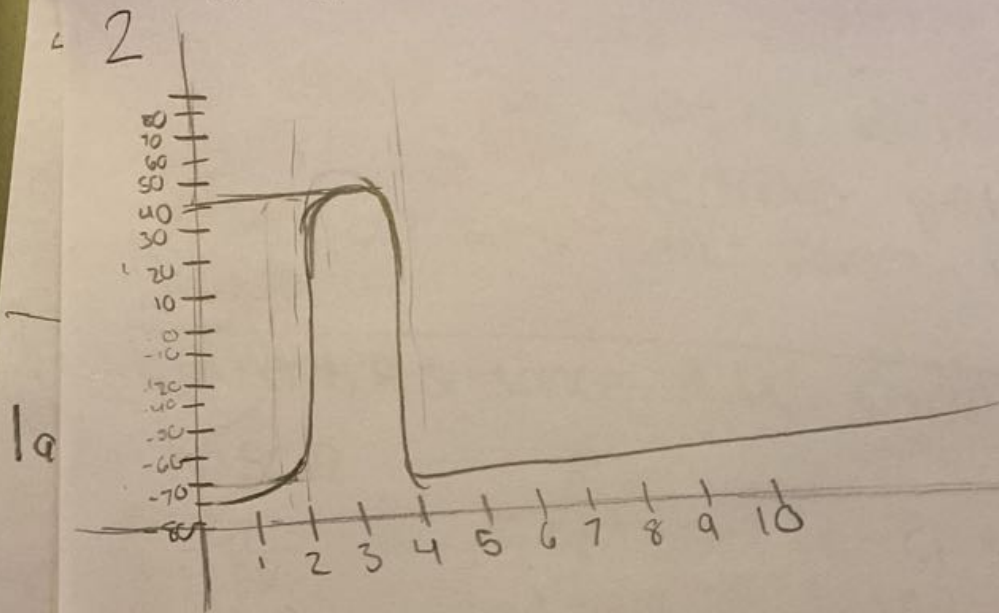
1b) $E = \frac{V}{d} = \frac{4 \times 10^3}{5 \times 10^{-2}} = 8 \times 10^4 \text{ V/m}$



3a) $C = \frac{\epsilon \cdot A}{d} = \frac{8.85 \times 10^{-12} \times 10^{-4}}{2 \times 10^{-3}} = 4.42 \times 10^{-13} \text{ F}$

3b) $\frac{1}{2} CV^2 = \frac{1}{2} \times 4.42 \times 10^{-13} \times 25$
 $= 55.31 \times 10^{-13} \text{ J}$

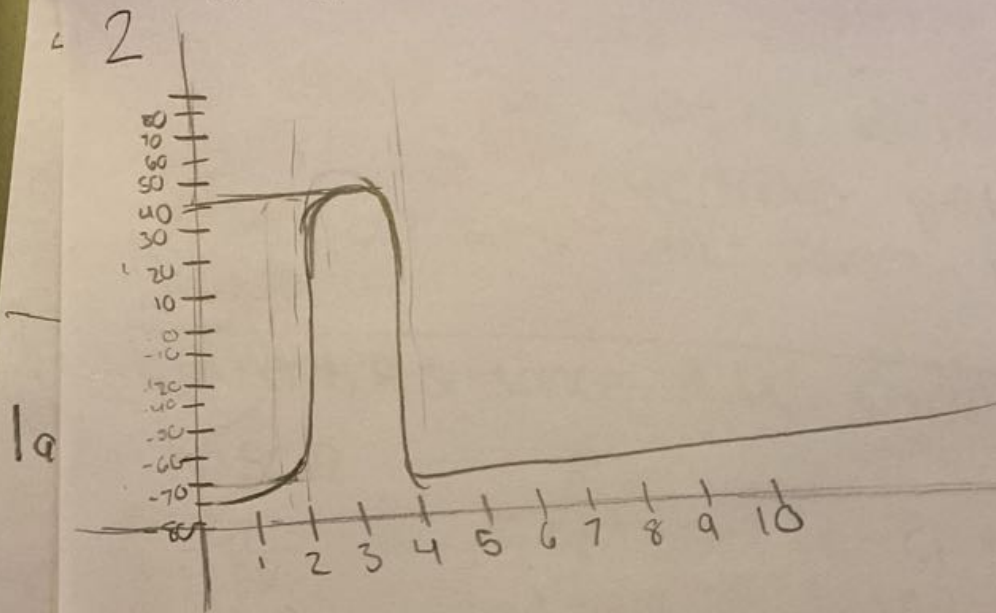
current resistance & DC circuits



a) pulse width is 2ms

b) $40 - (-75)$
 $= 40 + 75$
 $= 115\text{mV}$

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