

① a 1.0

② b 1.0

①  $U = \frac{Q^2}{2C}$

$Q = \sqrt{2CU}$

$Q = \sqrt{(2)(2\mu)(4)}$

$Q = 4mC$  0.3

$Q_1 = Q_2 = 2mC$

$C_{eq} = 2\mu + 2\mu$

$C_{eq} = 4\mu F$  0.3

$U = \frac{Q^2}{2C_{eq}}$

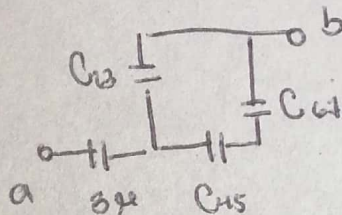
$U = \frac{(4m)^2}{2(4\mu)}$

$U = 2J$  0.4

② a  $C_{13} = 5\mu F$

$C_{45} = 10\mu F$

$C_{67} = 10\mu F$



$C_a = 5\mu F$

$C_b = 10\mu F$

$C_{eq} = 2.3\mu F$  1.0

③  $Q_T = (2.3\mu)(10)$

$Q_T = 23\mu C$

$V = \frac{Q}{C} = \frac{23\mu}{3\mu}$

$V_1 = 7.67V$  0.5

③  $V_2 = 10 - 7.67 = 2.33V$

$Q_3 = Q_{13} = C_{13}V_{13}$

$Q_3 = (5\mu)(2.33)$

$Q_3 = 11.7\mu C$  0.5

③ a  $C = \frac{\epsilon_0 A}{d-b} = \frac{(8.85 \times 10^{-12})(0.5)}{0.5 \times 10^{-2}} = 885 pF$

$C_2 = \frac{2\epsilon_0 A}{b} = \frac{(5)(8.85 \times 10^{-12})(0.5)}{0.3 \times 10^{-2}} = 7.38 nF$

0.5

Series

$C_{eq} = 790 pF$  0.5

③  $Q = CV = (790 pF)(125)$

$Q_0 = 98.8 nC$  0.5

③  $C_0 = \frac{\epsilon_0 A}{d} = \frac{\epsilon_0(0.5)}{0.8 \times 10^{-2}} = 553 pF$  0.5

$V = \frac{Q}{C_0} = \frac{98.8 n}{553 p} \rightarrow V = 178.3V$

4)

$$a) \frac{197g}{mol} \times \frac{1mol}{6.022 \times 10^{23} e} \times \frac{cm^3}{19.3g} \times \frac{(1m)^3}{(100cm)^3} = 1.695 \times 10^{-29} \frac{m^3}{e^-}$$

$$\boxed{n = 5.9 \times 10^{28} \bar{e}/m^3} \quad 0.8$$

6)

$$I = nqU_d$$

$$I = (5.9 \times 10^{28})(1.6 \times 10^{-19})(5.2 \times 10^{-4})(\pi)(1.5 \times 10^{-3})^2$$

$$\frac{I}{A} = nqU_d$$

$$\boxed{I = 34.7 A} \quad 0.7$$

$$I = nqU_d A$$

5)

$$R = \rho \frac{L}{A}$$

a)

$$\rho = \frac{RA}{L} = \frac{(30)(1.5 \times 10^{-4})}{20} = 2.25 \times 10^{-4} \Omega \cdot m$$

$$\sigma = 1/\rho = 1/2.25 \times 10^{-4} \rightarrow \boxed{\sigma = 4444 (\Omega m)^{-1}} \quad 0.8$$

$$b) P = \frac{V^2}{R} = \frac{(150)^2}{30}$$

$$\boxed{P = 83.3 W} \quad 0.7$$