

RED ALDER (Alnus rubra Bong.) AS A BIOACCUMULATOR
OF INDIUM AND DYSPROSIUM WITH AND WITHOUT DTPA
TREATMENT AS MEASURED BY NEUTRON ACTIVATION ANALYSIS

A Thesis

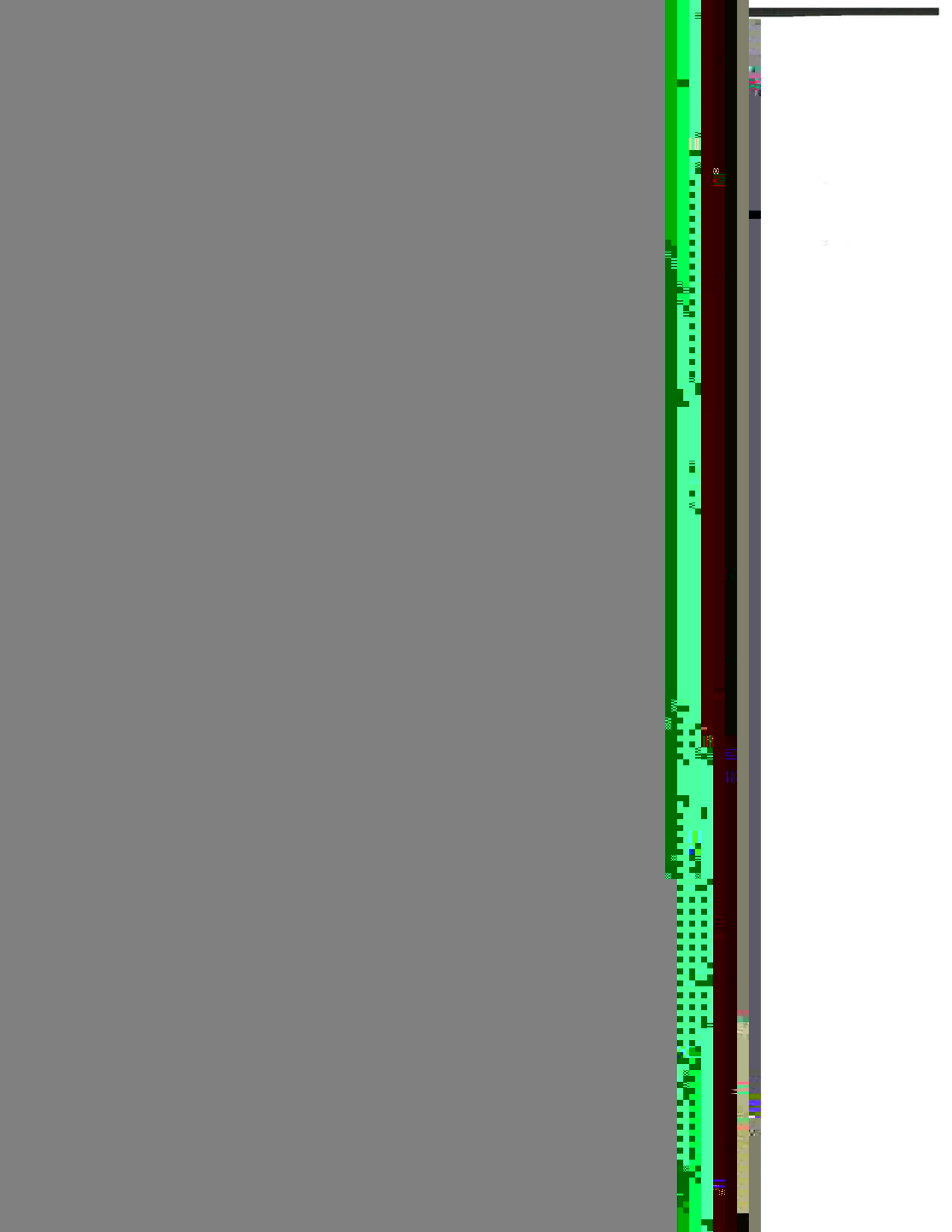
Submitted to the Graduate Faculty of the
Louisiana State University and
Agricultural and Mechanical College
in partial fulfillment of the
requirements for the degree of
Master of Science

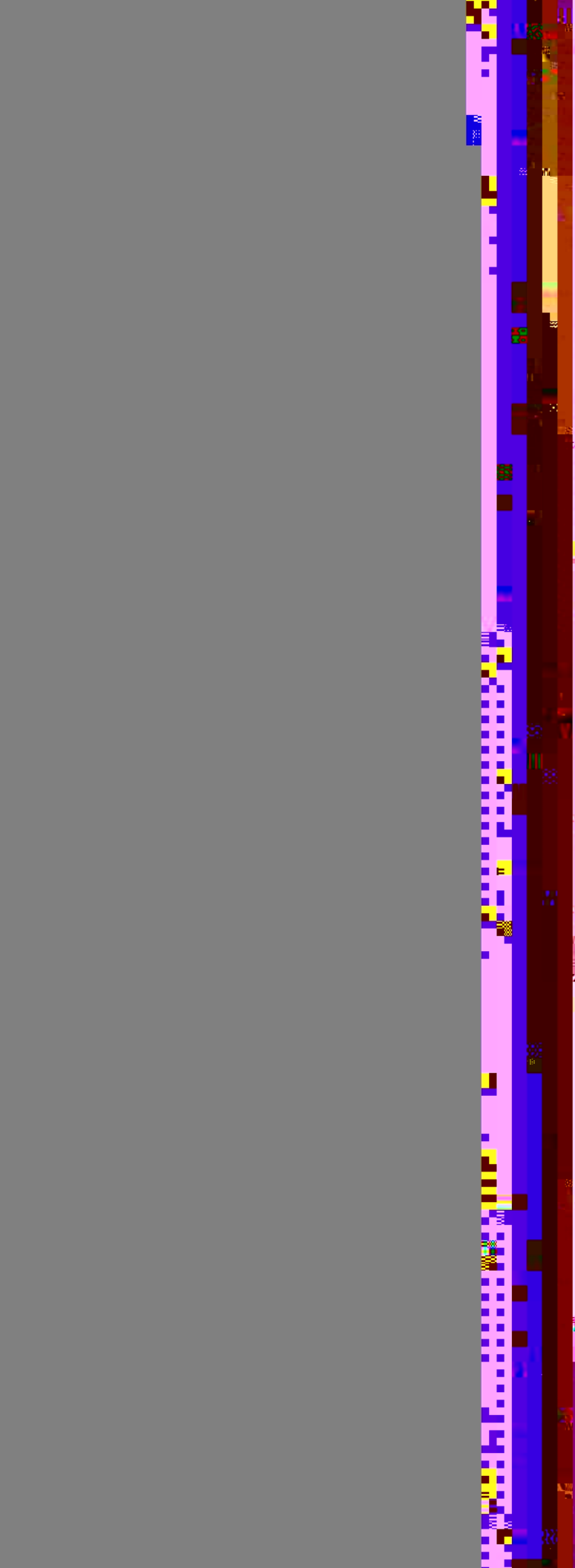
in

The Department of Botany

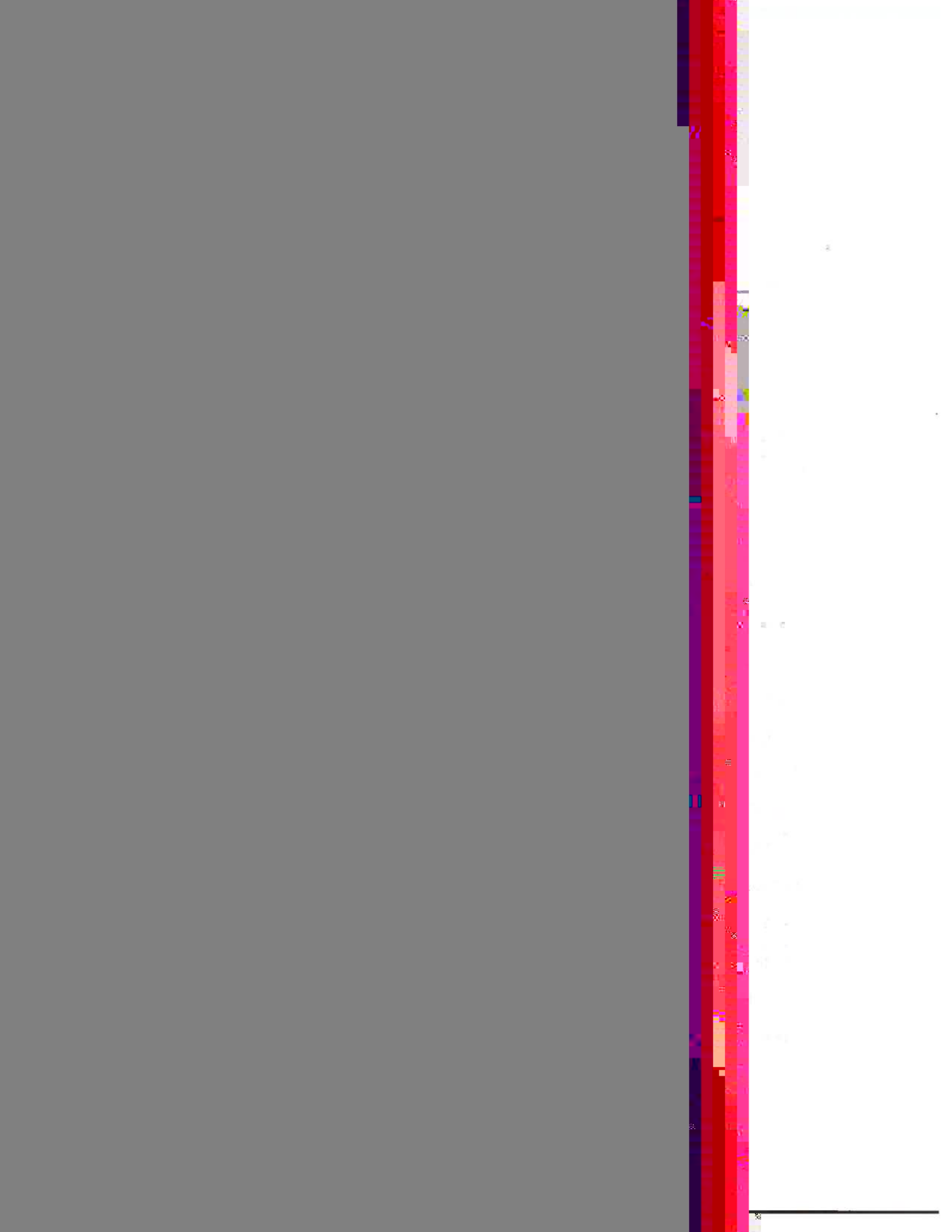
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The first part of the document
 discusses the importance of
 maintaining accurate records
 and the role of the
 various departments involved
 in the process. It also
 outlines the procedures for
 handling and reporting
 incidents, as well as the
 responsibilities of each
 individual involved. The
 document concludes with a
 summary of the key points
 and a list of references.

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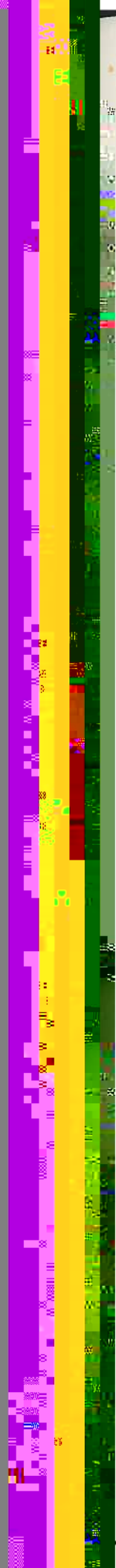
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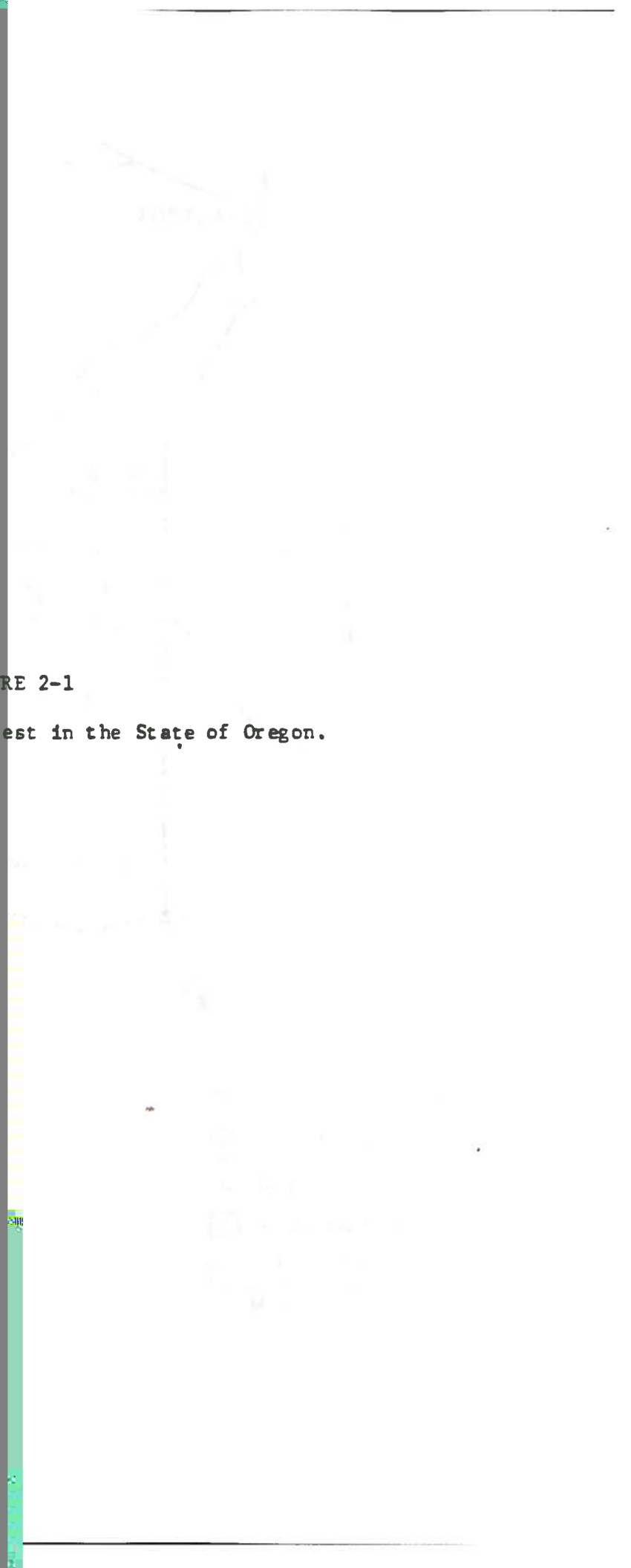
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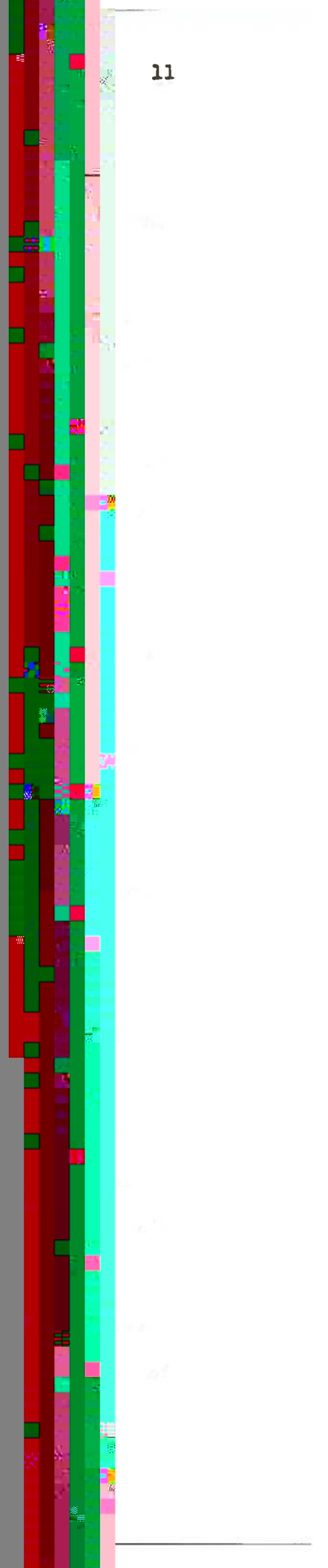


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FIGURE 2-1

Location of McDonald Forest in the State of Oregon.









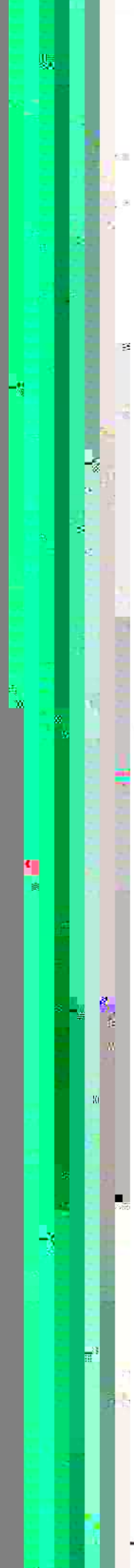


THE STATE OF TEXAS,
COUNTY OF DALLAS,
I, the undersigned,
Notary Public,
do hereby certify
that the within and
above described
instrument is
correctly
filed for record
in the office of
the County Clerk
of the County of
Dallas, Texas,
this _____ day
of _____, 19____.

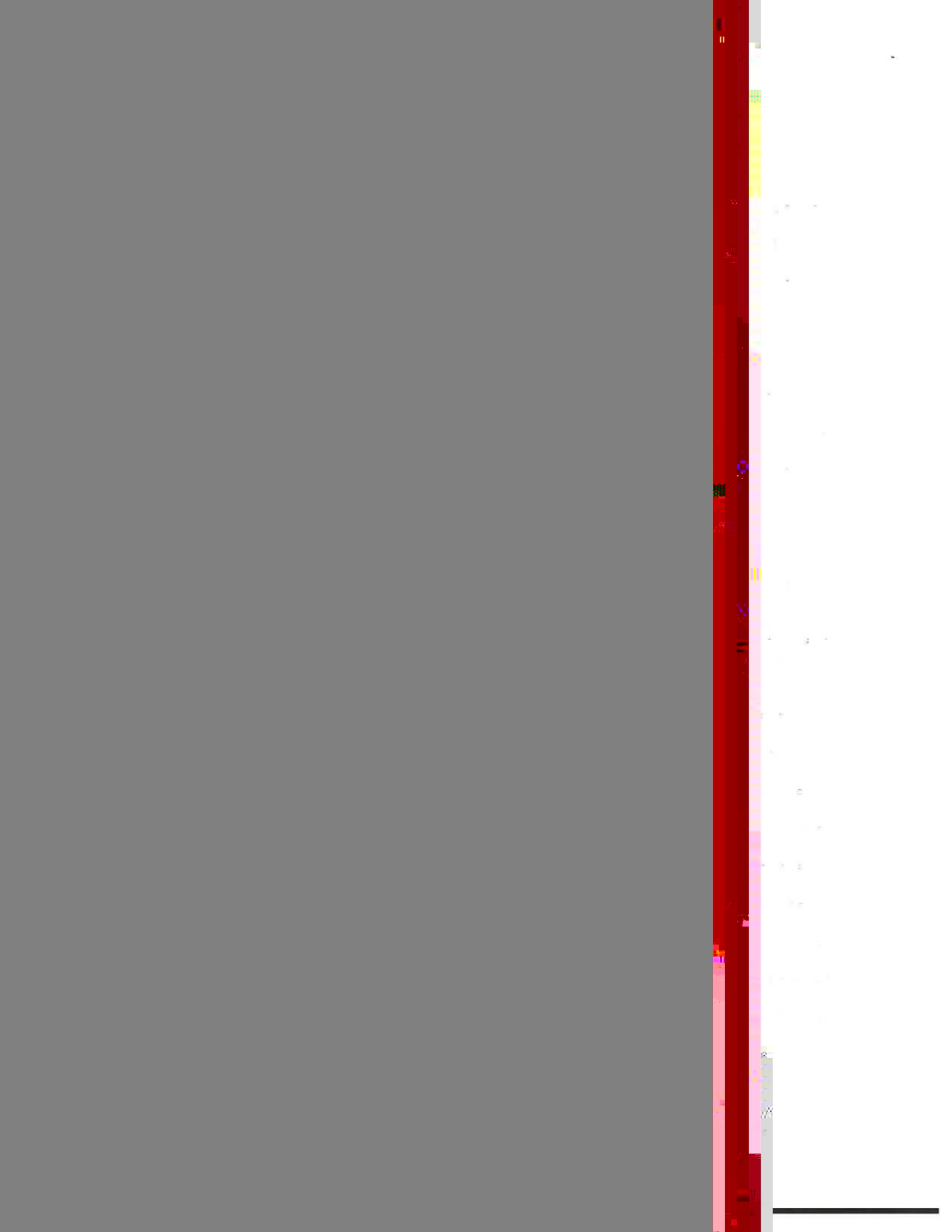
Notary Public,
My Commission Expires _____
at _____

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II









The following information is provided for your reference:
 The total number of pages in this document is 10.
 The document contains 10 pages of text.
 The text is organized into 10 paragraphs.
 The first paragraph discusses the importance of maintaining accurate records.
 The second paragraph describes the various methods used to collect data.
 The third paragraph details the analysis of the collected data.
 The fourth paragraph presents the results of the analysis.
 The fifth paragraph discusses the implications of the findings.
 The sixth paragraph provides a conclusion to the study.
 The seventh paragraph offers recommendations for future research.
 The eighth paragraph discusses the limitations of the study.
 The ninth paragraph provides a summary of the key findings.
 The tenth paragraph concludes the document.

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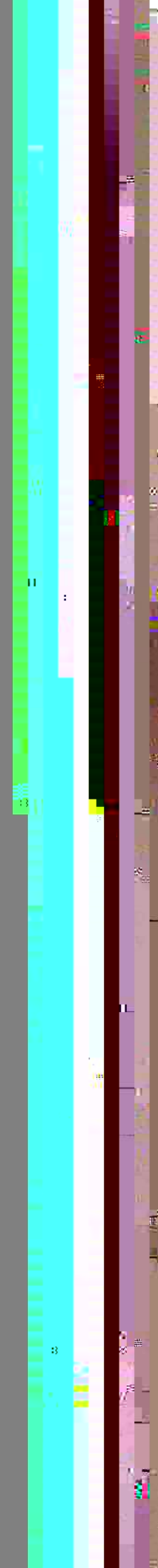
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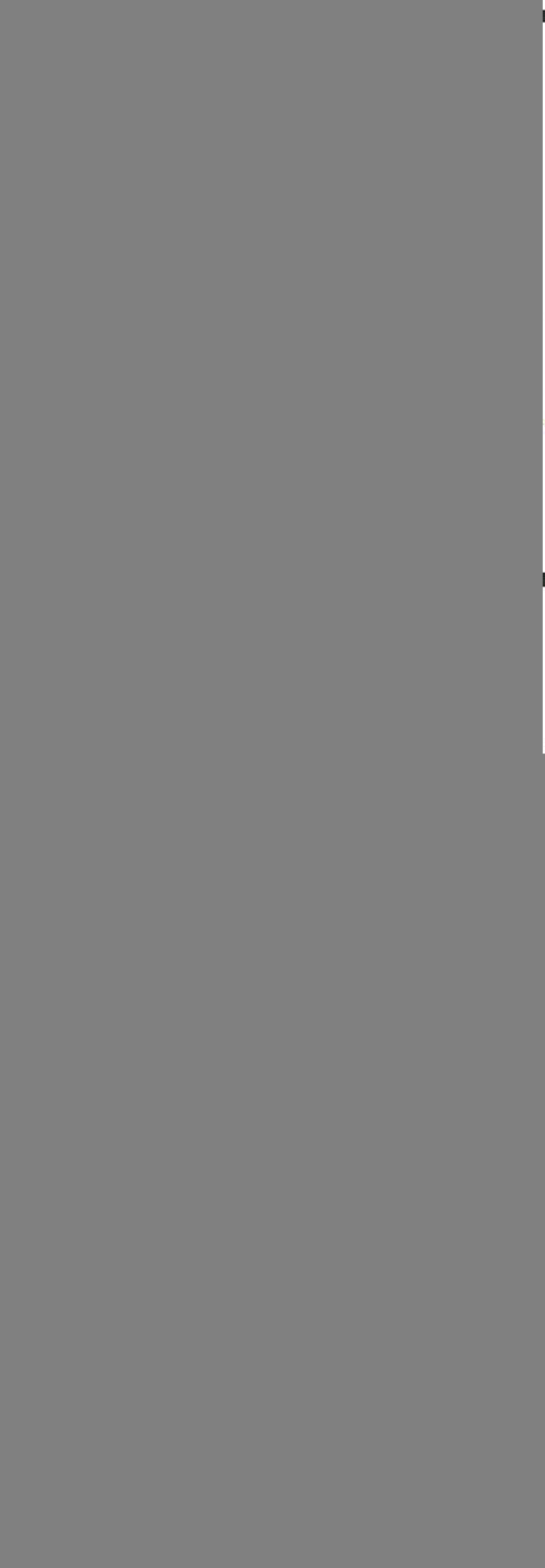
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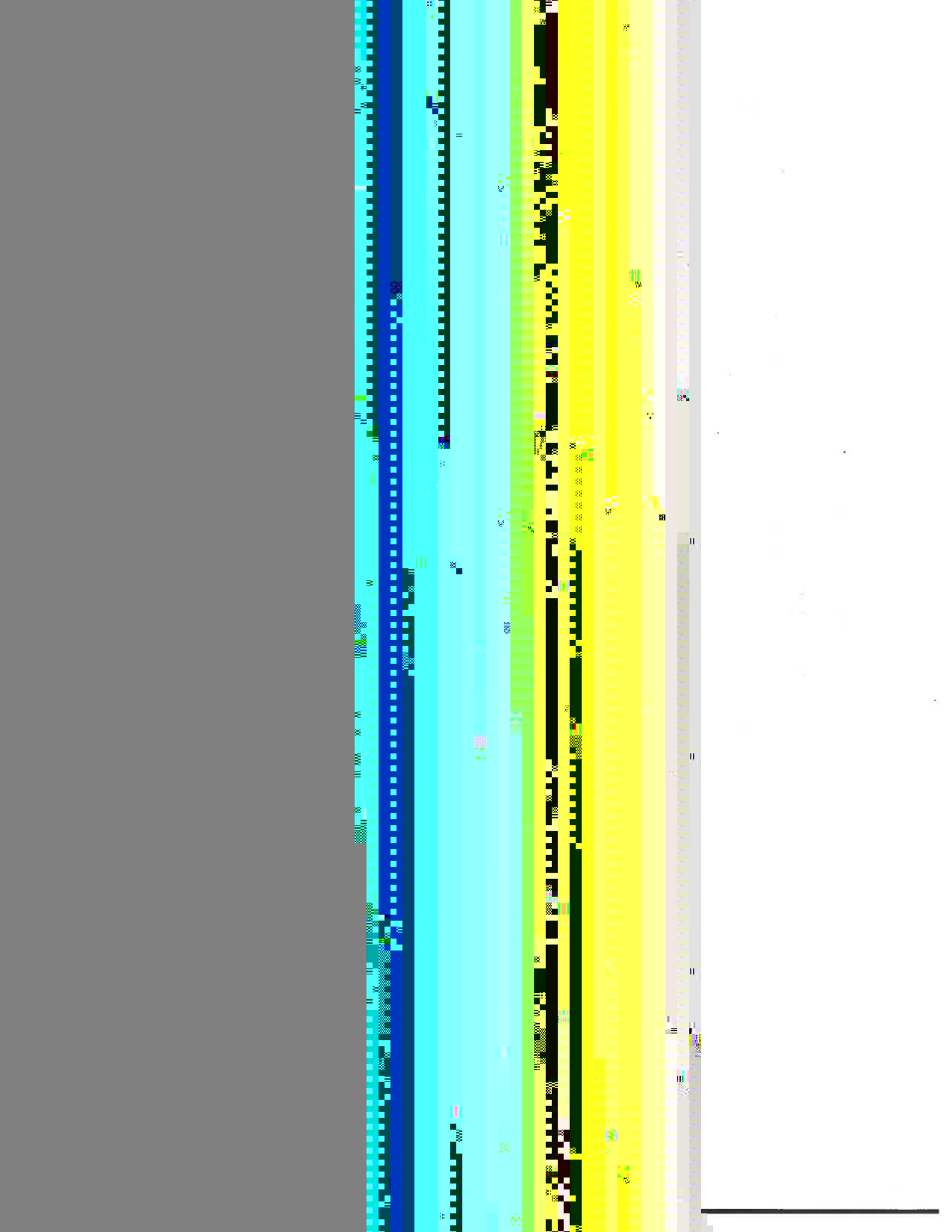
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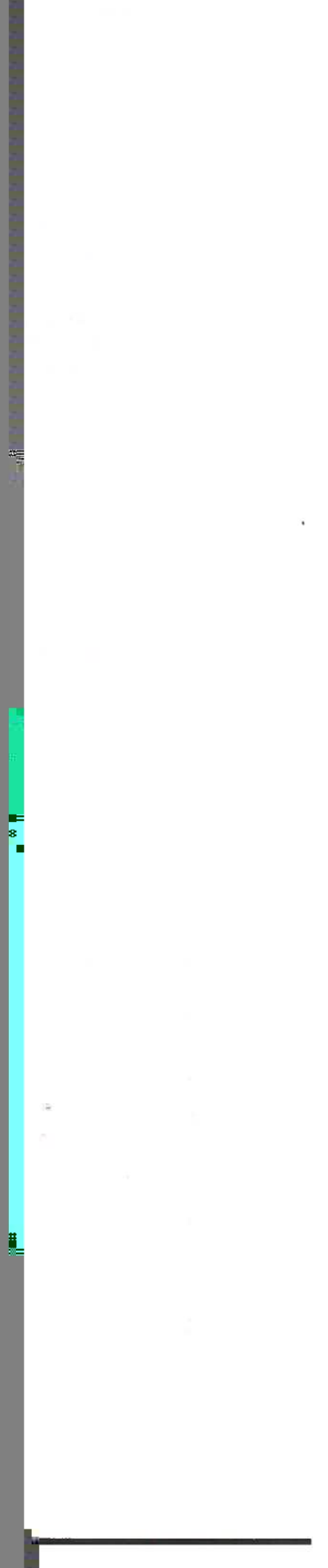


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Handwritten notes in the bottom right section of the page, possibly concluding the list or instructions.







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Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
1	10.2	11.5	12.8	14.1	15.4	16.7	18.0	19.3	20.6	21.9	23.2
2	11.5	12.8	14.1	15.4	16.7	18.0	19.3	20.6	21.9	23.2	24.5
3	12.8	14.1	15.4	16.7	18.0	19.3	20.6	21.9	23.2	24.5	25.8
4	14.1	15.4	16.7	18.0	19.3	20.6	21.9	23.2	24.5	25.8	27.1
5	15.4	16.7	18.0	19.3	20.6	21.9	23.2	24.5	25.8	27.1	28.4
6	16.7	18.0	19.3	20.6	21.9	23.2	24.5	25.8	27.1	28.4	29.7
7	18.0	19.3	20.6	21.9	23.2	24.5	25.8	27.1	28.4	29.7	31.0
8	19.3	20.6	21.9	23.2	24.5	25.8	27.1	28.4	29.7	31.0	32.3
9	20.6	21.9	23.2	24.5	25.8	27.1	28.4	29.7	31.0	32.3	33.6
10	21.9	23.2	24.5	25.8	27.1	28.4	29.7	31.0	32.3	33.6	34.9
11	23.2	24.5	25.8	27.1	28.4	29.7	31.0	32.3	33.6	34.9	36.2
12	24.5	25.8	27.1	28.4	29.7	31.0	32.3	33.6	34.9	36.2	37.5
13	25.8	27.1	28.4	29.7	31.0	32.3	33.6	34.9	36.2	37.5	38.8
14	27.1	28.4	29.7	31.0	32.3	33.6	34.9	36.2	37.5	38.8	40.1
15	28.4	29.7	31.0	32.3	33.6	34.9	36.2	37.5	38.8	40.1	41.4
16	29.7	31.0	32.3	33.6	34.9	36.2	37.5	38.8	40.1	41.4	42.7
17	31.0	32.3	33.6	34.9	36.2	37.5	38.8	40.1	41.4	42.7	44.0
18	32.3	33.6	34.9	36.2	37.5	38.8	40.1	41.4	42.7	44.0	45.3
19	33.6	34.9	36.2	37.5	38.8	40.1	41.4	42.7	44.0	45.3	46.6
20	34.9	36.2	37.5	38.8	40.1	41.4	42.7	44.0	45.3	46.6	47.9
21	36.2	37.5	38.8	40.1	41.4	42.7	44.0	45.3	46.6	47.9	49.2
22	37.5	38.8	40.1	41.4	42.7	44.0	45.3	46.6	47.9	49.2	50.5
23	38.8	40.1	41.4	42.7	44.0	45.3	46.6	47.9	49.2	50.5	51.8
24	40.1	41.4	42.7	44.0	45.3	46.6	47.9	49.2	50.5	51.8	53.1
25	41.4	42.7	44.0	45.3	46.6	47.9	49.2	50.5	51.8	53.1	54.4
26	42.7	44.0	45.3	46.6	47.9	49.2	50.5	51.8	53.1	54.4	55.7
27	44.0	45.3	46.6	47.9	49.2	50.5	51.8	53.1	54.4	55.7	57.0
28	45.3	46.6	47.9	49.2	50.5	51.8	53.1	54.4	55.7	57.0	58.3
29	46.6	47.9	49.2	50.5	51.8	53.1	54.4	55.7	57.0	58.3	59.6
30	47.9	49.2	50.5	51.8	53.1	54.4	55.7	57.0	58.3	59.6	60.9
31	49.2	50.5	51.8	53.1	54.4	55.7	57.0	58.3	59.6	60.9	62.2
32	50.5	51.8	53.1	54.4	55.7	57.0	58.3	59.6	60.9	62.2	63.5
33	51.8	53.1	54.4	55.7	57.0	58.3	59.6	60.9	62.2	63.5	64.8
34	53.1	54.4	55.7	57.0	58.3	59.6	60.9	62.2	63.5	64.8	66.1
35	54.4	55.7	57.0	58.3	59.6	60.9	62.2	63.5	64.8	66.1	67.4
36	55.7	57.0	58.3	59.6	60.9	62.2	63.5	64.8	66.1	67.4	68.7
37	57.0	58.3	59.6	60.9	62.2	63.5	64.8	66.1	67.4	68.7	70.0
38	58.3	59.6	60.9	62.2	63.5	64.8	66.1	67.4	68.7	70.0	71.3
39	59.6	60.9	62.2	63.5	64.8	66.1	67.4	68.7	70.0	71.3	72.6
40	60.9	62.2	63.5	64.8	66.1	67.4	68.7	70.0	71.3	72.6	73.9
41	62.2	63.5	64.8	66.1	67.4	68.7	70.0	71.3	72.6	73.9	75.2
42	63.5	64.8	66.1	67.4	68.7	70.0	71.3	72.6	73.9	75.2	76.5
43	64.8	66.1	67.4	68.7	70.0	71.3	72.6	73.9	75.2	76.5	77.8
44	66.1	67.4	68.7	70.0	71.3	72.6	73.9	75.2	76.5	77.8	79.1
45	67.4	68.7	70.0	71.3	72.6	73.9	75.2	76.5	77.8	79.1	80.4
46	68.7	70.0	71.3	72.6	73.9	75.2	76.5	77.8	79.1	80.4	81.7
47	70.0	71.3	72.6	73.9	75.2	76.5	77.8	79.1	80.4	81.7	83.0
48	71.3	72.6	73.9	75.2	76.5	77.8	79.1	80.4	81.7	83.0	84.3
49	72.6	73.9	75.2	76.5	77.8	79.1	80.4	81.7	83.0	84.3	85.6
50	73.9	75.2	76.5	77.8	79.1	80.4	81.7	83.0	84.3	85.6	86.9
51	75.2	76.5	77.8	79.1	80.4	81.7	83.0	84.3	85.6	86.9	88.2
52	76.5	77.8	79.1	80.4	81.7	83.0	84.3	85.6	86.9	88.2	89.5
53	77.8	79.1	80.4	81.7	83.0	84.3	85.6	86.9	88.2	89.5	90.8
54	79.1	80.4	81.7	83.0	84.3	85.6	86.9	88.2	89.5	90.8	92.1
55	80.4	81.7	83.0	84.3	85.6	86.9	88.2	89.5	90.8	92.1	93.4
56	81.7	83.0	84.3	85.6	86.9	88.2	89.5	90.8	92.1	93.4	94.7
57	83.0	84.3	85.6	86.9	88.2	89.5	90.8	92.1	93.4	94.7	96.0
58	84.3	85.6	86.9	88.2	89.5	90.8	92.1	93.4	94.7	96.0	97.3
59	85.6	86.9	88.2	89.5	90.8	92.1	93.4	94.7	96.0	97.3	98.6
60	86.9	88.2	89.5	90.8	92.1	93.4	94.7	96.0	97.3	98.6	99.9
61	88.2	89.5	90.8	92.1	93.4	94.7	96.0	97.3	98.6	99.9	101.2
62	89.5	90.8	92.1	93.4	94.7	96.0	97.3	98.6	99.9	101.2	102.5
63	90.8	92.1	93.4	94.7	96.0	97.3	98.6	99.9	101.2	102.5	103.8
64	92.1	93.4	94.7	96.0	97.3	98.6	99.9	101.2	102.5	103.8	105.1
65	93.4	94.7	96.0	97.3	98.6	99.9	101.2	102.5	103.8	105.1	106.4
66	94.7	96.0	97.3	98.6	99.9	101.2	102.5	103.8	105.1	106.4	107.7
67	96.0	97.3	98.6	99.9	101.2	102.5	103.8	105.1	106.4	107.7	109.0
68	97.3	98.6	99.9	101.2	102.5	103.8	105.1	106.4	107.7	109.0	110.3
69	98.6	99.9	101.2	102.5	103.8	105.1	106.4	107.7	109.0	110.3	111.6
70	99.9	101.2	102.5	103.8	105.1	106.4	107.7	109.0	110.3	111.6	112.9
71	101.2	102.5	103.8	105.1	106.4	107.7	109.0	110.3	111.6	112.9	114.2
72	102.5	103.8	105.1	106.4	107.7	109.0	110.3	111.6	112.9	114.2	115.5
73	103.8	105.1	106.4	107.7	109.0	110.3	111.6	112.9	114.2	115.5	116.8
74	105.1	106.4	107.7	109.0	110.3	111.6	112.9	114.2	115.5	116.8	118.1
75	106.4	107.7	109.0	110.3	111.6	112.9	114.2	115.5	116.8	118.1	119.4
76	107.7	109.0	110.3	111.6	112.9	114.2	115.5	116.8	118.1	119.4	120.7
77	109.0	110.3	111.6	112.9	114.2	115.5	116.8	118.1	119.4	120.7	122.0
78	110.3	111.6	112.9	114.2	115.5	116.8	118.1	119.4	120.7	122.0	123.3
79	111.6	112.9	114.2	115.5	116.8	118.1	119.4	120.7	122.0	123.3	124.6
80	112.9	114.2	115.5	116.8	118.1	119.4	120.7	122.0	123.3	124.6	125.9
81	114.2	115.5	116.8	118.1	119.4	120.7	122.0	123.3	124.6	125.9	127.2
82	115.5	116.8	118.1	119.4	120.7	122.0	123.3	124.6	125.9	127.2	128.5
83	116.8	118.1	119.4	120.7	122.0	123.3	124.6	125.9	127.2	128.5	129.8
84	118.1	119.4	120.7	122.0	123.3	124.6	125.9	127.2	128.5	129.8	131.1
85	119.4	120.7	122.0	123.3	124.6	125.9	127.2	128.5	129.8	131.1	132.4
86	120.7	122.0	123.3	124.6	125.9	127.2	128.5	129.8	131.1	132.4	133.7
87	122.0	123.3	124.6	125.9	127.2	128.5	129.8	131.1	132.4	133.7	135.0
88	123.3	124.6	125.9	127.2	128.5	129.8	131.1	132.4	133.7	135.0	136.3
89	124.6	125.9	127.2	128.5	129.8	131.1	132.4	133.7	135.0	136.3	137.6
90	125.9	127.2	128.5	129.8	131.1	132.4	133.7	135.0	136.3	137.6	138.9
91	127.2	128.5	129.8	131.1	132.4	133.7	135.0	136.3	137.6	138.9	140.2
92	128.5	129.8	131.1	132.4	133.7	135.0	136.3	137.6	138.9	140.2	141.5
93	129.8	131.1	132.4	133.7	135.0	136.3	137.6	138.9	140.2	141.5	142.8
94	131.1	132.4	133.7	135.0	136.3	137.6	138.9	140.2	141.5	142.8	144.1
95	132.4	133.7	135.0	136.3	137.6	138.9	140.2	141.5	142.8	144.1	145.4
96	133.7	135.0	136.3	137.6	138.9	140.2	141.5	142.8	144.1	145.4	146.7
97	135.0	136.3	137.6	138.9	140.2	141.5	142.8	144.1	145.4	146.7	148.0
98	136.3	137.6	138.9	140.2	141.5	142.8	144.1	145.4	146.7	148.0	149.3
99	137.6	138.9	140.2	141.5	142.8	144.1	145.4	146.7	148.0	149.3	150.6







$$\frac{5.00 \text{ g of the element}}{105 \text{ ml}} = 0.0476 \text{ g/ml or } 4.76 \times 10^4 \text{ } \mu\text{g of the element/ml}$$

$$\frac{4.76 \times 10^4 \text{ } \mu\text{g/ml}}{200} = 2.38 \times 10^2 \text{ } \mu\text{g/ml} \quad (1)$$

$$\frac{2.38 \times 10^2 \text{ } \mu\text{g/ml}}{100} = 2.38 \text{ } \mu\text{g/ml} \quad (2)$$



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ne mole of (ML)

based on mole basis for the reaction

cers used to the selected chelating agent:

and

$$\frac{4.25 \text{ g}}{162.5} = 0.026 \text{ moles of Dy}$$



A volume of 96 ml of commercial DTPA was used to give an excess amount of the chelating agent.

The concentration of chelated In and Dy in $\mu\text{g/ml}$ (ppm) in the original stock solution of 150 ml (the solution that introduced to the stream) were calculated as follows:

$$\begin{aligned} \text{The concentration of chelated In} &= \frac{\text{wt. in grams}}{\text{volume in ml}} = \frac{5 \text{ g}}{150 \text{ ml}} \\ &= 3.33 \times 10^4 \mu\text{g/ml} \end{aligned}$$

The In-DTPA and
out as follows:

- a) 1.0 ml from the original stock solution was diluted with 99 ml DW.

$$\begin{aligned} \frac{3.33 \times 10^4 \mu\text{g/ml}}{100 \text{ ml}} &= 3.3 \times 10^2 \mu\text{g/ml} && (\text{In}) \\ \frac{2.83 \times 10^4 \mu\text{g/ml}}{100 \text{ ml}} &= 2.83 \times 10^2 \mu\text{g/ml} && (\text{Dy}) \end{aligned} \tag{1}$$

- b) A second dilution of 100 times was obtained by mixing 1.0 ml from the above stock solution + 99 ml DW the concentration became:



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APPENDIX C

Oregon State University Radiation Center Safety Procedures

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Mathematical Induction

Let $P(n)$ be a statement involving n .

1. $P(1)$ is true.

2. $P(k) \Rightarrow P(k+1)$.

Then $P(n)$ is true for all $n \in \mathbb{N}$.

Example: $1 + 2 + \dots + n = \frac{n(n+1)}{2}$.

Let $P(n)$ be the statement $1 + 2 + \dots + n = \frac{n(n+1)}{2}$.

1. $P(1)$ is true.

2. $P(k) \Rightarrow P(k+1)$.

Then $P(n)$ is true for all $n \in \mathbb{N}$.

Example: $1^2 + 2^2 + \dots + n^2 = \frac{n(n+1)(2n+1)}{6}$.

Let $P(n)$ be the statement $1^2 + 2^2 + \dots + n^2 = \frac{n(n+1)(2n+1)}{6}$.

1. $P(1)$ is true.

2. $P(k) \Rightarrow P(k+1)$.

Then $P(n)$ is true for all $n \in \mathbb{N}$.

Example: $1^3 + 2^3 + \dots + n^3 = \left(\frac{n(n+1)}{2}\right)^2$.

Let $P(n)$ be the statement $1^3 + 2^3 + \dots + n^3 = \left(\frac{n(n+1)}{2}\right)^2$.

1. $P(1)$ is true.

2. $P(k) \Rightarrow P(k+1)$.

Then $P(n)$ is true for all $n \in \mathbb{N}$.

Example: $1^4 + 2^4 + \dots + n^4 = \frac{n(n+1)(2n+1)(3n^2+3n-1)}{30}$.

Let $P(n)$ be the statement $1^4 + 2^4 + \dots + n^4 = \frac{n(n+1)(2n+1)(3n^2+3n-1)}{30}$.

1. $P(1)$ is true.

2. $P(k) \Rightarrow P(k+1)$.

Then $P(n)$ is true for all $n \in \mathbb{N}$.

Example: $1^5 + 2^5 + \dots + n^5 = \frac{n^2(n+1)^2(2n^2+5n+3)}{12}$.

Let $P(n)$ be the statement $1^5 + 2^5 + \dots + n^5 = \frac{n^2(n+1)^2(2n^2+5n+3)}{12}$.

1. $P(1)$ is true.

2. $P(k) \Rightarrow P(k+1)$.

Then $P(n)$ is true for all $n \in \mathbb{N}$.

Example: $1^6 + 2^6 + \dots + n^6 = \frac{n(n+1)(2n+1)(3n^3+6n^2-3n-1)}{42}$.

Let $P(n)$ be the statement $1^6 + 2^6 + \dots + n^6 = \frac{n(n+1)(2n+1)(3n^3+6n^2-3n-1)}{42}$.

1. $P(1)$ is true.

2. $P(k) \Rightarrow P(k+1)$.

Then $P(n)$ is true for all $n \in \mathbb{N}$.

The concentration of Dy in the stream water after 2.1 hr
of tracer administration:

$$i \quad \frac{D}{D_1} = 0.332 \text{ ugDy/ml} \quad (3)$$



uda El-Fawaris

Approved:

Stephen Whigite, Co-Chairman
Major Professor and Chairman
Ronald Knays, Co-Chairman
James H. Trajnham
Dean of the Graduate School

Date of Examination:

Monday, April 21, 1980





Force
controls



