

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

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

<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>

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

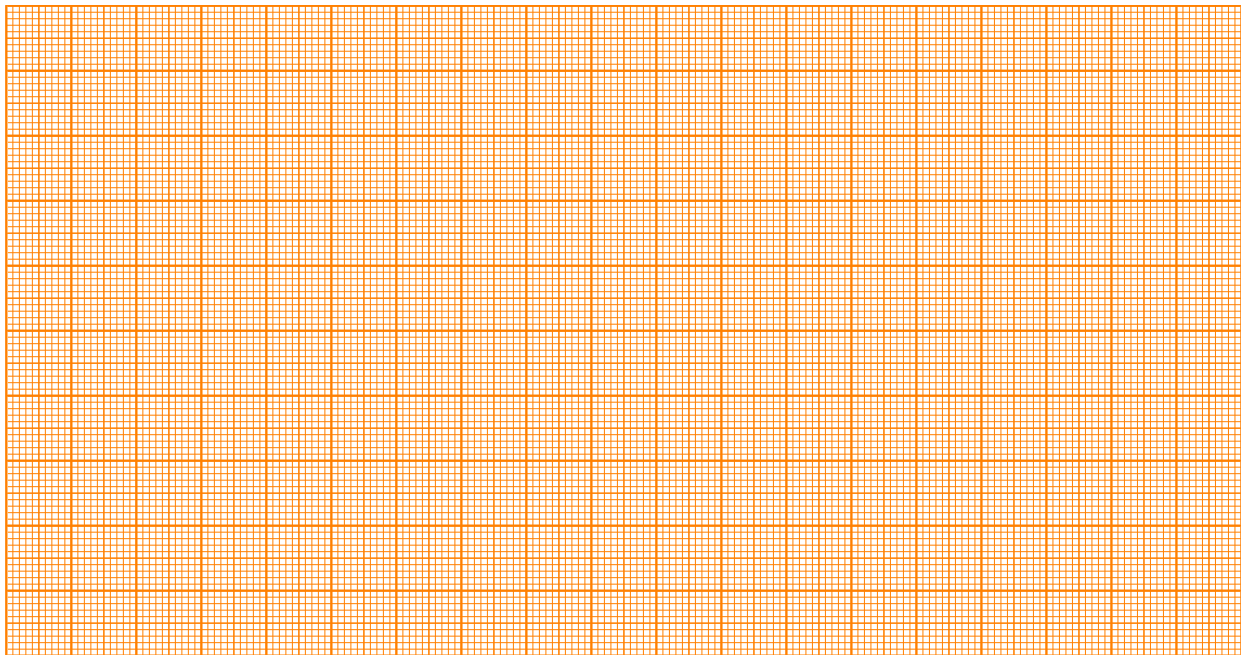
**A.1** (0.6 pt)

$s =$

$I$	$V$	$I$	$V$

Plot your data in **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** for your results.

## Part D. Geometrical correction factor (1.9 points)

### D.1 (1.0 pt)

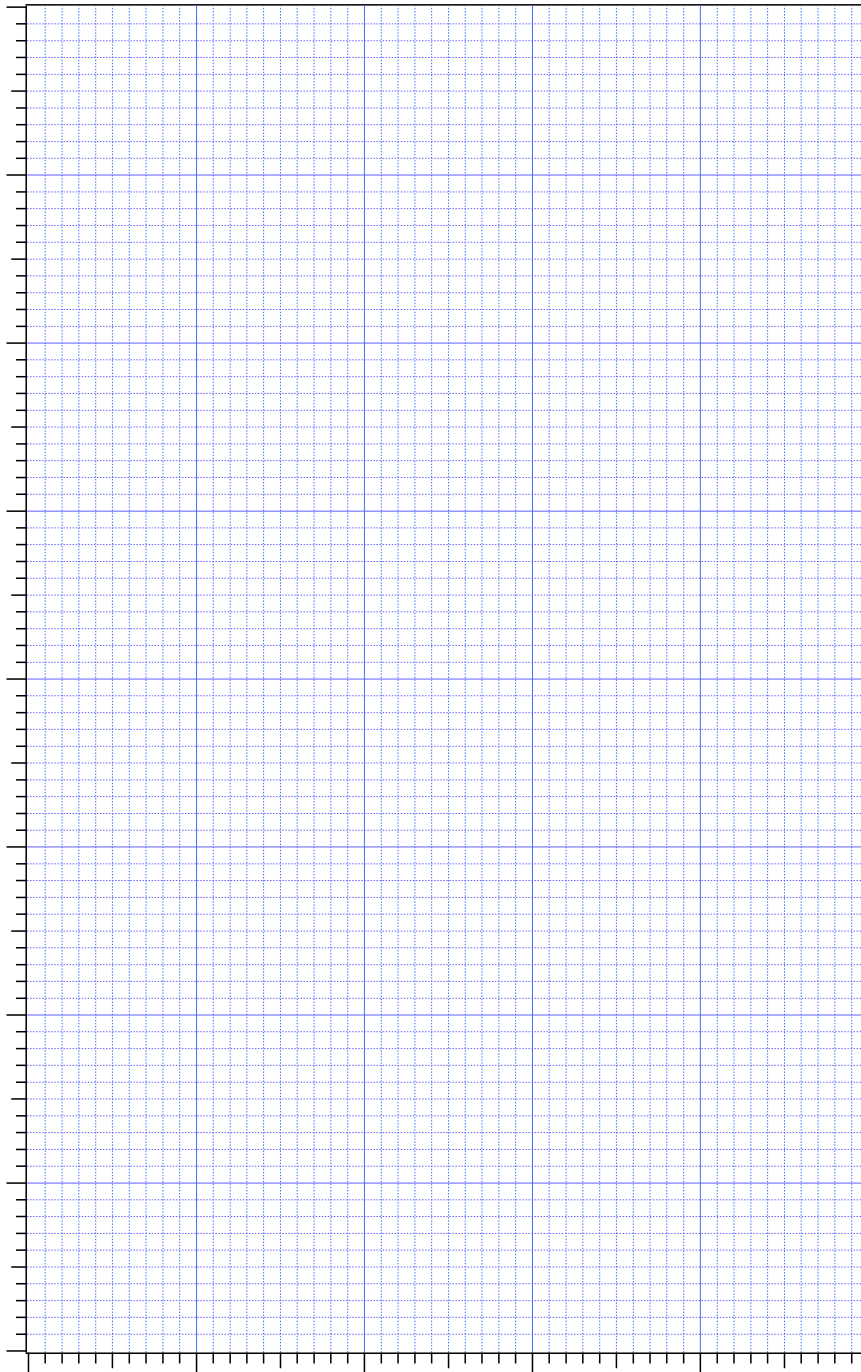
Plot your data on the appropriate graph paper: linear (Graph **D.1a**), semi-logarithmic (**D.1b**) or double-logarithmic (**D.1c**) on the following pages.

### D.2 (0.9 pt)

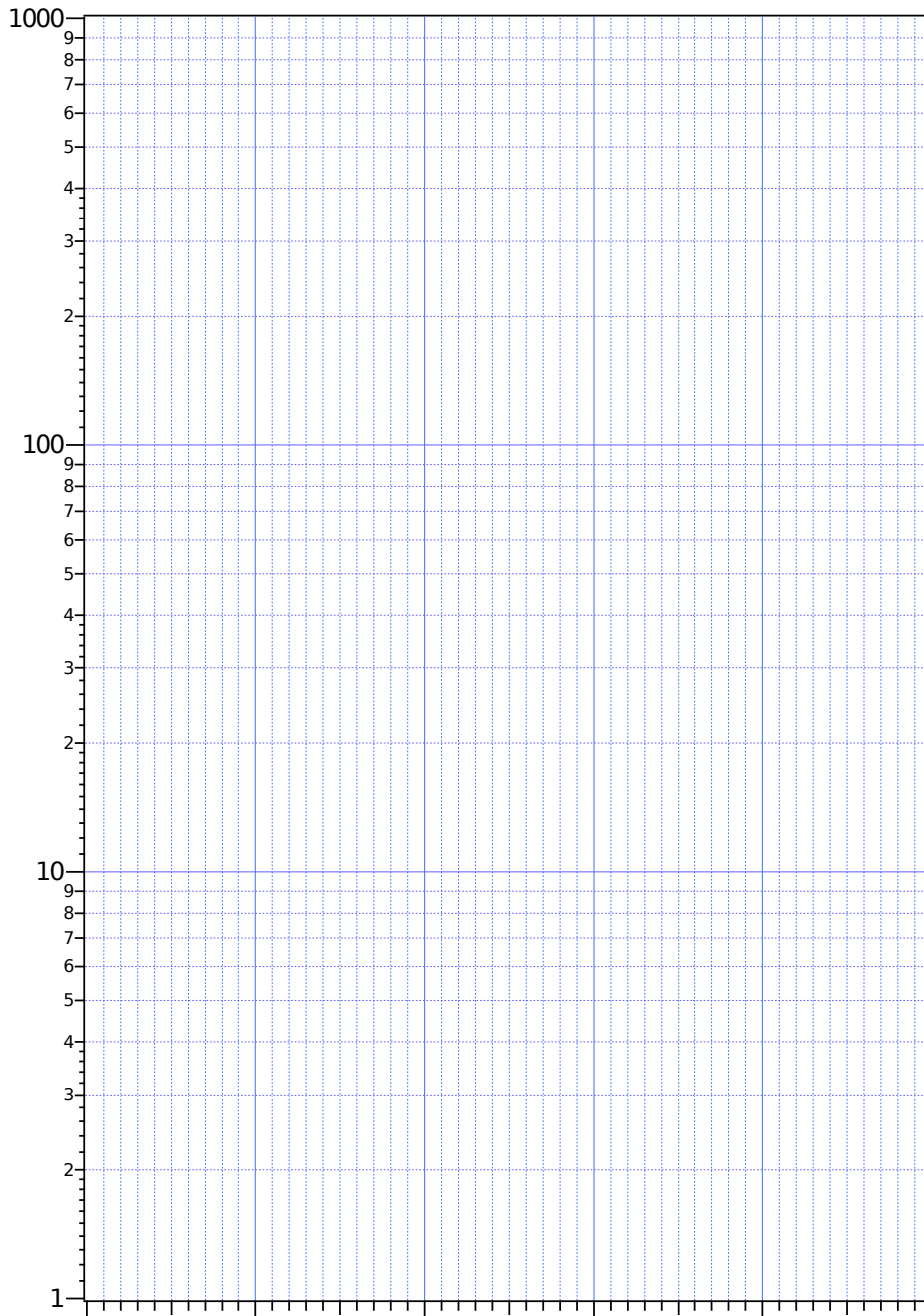
$a =$

$b =$

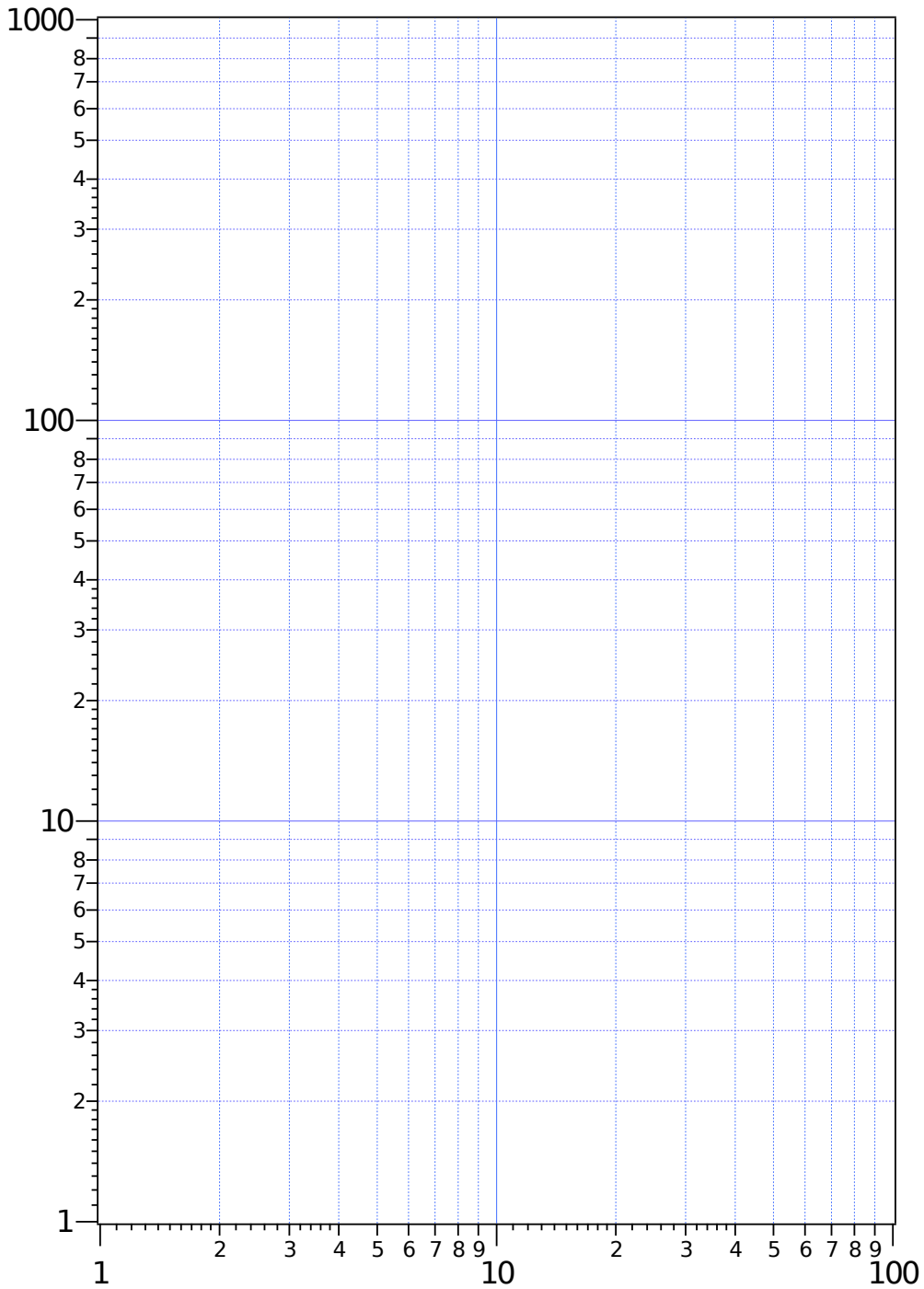
**Graph D.1a: linear scale:**



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)**

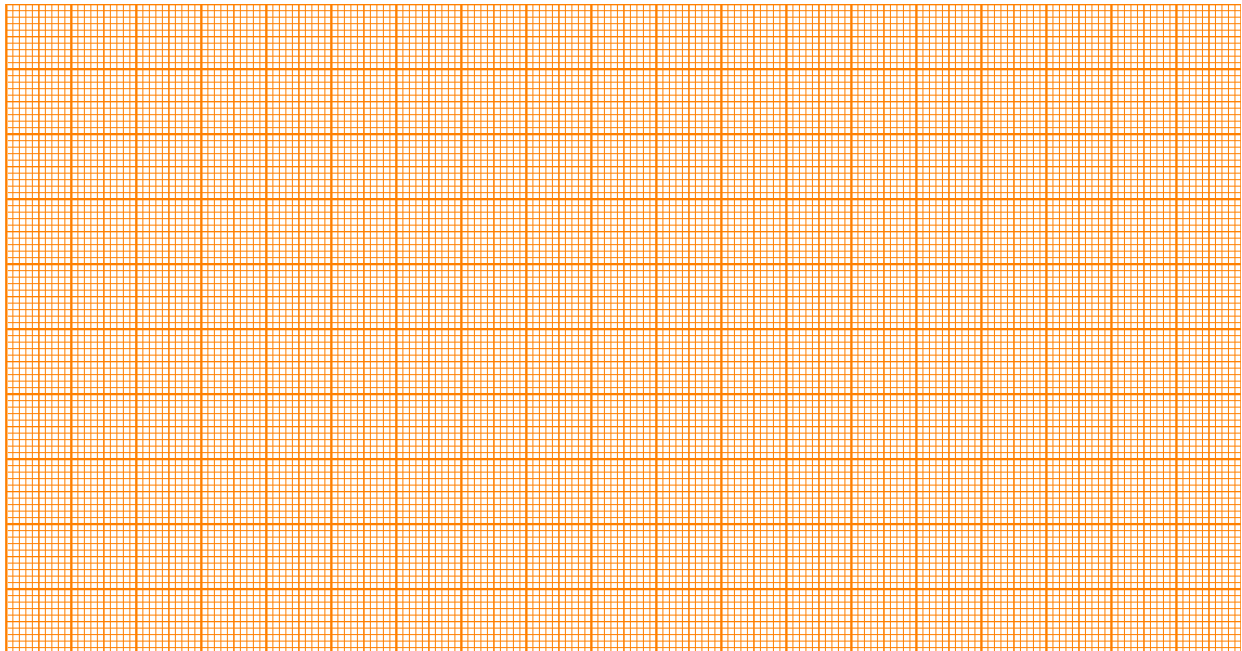
Note the number of your wafer here:

**E.1** (0.4 pt)

$I$	$V$	$I$	$V$

**E.2** (0.4 pt)

**Graph E.2:**  $I$  vs  $V$



$R_{4PP} =$

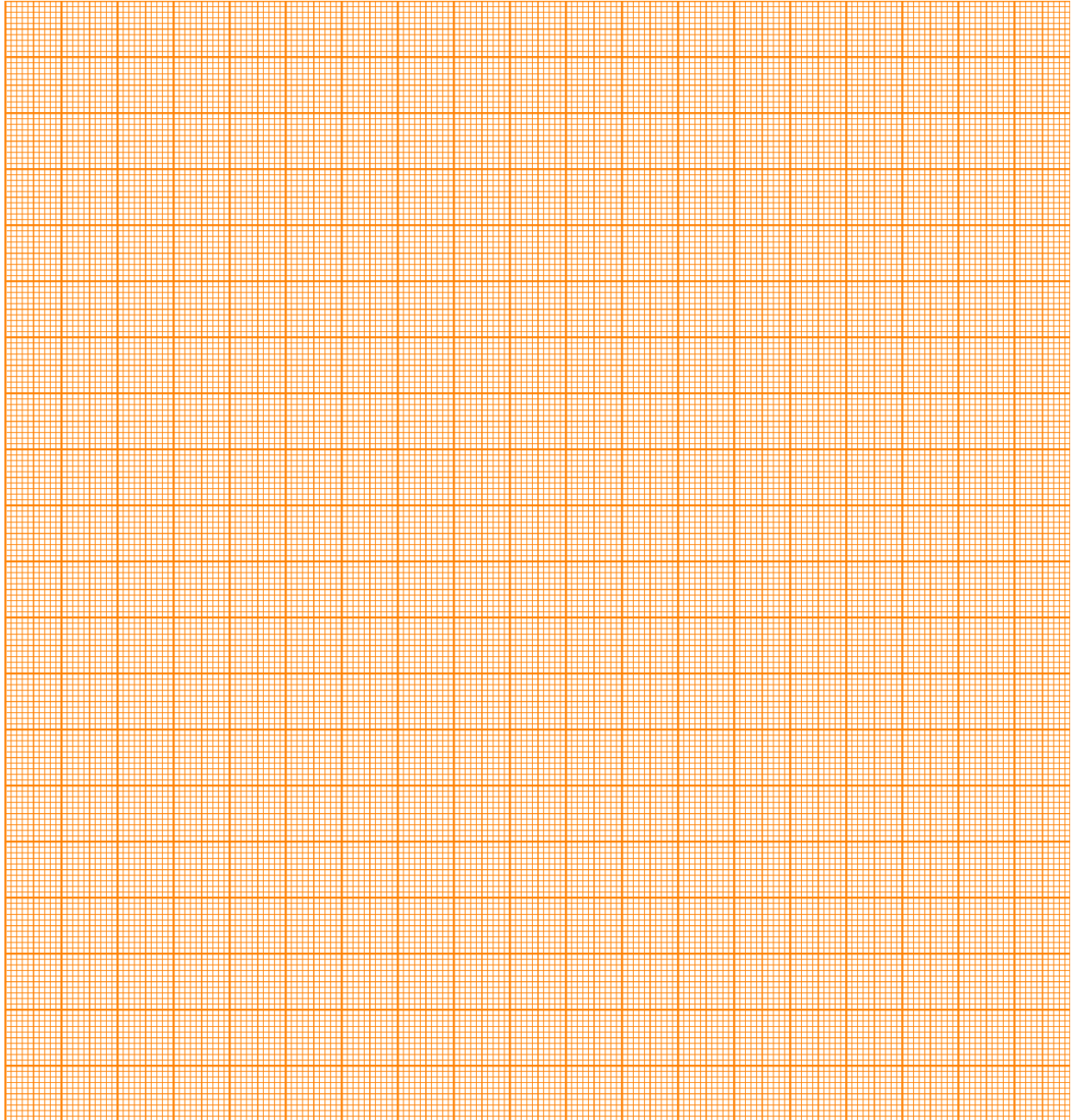






**E.7** (0.5 pt)

**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  $\rho =$