

Problem 1: Electrical conductivity in two dimensions (10 points)

Write the numbers from 0 to 9 in the following table:

0	1	2	3	4	5	6	7	8	9

Part A. Four-point-probe (4PP) measurements (1.2 points)

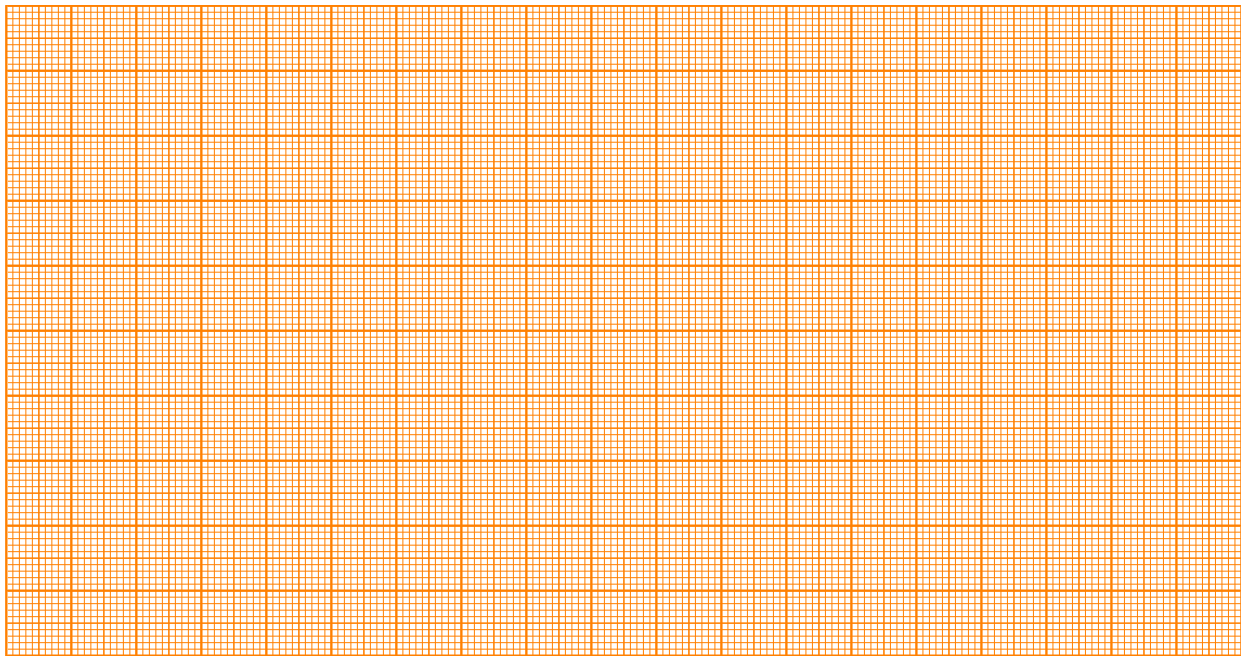
A.1 (0.6 pt)

$s =$

I	V	I	V

Plot your data into **Graph A.1**.

Graph A.1: I vs. V



A.2 (0.2 pt)

$$R =$$

A.3 (0.4 pt)

$$\Delta R =$$

Part B. Sheet resistivity (0.3 points)

B.1 (0.3 pt)

$$\rho_{\square} \equiv \rho_{\infty} =$$

Part C. Measurements for different sample dimensions (3.2 points)

C.1 (3 pt)

$s =$

$\rho_{\infty} =$

The empty columns can be used for intermediate results.

w/s						$f(w/s)$

C.2 (0.2 pt)
Use Table **C.1** to present your results.

Part D. Geometrical correction factor (1.9 points)

D.1 (1.0 pt)

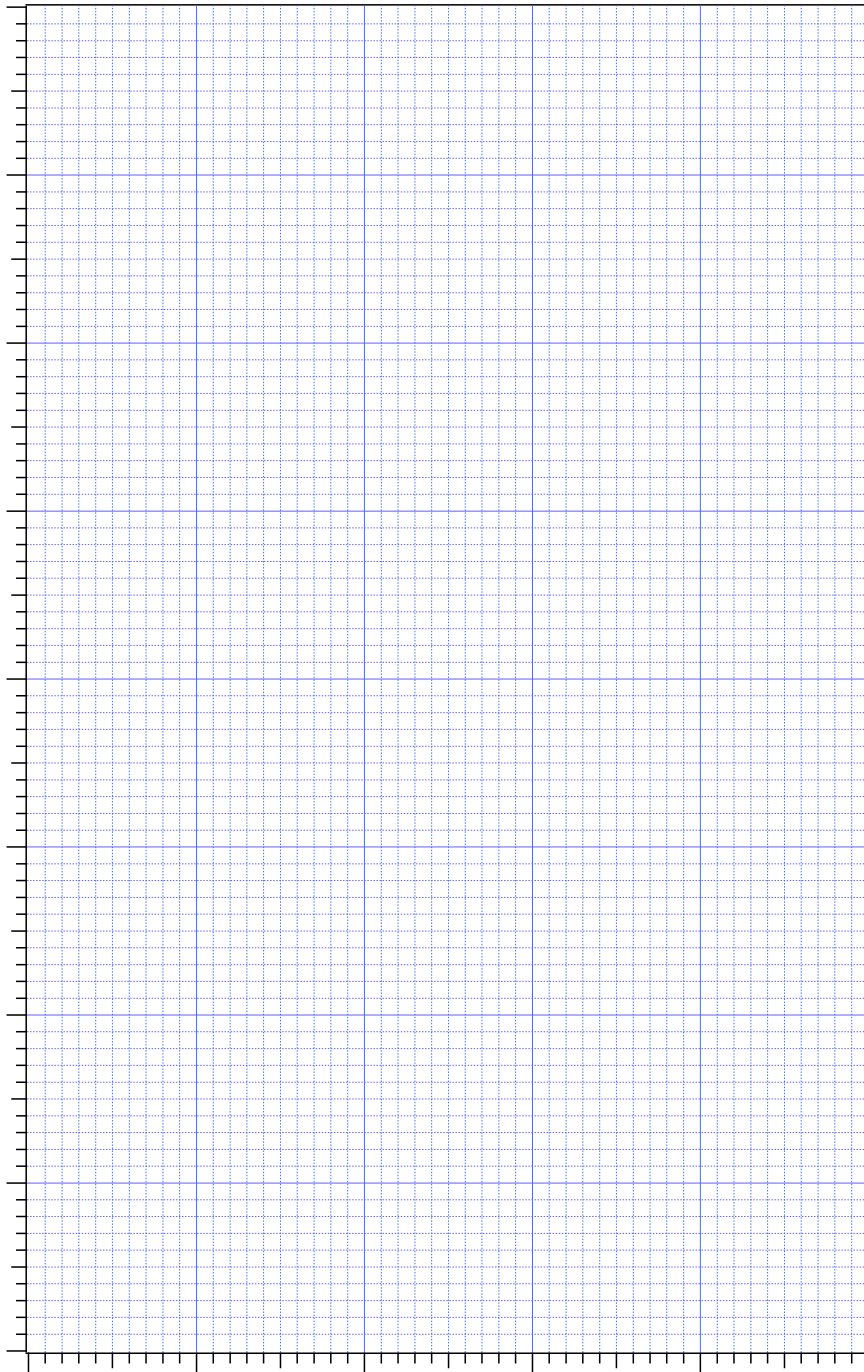
Plot your data on the appropriate graph paper: **either** linear (Graph **D.1a**), **or** semi-logarithmic (**D.1b**) **or** double-logarithmic (**D.1c**) on the following pages (A1-5 to A1-7).

D.2 (0.9 pt)

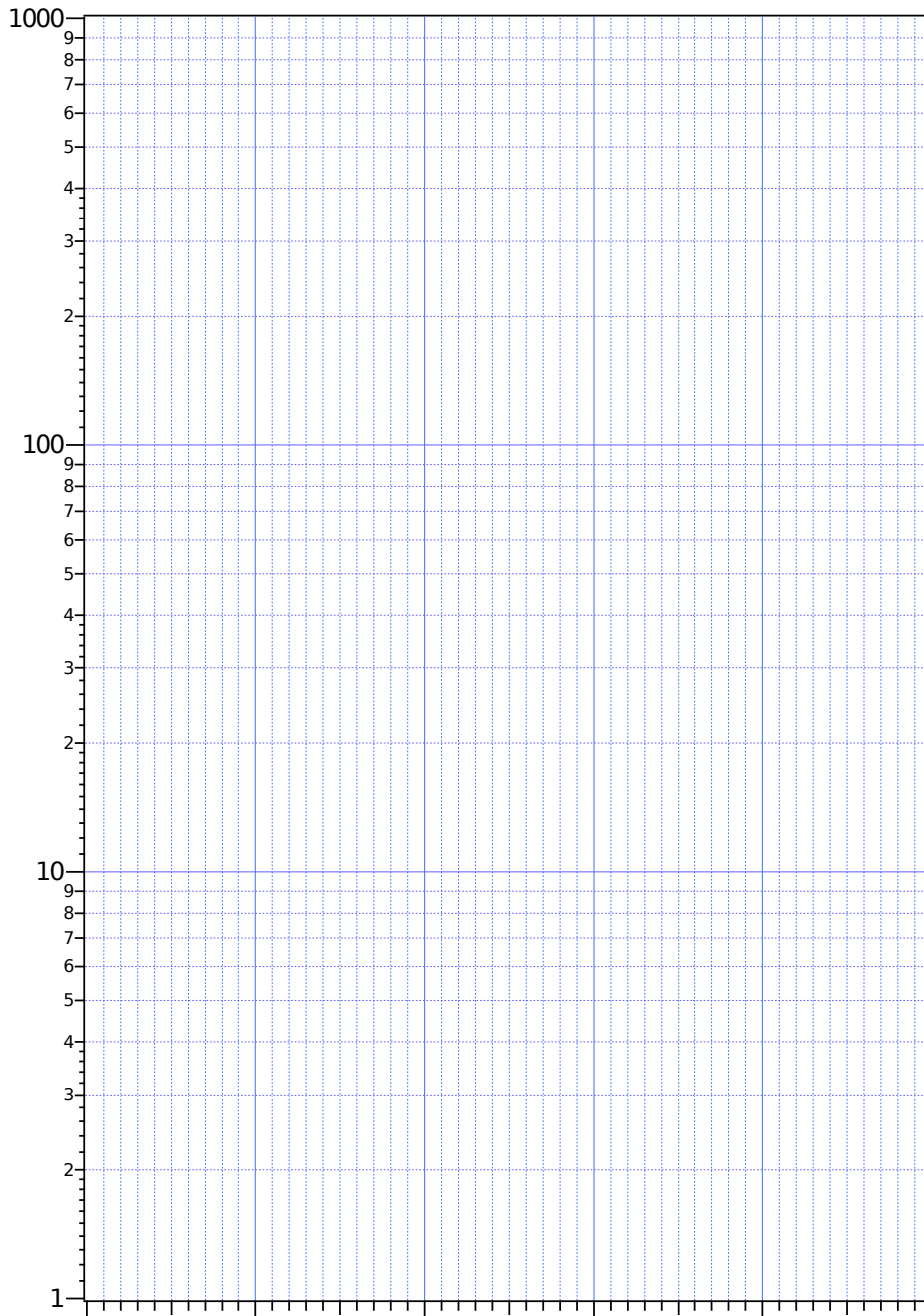
$a =$

$b =$

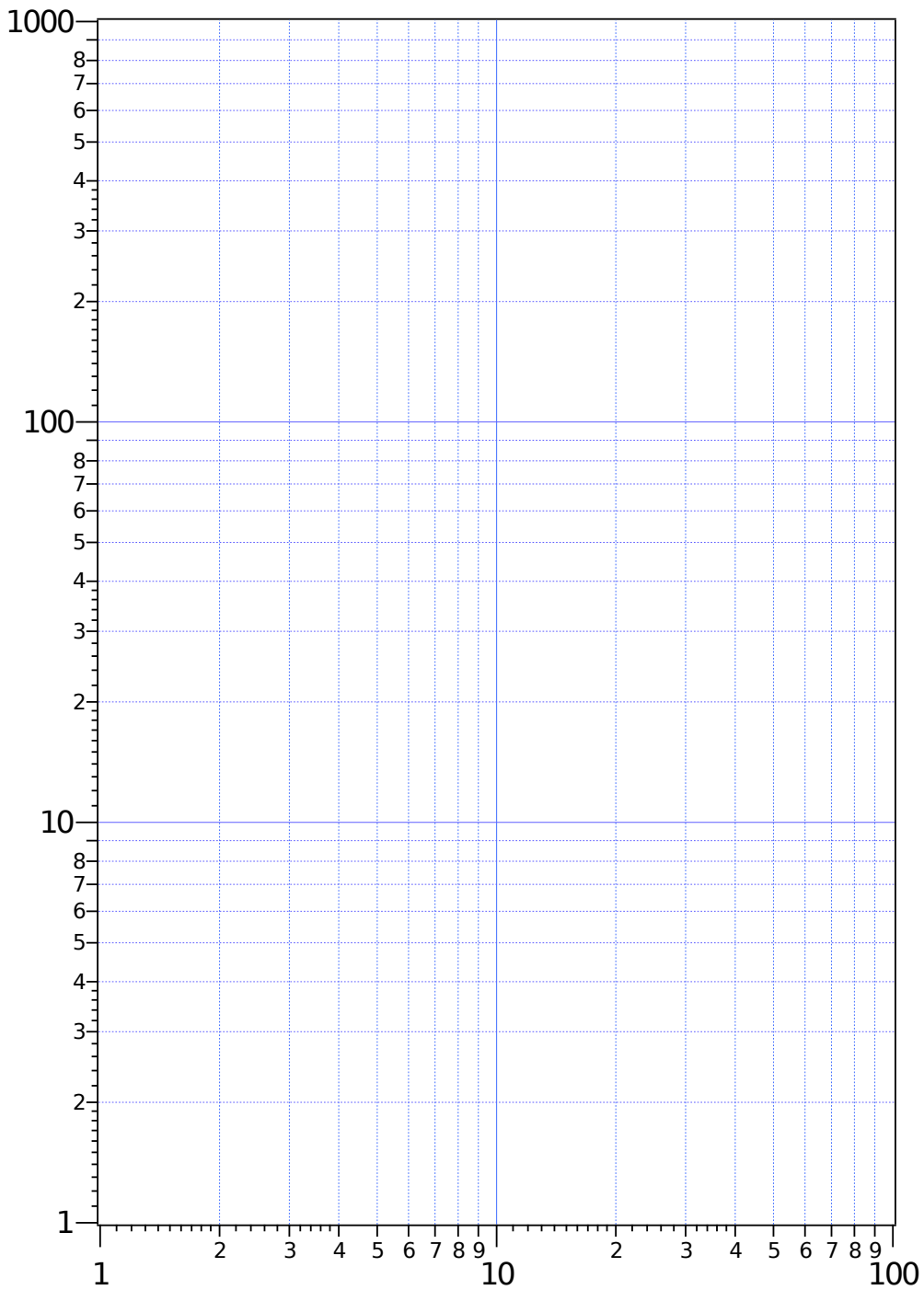
Graph D.1a: linear scale:



Graph D.1b: semi-log scale:



Graph D1c: double-log scale:



Part E. The silicon wafer and the van der Pauw-method (3.4 points)

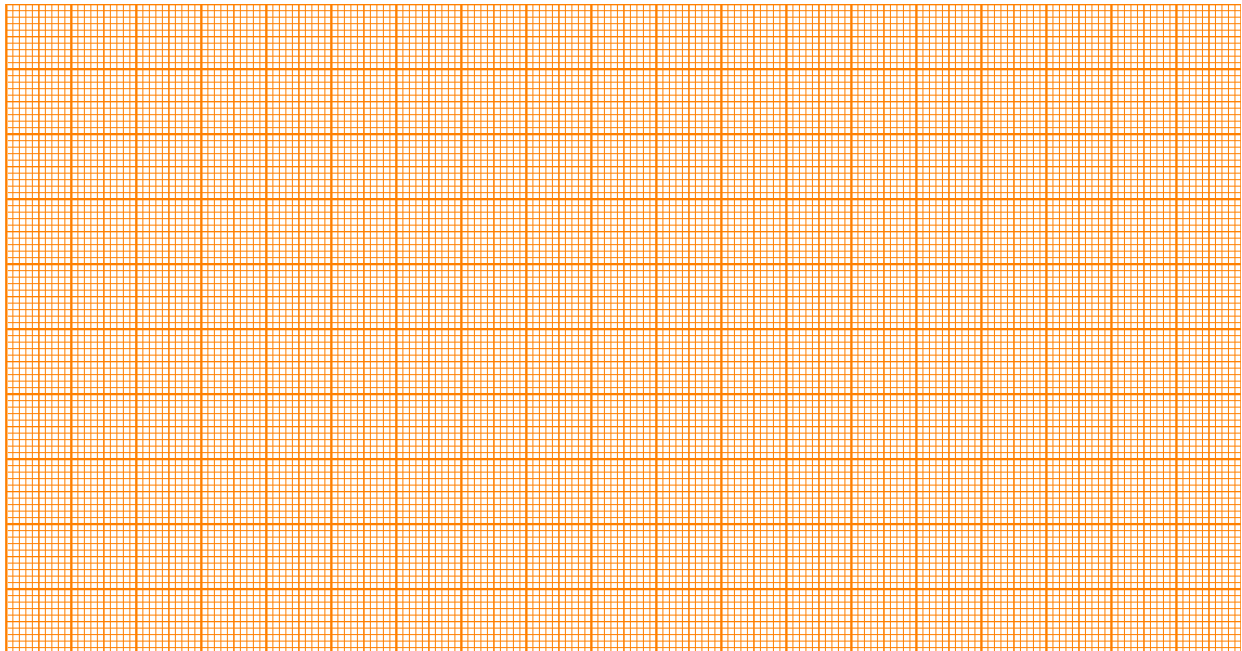
Note the number of your wafer here:

E.1 (0.4 pt)

I	V	I	V

E.2 (0.4 pt)

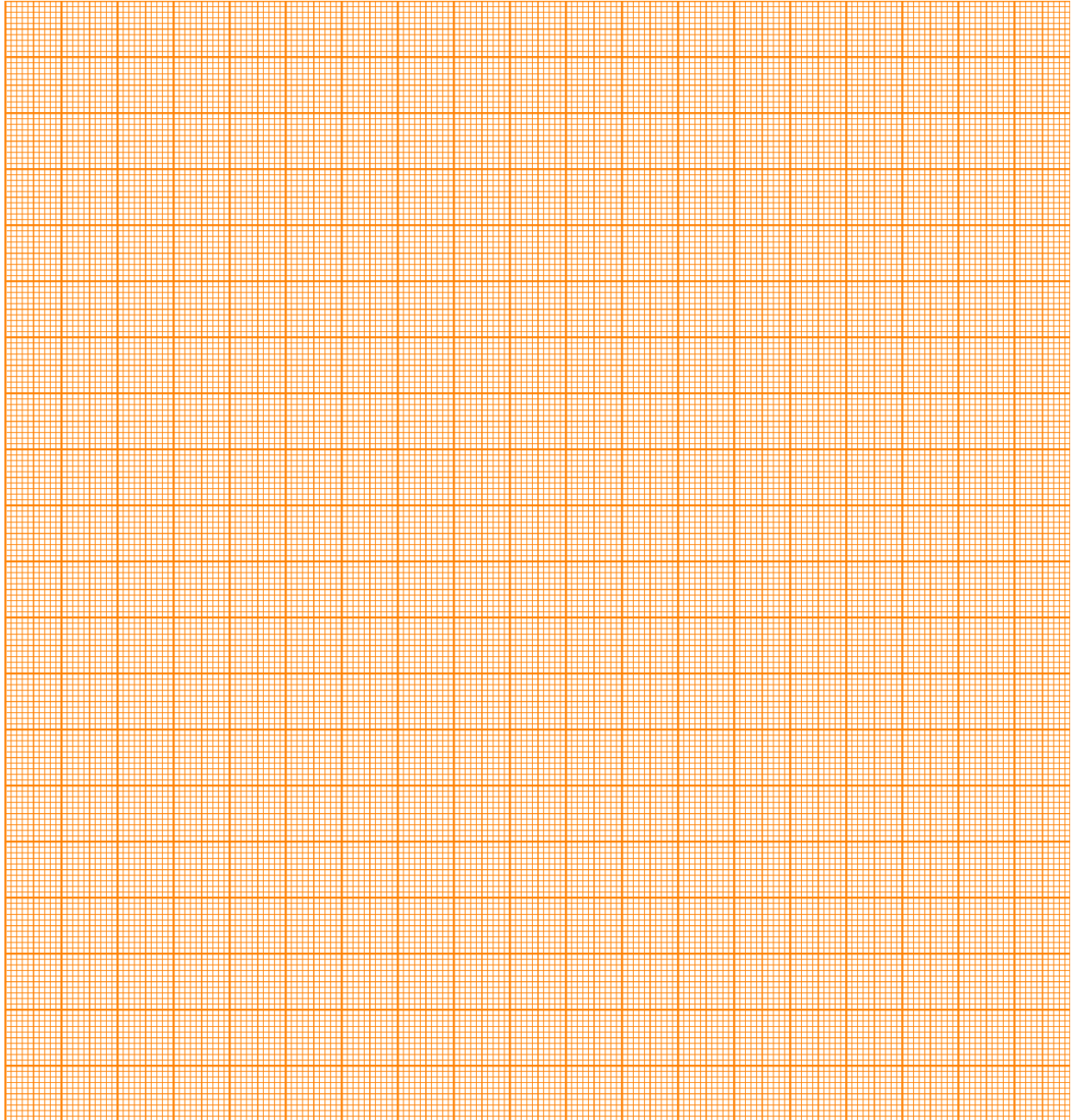
Graph E.2: I vs V



$R_{4PP} =$

E.7 (0.5 pt)

Graph E.7: I vs. V



$\langle R \rangle =$

E.8 (0.4 pt)
Calculation:

$$\rho_{\square} =$$

E.9 (0.1 pt)

$$\frac{\Delta \rho_{\square}}{\rho_{\square}} = \quad = \quad \%$$

E.10 (0.1 pt)

Resistivity of the Cr thin film $\rho =$