2021级物理实验（上）期末大作业——答题纸（正反面打印）

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一、计算题1

解：图1：70.28mm　　图二：12.519mm

（1）由题得，$\overline{D} = \dfrac{(20.42 + 20.34 + 20.40 + 20.46 + 20.40 + 20.42)mm}{6} = 20.41mm$

$U_B = U_{ins} = 0.02mm$

当 $n=6$，$\dfrac{t}{\sqrt{n}} = 1.05$

$U_A = \dfrac{t}{\sqrt{n}}\sqrt{\dfrac{\frac{1}{6}\sum(Di-)^2}{6-1}} = \dfrac{t}{\sqrt{n}}\sqrt{\dfrac{\sum(Di-\overline{D})^2}{6-1}} = 1.05 \times \sqrt{\dfrac{(20.42-20.41)^2 + (20.34-20.41)^2 + (20.40-20.41)^2 + (20.46-20.41)^2 + (20.40-20.41)^2 + (20.42-20.41)^2}{5}}$

$= 0.0435mm$

$U_D = \sqrt{U_B^2 + U_A^2} = 0.048mm$

则，D的表达式为 $D = 20.410 \pm 0.048mm$

二、计算题2

解：（1）$\overline{d} = (41.20 + 41.22 + 41.26)/3 = 41.23mm$

$h = (12.361 - 0.005)mm = 12.356mm$

则，$\overline{V} = \dfrac{\pi d^2 h}{4} = \dfrac{3.14 \times 41.23^2 \times 12.356}{4}mm^3 = 16488.237mm^3$

$= 1.6488237 \approx 1.65 \times 10^4 mm^3$

（2）$V = \dfrac{\pi d^2 h}{4}$

两边取自然对数

$\ln V = \ln\dfrac{\pi}{4} + 2\ln d + \ln h$

对 $\ln V$ 求关于 d 与 h 的偏导：

$\dfrac{\partial \ln V}{\partial d} = \dfrac{2}{d}$；$\dfrac{\partial \ln V}{\partial h} = \dfrac{1}{h}$

则有，

$\dfrac{U_V}{\overline{V}} = \sqrt{\left(2\dfrac{U_d}{d}\right)^2 + \left(\dfrac{U_h}{h}\right)^2}$

$E_V = \dfrac{U_V}{\overline{V}}$，所以

$U_V = \overline{V}\sqrt{4\left(\dfrac{U_d}{d}\right)^2 + \left(\dfrac{U_h}{h}\right)^2}$

（3）由题得，

$U_h = 0.004mm$

对于 U_d，$U_B = 0.01mm$

$U_A = \dfrac{t}{\sqrt{n}}\sqrt{\dfrac{\sum_{i=1}^{3}(di-\overline{d})^2}{3}} = \sqrt{\dfrac{\sum(di-\overline{d})^2}{2}}$

$(n=3, \dfrac{t}{\sqrt{n}} = 2.48) = \sqrt{\dfrac{(41.20-41.23)^2 + (41.22-41.23)^2 + (41.26-41.23)^2}{2}} \times 2.48$

$= 0.0764mm$

则，$U_d = \sqrt{U_A^2 + U_B^2} = 0.076 \approx 0.0790mm$

$U_V = \overline{V}\sqrt{4\left(\dfrac{U_d}{d}\right)^2 + \left(\dfrac{U_h}{h}\right)^2} = 0.007 \times 10^4 mm^3$

则，$V = \overline{V} \pm U_V = (1.650 + 0.007) \times 10^4 mm^3$

三、作图题

伏安法测得测电阻R的伏安 U-I图
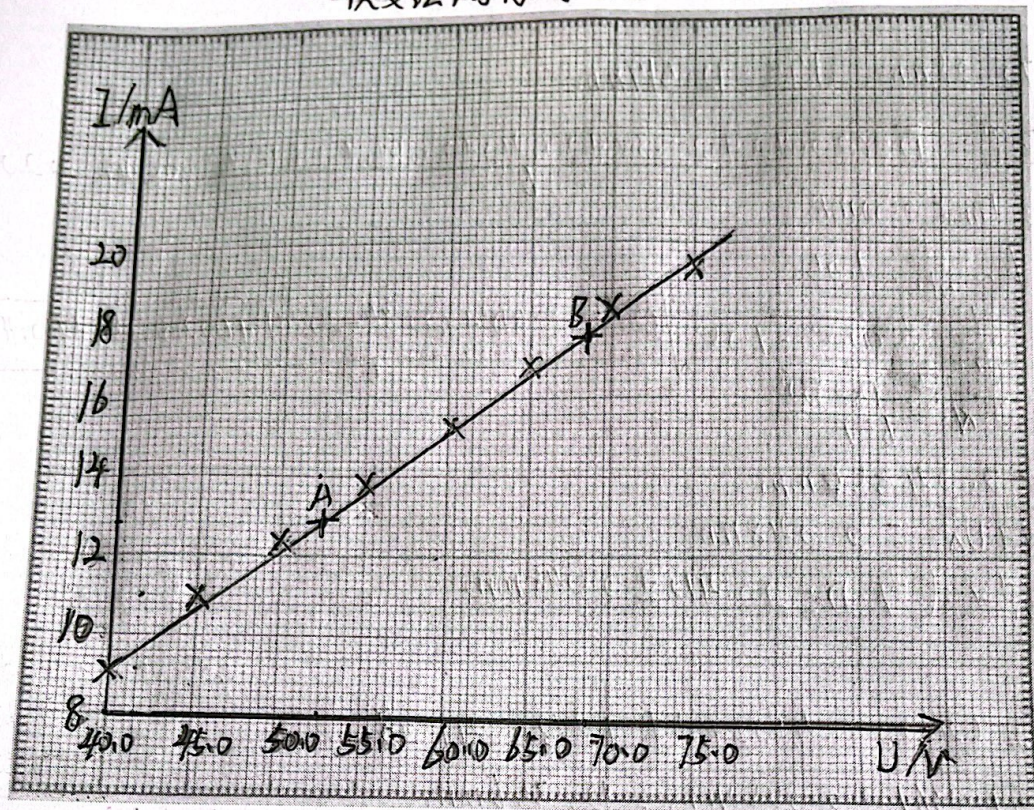
解: 求阻值R.

在图上选取两点 A(52.5, 12.8) 和 B (68.5, 17.6)

$$R = \frac{52.5 - 68.5}{12.8 - 17.6} \times 10^3 \, \Omega = 3.3 \times 10^3 \, \Omega$$