Cambridge
O Level

Cambridge International Examinations
Cambridge Ordinary Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

3011113809

PHYSICS **5054/31**

Paper 3 Practical Test **May/June 2015**

2 hours

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
For each of the questions in Section A, you will be allowed to work with the apparatus for a maximum of 20 minutes. For the question in Section B, you will be allowed to work with the apparatus for a maximum of 1 hour.

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.

Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

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.

For Examiner's Use	
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This document consists of **10** printed pages and **2** blank pages.

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Section A

Answer **all** questions in this section.

1 *In this experiment, you will determine the density of a salt solution.*

You have been provided with

- a 100 cm^3 measuring cylinder,
- a beaker containing salt solution.

You also have access to a top-pan balance.
If your measuring cylinder is calibrated in ml, then note that 100 ml = 100 cm^3.

(a) (i) Use the top-pan balance to measure the mass m_E of the empty measuring cylinder.

m_E = ...

(ii) Pour a large volume of the salt solution into the measuring cylinder and record accurately the volume V of the solution.

V = ...

(iii) Measure the mass m_T of the measuring cylinder with the solution.

m_T = ...

(iv) Determine the mass m of the solution in the measuring cylinder.

m = ...
[2]

(b) Explain, with the aid of a diagram, how you ensured that V was measured as accurately as possible. Show the position of your eye when taking the measurement.

.....

.....

.....[1]

(c) Calculate the density ρ of the salt solution using $\rho = \frac{m}{V}$.

ρ = ...[1]

(d) Explain an advantage of using a **large** volume of salt solution in this experiment.

.....

.....

.....[1]

[Total: 5]

2 *In this experiment, you will investigate a potential divider circuit.*

You have been provided with an incomplete circuit consisting of

- a power supply,
- a switch,
- a resistor labelled R,
- connecting leads.

The Supervisor has set up the incomplete circuit shown in Fig. 2.1.

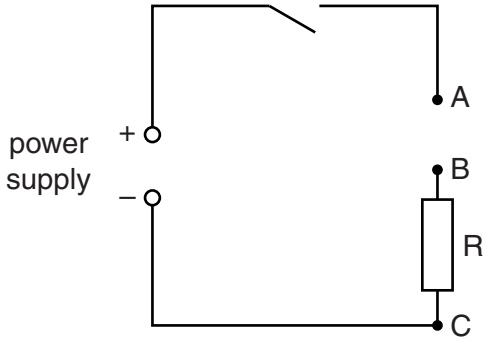


Fig. 2.1

You have also been provided with

- a 100 Ω resistor,
- a 220 Ω resistor,
- a voltmeter,
- additional connecting leads.

(a) Connect the 100 Ω resistor between points A and B in the circuit.

(i) Using two connecting leads, connect the voltmeter between points A and C. Close the switch and measure the potential difference V_{AC}.

V_{AC} = ...

(ii) Open the switch and disconnect the voltmeter. Connect the voltmeter between points B and C. Close the switch and measure the potential difference V_{BC}.
Open the switch.

V_{BC} = ...

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(iii) Calculate the ratio F_1 of the potential differences using $F_1 = \frac{V_{BC}}{V_{AC}}$.

F_1 = ...
[2]

(b) Replace the 100 Ω resistor with the 220 Ω resistor. Repeat **(a)(i)** and **(a)(ii)** to obtain new values for V_{AC} and V_{BC}.

Calculate a new value F_2 for the ratio of the potential differences.

V_{AC} = ...

V_{BC} = ...

F_2 = ...
[2]

(c) Using ideas about potential dividers, explain why V_{BC} has changed.

.....

.....

.....

.....[1]

[Total: 5]

3 *In this experiment, you will estimate the specific heat capacity of the material from which a stopper (bung) is made.*

At your workstation you have been provided with

- a stopper labelled B,
- a card on which is written the mass of a stopper,
- a 250 cm^3 beaker labelled C, containing water at room temperature,
- a 100 cm^3 beaker labelled D,
- a 100 cm^3 measuring cylinder,
- a thermometer,
- a stirrer.

(a) (i) You are required to determine the volume V of water needed to just cover the stopper B in beaker D.

Place stopper B in beaker D.
Pour water from beaker C into D until the stopper is just covered.
Carefully remove the stopper from D.
Using the measuring cylinder, measure the volume V of the water in D.

V = ...

(ii) Pour the water from the measuring cylinder back into D.
Assuming that 1.0 cm^3 (1.0 ml) of water has a mass of 1.0 g, state the mass m_W of the water in D.

m_W = ...
[1]

(b) Measure the temperature θ_1 of the water in beaker D.

θ_1 = ...[1]

(c) The Supervisor has placed a similar stopper in boiling water for you to use. **Take care when handling this stopper, as the initial temperature will be 100 °C.**

Take beaker D to where the stoppers are in boiling water.
Using the string, remove a stopper from the boiling water, quickly shake off excess water and place the stopper into beaker D.
Allow the string to hang over the side of the beaker.
Return to your workstation.
Ensure the stopper is completely immersed. You may use the stirrer to change the position of the stopper if necessary.
Stir the water and place the thermometer in the water.
Record the highest temperature θ_2 reached by the water in beaker D.

θ_2 = ...[1]

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(d) (i) Record the mass m_S of the stopper, which is given on the card.

m_S = ...

(ii) The specific heat capacity c_S of the material from which the stopper is made is found using

$$c_S = \frac{c_W\, m_W\, (\theta_2 - \theta_1)}{m_S\, (100 - \theta_2)}$$

where the specific heat capacity c_W of water is 4.2 J/(g °C) and all temperatures are measured in °C.

Calculate c_S.

c_S = ...
[2]

[Total: 5]

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Section B

4 *In this experiment, you will determine the focal length of a lens.*

You have been provided with

- a converging lens in a holder,
- an object consisting of a cross-wire,
- a light source to illuminate the object,
- a screen,
- a metre rule,
- a set square.

(a) Set up the apparatus as shown in Fig. 4.1. The object is at the 0.0 cm mark on the metre rule.

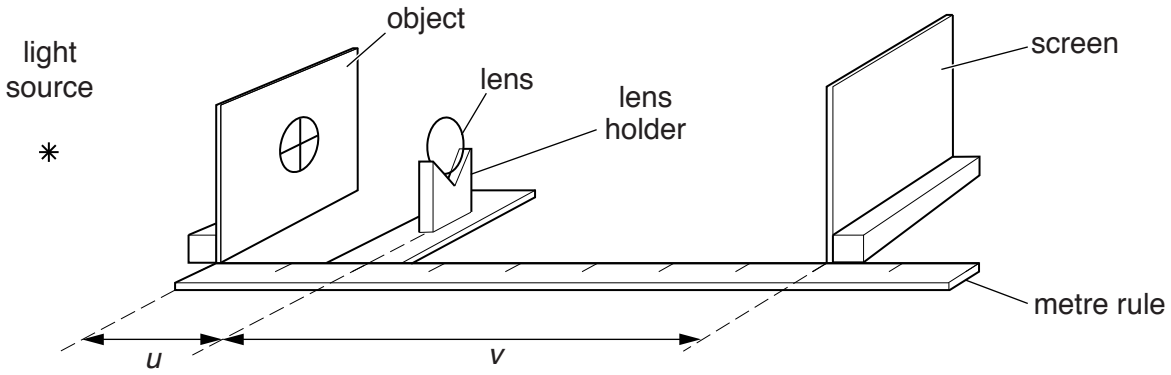


Fig. 4.1

Place the lens at the 20.0 cm mark on the rule and move the screen until a focused image of the object is formed on the screen.

(i) State the value of the distance *u* between the object and the centre of the lens.

u = ...

(ii) Determine an accurate value for the distance *v* between the centre of the lens and the focused image.

v = ...
[3]

(b) Explain how you ensured that the position of the focused image was found as accurately as possible.

.....

.....

.....[1]

(c) Place the screen at a range of distances from the object of between 60.0 cm and 100.0 cm. For each position of the screen, move the lens to focus the image of the object on the screen. Record your values of u and v in a table in the space below and include your results from **(a)**. Also include columns for $(u + v)$ and uv.

[5]

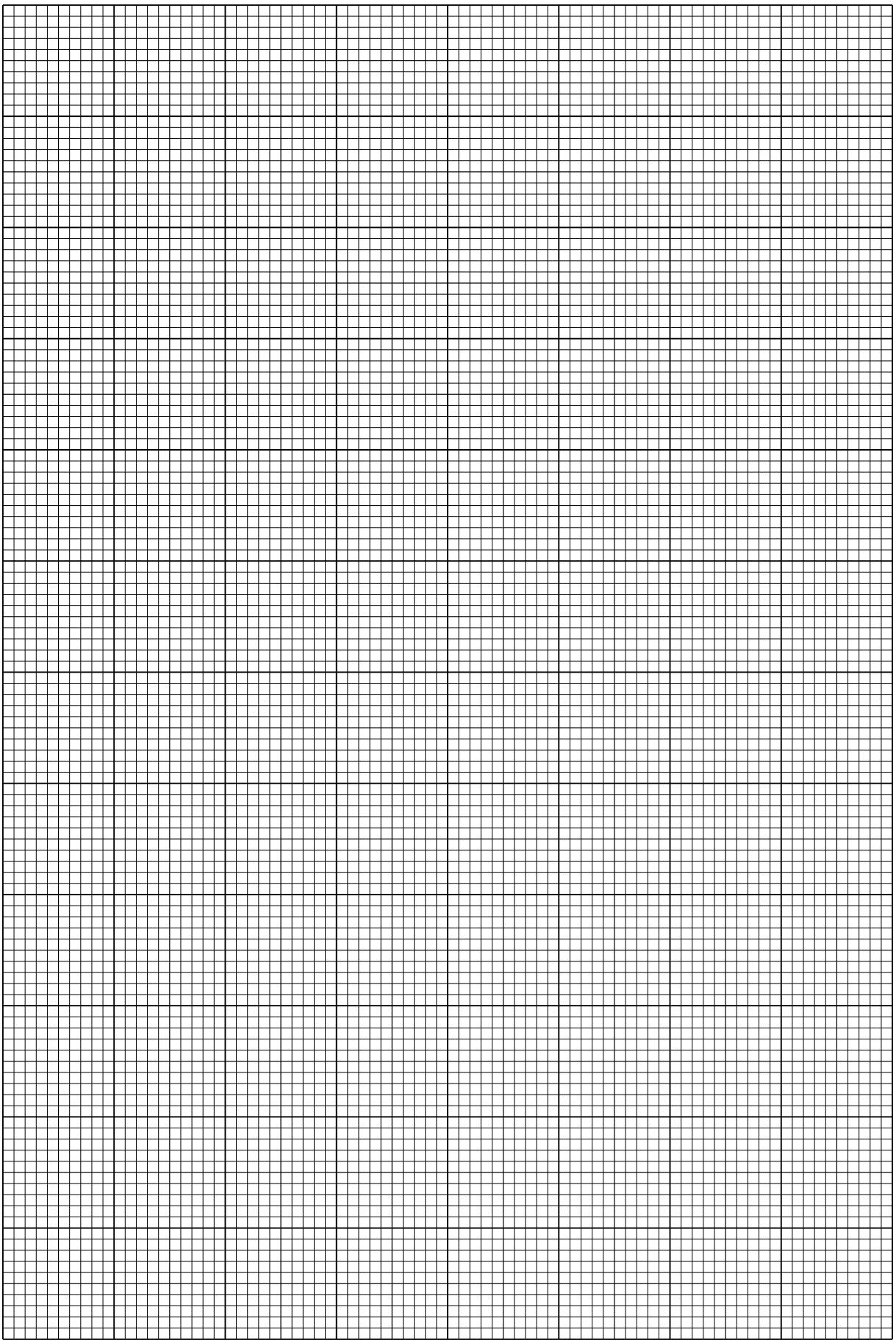
(d) Using the grid opposite, plot a graph of uv on the y-axis against $(u + v)$ on the x-axis. Draw the straight line of best fit through your points. [4]

(e) The gradient of your line gives the focal length f of the lens. Determine f.

$f =$ .....[2]

[Total: 15]

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