Name :	Class	Index no.

DEYI SECONDARY SCHOOL

Preliminary Examination 2021
Secondary Four Express

PHYSICS **6091/03**

Paper 3 Practical

12 August

2021

1 hour 50 minutes

Candidates answer on the Question Paper.
Additional Materials: As listed in Instructions to Supervisors.

READ THESE INSTRUCTIONS FIRST

Do not open these booklets until you are told to do so.
Write your **name** and **class/register number** in the spaces above.
Write in dark blue or black ink. You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

Answer **all** questions.
All of your answers should be written in this Question Paper: scrap paper should **not** be used.
Graph paper is provided in this Question Paper. Additional sheets of graph paper should be used only if it is necessary to do so.

You will be allowed to work with the apparatus for a maximum of 55 minutes for each section.

For Examiner's Use	
1	
2	
3	
Total	

You are expected to record all your observations as soon as these observations are made.
An account of the method of carrying out the experiments is **not** required.
The use of an approved scientific calculator is expected, where appropriate.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

Section A

[Turn over

1 *In this experiment, you will investigate the extension of a spring.*

You have been provided with

- a length of string tied to a spring,
- an S-hook,
- a stand, boss and clamp,
- a piece of plastic pipe,
- a mass of weight 1.5 N,
- a set square,
- a 30 cm ruler,
- a 50 cm rule,
- a metre rule fixed to the bench with Blu-tac,
- a loop of string on the metre rule.

(a)(i) Measure and record the unstretched length l_o of the spring, as shown in **Fig. 1.1**.

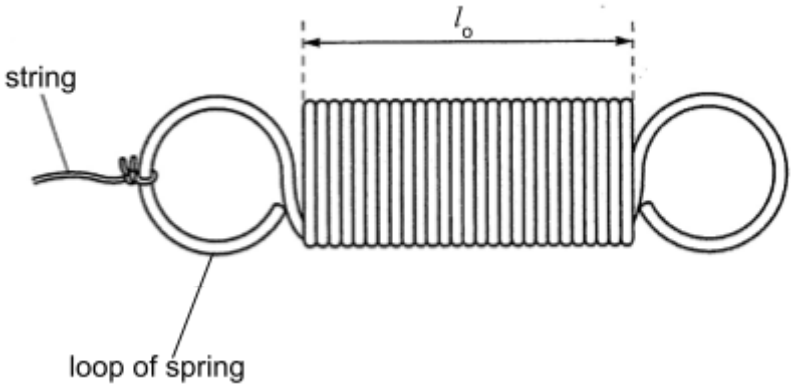

Fig. 1.1

l_o = …….. [1]

(a)(ii) Place one of the loops of the spring onto the rod of the clamp, as shown in **Fig. 1.2**. Suspend the mass on the other loop.

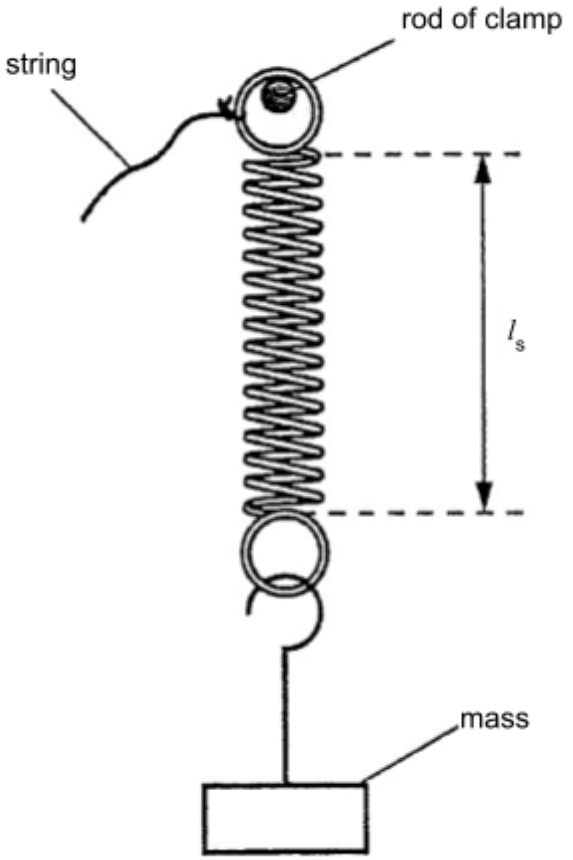

Fig. 1.2

Measure and record the stretched length l_s of the spring.
Determine the extension e_o of the spring using the equation $e_o = l_s - l_o$.

l_s = ... [1]

e_o = ... [1]

(b) Use your value of e_o from **(a)(ii)** and the equation $F = ke_o$, where F = 1.5 N, to determine the spring constant k for the spring.

k = ... [1]

(c) Remove the spring from the rod of the clamp. Place the plastic pipe in the clamp. Adjust

the height of the boss so that the centre of the plastic pipe is 50 cm above the bench. Adjust the positon of the clamp stand so that the centre of the plastic pipe is aligned with the 50 cm mark on the metre rule.

Attach the S-hook to the loop of string on the metre rule. Attach the spring to the S-hook. Place the string over the plastic pipe and suspend the mass from the loop at the end of the string, as shown in **Fig. 1.3**.

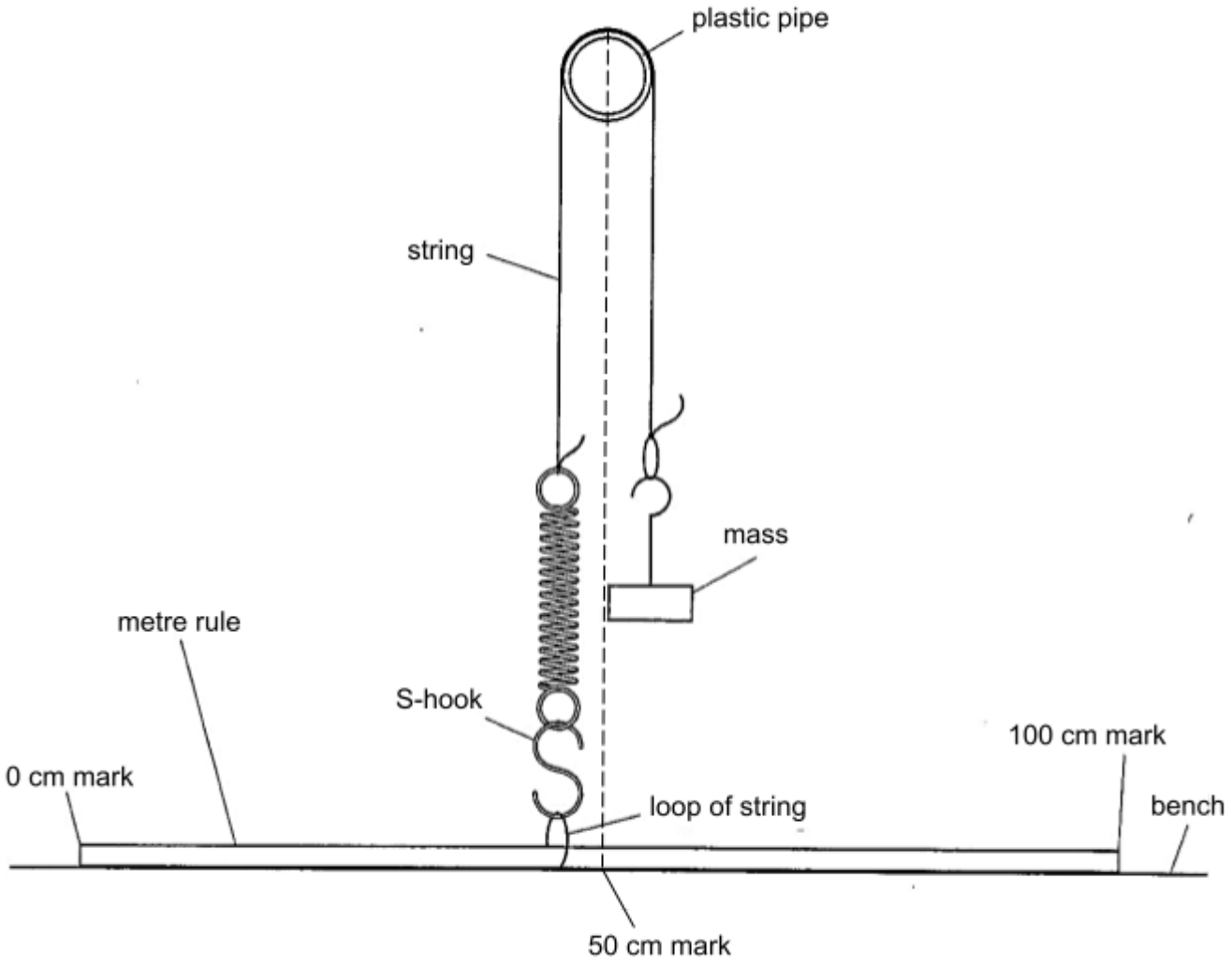

Fig. 1.3

(i) Adjust the position of the loop of string on the metre rule until the spring is vertical.

Measure and record the stretched length l_1 of the spring.
Determine the extension e_1 of the spring using the equation $e_1 = l_1 – l_o$.

l_1 = ……

e_1 = ……[1]

(c)(ii) With the mass still suspended from the string, carefully move the loop of string on the metre rule so that it is at the 15 cm mark.

Measure and record the stretched length l_2 of the spring.
Determine the extension e_2 of the spring using the equation $e_2 = l_2 – l_o$.

l_2 = ……..……

e_2 = ……..……[1]

(d) Use your value of k, values of e_1 and e_2 and the equation from **(b)** to calculate the forces F_1 and F_2 in the spring with the loop in the two different positions on the metre rule.

F_1 = ……..…… [1]

F_2 = ……..…… [1]

(e) Explain why F_1 is not equal to the weight of the mass on the spring. [1]

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(f) Identify one source of error in this experiment. [1]

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2 *In this experiment, you will investigate a type of semi-conducting diode called a light-emitting diode (LED), which is a semiconductor diode that emits light.*

You have been provided with

- a power supply,
- a switch,
- a light-emitting diode (LED),
- a 10 Ω resistor,
- a voltmeter,
- an ammeter,
- a variable resistor
- connecting leads.

You are to set up the circuit as shown in **Fig. 2.1**.

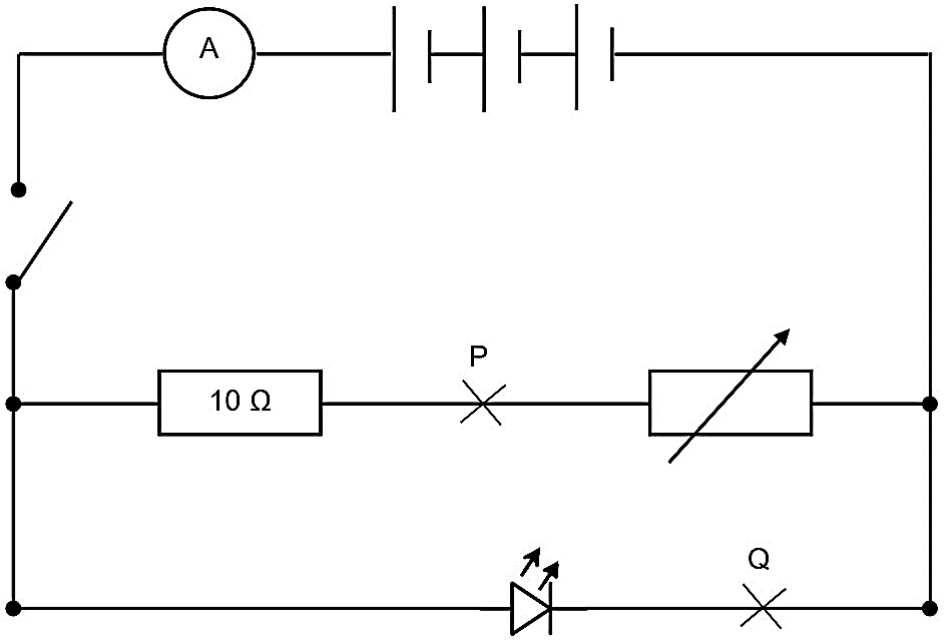

Fig. 2.1

(a) Close the switch and adjust the variable resistor to the maximum resistance. Connect a voltmeter across the LED. Record the current I_1 shown on the ammeter and the potential difference V_1 shown on the voltmeter.

I_1 = ……[1]

V_1 = ……..…[1]

(b) Using the formula P = IV, calculate the power P dissipated in the LED using the values found in **(a)**.

power = ……..[1]

(c) Remove the voltmeter and connect it across points P and Q.

Record the current I shown on the ammeter and the potential difference V shown on the voltmeter.

I = ……

V = ……... [1]

(d) ***Plan***

*A student suggests that the current I is linearly related to the potential difference V across points P and Q such that V = **k**I + c.*

Plan an experiment to investigate this relationship.

Your plan should include

- the quantities that you will keep constant,
- a description of how you would perform the investigation,
- an indication of how you will achieve accurate results,
- a statement of the graph you would plot to test the relationship,
- an explanation of how **k** would be found from the graph.

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[6]

Section B

3 *In this experiment, you will investigate how rays coming from an object which have been reflected by a plane mirror change when the position of the mirror changes.*

You have been provided with
- a plane mirror with a line drawn in the middle
- a mirror stand
- four optical pins
- an A4 plain paper
- a soft board
- a half metre rule

(a) On a piece of plain paper, draw three lines parallel to a long edge as shown in **Fig. 3.1**. Label these lines as shown in **Fig. 3.1**.

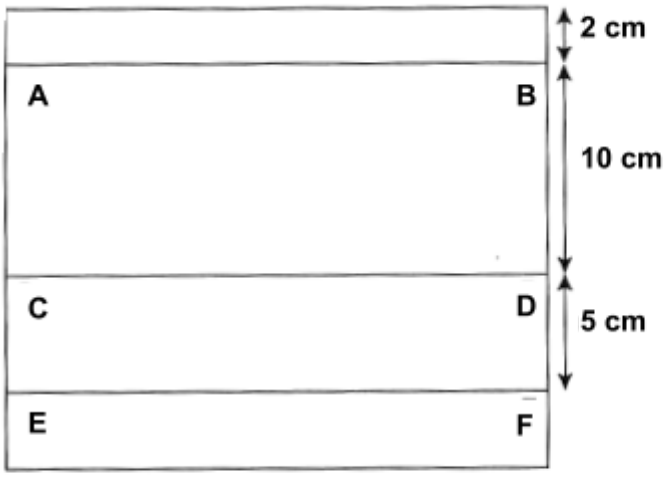

Fig. 3.1

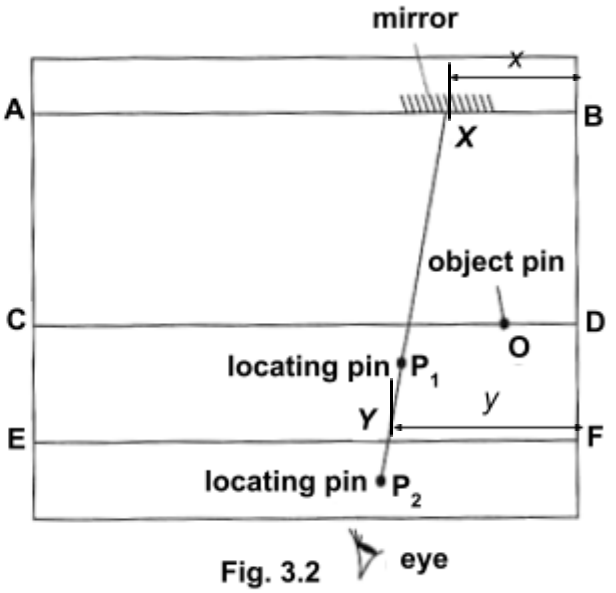

Fig. 3.2

Place a pin, to act as an object, at a point **O** on the line **CD** such that the distance **OD** is 2.0 cm as shown in **Fig. 3.2**. [2]

(b) The plane mirror which is to be used has a line drawn on its face. Set this mirror on the line **AB** so that the line on the mirror is vertical and directly above a point **X** on the line **AB**, such that **XB** is 4.0 cm as shown in **Fig. 3.2**.

(c) By looking into the mirror, observe the image of the pin placed at **O**. Place two pins, $\mathbf{P_1}$ and $\mathbf{P_2}$, such that they are in line with the line on the surface of the mirror at point **X** and the image of the object. [1]

(d) On the trace, draw $\mathbf{XP_2}$, the direction of the reflected ray. Mark the point **Y**, where the line $\mathbf{XP_2}$, crosses the line **EF**.

(e) Measure and record the distance x = **XB** and the distance y = **YF**.

(f) By placing the mirror at different positions on the line **AB**, repeat steps **(b)** to **(e)** for values of x.

Record your results for x and y in a table. The values for x and y should be recorded in centimetres. Also include your results from **(e)** in the table. [5]

(g) It is suggested that the relationship between x and y is given by the equation

$y = Gx + C$

where G and C are constants.

(h) Plot a graph of y against x using the graph paper provided on **page 12**. [5]

(i) Determine the constant G, showing clearly on your graph how you did this. [2]

G = ……

(j) With the value of G calculated in **(i)**, determine the value of constant C. [1]

C = ……

(k) Using the graph obtained, comment on the relationship between y and x.

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……[1]

(l) Identify one source of error in this experiment. Suggest a modification to improve the accuracy of the experiment and explain why your modification would improve the accuracy.

Source

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Modification

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Explanation

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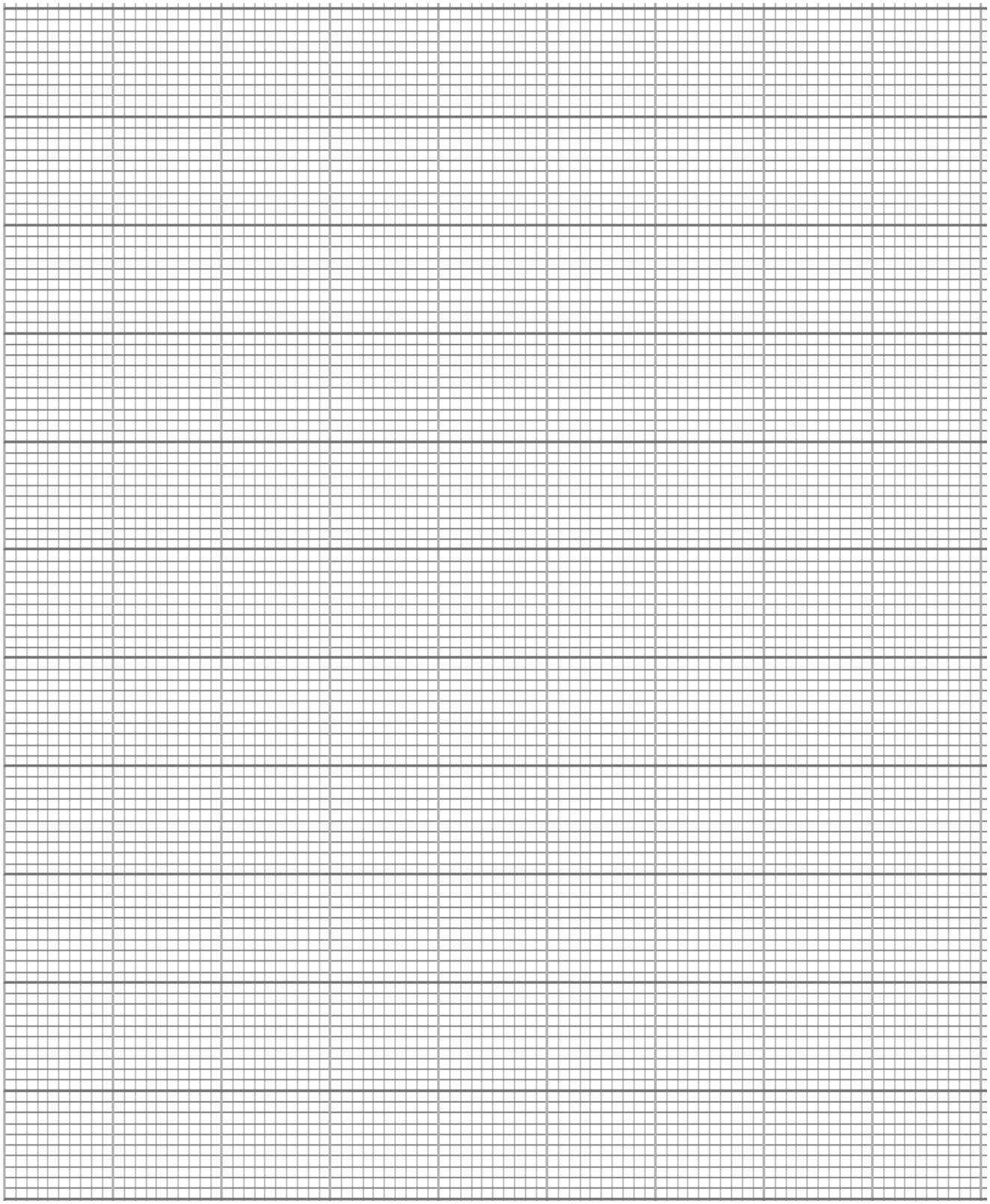
[3]



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