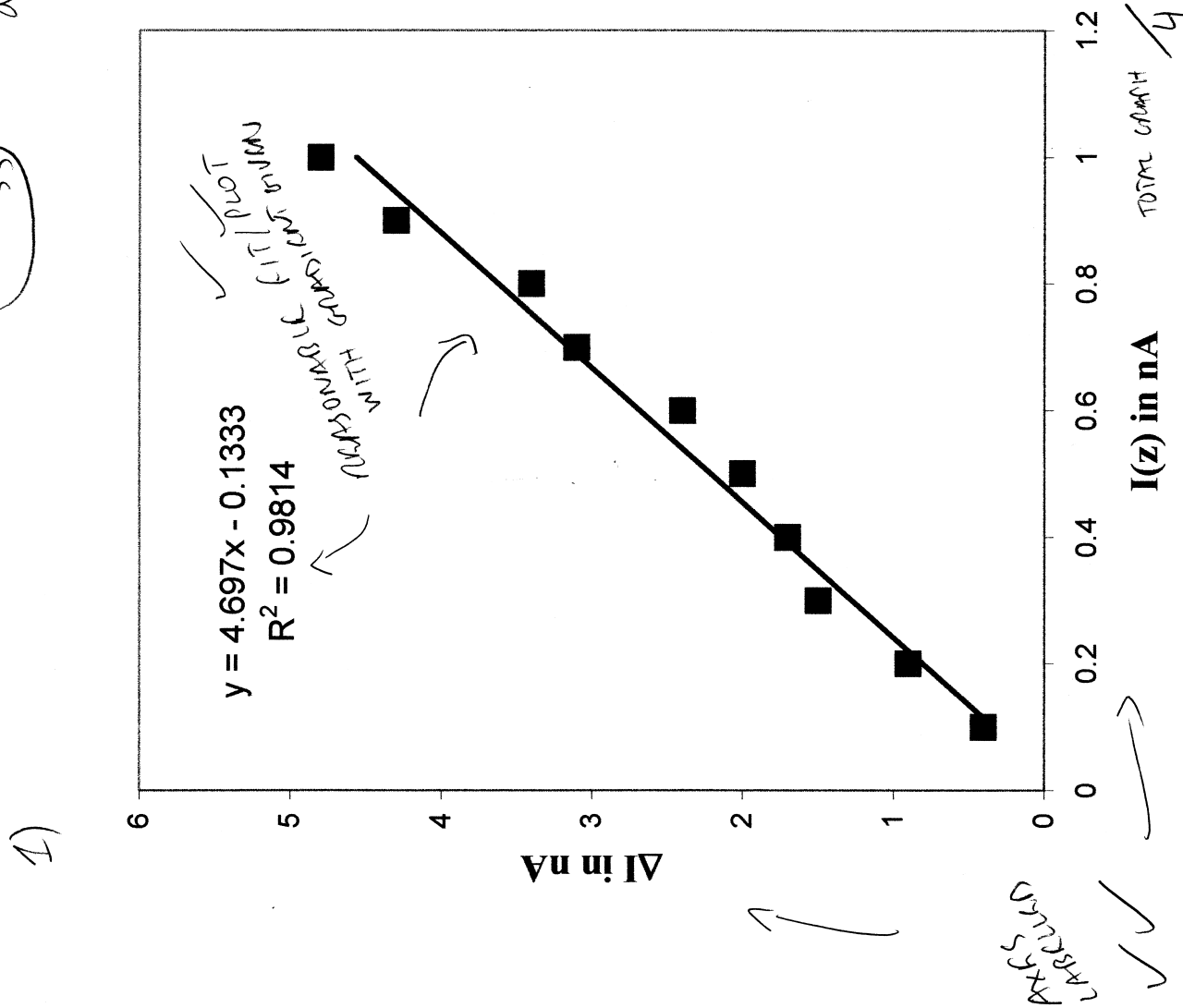


TOTAL / 33

TOTAL / 33



6



$$|AI| = 2k\Delta z I(z)$$

$$\mu = \text{card}(\bar{w}) = 2k \Delta z \quad (\text{dimensionsless})$$

$$k = \sqrt{\frac{2m_e \phi_{\text{work}}}{\hbar^2}}$$

$$\Delta z = 0.2 \text{ nm} = 2 \times 10^{-10} \text{ m}$$

$$\mu = Z\Delta z \sqrt{\frac{2mep_{\text{Hofu}}}{h^2}}$$

$$\varphi_{\text{HRC}} = \frac{\mu^2 \hbar^2}{8m_e (\Delta z)^2}$$

$$\phi_{1904} = \mu^2 \times \frac{(6.58 \times 10^{-16})^2 \times 9 \times 10^{16}}{8 \times 5.11 \times 10^5 \times (2 \times 10^{-13})^2} = \mu^2 \times 0.238 \text{ eV}$$

$$\varphi_{\text{HOMO}} = 4.7^{\circ} \times 0.238 = 5.26 \text{ eV}$$

USING GRAPH
FROM GRAPH

ACCUSATION

Q_{VAWC}

+ 5 for 2nd $\uparrow \frac{1}{4}$ $\text{Cr}^{2+} + 1 \text{ mole}$

DATA-5
/S

1) b)

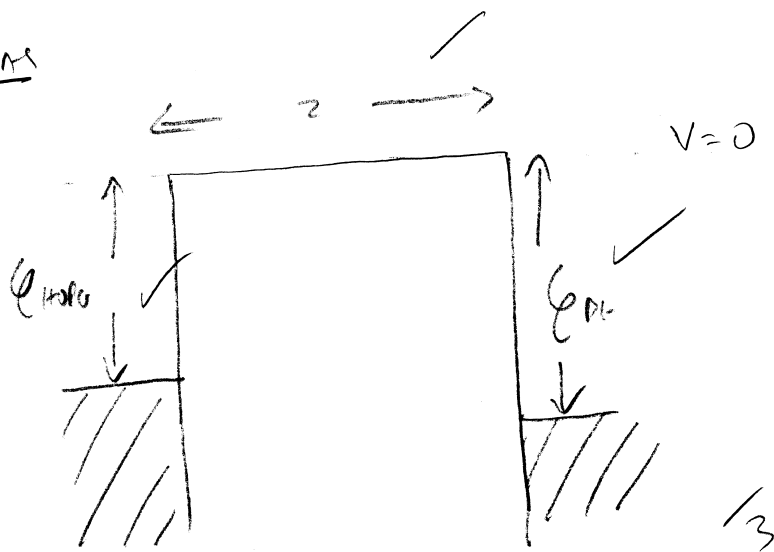
INFORMATION REQUIRED:

ϕ_{Pt} , ϕ_{HfO_2}

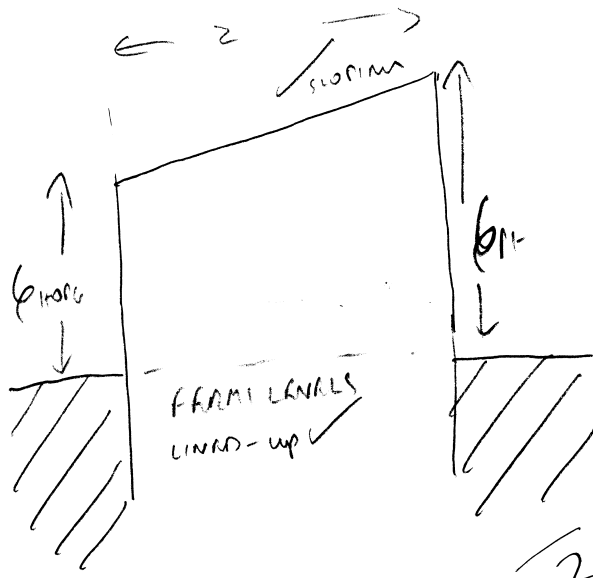
NOW ... LOOKING UP $\phi_{Pt} \sim 6\text{eV}$ ✓

$\phi_{HfO_2} \sim 4.5\text{eV}$ ✓ $\frac{1}{2}$

NO BIAS



SHORTED



⇒ MODIFICATION,
APPLY SMALL POSITIVE
BIAS TO THE PLATINUM
(SAY 100mV)
TO ALLOW TUNNELING

TOTAL 21
21

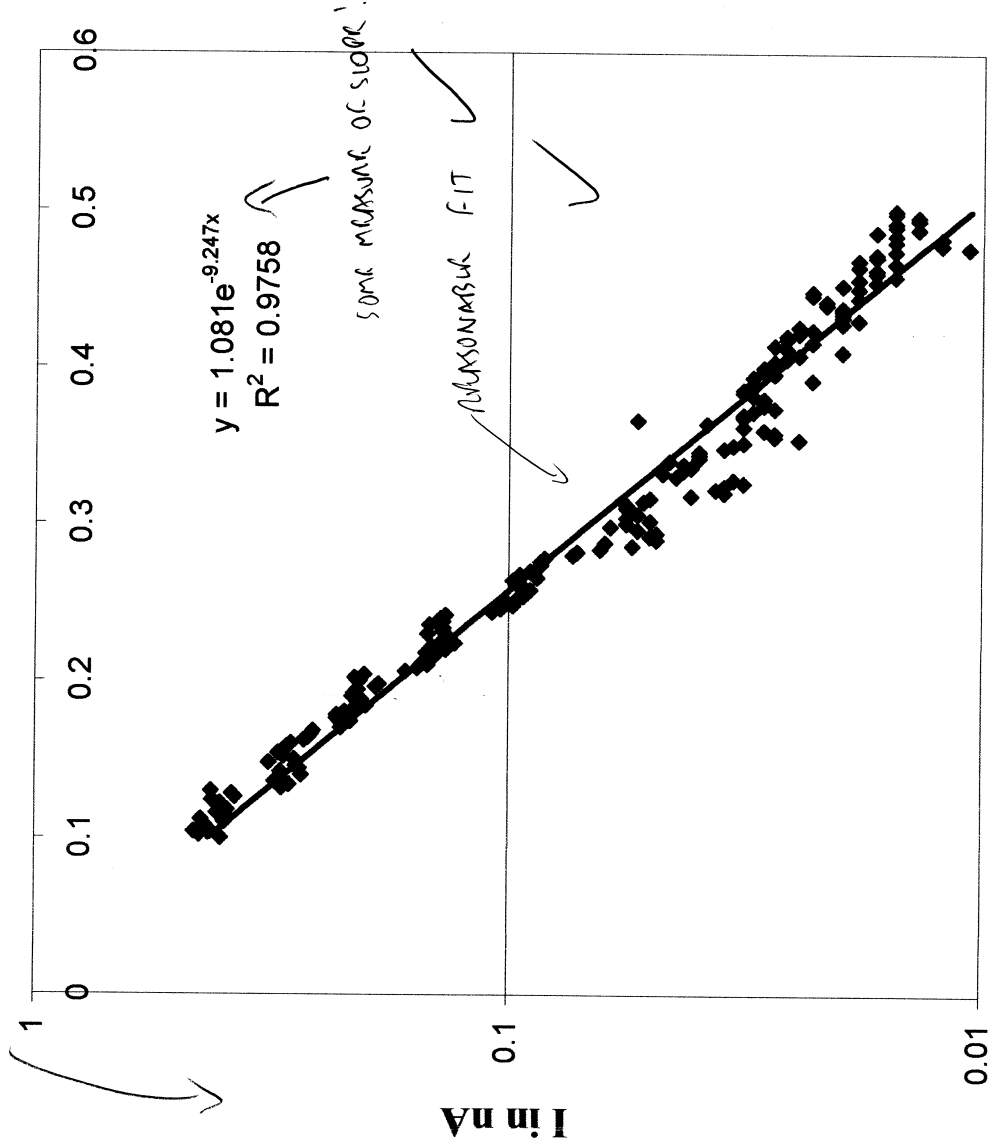
2)

3

LOG-LINEAR
(LINEAR)
ON SEMILOG PLOT

AXES LABELLED

z in nm



TOTAL GRAPH

5

$$I(z) = I_0 e^{-2\kappa z} \quad \checkmark \quad \kappa = \sqrt{\frac{2m\phi}{\hbar^2}}$$

$$\ln I = -2\kappa z + \ln I_0 \quad \log_{10} x = \frac{\ln x \cdot \ln 10}{2.3}$$

$$2.3 \log_{10} I = -2\kappa z + 2.3 \log_{10} I_0 \quad \checkmark$$

FROM LOG-LINEAR ON SEMILOG PLOT

$$\mu = -2\kappa \quad \checkmark \quad \mu = -9.25 \text{ nm}^{-1} = -9.25 \times 10^9 \text{ m}^{-1}$$

$$\mu^2 = 41 \cdot \frac{2m\phi}{\hbar^2} \quad \mu^2$$

$$\phi = \frac{\mu^2 \hbar^2}{8m} = \frac{(6.58 \times 10^{-16})^2 \times 9 \times 10^{16} \times (9.25 \times 10^9)^2}{8 \times 5.11 \times 10^{-31}} \quad \checkmark$$

$$\phi_{\text{HOLG}} = 0.81 \text{ eV} \quad \checkmark \quad \text{TOTAL CALC} \quad \checkmark$$

FOR TOO SMALL COMPARED TO Q1
(ALMOST AN ORDER OF MAGNITUDE!)

(ANY INTELLIGENT COMMENT) / 2

TOTAL Q2
12