



Rewarding Learning

ADVANCED

General Certificate of Education

Centre Number

--	--	--	--	--

Candidate Number

--	--	--	--	--

Physics

Assessment Unit A2 3A

assessing

Practical Techniques and Data Analysis



APH31

[APH31]

Assessment

TIME

1 hour.

Assessment Level of Control:

Tick the relevant box (✓)

Controlled Conditions	
Other	

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.

Write your answers in the spaces provided in this question paper.

Answer **both** questions.

The Supervisor will tell you the order in which you are to answer the questions. Not more than 28 minutes are to be spent in answering each question, and after 26 minutes you must stop using the apparatus in Questions 1 and 2 so that it can be re-arranged for the next candidate. At the end of the 28-minute period you will be instructed to move to the station for the next question. At the end of the Test a 4-minute period will be provided for you to complete your answer to any question, but you will not have access to the apparatus during this time.

INFORMATION FOR CANDIDATES

The total mark for this paper is 40.

Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.

You may use an electronic calculator.

For Examiner's use only		
Question Number	Marks	Remark
1		
2		
Total Marks		

- 1 In this experiment you will investigate the refraction of light by water in a container with a white base. Due to total internal reflection and refraction of light, a dark circle with a bright centre is observed on the bottom of the container. The diameter of this circle varies with the volume of liquid in the container.

Aims

The aims of this experiment are:

- to vary the volume of water in the container and measure the diameter of the dark circle observed
- to plot a linear graph
- to determine a value for the refractive index of water.

Apparatus

You are provided with a bulb and lens, two containers of the same dimensions (one with a white base containing water), a pair of dividers, a 30 cm rule, a measuring cylinder and a beaker of water.

The apparatus has been set up for you as shown in **Fig. 1.1**.

Do not alter the position of the bulb or platform throughout the experiment

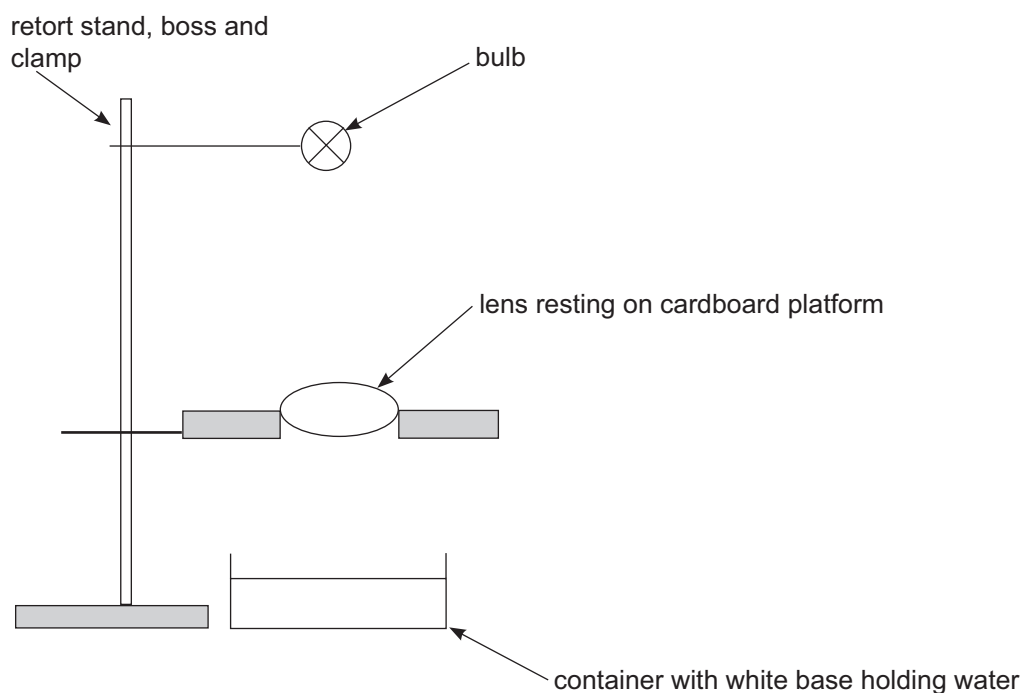


Fig. 1.1

Record the diameter D of this circle, for the volume of water $V = 40 \text{ cm}^3$, in **Table 1.2**.

Use the beaker of water and measuring cylinder supplied to add 20 cm^3 of water to the container and measure the new diameter D . Repeat this procedure until a maximum volume of 120 cm^3 is in the container.

[3]

Table 1.2

V / cm^3	D / cm
40	
60	
80	
100	
120	

Analysis

The diameter D of the dark circle is related to the volume V of water and external area A of the base by **Equation 1.1**.

$$D = \frac{4V}{A\sqrt{(n^2 - 1)}} \quad \text{Equation 1.1}$$

where n is the refractive index of the water.

- (c) Select suitable scales and label the axes to enable you to plot a graph of D against V on the grid of **Fig. 1.3**. Draw the best-fit straight line for the points plotted.

[5]

Examiner Only	
Marks	Remark

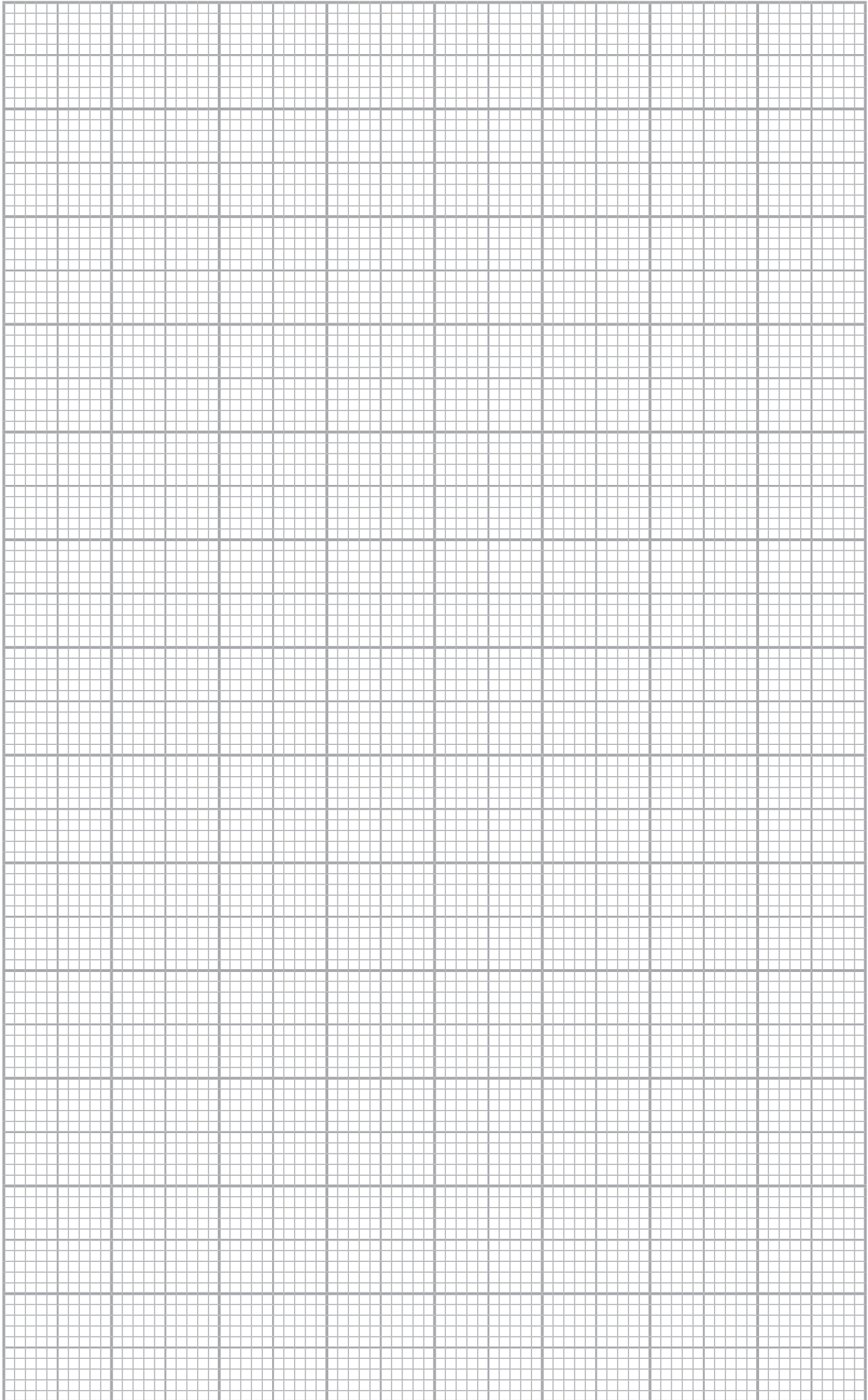


Fig. 1.3
5

- (d) (i) Calculate the gradient of the graph and state the unit of the gradient.

Gradient = _____

Unit of gradient = _____ [3]

- (ii) Use your answer to (d)(i) and your value of A obtained in part (a) to determine a value for the refractive index n of water.

n = _____ [5]

Examiner Only

Marks Remark

2 In this experiment you will determine the mass of a metre rule.

Aims

The aims of this experiment are:

- to vary the horizontal force added to a pivoted metre rule and measure the angle of the metre rule to the vertical
- to plot a linear graph
- to use the graph to determine the mass of the metre rule.

Apparatus

You are provided with a metre rule pivoted near the top end. A plumb line and protractor are attached at the pivot. A string is attached near the lower end and a horizontal force is applied by attaching a mass m to the other end of the string, which is passed over a pulley. The apparatus has been set up for you with a mass hanger of mass 50 g attached to the string. This is shown in **Fig. 2.1**.

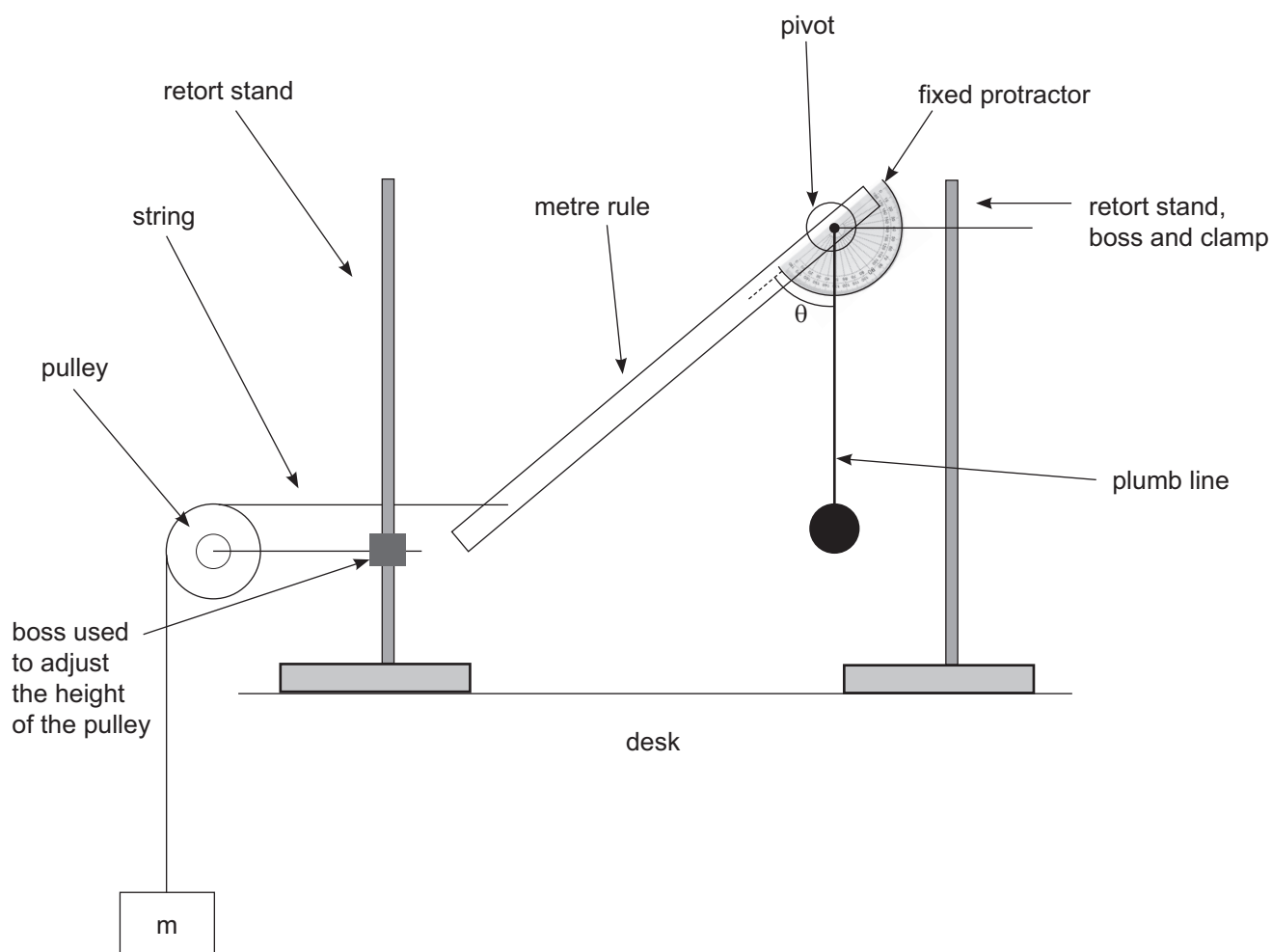


Fig. 2.1

© Getty Images

- (iii) Select suitable scales and label the axes to enable you to plot a graph of $\log_{10}(m/g)$ against $\log_{10}(\tan\theta)$ on the grid of **Fig. 2.2**. Draw the best-fit straight line for the points plotted. [5]

Examiner Only	
Marks	Remark

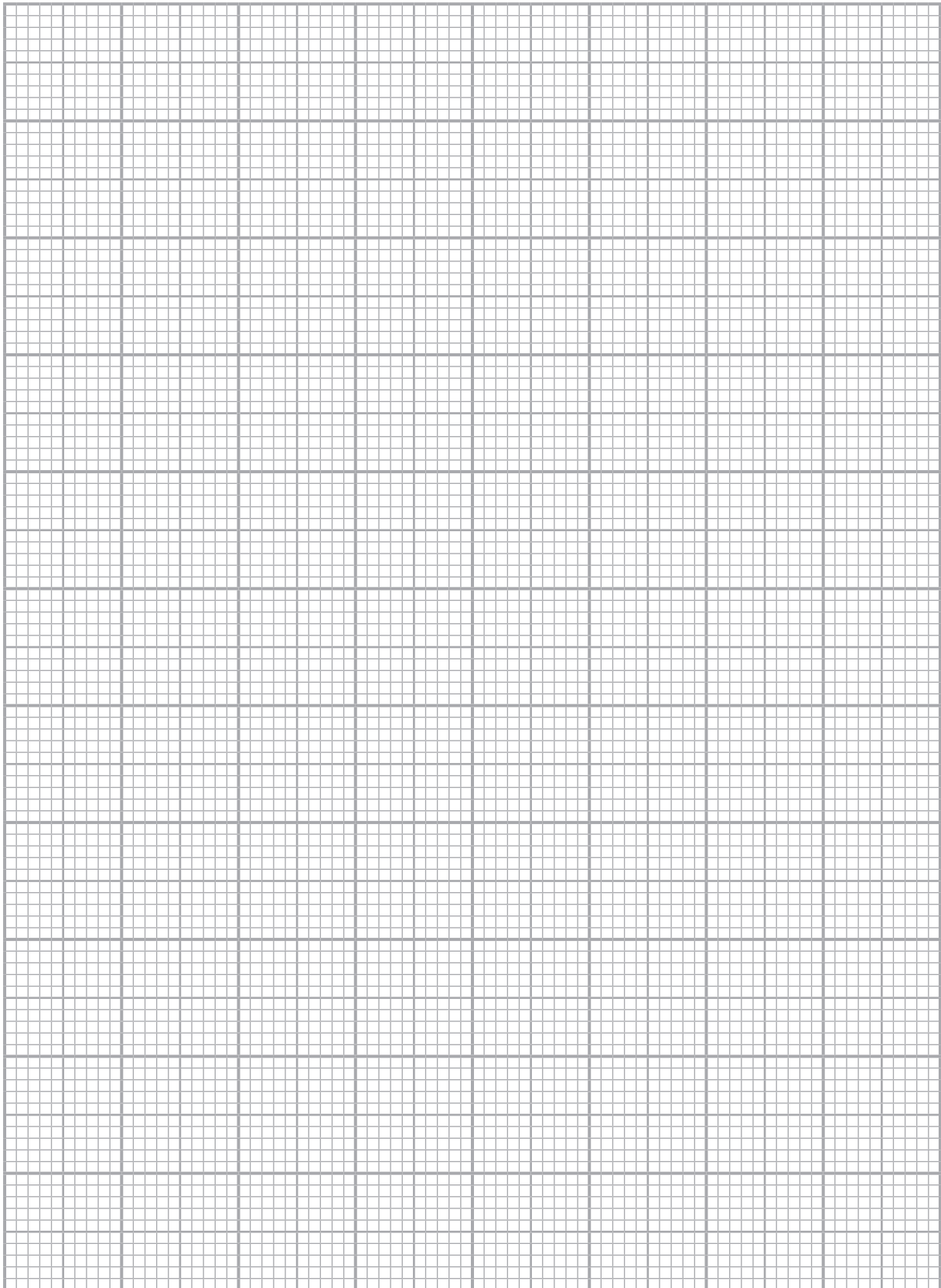


Fig. 2.2

Permission to reproduce all copyright material has been applied for.
In some cases, efforts to contact copyright holders may have been unsuccessful and CCEA
will be happy to rectify any omissions of acknowledgement in future if notified.



Rewarding Learning

ADVANCED
General Certificate of Education

Physics

Assessment Unit A2 3A

Practical Techniques and Data Analysis

[APH31]
Assessment

APPARATUS AND MATERIALS LIST

PHYSICS UNIT 3 (A2 3A)
APPARATUS AND MATERIALS REQUIRED FOR PRACTICAL ASSESSMENT

CONFIDENTIAL

This document gives preliminary information on the apparatus and materials required for the A2 Practical Assessment.

The A2 3 Practical Techniques Assessment is a test of practical skills consisting of **two** experimental tests (40 marks). The duration of the assessment is 1 hour.

The apparatus in the following list will allow for **one experiment** to be set up for the practical test which makes up questions 1–2. In other words, each set of apparatus (as listed on **page 3**) will accommodate two candidates when doing the circus of experiments.

Question 1

Component

- Retort stand
- 2 × Clamp and boss
- 12V, 36W filament bulb and holder
- Power supply
- $f = 100\text{ mm}$ converging lens
- Cardboard approx $10\text{ cm} \times 10\text{ cm}$
- 8 section gratnell tray insert (1 tray (8 sections) will accommodate 4 candidates)
Base dimensions of each section $11.6\text{ cm} \times 7.0\text{ cm}$
Timstar (TR16198) or equivalent
- 30 cm ruler
- Dividers (as in a maths set) or compasses
- Measuring cylinder – 50 cm^3
- 250 cm^3 beaker
- White oil based paint
- Paper towels
- 2 connecting leads

Question 2

Component

- 2 × Retort stand (1 retort stand 1m tall if possible)
- 2 × Clamp and boss
- 2 × G clamp
- Metre rule of mass $>80\text{ g}$ and $\leq 90\text{ g}$
- Half metre rule
- Protractor that measures to nearest 1°
- Pulley
- 50 g mass hanger
- 4 × 20 g mass
- 0.5 metre string
- Plumb line – made with fine thread and a pendulum bob
- Cork and nail/optical pin
- Sellotape or blu tac