NAME:		( )	CLASS:	

YISHUN TOWN SECONDARY SCHOOL

PRELIMINARY EXAMINATION 2022

SEC 4 EXPRESS

PHYSICS

(6091/3)

DATE : 25 Aug 2022 **DAY : Thursday**

DURATION: 1 hr 50 min **MARKS: 40 marks**

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number in the spaces provided at the top of this page.

Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use glue or correction fluid.
You are to submit the separate sheet of paper provided together with your answers.

Answer **all** the questions in the spaces provided.

INFORMATION FOR CANDIDATES

The use of an approved scientific calculator is expected, where appropriate. You may lose marks if you do not show your working or if you do not use appropriate units.

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

YTSS PRELIM P3 2022 Go through video

Question 1	
Question 2	
Question 3	
TOTAL	

This question paper consists of **13** printed pages.

Section A

1 *In this experiment, you will determine the specific heat capacity of cooking oil.*

You have been provided with

- an arrangement of resistors to act as a heater (from 2021 O level)
- an ammeter (0 – 1A range)
- a voltmeter (0 – 5V range)
- a 4.5V power supply
- a switch
- 6 x leads and crocodile clips
- a beaker containing 40 cm^3 cooking oil
- a thermometer
- a retort stand, boss and clamp
- a stopwatch

The heater is made from five resistors connected in parallel. Do **not** separate the resistors.

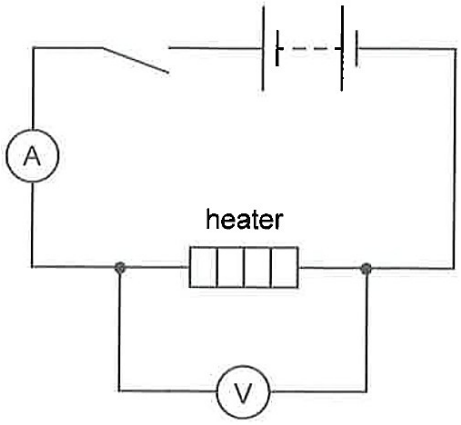


Fig 1.1

Assemble the circuit shown in Fig 1.1. Close the switch. Take the readings in **(a)** and then immediately open the switch.

(a) **(i)** Record the current *I*.

I = ...[1]

(ii) Record the potential difference *V* across the heater.

V = ...[1]

(iii) Calculate the power P of the heater using the equation shown.

$$P = VI$$

P = ...[1]

(b) Disconnect the voltmeter from the circuit and arrange the apparatus shown in Fig 1.2 with the heater placed in the cooking oil. The thermometer should be placed close to, but not in contact with the heater.

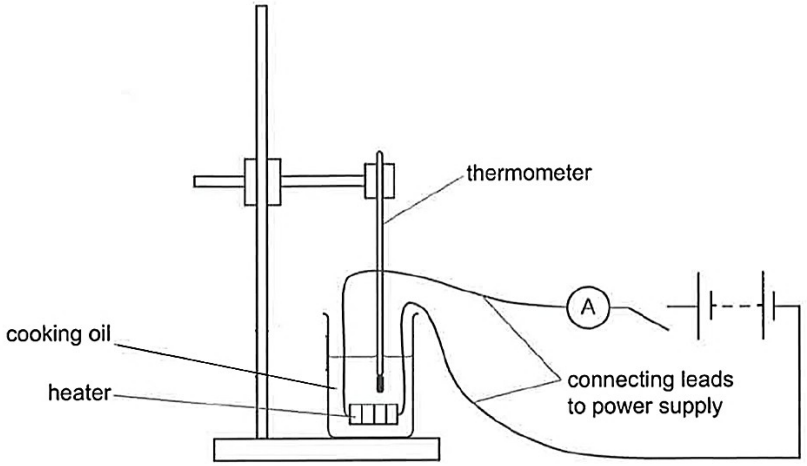


Fig 1.2

(c) Calculate the mass m of the cooking oil using the equation

$$m = \rho v$$

where the density of the oil ρ is 0.90 g/cm^3 and the volume of oil v is 40 cm^3.

m = ...[1]

(d) Close the switch and start the stopwatch. Stop the stopwatch when the temperature of the oil has increased by $\Delta\theta$ = 2.0 °C.

Open the switch.

Record the time taken t in seconds.

t = ...[1]

(e) A suggested relationship between them is

$$Pt = mc\Delta\theta$$

where P is the power of the heater from **(a)** and c is the specific heat capacity of the oil in the beaker.

Using the same apparatus in Fig 1.2, plan an experiment to investigate this relationship.

Your plan should include

- the quantities that you should keep constant,
- a detailed description of how you will perform the experiment,
- a suitable table in which to display your measurements and calculated values (you do **not** need to enter any data into the table),
- a statement of the graph that you would plot to test the relationship,
- an explanation of how you would obtain a value of the constant, c, from your graph

.....[5]

2 *In this experiment, you will investigate the magnification produced by a converging lens when it is used as a magnifying glass.*

You have been provided with

- a 30 cm ruler
- a meter rule
- a magnifying glass with an orange handle
- a lens holder
- a screen
- a boss and clamp
- a retort stand (from question 1)
- an insert with Fig 2.1 printed on it (see page 13)

(a) Detach the insert on page 13 from the question booklet and measure the distance between points A and B on Fig 2.1. Record the distance as h_0.

h_0 = ...

(b) Set up the apparatus as shown in Fig. 2.2. Clamp the magnifying glass by its handle.

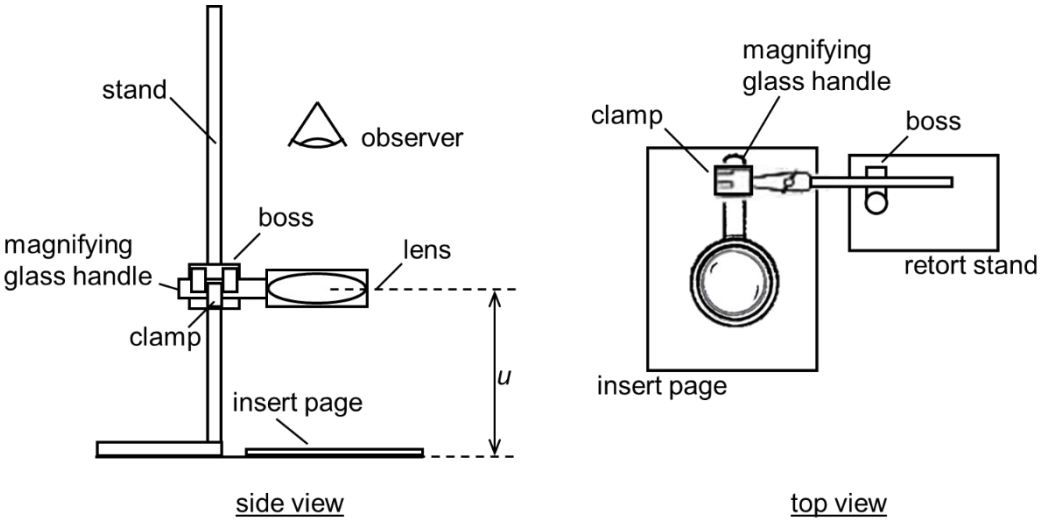


Fig 2.2

(c) Place the lens above Fig 2.1 on the insert. Adjust the height of the boss until the distance, u, is about 5 cm. Record the value of u.

u = ...[1]

(d) With the given apparatus, other than taking the average, describe how you could improve the accuracy of u.

.....

.....

.....[1]

(e) Position your eye about 30 cm above the lens. Look through the lens at Fig 2.1 and observe the points labelled A and B.

Hold the 30 cm ruler on top of the lens and measure the apparent distance h_1 between image A and B as viewed through the lens in Fig 2.3

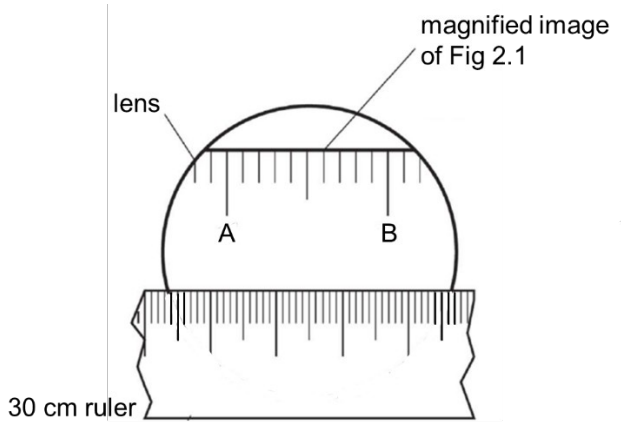


Fig 2.3

Measure and record an accurate value of h_1.

h_1 = ... [2]

(f) Describe one difficulty in obtaining an accurate value of h_1.

.....

.....[1]

(g) Calculate the magnification M using the equation as shown.

$$M = \frac{2h_1}{h_0}$$

M = ... [1]

(h) Calculate the focal length f_1 using the equation as shown.

$$f_1 = \frac{Mu}{M - 1}$$

f_1 = ... [1]

(i) A student suggests that the focal length of a convex lens is given by the image distance when a sharp image of a distance object is formed.

Place the magnifying glass on the lens holder and aim it at a distant bright object, such as a window or the doorway. Adjust the screen until a sharp image is formed as shown in Fig 2.4. You can use your hand to shield the ambience light from the screen.

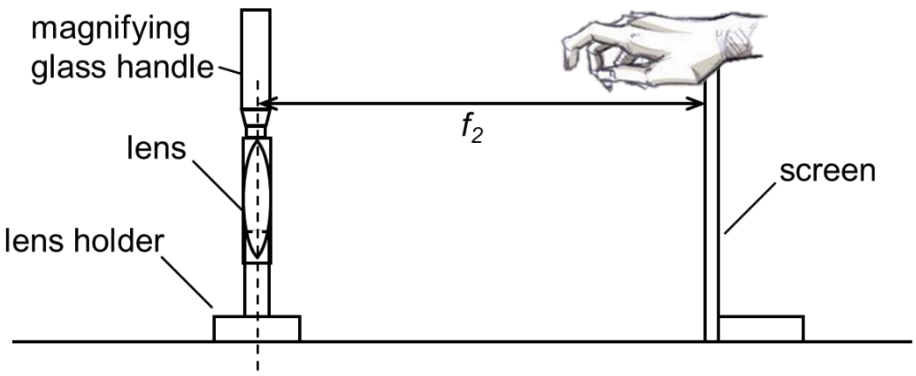


Fig 2.4

Measure and record the value of f_2.

f_2 = ... [1]

(j) Explain whether your value for f_1 in **(h)** supports the suggestion made by the student in **(i)**

.....

.....

.....[2]

Section B

3 *In this experiment, you will investigate how the angle of inclination of a string affects the magnitude of the tension in the string.*

You have been provided with

- an unknown mass A (do **not** remove the sticker)
- a Newton meter (0 – 1N range)
- a protractor
- a meter rule
- a 30 cm ruler
- 2 x retort stand, boss and clamp
- A 1.5 m connecting string with two loops, X and Y, about 6-8 cm apart

(a) Set up the apparatus as shown in Fig 3.1.

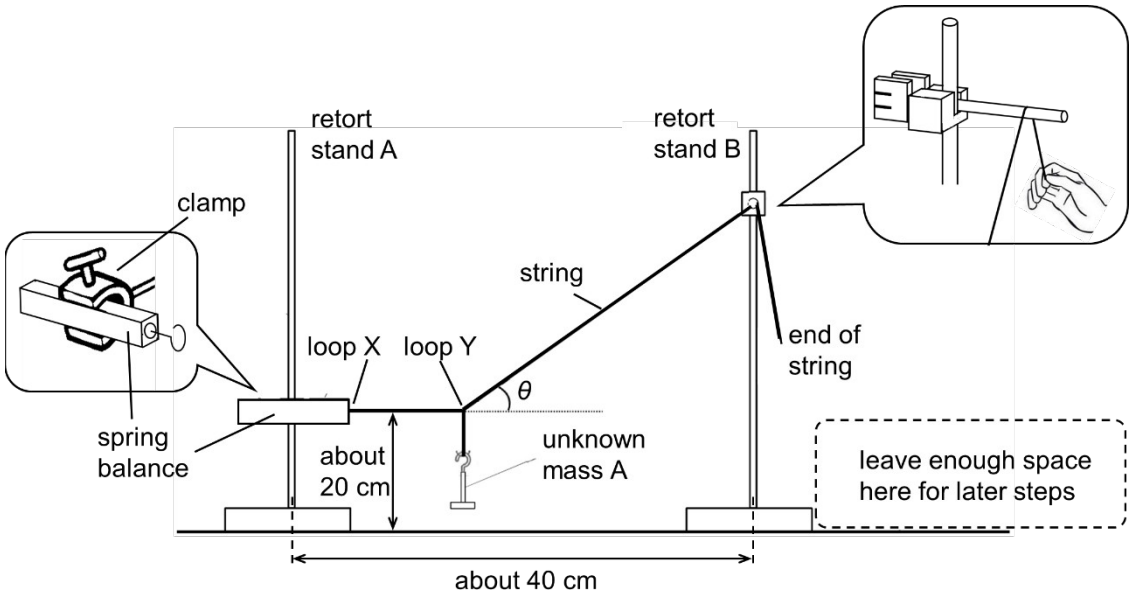


Fig 3.1

Adjust the boss on retort stand A so that it is about 20 cm above the bench top. Place retort stand B about 40 cm from retort stand A and leave about 60 cm of space on the right side of retort stand B. Pull on the end of the string so that the string between loop X and Y is horizontal.

(b) **(i)** Measure the record the angle θ.

θ = ...

(ii) Use the Newton meter to measure and record the tension in string XY as *T*.

T = ... [1]

(c) Calculate $\frac{1}{\tan\theta}$, which has no unit.

$\frac{1}{\tan\theta}$ = ... [1]

(d) Describe how you ensured that the string XY is horizontal.

.....

.....[1]

(e) Continue the experiment by shifting retort stand B further towards the right and repeating **(a)** to **(c)** with different values of θ.

Record your values for θ, $\frac{1}{\tan\theta}$ and T in a suitable table. Include your values from **(b)** and **(c)**. The minimal range of θ in your table is 35°.

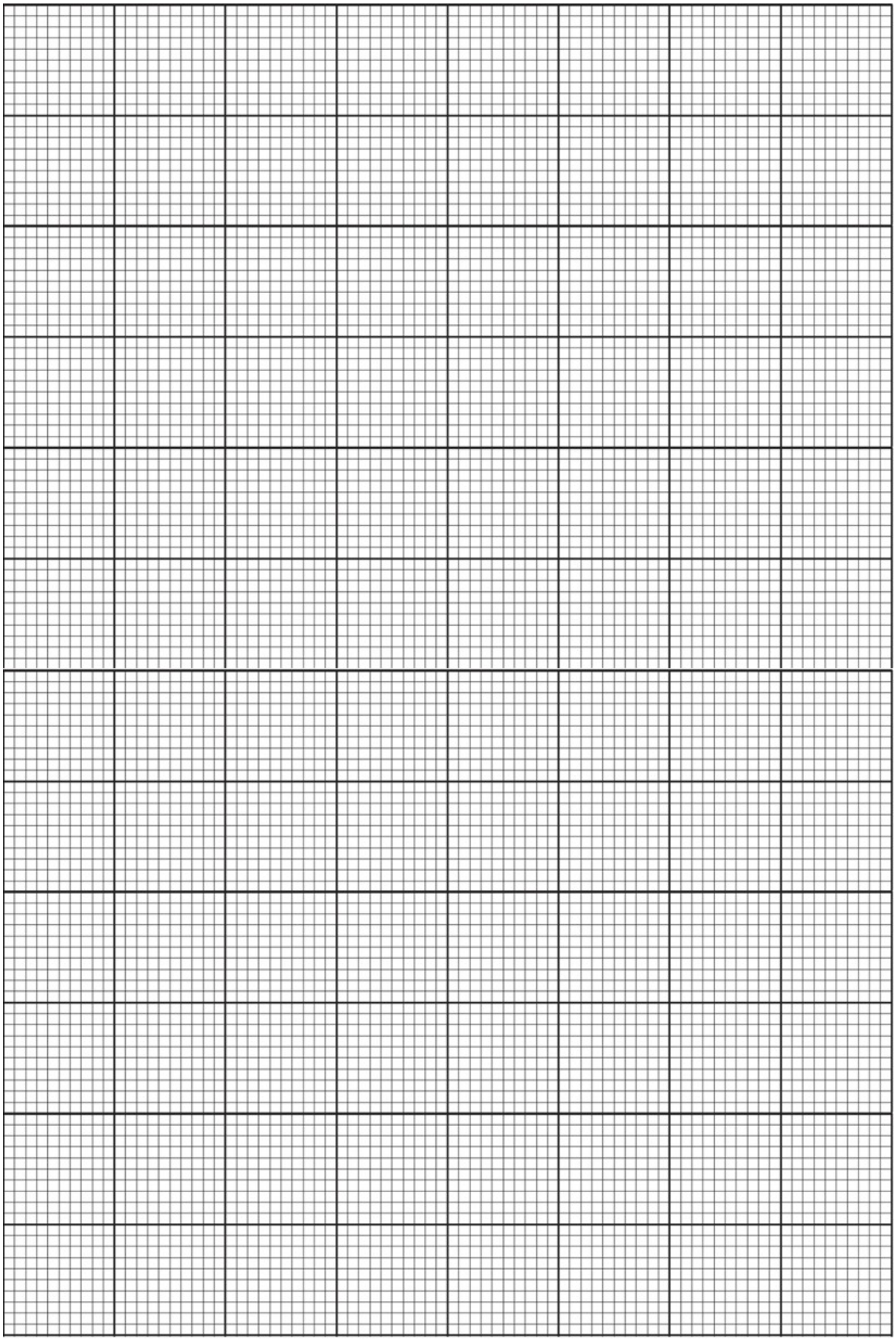
[5]

(f) A suggested relationship between T and θ is

$$T = W \times \frac{1}{\tan\theta}$$

where W is the weight of the unknown mass A.

On the grid, plot a graph of T against $\frac{1}{\tan\theta}$.



[4]

(g) Calculate the gradient of the graph.

gradient = ... [3]

(h) Using the spring balance, measure the weight of the unknown mass directly and record it as W_D.

W_D = ... [1]

(i) By comparing the values obtained in **(h)** and **(g)**, explain whether the suggested relationship in **(f)** is true.

.....

.....[1]

(j) Assuming the relationship suggested in **(f)** is true, explain why it is impossible to set up the apparatus such that $\theta = 0^o$

.....

.....[1]

(k) Describe one source of error in this experiment.

.....

.....

.....

.....[2]

THE END

INSERT

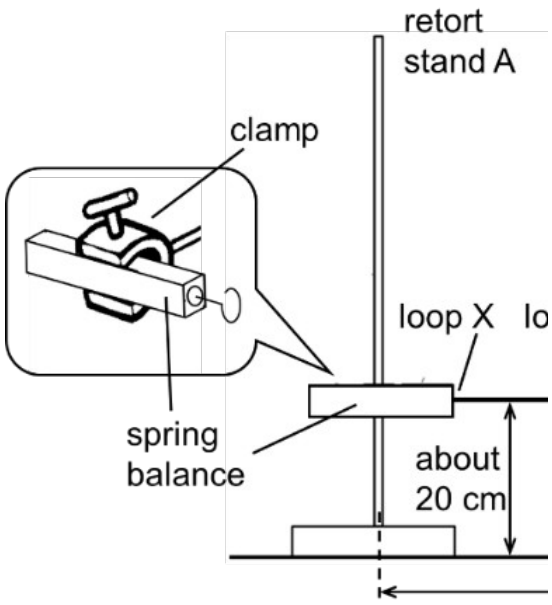
This page is to be submitted to the invigilator after the examination
Candidates are <u>NOT</u> allowed to bring this out of the examination venue

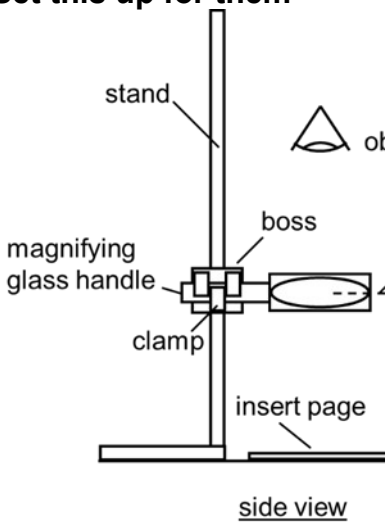
You need <u>NOT</u> write your name on this page

Fig 2.1

4E P-Phy Prelim P3 2022 – Prep List

<table>
<tr><th colspan="2">Section A</th><th colspan="2">Section B</th></tr>
<tr><td>Q1</td><td>• an arrangement of resistors to act as a heater (from 2021 O level)
• an ammeter (0 – 1A range)
• a voltmeter (0 – 5V range)
• a 4.5V power supply
• a switch
• 6 x leads and crocodile clips
• a beaker containing 40 cm^3 cooking oil
• a thermometer
• a retort stand, boss and clamp
• a stopwatch</td><td rowspan="2">Q3</td><td rowspan="2">• an unknown mass A (50g cover by tape)
• a Newton meter (0 – 1N range)
• a protractor
• a meter rule
• a 30 cm ruler
• 2 x retort stand, boss and clamp
• A 1.5 m connecting string with two loops, X and Y, about 6-8 cm apart

Set this up for them
 
</td></tr>
<tr><td>Q2</td><td>• a 30 cm ruler
• a meter rule
• a magnifying glass with an orange handle
• a lens holder
• a screen
• a boss and clamp
• a retort stand (from question 1)

Set this up for them
 

side view</td></tr>
</table>