

## 2021 级物理实验 (上) 期末大作业——答题纸 (正反面打印)

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得分

## 一、计算题 1

解: 图 1:  $70.28 \text{ mm}$  图 2:  $12.519 \text{ mm}$ 

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

$$U_D = U_{\text{me}} = 0.02 \text{ mm}$$

$$\text{当 } n=6, \frac{1}{\sqrt{n}} = 1.05$$

$$U_A = \frac{1}{\sqrt{n}} \sqrt{\frac{\sum_{i=1}^n (D_i - \bar{D})^2}{n-1}} = 1.05 \times \sqrt{\frac{(20.42-20.41)^2 + (20.34-20.41)^2 + (20.40-20.41)^2 + (20.46-20.41)^2 + (20.40-20.41)^2 + (20.42-20.41)^2}{5}}$$

$$= 0.0435 \text{ mm}$$

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

$$\text{则, } D \text{ 的表达式为 } D = 20.410 \pm 0.048 \text{ mm}$$

## 二、计算题 2

$$\text{解: (1) } \bar{d} = (41.20 + 41.22 + 41.16) / 3 = 41.19 \text{ mm}$$

$$h = (12.361 - 0.005) \text{ mm} = 12.356 \text{ mm}$$

$$\text{则, } \bar{V} = \frac{\pi \bar{d}^2 h}{4} = \frac{3.14 \times 41.19^2 \times 12.356}{4} \text{ mm}^3 = 16488.237 \text{ mm}^3$$

$$= 1.6488237 \times 10^4 \text{ mm}^3$$

$$(2) \bar{V} = \frac{\pi \bar{d}^2 h}{4}$$

两边取自然对数

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

对  $\ln \bar{V}$  求关于  $d$  与  $h$  的偏导:

$$\frac{\partial \ln \bar{V}}{\partial d} = \frac{2}{d}; \quad \frac{\partial \ln \bar{V}}{\partial h} = \frac{1}{h}$$

则有

$$U_{\bar{V}} = \bar{V} \sqrt{4 \left( \frac{U_d}{\bar{d}} \right)^2 + \left( \frac{U_h}{\bar{h}} \right)^2}$$

而  $U_{\bar{V}} = \frac{U_V}{\bar{V}}$ , 所以

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

(3) 由题得

$$U_h = 0.004 \text{ mm}$$

$$\text{对于 } U_d, U_h = 0.02 \text{ mm}$$

$$U_A = \frac{1}{\sqrt{n}} \sqrt{\frac{\sum_{i=1}^n (d_i - \bar{d})^2}{n-1}} = \sqrt{\frac{(41.20-41.19)^2 + (41.22-41.19)^2 + (41.16-41.19)^2}{2}}$$

$$(n=3, \frac{1}{\sqrt{n}} = 2.48) = \sqrt{\frac{(41.20-41.19)^2 + (41.22-41.19)^2 + (41.16-41.19)^2}{2}}$$

$$= 0.0764 \text{ mm}$$

$$\text{则, } U_d = \sqrt{U_A^2 + U_B^2} = 0.0764 + 0.0790 \text{ mm}$$

$$U_V = \bar{V} \sqrt{4 \left( \frac{U_d}{\bar{d}} \right)^2 + \left( \frac{U_h}{\bar{h}} \right)^2} = 1.650 \times 10^4 \text{ mm}^3$$

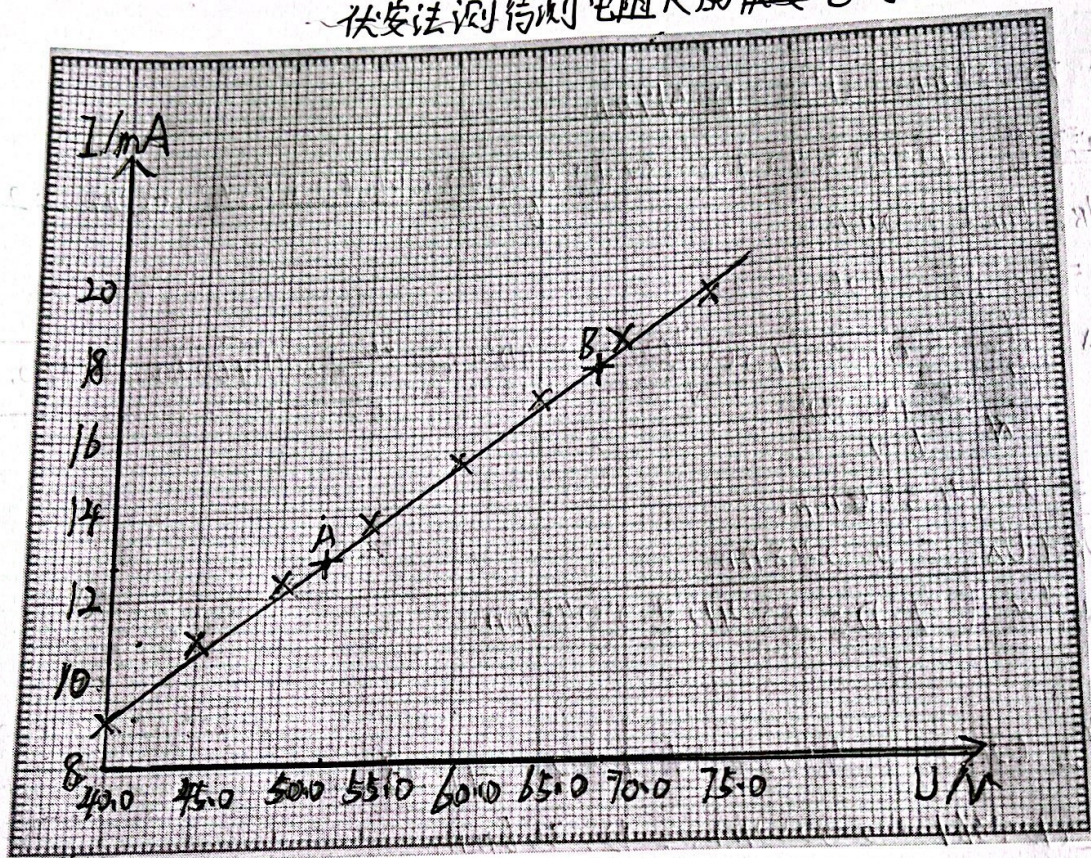
$$\text{则, } V = \bar{V} \pm U_V = (1.650 \pm 0.007) \times 10^4 \text{ mm}^3$$





三、作图题

伏安法测待测电阻  $R$  的  $U-I$  图



解: 求阻值  $R$ .

在图 1 上选取两点 A (52.5, 12.8) 和 B (68.5, 17.6)

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

