

<b>Student Code</b>						
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## Determination of Refractive Index Gradient and Diffusion Coefficient of Salt Solution from Laser Deflection Measurement (10 pt.)

### A. Measurement of Refractive Index Gradient of Salt-Water Solution (4.5 pt.)

Question	Answer	Marks
A.1 (1.2 pt.)	Enclose the millimeter block paper that has been used for making the deflectogram. Please make sure that you have written your student code numbers and the concentration of the solutions that you used on this millimeter block paper.	Deflectogram of $C_0 = 23$ g/150 mL
A.1	Enclose the millimeter block paper that has been used for making the deflectogram. Please make sure that you have written your student code numbers and the concentration of the solutions that you used on this millimeter block paper.	Deflectogram of $C_0 = 28$ gr/150 mL
A.1	Enclose the millimeter block paper that has been used for making the	Deflectogram

# Experiment

English (Official)

# AE1

deflectogram. Please make sure that you have written your student code numbers and the concentration of the solutions that you used on this millimeter block paper.

of

$C_0 = 33 \text{ g/150 mL}$

48<sup>TH</sup> IPhO 2017

A2.

(1.5 pt.)

$i$	$\delta_i$ (cm)	$\xi_i$ (cm)	$Z_0$ (cm)	$d$ (cm)	$Z$ (cm)
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Table 1 of

$C_0 = 23 \text{ g/150 mL}$

# Experiment

English (Official)

# AE1

A.2	<table border="1"> <thead> <tr> <th><math>i</math></th> <th><math>\delta_i</math> (cm)</th> <th><math>\xi_i</math> (cm)</th> <th><math>Z_0</math> (cm)</th> <th><math>d</math> (cm)</th> <th><math>Z</math> (cm)</th> </tr> </thead> <tbody> <tr><td>1</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>2</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>3</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>4</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>5</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>6</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>7</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>8</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>9</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>10</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>11</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>12</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>13</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>14</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>15</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>16</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>17</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>18</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>19</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>20</td><td></td><td></td><td></td><td></td><td></td></tr> </tbody> </table>	$i$	$\delta_i$ (cm)	$\xi_i$ (cm)	$Z_0$ (cm)	$d$ (cm)	$Z$ (cm)	1						2						3						4						5						6						7						8						9						10						11						12						13						14						15						16						17						18						19						20						Table 1 of $C_0 = 28$ g/150 mL
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# Experiment

English (Official)

# AE1

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48<sup>TH</sup> **IPHO** 2017  
YOGYAKARTA- INDONESIA  
16 - 24 JULY 2017

A.3  
(1.5 pt.)

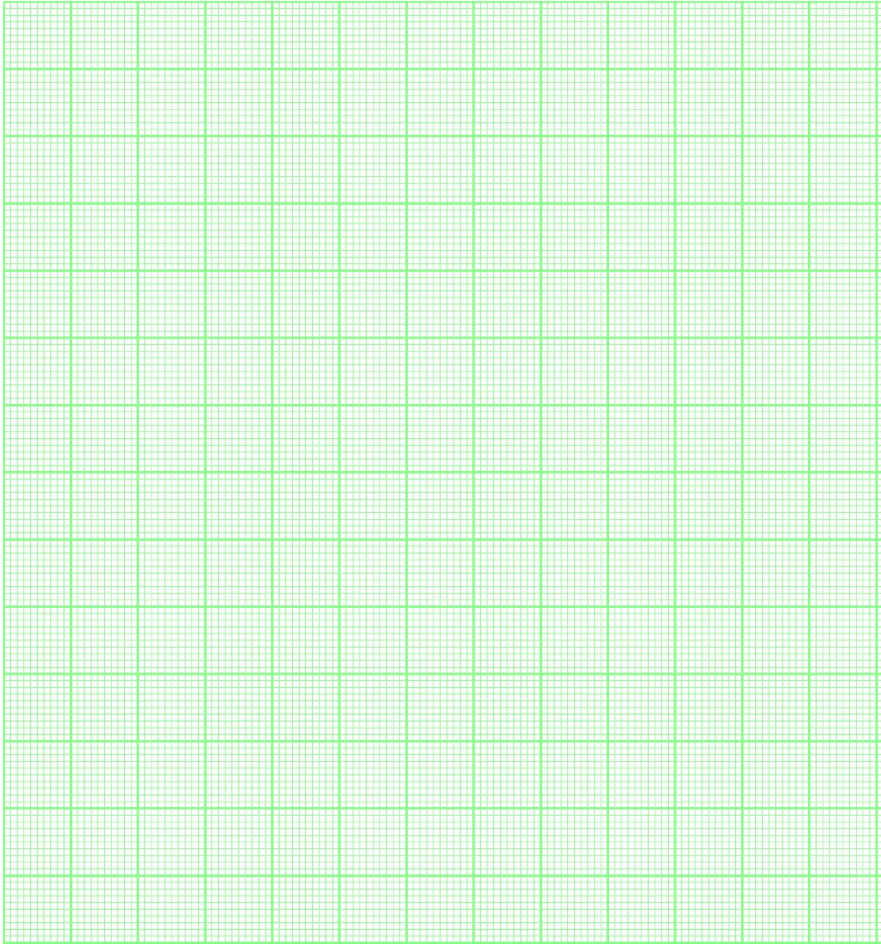
$i$	$Y_i$ (cm)	$dn/dY$
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Table 2 of  
 $C_0 = 23$  g/150  
mL

# Experiment

English (Official)

# AE1

A.3		Plot $\frac{dn}{dY}$ vs $Y$ $C_0 = 23 \text{ g/150 mL}$

A.3	<table border="1"><thead><tr><th><math>i</math></th><th><math>Y_i</math> (cm)</th><th><math>dn/dY</math></th></tr></thead><tbody><tr><td>1</td><td></td><td></td></tr><tr><td>2</td><td></td><td></td></tr><tr><td>3</td><td></td><td></td></tr><tr><td>4</td><td></td><td></td></tr><tr><td>5</td><td></td><td></td></tr><tr><td>6</td><td></td><td></td></tr><tr><td>7</td><td></td><td></td></tr><tr><td>8</td><td></td><td></td></tr><tr><td>9</td><td></td><td></td></tr><tr><td>10</td><td></td><td></td></tr></tbody></table>	$i$	$Y_i$ (cm)	$dn/dY$	1			2			3			4			5			6			7			8			9			10			Table 2 of $C_0 = 28 \text{ g/150 mL}$
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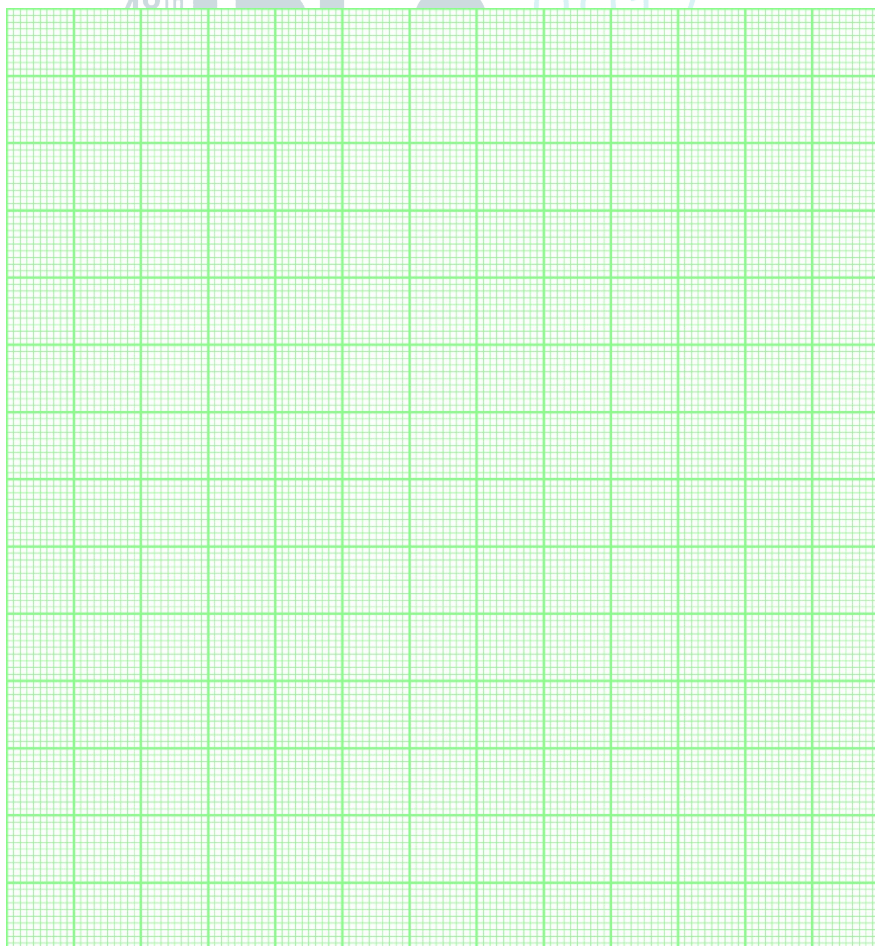
# Experiment

English (Official)

# AE1

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A.3



Plot

$$\frac{dn}{dY} \text{ vs } Y$$

$$C_0 = 28 \text{ g/150 mL}$$

# Experiment

English (Official)

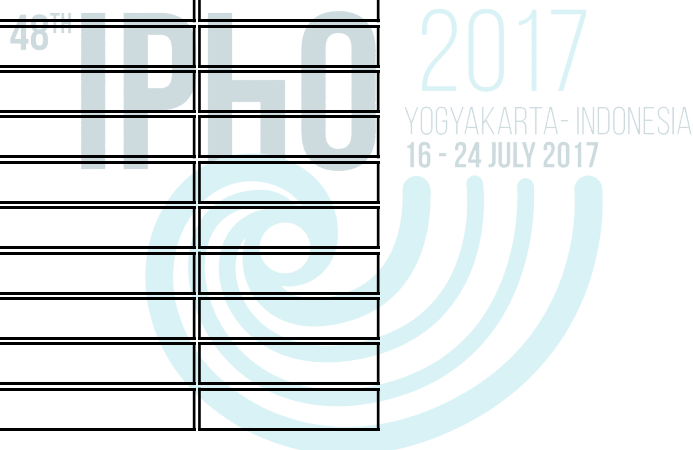
# AE1

A.3

$i$	$Y_i$ (cm)	$dn/dY$
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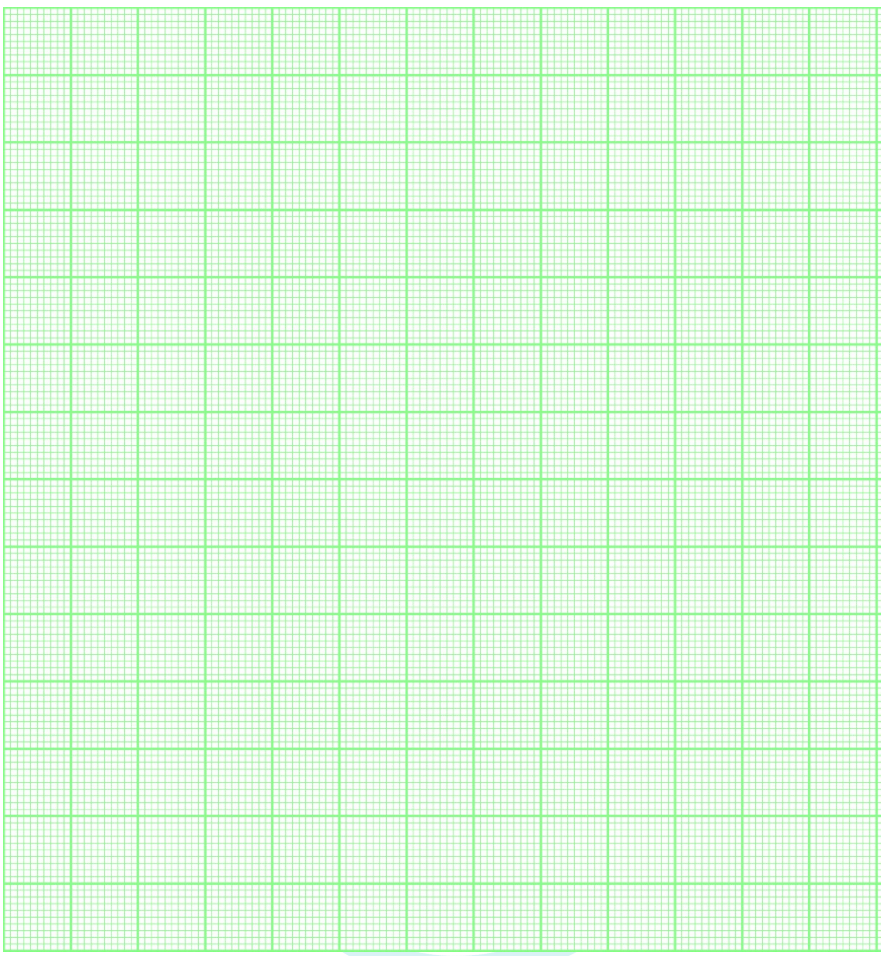
$C_0 = 33$  g/150 mL



# Experiment

English (Official)

# AE1

A.3		Plot $\frac{dn}{dY}$ vs $Y$ $C_0 = 33 \text{ g/150 mL}$
A.4 (0.3 pt.)	$h$ for 23 g/150 mL =          cm  $h$ for 28 g/150 mL =          cm  $h$ for 33 g/150 mL =          cm	



# Experiment

English (Official)

# AE1

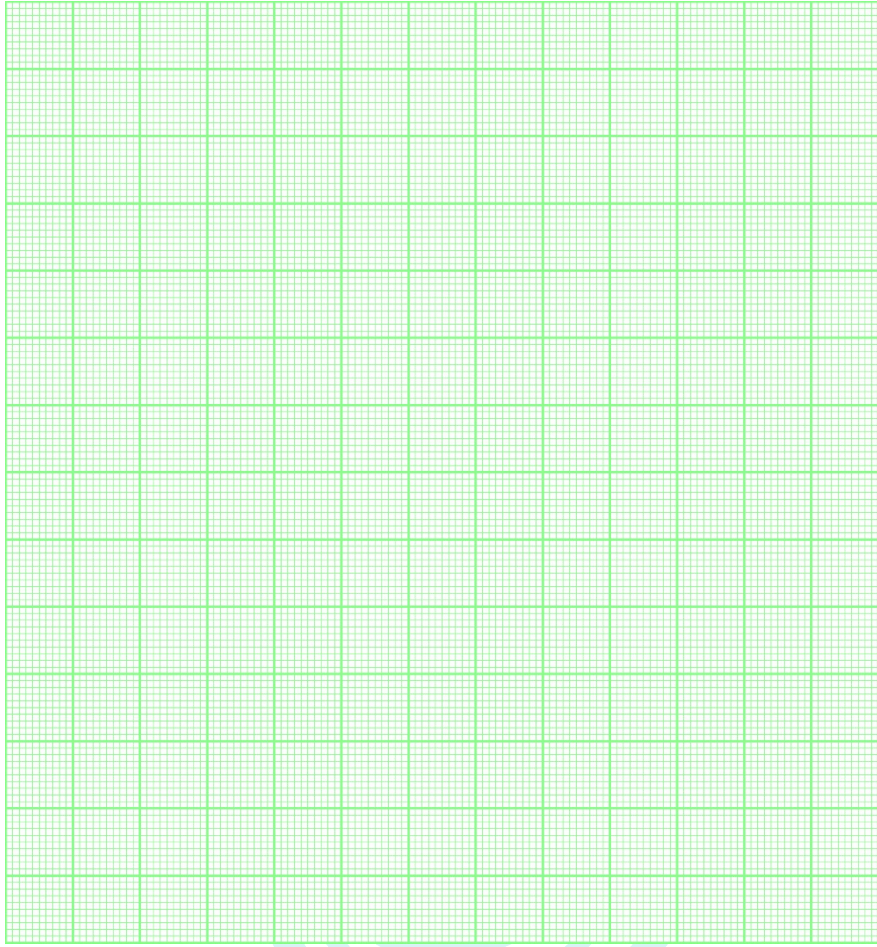
## B: Determination of Diffusion Coefficient (4.2 points)

Question	Answer	Marks																																																															
<p>B.1 (0.9 pt.)</p>	<p>Linear form of eq.(3)</p>																																																																
<p>B.2 (1.8 pt.)</p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 5%; text-align: center;"><i>i</i></th> <th style="width: 15%;"></th> <th style="width: 15%;"></th> </tr> </thead> <tbody> <tr><td style="text-align: center;">1</td><td></td><td></td></tr> <tr><td style="text-align: center;">2</td><td></td><td></td></tr> <tr><td style="text-align: center;">3</td><td></td><td></td></tr> <tr><td style="text-align: center;">4</td><td></td><td></td></tr> <tr><td style="text-align: center;">5</td><td></td><td></td></tr> <tr><td style="text-align: center;">6</td><td></td><td></td></tr> <tr><td style="text-align: center;">7</td><td></td><td></td></tr> <tr><td style="text-align: center;">8</td><td></td><td></td></tr> <tr><td style="text-align: center;">9</td><td></td><td></td></tr> <tr><td style="text-align: center;">10</td><td></td><td></td></tr> <tr><td style="text-align: center;">11</td><td></td><td></td></tr> <tr><td style="text-align: center;">12</td><td></td><td></td></tr> <tr><td style="text-align: center;">13</td><td></td><td></td></tr> <tr><td style="text-align: center;">14</td><td></td><td></td></tr> <tr><td style="text-align: center;">15</td><td></td><td></td></tr> <tr><td style="text-align: center;">16</td><td></td><td></td></tr> <tr><td style="text-align: center;">17</td><td></td><td></td></tr> <tr><td style="text-align: center;">18</td><td></td><td></td></tr> <tr><td style="text-align: center;">19</td><td></td><td></td></tr> <tr><td style="text-align: center;">20</td><td></td><td></td></tr> </tbody> </table>	<i>i</i>			1			2			3			4			5			6			7			8			9			10			11			12			13			14			15			16			17			18			19			20			<p>Table 3 of <math>C_0</math> = 23 g/150 mL</p>
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<p>B.2</p>		<p>Plot of Table 3 <math>C_0 = 23 \text{ g/150 mL}</math></p>																																																															

# Experiment

English (Official)

# AE1



$m$  (slope of the graph) =

B.2

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Table 3 of  $C_0$   
= 28 g/150 mL

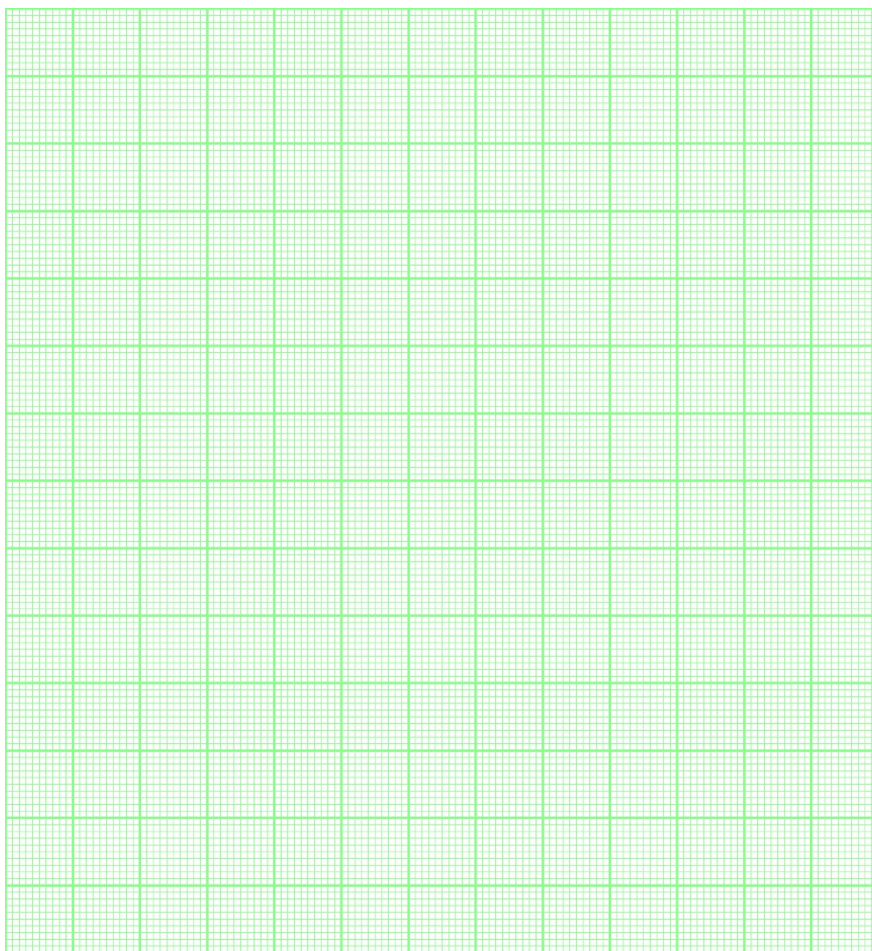
# Experiment

English (Official)

# AE1

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B.2



Plot of  
Table 3

$C_0 = 28 \text{ g/150 mL}$

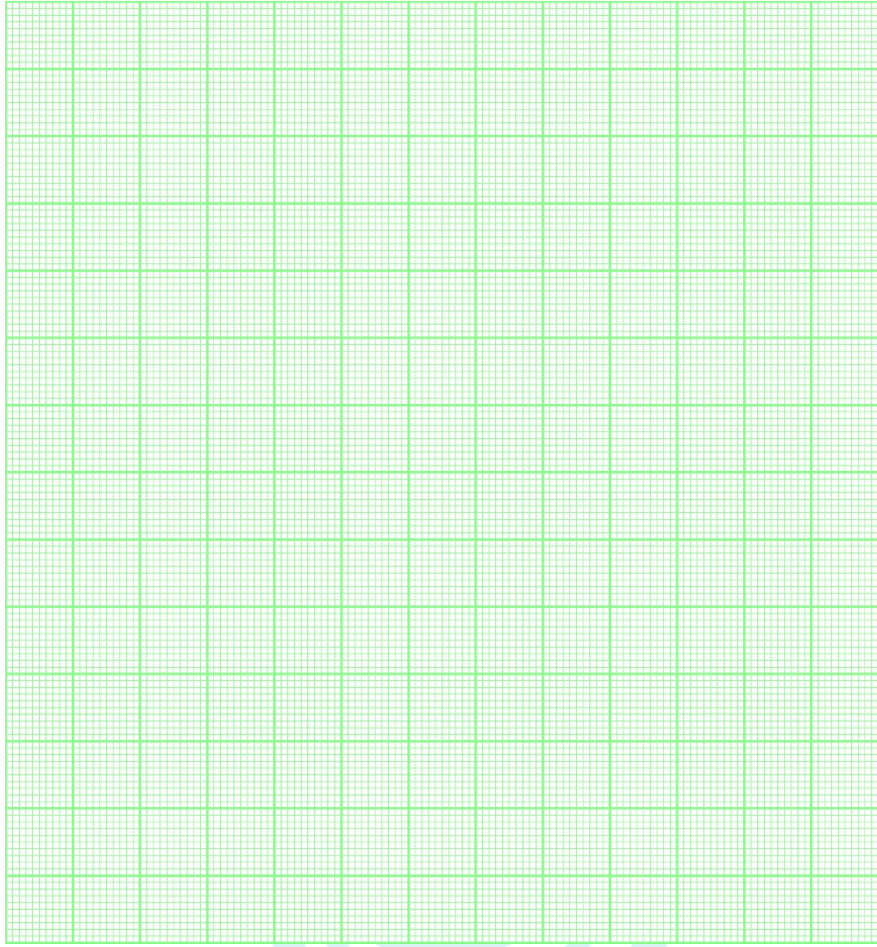
$m$  (slope of the graph) =

<p>B.2</p>	<table border="1"> <thead> <tr> <th><math>t</math></th> <th></th> <th></th> </tr> </thead> <tbody> <tr><td>1</td><td></td><td></td></tr> <tr><td>2</td><td></td><td></td></tr> <tr><td>3</td><td></td><td></td></tr> <tr><td>4</td><td></td><td></td></tr> <tr><td>5</td><td></td><td></td></tr> <tr><td>6</td><td></td><td></td></tr> <tr><td>7</td><td></td><td></td></tr> <tr><td>8</td><td></td><td></td></tr> <tr><td>9</td><td></td><td></td></tr> <tr><td>10</td><td></td><td></td></tr> <tr><td>11</td><td></td><td></td></tr> <tr><td>12</td><td></td><td></td></tr> <tr><td>13</td><td></td><td></td></tr> <tr><td>14</td><td></td><td></td></tr> <tr><td>15</td><td></td><td></td></tr> <tr><td>16</td><td></td><td></td></tr> <tr><td>17</td><td></td><td></td></tr> <tr><td>18</td><td></td><td></td></tr> <tr><td>19</td><td></td><td></td></tr> <tr><td>20</td><td></td><td></td></tr> </tbody> </table>	$t$			1			2			3			4			5			6			7			8			9			10			11			12			13			14			15			16			17			18			19			20			<p>Table 3 of <math>C_0</math> = 33 g/150 mL</p>
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# Experiment

English (Official)

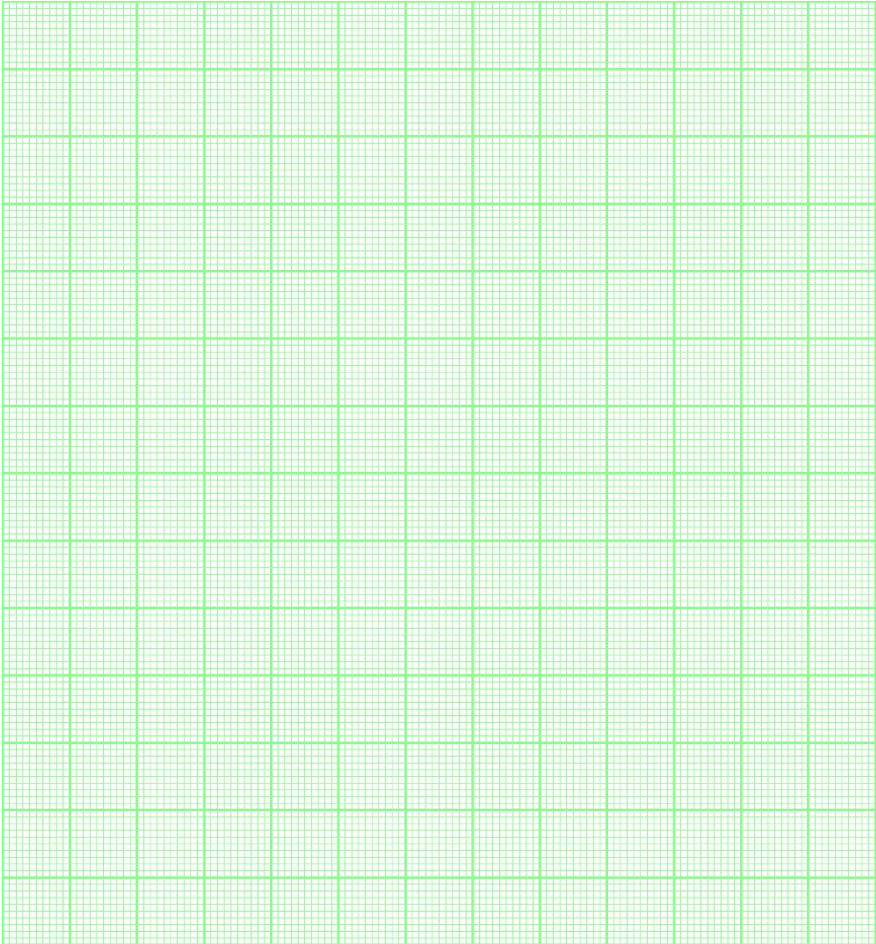
# AE1



$m$  (slope of the graph) =

<p>B.3 (1.5 pt.)</p>	<p><math>D</math> of 23 g/150 mL = <math>\text{cm}^2/\text{s}</math></p> <p><math>D</math> of 28 g/150 mL = <math>\text{cm}^2/\text{s}</math></p> <p><math>D</math> of 33 g/150 mL = <math>\text{cm}^2/\text{s}</math></p>	
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## C. Nonlinear diffusion (1.3 points)

Question	Answer	Marks
C.1 (1.3 pt.)		Plot $D$ vs. $C_0$
C.1	The rate change of diffusion coefficient w.r.t the change of salt solution concentrations:	

