physics flod term redoing

(2) 1a) $E = \frac{1}{4\pi\epsilon_0} \frac{q}{r^2}$

$r = 1mm$

$E = 2 \times 10^{-3}$

$2 \times 10^{-3} = \frac{1}{4\pi\epsilon_0} \frac{q}{(1 \times 10^{-3})^2}$

$r = 5mm$

$2 \times 10^{-3} \times 1 \times 1^{-6} = \frac{q}{4\pi\epsilon_0}$

↳ $E = \frac{1}{4\pi\epsilon_0} \frac{q}{(5 \times 10^{-3})^2}$

$2 \times 10^{-3} \times 10^{-6} \cdot \frac{1}{25 \times 10^{-6}}$

$E = 0.08 \times 10^{-3} \rightarrow 8 \times 10^{-5}$ N/C

1b) $E = \frac{1}{4\pi\epsilon_0} \frac{q}{r^2}$

$q = 1 \mu C$

$E = 8 \times 10^{-3}$ N/C

$8 \times 10^{-3} = \frac{1}{4\pi\epsilon_0} \cdot \frac{1 \times 10^{-6}}{r^2}$

$8 \times 10^{-3} = \frac{1}{4\pi\epsilon_0 r^2}$

$q = 3 \mu C$

$E = \frac{1}{4\pi\epsilon_0} \frac{3 \times 10^{-6}}{r^2}$

$E = 8 \times 10^{3} \times 3 \times 10^{-6}$

$E = 24 \times 10^{-3}$ N/C

2a)

$m = 4 \times 10^{-16}$ kg

E = field = 6131.25

charge = q

$qE = mg \Rightarrow q = \frac{mg}{E} = \frac{4 \times 10^{-16} \times 9.8}{6131.25} = 6.39348 \times 10^{-19}$

$q = ne$ $\quad n = 3.9959 \approx 4$ electrons

$\frac{q}{e} = n$

2b) $q = q - e = 4.7934760 45 \times 10^{-19}$ ↳ (FE) $- q'E$

$= 2.939 \times 10^{-15}$

$m' = m - m_e \approx 4.0 \times 10^{-16}$

$m_e = 9.1 \times 10^{-31}$ kg

$F_g = m'g = 3.92 \times 10^{-15}$ N

(3)

1a $KE = qV$ $\Delta V = 4\,kV$ $H = +1qe$ $He = +2qe$

$KE_{hydrogens} = 1.6\times10^{-19} \times 4\times10^{3}$ – ~~..~~ – Hydrogens

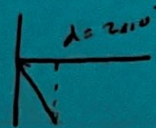
$KE_{He} = 2\times10^{-19} \times 4\cdot10^{3} = 12.8\times10^{-16}\,J$ – Helium

1b) $E\ \frac{\Delta V}{\Delta x} = \frac{4\times10^{3}}{5\times10^{-2}} = 8\times10^{4}\ V/m$ = E-field

$\Delta x = 5\,cm$

2) $E = 1k\ V/m \Rightarrow E\ 1000\ V/m$

as $E = \frac{-dv}{dx}$ or $V = -E\,x$



slope = m = 1000 V/m

y-int = 0

3a) $C = \frac{\varepsilon_0 A}{d} = \frac{8.85\times10^{-12}\times10^{-4}}{2\times10^{-3}} = 4.425\times10^{-13}\,F$

$A = 1\,cm^2$

$V = 5\,V$

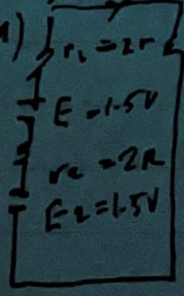
3b) Energy $= \frac{1}{2}CV^2 = \frac{1}{2}\times 4.425\times10^{-13}\times25 = \boxed{55.31\times10^{-13}\,J}$

4a) for more capacitance we should connect the Identical capacitors in parallel, because capacitance gets added up in parallel combination.

4b) $C_{net} = C_1 + C_2 = 2C$

$4.425\times10^{-13} + 4.425\times10^{-13} = \boxed{8.85\times10^{-13}\,F}$

4) 1a)



$R = 50\Omega$

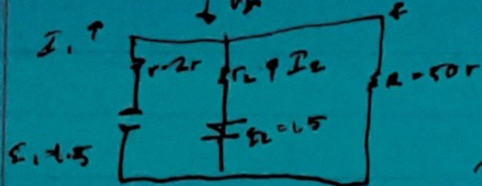
$-E_2 + IR_2 + Ir_1 - E_1 + IR = 0$

$-1.5 + I\,(r_1 + r_2 + R) - 1.5V = 0$

$I = \frac{3V}{r_1 + r_2 + R} = \frac{3}{2+2+50} = \frac{3}{54} = 55.56\,mA$

cont.

④ 1(a) Parallel



$$\frac{Vr-1.5}{2}+\frac{Vr-1.5}{2}+\frac{Vr}{50}=0$$

$$\frac{25Vr-37.5+25Vr-37.5+Vr}{50}=0$$

$51Vr=75,\ \boxed{Vr=1.470}$

$I_1=\frac{1.5-1.47}{2r}=15\text{ mAmp}$

$I=I_1+I_2$
$=30\text{ mA}$

$I_2=\frac{1.5-1.47}{2}=15\text{ mAmp}$

1(b) $P_{total}=P_{r1}+P_{r2}+P_r$
$=I^2r_1+I^2r_2+I^2r$
$=55.5\text{mA}^2\cdot2+(55.6\text{mA})^2\cdot2+(55.56\text{mA})^2\cdot50$
$=6.17\text{mW}+6.17\text{mW}+154.34\text{mW}$
$=277.51\text{mW}$ $R\Rightarrow P_r=154.34\text{mW}$

$P_{total}=P_{r1}+P_{r2}+P_r$
$=I_1^2r+I_2^2r+I^2r$
$=(15m)^2+(15m^2)\cdot2+(30m)^2\cdot50$
$=0.45\text{mW}+0.45\text{mW}+45\text{mW}$
$=\boxed{145.9\text{mW}}$
$r=P_r=I^2r=(30m)^2\cdot50$
$=\boxed{45\text{mW}}$

2a) $\boxed{\text{Pulse width}=2\text{ms}}$

2b) $=30-(-35)$
$\boxed{30+35=65\text{ mV}=V\text{ peak-peak}}$

2c) It would take approximately 20-24ms for the signal to travel from the toe to the spinal cord