**NAME: ……………………………… INDEX NUMBER: ………….…………………….. SCHOOL…………………….. SIGNATURE:…………................. DATE:……………….**

**232/3**

**PHYSICS**

**PAPER 3**

**FORM 4**

**TIME: (2½ HOURS)**

**DECEMBER EXAM 2021**

**KENYA CERTIFICATE OF SECONDARY EDUCATION**

**PHYSICS**

**Instructions to candidates**

1. Write your **name, index number, school** and **stream** in the spaces provided **above**.
2. Sign and write the date of examination in the spaces provided **above**.
3. Answer **ALL** the questions in the spaces provided in the question paper
4. You are supposed to spend the first **15 minutes** of 2 ½ hours allowed for this paper reading the whole paper carefully before commencing the work.
5. Marks are given for clear record of the observations actually made, their suitability, accuracy and the use made of them.
6. Candidates are advised to record their observations as soon as they are made
7. **Silent non-programmable** electronic calculators may be used.

*For Examiners use only*

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Question 1** | (a) | (e) | (g) | (h) | (i) | (j) | (k) | Total marks |
| **Max score** | 1 | 2 | 5 | 5 | 3 | 2 | 2 | 20 |
| **Candidate’s score** |  |  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Question 2** | (d) | (h) | (j) | (k) | (l) | (m) | (o) | (p) | Total marks |
| **Max score** | 1 | 1 | 4 | 5 | 3 | 1 | 2 | 3 | 20 |
| **Candidate’s score** |  |  |  |  |  |  |  |  |  |

**GRAND TOTAL**

*This paper consists of 8 printed pages. Candidates should check the question paper to ensure that all the pages are printed as indicates and no questions are missing.*

**QUESTION 1**

You are provided with the following apparatus;

* A 250ml beaker containing a liquid
* A wooden block labeled P
* Clamp, stand and boss
* Three pieces of threads
* A 50g mass
* A metre rule
* Vernier calipers *(To be shared)*
* A piece of masking tape

**Proceed as follows**

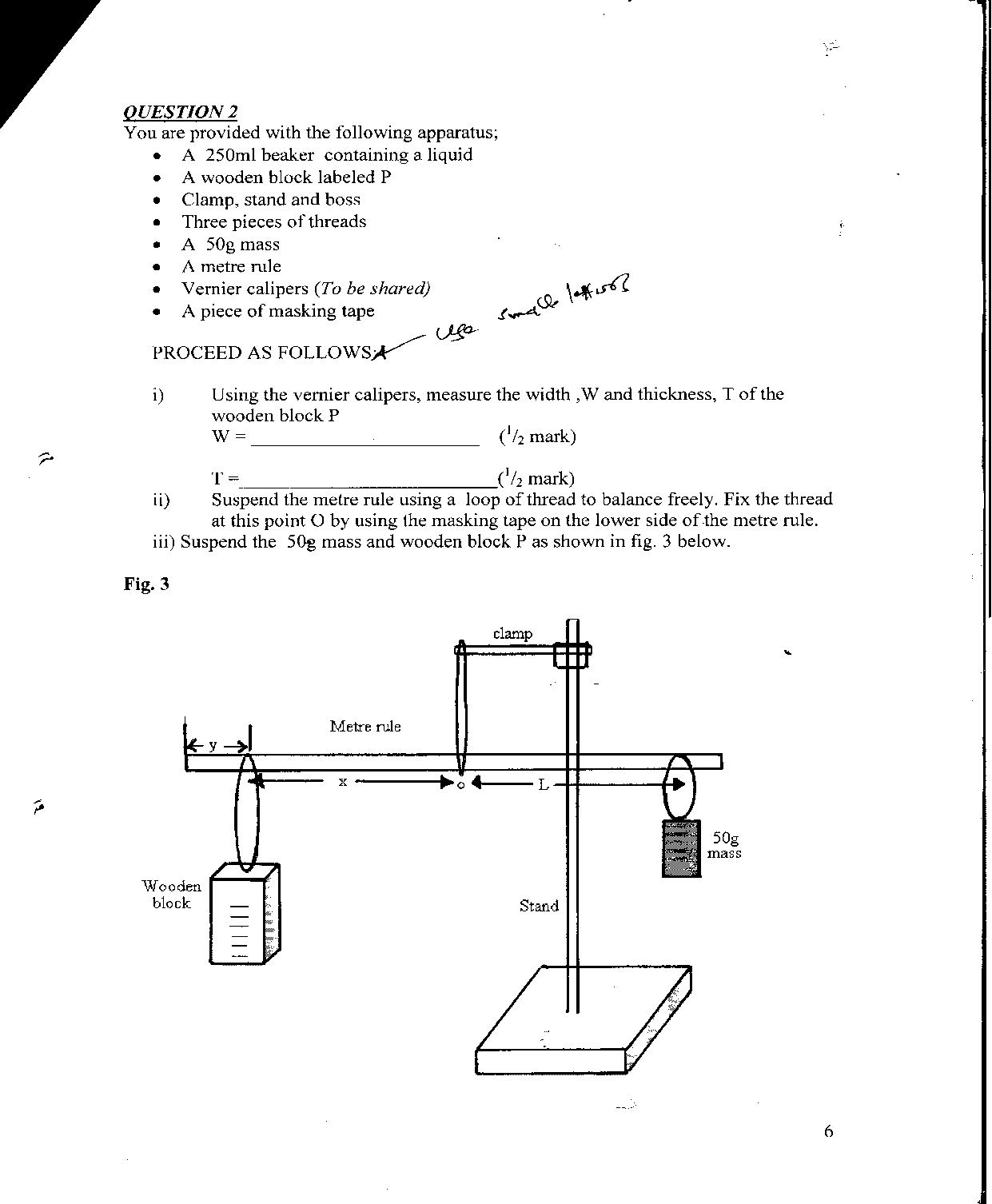
(a) Using the vernier calipers, measure the width, W and thickness, T of the wooden block p

W = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ( ½ mark)

T = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ( ½ mark)

(b) Suspend the metre rule using a loop of thread to balance freely. Fix the thread at this point O by using the masking tape on the lower side of the metre rule.

(c) Suspend the 50g mass and wooden block P as shown in fig. 1 below.



(d) Suspend the wooden block at a distance y = 10cm

(e) Adjust the position of point of suspension of the 50g mass until equilibrium is attained. Determine the distance lo

lo =\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_cm ( ½ )

X = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ cm ( ½ )

Determine the weight of the wooden block, W by using the formula

W =  (1 mk)

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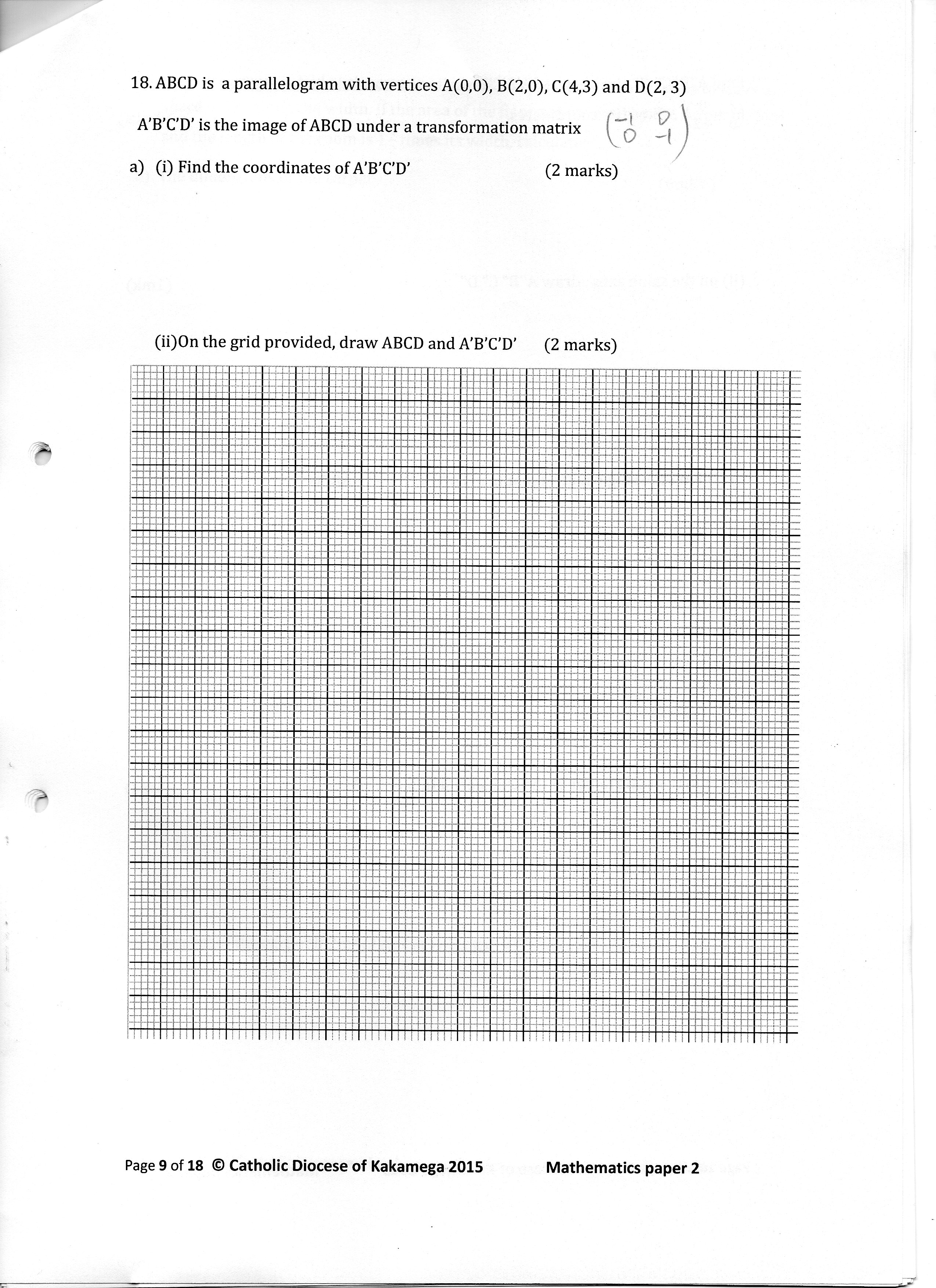
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(f) Place the beaker containing the liquid below the wooden block. Lower the clamp so that the block is slightly immersed. Adjust the 50g mass so that the liquid **just** reaches the first mark on the block. The depth immersed is 0.5cm Determine the new value of L and record in the table given below.

(g) Repeat step (f) for the other marks to fill the table. (5 mks)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Mark | 1 | 2 | 3 | 4 | 5 | 6 |
| Depth immersed, d (cm) | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 |
| L (cm) |  |  |  |  |  |  |

(h) Plot a graph of L (y-axis) against d. (5 mks)



(i) Determine the slope of the graph. (3 mks)

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(j) Determine the cross section area of the block by using the values obtained in (a) above.

A = WT (2 mks)

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(k) The relationship between L and d obeys the following equation;

**L = 2(Weight) - 20ρAd**

Use the graph to determine the value of **ρ**. (2 mks)

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2. **PART A**

You are provided with the following apparatus

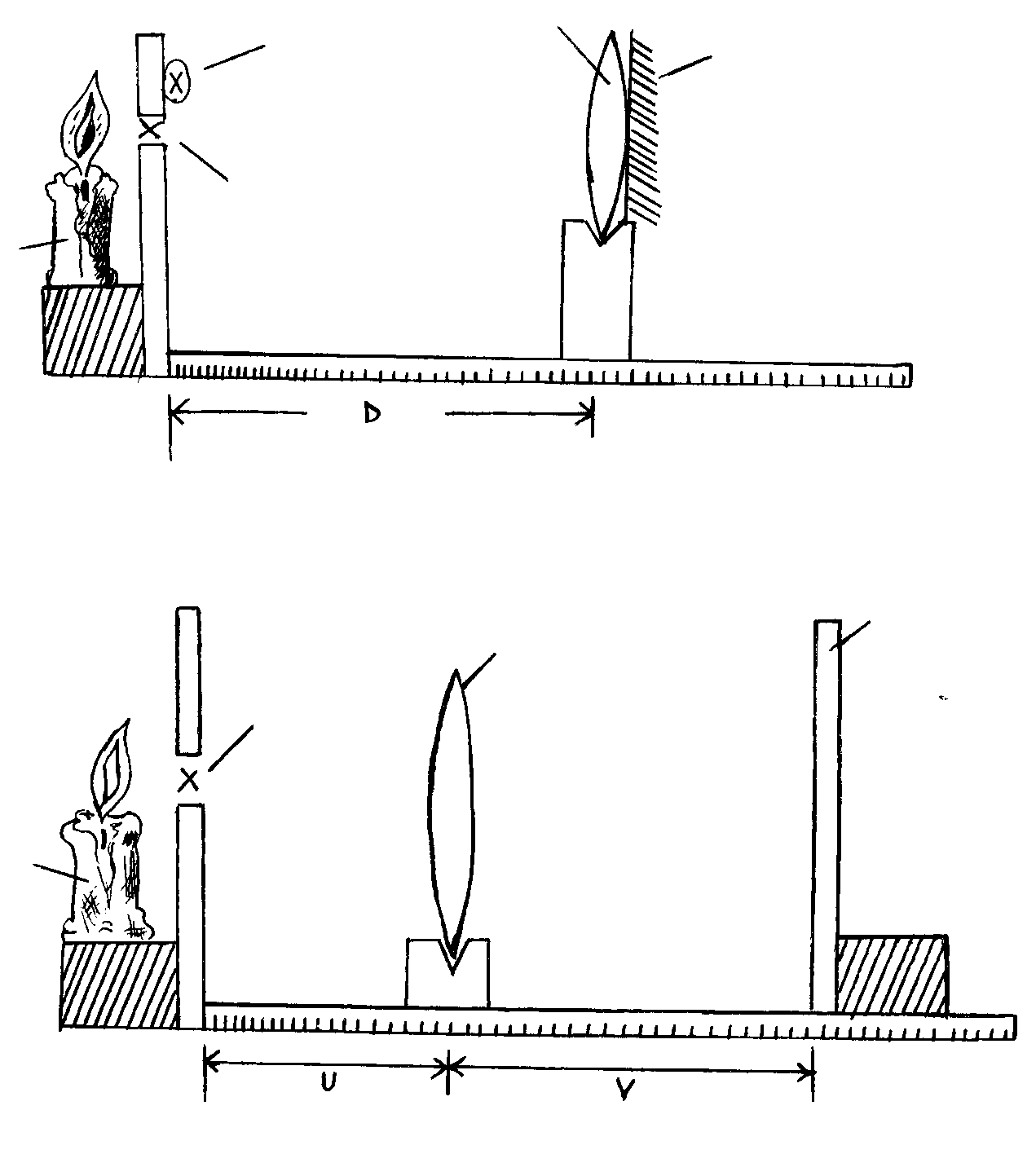
* a metre rule
* a thin lens
* a lens holder
* a white cardboard screen
* a piece of plasticine
* a lit candle
* a cross – wire ( fixed into a hole in a cardboard screen)
* a plane mirror
* a piece of cellotape.

**PART I**

(a) Attach the plane mirror carefully to the thin lens using cellotape such that the reflecting side faces the lens and then place the lens on the lens holder.

(b) With the cross – wire at the zero centimetre mark of the metre rule, arrange the apparatus as shown in figure 2.

(The metre rule can be fixed on the bench using a piece of plasticine)



d

Fig 2

Candle

Cross-wire

Approximate position of image

Plane mirror

Lens

(c) Move the lens along the metre rule until a sharp image of the cross- wire is formed alongside the object cross- wire.

(d) Take at least two readings of the length, d, between the lens and the screen and determine the average

d = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_m (1mk)

**PART II**

(e) **Set up** the apparatus as shown in figure 3.

The flame of the candle should be approximately at the same height as the cross- wire.

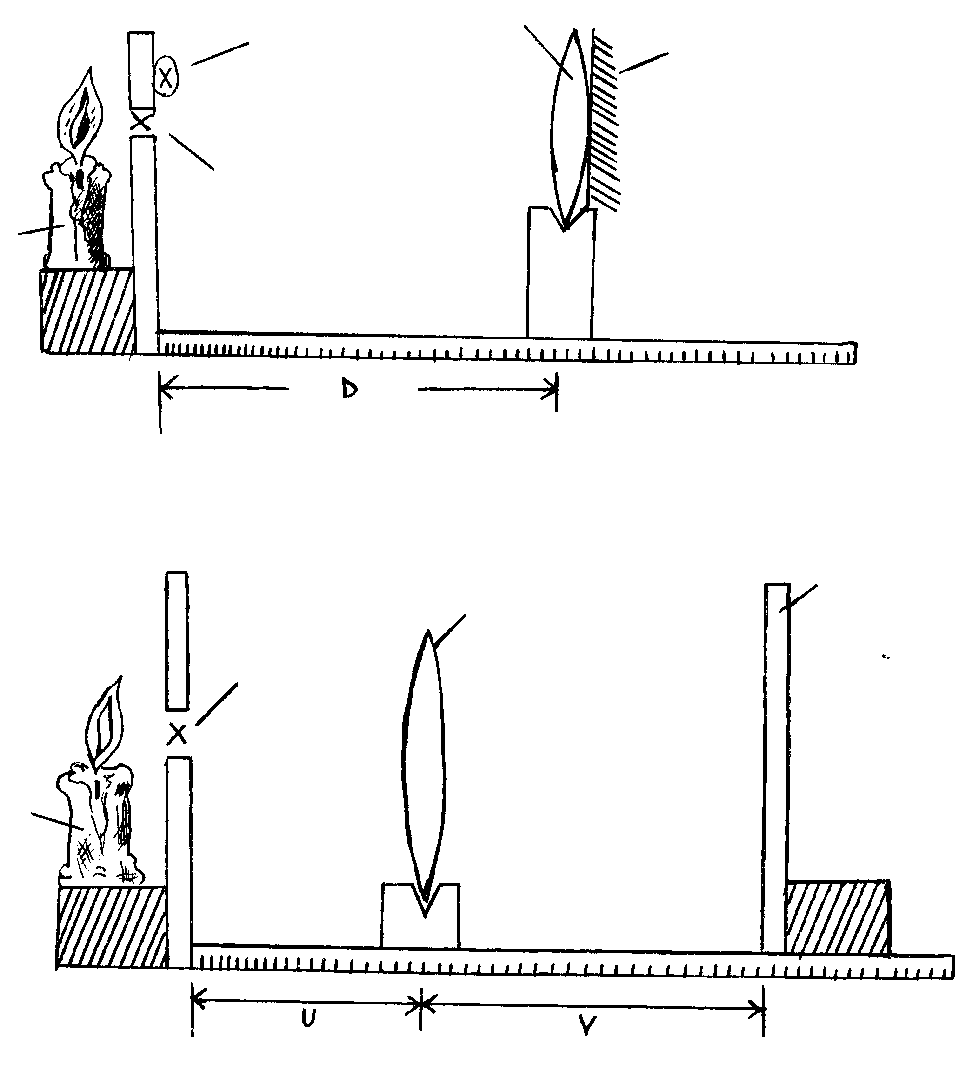


Fig 3

Screen

Lens

Cross wire

Candle

(f) Place the cross- wire at the zero centimetre mark of the metre rule.

(g) Set the object distance, u, by adjusting the lens position so that it is at 60cm.

(h) Adjust the screen until a sharp image of the cross – wire is obtained on it. Note the

image distance v, between the screen and the lens

v = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_cm ( 1mk)

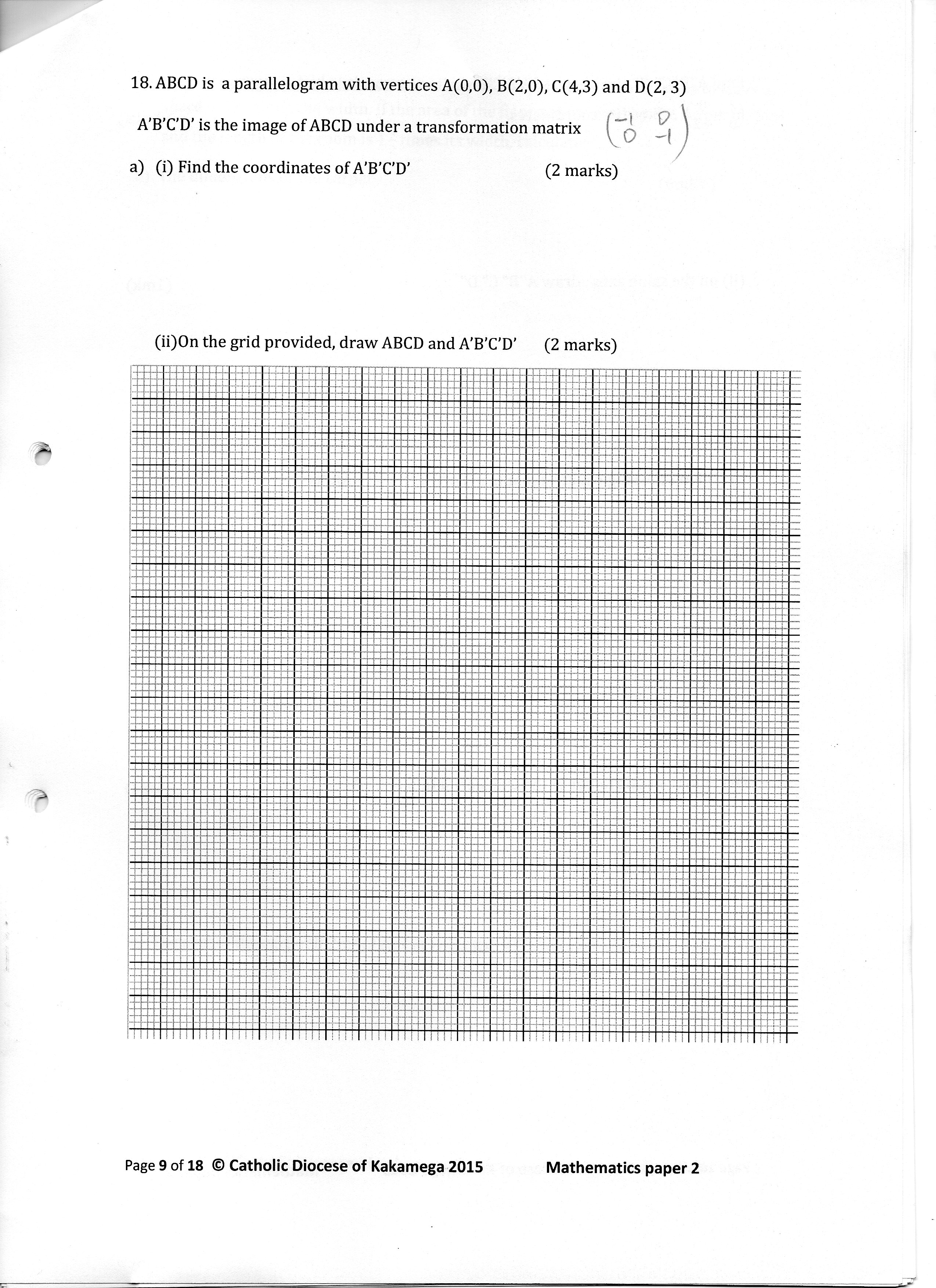
(i) Repeat the procedure above to obtain corresponding values of v when u = 70cm, 50cm, 40cm,

35cm and 30cm.

(j) Tabulate your results below. (4mks)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Object distance u (cm) | 30 | 35 | 40 | 50 | 60 | 70 |
| Image distance v(cm) |  |  |  |  |  |  |
| (u + v) (cm) |  |  |  |  |  |  |
| uv(cm2) |  |  |  |  |  |  |

(k) Use the table to plot a graph of uv on y – axis against ( u + v) ( 5mks)



(l) Determine the slope of the graph and hence the power of the lens. (3mks)

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(m) Explain how the quantity d in PART I and the power of the lens obtained in (l)

above relate. (1mk)

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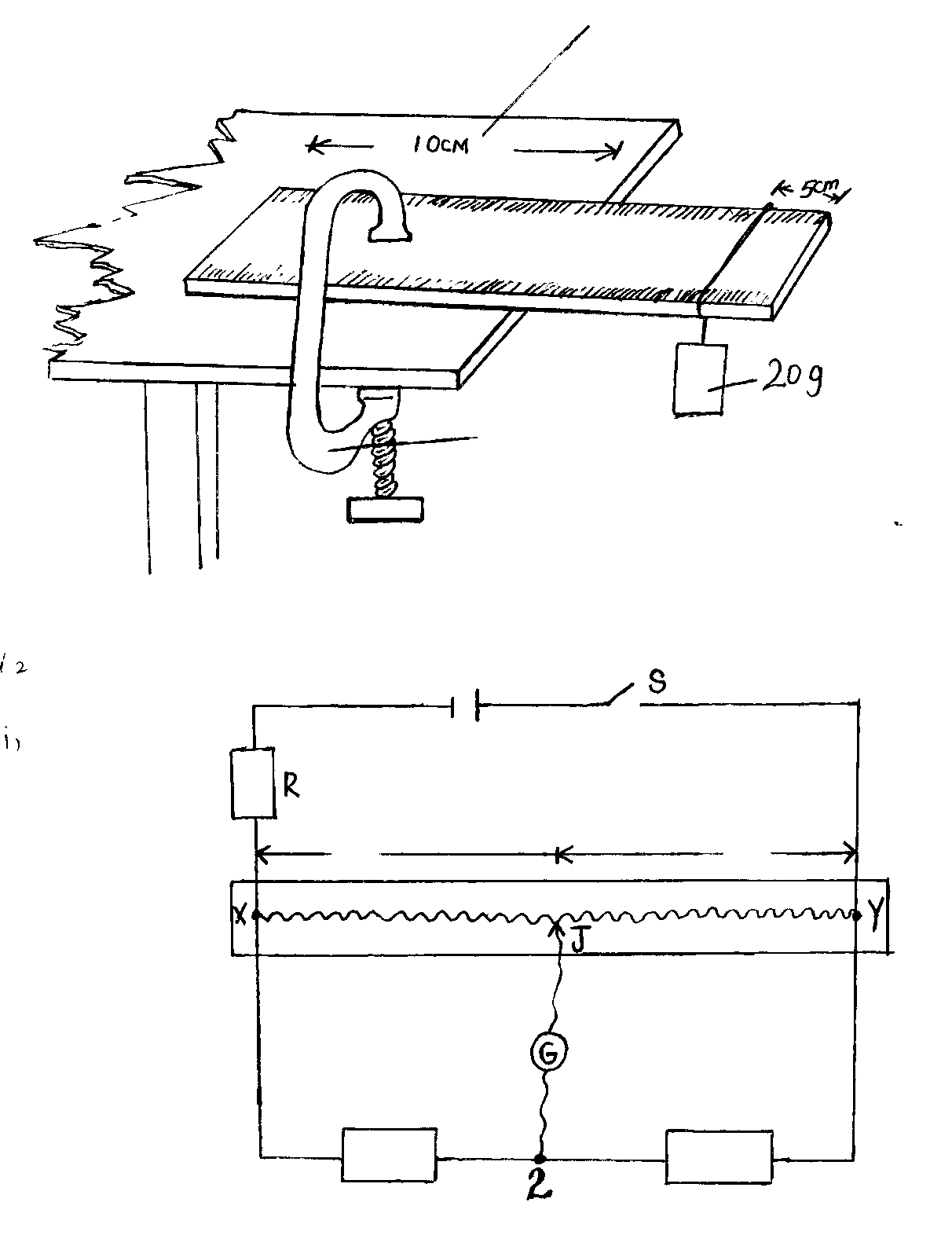
**PART B**

You are provided with the following apparatus :

* dry cell
* a cell holder
* a switch
* nichrome wire mounted on a metre rule.
* Component C
* a centre zero galvanometer
* 8 connecting wires, four of which with crocodile clips at both ends
* a resistor, R
* a 4 Ω resistor.

Proceed as follows.

(n) Arrange the apparatus as illustrated in figure 4



Z

Component C

4Ω

l2

Fig.4

l1

Ensure that the switch is initially open. Connect the zero mark of the wire to X

and 100cm mark at Y. The crocodile clip on the wire connected from the

galvanometer, G, should be free to move along the wire XY. (Precaution: Any

rusty terminal can distort the results).

(o) Put on the switch and move the crocodile clip, J, along the wire XY until the galvanometer, G, reads zero. This is achieved by placing gently the crocodile clip on the wire XY at one extreme end and then moving it along the wire carefully.

Repeat the procedure at least once and find the average reading of l1 and l2.

l1 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ cm (1mk)

l2 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_cm (1mk)

(p) Using the values of l1, and l2 and 4Ω resistor, determine the resistance of the component

C. (3mks)

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