



Rewarding Learning

**ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2012**

Centre Number

71

Candidate Number

Physics

Assessment Unit AS 3

assessing

**Practical Techniques (Internal Assessment)
Session 1**

[AY131]



FRIDAY 11 MAY, MORNING

TIME

1 hour 30 minutes.

INSTRUCTIONS TO CANDIDATES

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

Turn to page 2 for further Instructions and Information.

Question Number	Marks	
	Teacher Mark	Examiner Check
1		
2		
3		
4		
5		
Total Marks		



INSTRUCTIONS TO CANDIDATES

Answer **all** the questions in this booklet. Rough work and calculations must also be done in this booklet. Except where instructed, do **not** describe the apparatus or experimental procedures. The Teacher/Supervisor will tell you the order in which you are to answer the questions.

One hour is to be spent on Section A and 30 minutes on Section B.

Section A consists of four short experimental tests. **You will have access to the apparatus for 13 minutes for each of the tests.** At the end of this 13-minute experimental period there is a 2-minute changeover to the area set aside for the next test. Any spare time before the start of the next test may be used to write up anything you have not yet completed.

At the end of your Section A work you will be told to move to the area set aside for Section B.

Section B consists of one question in which you will analyse a set of experimental results.

INFORMATION FOR CANDIDATES

The total mark for this paper is 40.

Section A and Section B carry 20 marks each.

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

You may use an electronic calculator.

BLANK PAGE
(Questions start overleaf)

- Diameter = _____ cm [1]

-
- A grayscale illustration of a golf ball with a dimpled texture. A square hole is cut into the upper-left portion of the ball. A solid black zigzag line is drawn across the ball's surface, passing through the hole. Three dashed lines intersect at the center of the ball: a vertical line, a horizontal line, and a diagonal line running from the bottom-left to the top-right. The ball is casting a soft shadow on the surface below it.

© iStockphoto / Thinkstock

Mean diameter = _____ cm

- Mass = _____ g [1]

7617

(i) Measure the current flowing in the circuit by using the milliammeter provided.

(ii) Measure the potential difference (P.D.) across component P by using the voltmeter provided.

P.D. = _____ V [1]

Examiner Only	
Marks	Remark

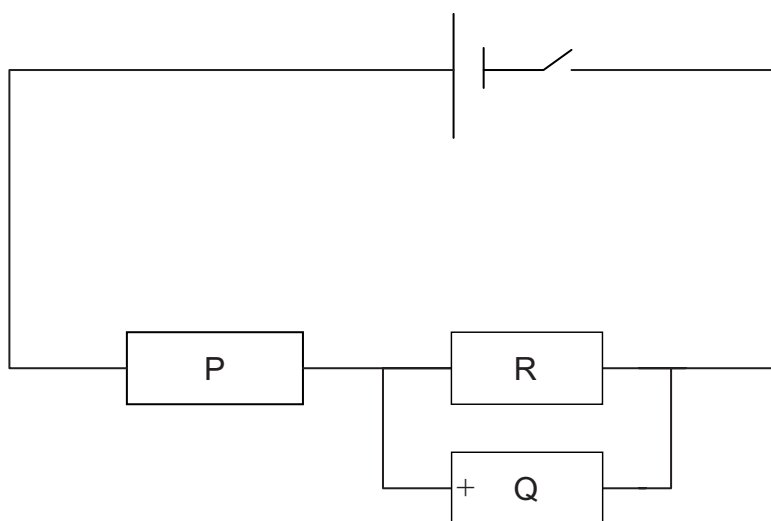


Fig. 2.2

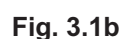
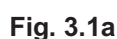
- Current into Q = _____ mA [1]

- Measure the current flowing through component Q after reversing component Q.

Current into Q = _____ mA [1]

- e.m.f. = _____ V [1]

Examiner Only	
Marks	Remark



Take readings that will allow an accurate value for the periodic time of the pendulum to be determined. **Tabulate all readings** taken in the space below.

[5]

[Turn over

-

Weight (W_1) = _____ N [2]

- Volume (V) = _____ cm^3 [1]

- Weight (W_2) = _____ N [1]

- $$R = \frac{W_1 - W_2}{V} \quad \text{Equation 4.1}$$

$$R = \underline{\hspace{2cm}} \text{ Ncm}^{-3} \quad [1]$$

8

Section B

- 5 Many governments and private companies are sponsoring research into the generation of electrical energy from wind.

(a) The electrical power output from a wind turbine for a variety of wind speeds is recorded in **Table 5.1**.

Table 5.1

Wind speed/ m s^{-1}	Electrical Power Output/kW			
	Trial 1	Trial 2	Trial 3	Average
5.32	46.9	45.7	47.2	46.6
7.55	134	132	137	134
8.28	176	177	174	
10.7	381	383	380	381
12.6	623	621	623	622
14.4	632	932	931	932

- (i) To how many significant figures are all the values given in **Table 5.1**?

Number of significant figures = _____ [1]

- (ii) Complete **Table 5.1** by calculating the average electrical power output for a wind speed of 8.28 m s^{-1} and inserting the value, to the correct number of significant figures, into the table. [1]

- (iii) Consider the electrical power output values for wind speed 14.4 m s^{-1} . State whether or not a mistake has been made in calculating the average and explain your answer.

 _____ [2]

Examiner Only

Marks

Remark

(iii) Calculate the electrical power P for turbine D .

Power $P =$ _____ kW

[2]

Examiner Only	
Marks	Remark

- (c) The maximum harvestable power $P_{\max}$ that can be extracted from the wind has a theoretical limit called the Betz Limit. **Equation 5.4** gives the relationship for the maximum harvestable power

$$P_{\max} = \frac{\pi}{8} \rho B_c Z \quad \text{Equation 5.4}$$

where ρ is the air density, Z is a constant and B_c is the Betz coefficient.

Table 5.3 provides values for some of the quantities in **Equation 5.4** along with the uncertainty in those values.

Table 5.3

Quantity	Value	Uncertainty	
		Absolute	Percentage
$P_{\max}$	656 kW	± 33 kW	
ρ	1.29 kg m^{-3}		$\pm 3\%$
Z	$2.18 \times 10^6 \text{ m}^5 \text{ s}^{-3}$	$\pm 5 \times 10^4 \text{ m}^5 \text{ s}^{-3}$	$\pm 2\%$

- (i) Complete **Table 5.3** by

- calculating the percentage uncertainty for $P_{\max}$ and entering it in **Table 5.3** [1]
- calculating the absolute uncertainty for ρ and entering it in **Table 5.3** [1]

- (ii) Calculate the value for the Betz coefficient B_c and state its percentage uncertainty.

$$B_c = \underline{\hspace{2cm}}$$

$$\text{Uncertainty} = \underline{\hspace{2cm}} \% \quad [3]$$

THIS IS THE END OF THE QUESTION PAPER

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Rewarding Learning

**ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2012**

Physics

Assessment Unit AS 3

assessing

Practical Techniques (Internal Assessment)
Session 1 (pp 3–9) and 2 (10–16)

[AY131] [AY132]

FRIDAY 11 AND MONDAY 14 MAY

CONFIDENTIAL INSTRUCTIONS TO TEACHERS

**CONFIDENTIAL INSTRUCTIONS FOR PHYSICS (ADVANCED SUBSIDIARY)
PRACTICAL TECHNIQUES (INTERNAL ASSESSMENT)**

Confidentiality

To maintain the integrity of the Assessment, **no** question papers or any material pertaining to the Assessment should be publicly released until after the final session of the second day.

General

The Internal Assessment will contain five compulsory questions, of which Section A is made up of four 15-minute experimental tests and Section B is a 30-minute question testing Data Analysis. The total time allowed is 1 hour 30 minutes. The order in which candidates are to take the questions in Section A is to be decided by the Supervisor. Candidates will have access to the apparatus in each experimental task for 13 minutes each, the final two minutes being reserved for adjustment of the apparatus by the Supervisor. During this 2 minute changeover period candidates may write-up anything they have not completed; however, they will not have access to the apparatus. At the end of Section A, candidates should be directed to an area set aside for Section B which consists of one question in which a set of experimental results will be analysed.

SESSION 1

Question 1

Principal Requirements

Golf ball
Vernier callipers
Scales (electronic, accurate to 0.01 g)
Glass beaker (100 ml)
Wooden blocks
Metre rule

Preparation

The supervisor must record the golf ball mass for each set of scales used as **this will be required for marking purposes**.

The supervisor must also ensure the mean diameter for each golf ball used is 4.23 cm–4.29 cm.

Before Examination

Level the electronic scales and set to zero.
Close the vernier callipers.
Place the golf ball in the beaker and leave beside the scales.
Place the metre rule and blocks of wood alongside the other apparatus.

Action at changeover

Level the electronic scales and set to zero.
Close the vernier callipers.
Place the golf ball in the beaker and leave beside the scales.
Place the metre rule and blocks of wood alongside the other apparatus.

Information required by examiners

None.

SESSION 1

Question 2

Principal Requirements

Cell
Cell holder
Push-to-make switch
4 mm sockets
Component channels (boxes)
Diode
75 Ω resistor
150 Ω resistors
330 Ω resistor
4 mm leads
Voltmeter
Milliammeter
Masking tape

Preparation

- (a) Drill two holes into each component channel (at either end) and fit 4 mm sockets.
- (b) Solder the 75 Ω resistor into the channel and label it 'P'. Use masking tape to cover the resistor so that it cannot be seen.
- (c) Solder the 330 Ω resistor into the channel and label it 'R'. Use masking tape to cover the resistor so that it cannot be seen.
- (d) Solder the diode to a 150 Ω resistor so they are in series and solder both into the channel so that the diode anode is attached to the LH socket (viewed from the outside). Solder a second 150 Ω resistor in parallel with the diode and the first 150 Ω resistor. Label this component channel 'Q'. Mark the LH socket '+' and use masking tape to cover the resistors and diode so that they cannot be seen. See **Fig. 2.1**.

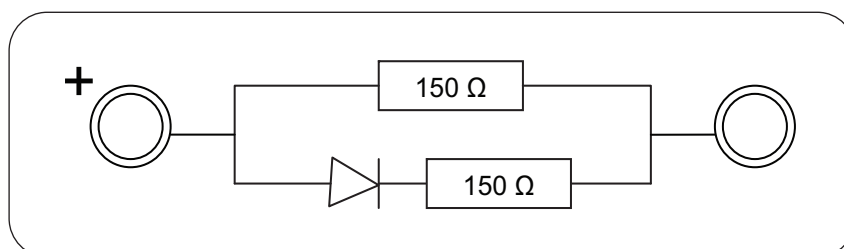


Fig. 2.1

Testing

Ensure that the cell provides a voltage of ~ 1.5 V.

Check that with the switch, component 'P' and component 'R' connected to the cell in series, the current flowing is ~ 3.7 mA and the p.d. across 'P' is ~ 0.27 V.

Connect components 'P', 'R' and 'Q' as shown in **Fig. 2.2** and record the current flowing through 'Q'. **Please note that this value will be required for marking purposes.**

Reverse component 'Q' and ensure that the current flowing through 'Q' has decreased.

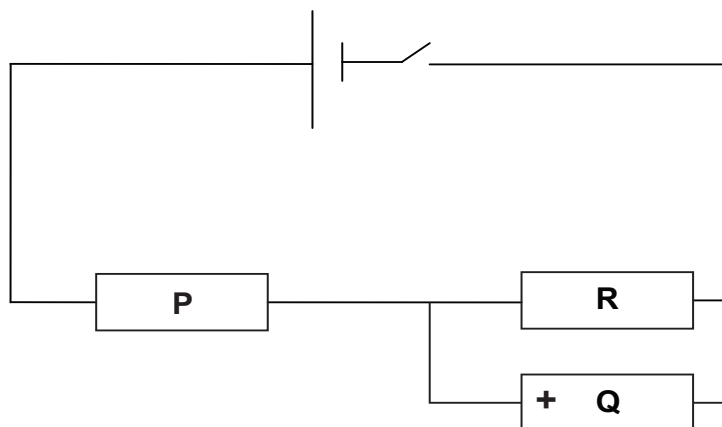


Fig. 2.2

Before Examination

Set up the circuit shown in **Fig. 2.3**.

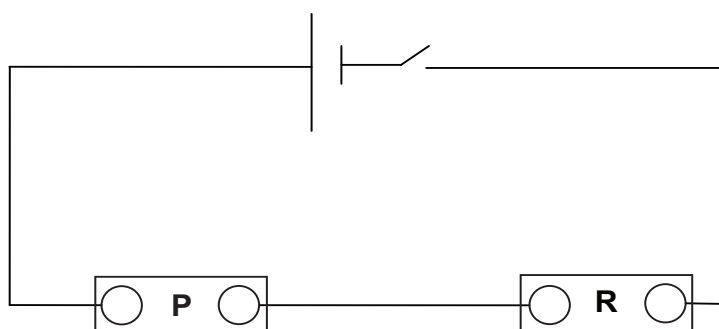


Fig. 2.3

Leave component Q, the milliammeter, the voltmeter and five leads adjacent to the circuit.

SESSION 1

Action at changeover

Set up the circuit shown in **Fig. 2.3**.

Leave component Q, the milliammeter, the voltmeter and five leads adjacent to the circuit.

Information required by examiners

None.

SESSION 1**Question 3****Principal Requirements**

Retort stand
Boss head
Clamp
Split cork
Pendulum bob
String/thread (~ 1 m)
Stopwatch/stopclock (accurate to 0.01 s)
Metre rule
Metre rule support
90° set square
G-clamp

Preparation

Clamp the retort stand to the bench.
Ensure there is minimal movement in the retort stand when the pendulum is swinging.
Ensure the edges of the cork around the split are clean.
Arrange the cork in the clamp so that it tapers down to allow the clamp to be opened slightly without the cork falling.

Before Examination

Adjust pendulum length to between 500 mm and 550 mm.
Zero the stopwatch/stopclock.
Leave the stopwatch/stopclock, set square and metre rule in holder adjacent to the pendulum.

Action at changeover

Adjust pendulum length to between 500 mm and 550 mm.
Zero the stopwatch/stopclock.
Leave the stopwatch/stopclock, set square and metre rule in the support adjacent to the pendulum.

Information required by examiners

None.

SESSION 1

Question 4

Principal Requirements

Spring balance (range to 10 N)
 Graduated cylinder (200 cm³ in 2 cm³ intervals)
 Slotted masses (50 g, diameter < 30 mm)
 Thread (~ 0.5 m)
 Retort stand
 Boss head
 Clamp
 Tape (e.g. insulating tape)

Preparation

Stack the four 50 g masses and tape tightly together into a cylinder shape.
 Ensure the masses are completely covered in tape.
 Securely attach the thread to the mass cylinder, using more insulating tape, so that a loop exists see **Fig. 3.1** below (to facilitate adding the cylinder to the spring balance).

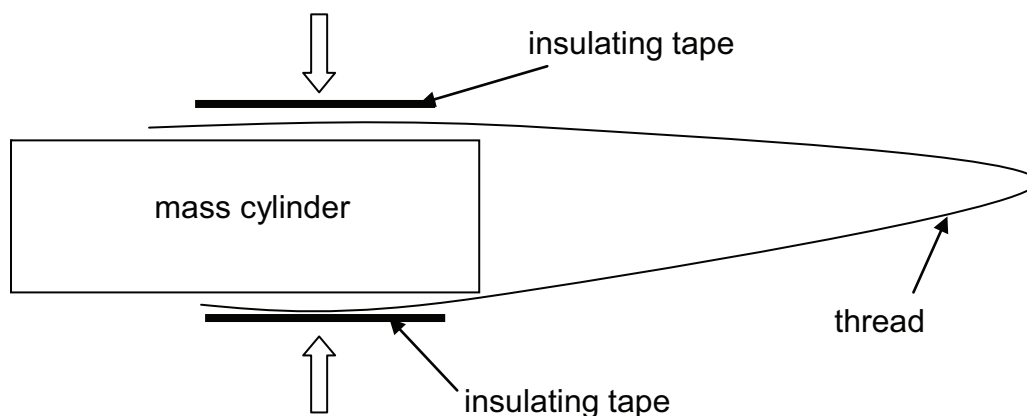


Fig. 3.1

Before Examination

Setup the retort stand, boss head and clamp.
 Adjust the spring balance so that it reads +0.5 N with no load (zero error).
 Fill the graduated cylinder with water to the 94 cm³ mark.
 Place the spring balance on the clamp.
 Adjust the height of the clamp so that the mass when suspended from the spring balance will be immersed in the water in the graduated cylinder.
 Leave the stack of four 50 g masses on the bench beside the other apparatus.

Action at changeover

Place the spring balance on the clamp.
 Ensure the spring balance has a zero error of +0.5 N
 Ensure the water level in the graduated cylinder is 94 cm³.
 Leave the stack of four 50 g masses on the bench beside the other apparatus.

Information required by examiners

None.
 7616.06

SESSION 1

Question 5

Apart from the provision of a suitable working area, no apparatus is required for this Data Analysis Question.

Information required by examiners

None.

SESSION 2

Question 1

Principal Requirements

Table tennis ball
Vernier callipers
Scales (electronic, accurate to 0.01 g)
Glass beaker (100 ml)
Wooden blocks
Metre rule

Preparation

The supervisor must record the table tennis ball mass for each set of scales used **as this will be required for marking purposes**.

The supervisor must also ensure that the mean diameter for each table tennis ball used is 3.97 cm–4.03 cm.

Before Examination

Level the electronic scales and set to zero.
Close the vernier callipers.
Place the table tennis ball in the beaker and leave beside the scales.
Place the metre rule and blocks of wood alongside the other apparatus.

Action at changeover

Level the electronic scales and set to zero.
Close the vernier callipers.
Place the table tennis ball in the beaker and leave beside the scales.
Place the metre rule and blocks of wood alongside the other apparatus.

Information required by examiners

None.

SESSION 2

Question 2

Principal Requirements

Cell
 Cell holder
 Push-to-make switch
 4 mm sockets
 Component channels (boxes)
 Diode
 75 Ω resistor
 150 Ω resistor
 330 Ω resistors
 4 mm leads
 Voltmeter
 Milliammeter
 Masking tape

Preparation

- (a) Drill two holes into each component channel (at either end) and fit 4 mm sockets.
- (b) Solder the 75 Ω resistor into the channel and label it 'P'. Use masking tape to cover the resistor so that it cannot be seen.
- (c) Solder the 150 Ω resistor into the channel and label it 'R'. Use masking tape to cover the resistor so that it cannot be seen.
- (d) Solder the diode to a 330 Ω resistor so they are in series and solder both into the channel so that the diode anode is attached to the LH socket (viewed from the outside). Solder a second 330 Ω resistor in parallel with the diode and the first 330 Ω resistor. Label this component channel 'Q'. Mark the LH socket '+' and use masking tape to cover the resistor and diode so that they cannot be seen. See **Fig. 4.1**.

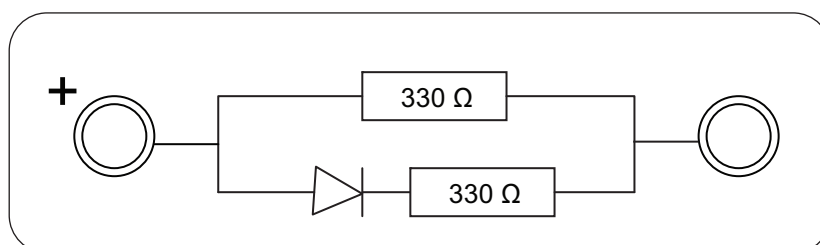


Fig. 4.1

Testing

Ensure that the cell provides a voltage of $\sim 1.5\text{ V}$.

Check that with the switch, component 'P' and component 'R' connected to the cell in series, the current flowing is $\sim 6.7\text{ mA}$ and the p.d. across 'P' is $\sim 0.5\text{ V}$.

Connect components 'P', 'R' and 'Q' as shown in **Fig. 4.2** and record the current flowing through 'Q'. **Please note that this value will be required for marking purposes.**

Reverse component 'Q' and ensure that the current flowing through 'Q' has decreased.

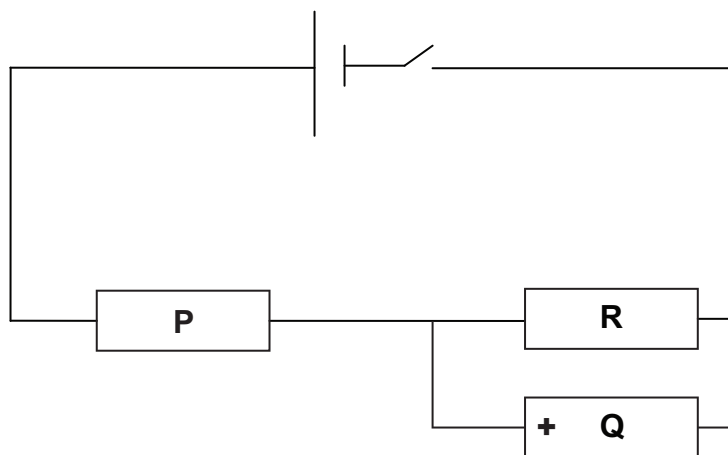


Fig. 4.2

Before Examination

Set up the circuit shown in **Fig. 4.3**.

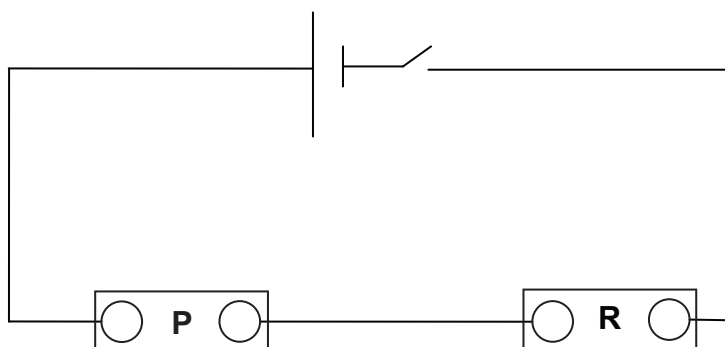


Fig. 4.3

Leave component Q, the milliammeter, the voltmeter and five leads adjacent to the circuit.

SESSION 2

Action at changeover

Set up the circuit shown in **Fig. 4.3**.

Leave component Q, the milliammeter, the voltmeter and five leads adjacent to the circuit.

Information required by examiners

None.

SESSION 2**Question 3****Principal Requirements**

Retort stand
Boss head
Clamp
Split cork
Pendulum bob
String/ thread (~ 1 m)
Stopwatch/stopclock (accurate to 0.01 s)
Metre rule
Metre rule support
90° set square
G-clamp

Preparation

Clamp the retort stand to the bench.
Ensure there is minimal movement in the retort stand when the pendulum is swinging.
Ensure the edges of the cork around the split are clean.
Arrange the cork in the clamp so that it tapers down to allow the clamp to be opened slightly without the cork falling.

Before Examination

Adjust pendulum length to between 500 mm and 550 mm.
Zero the stopwatch/stopclock.
Leave the stopwatch/stopclock, set square and metre rule in holder adjacent to the pendulum.

Action at changeover

Adjust pendulum length to between 500 mm and 550 mm.
Zero the stopwatch/stopclock.
Leave the stopwatch/stopclock, set square and metre rule in the support adjacent to the pendulum.

Information required by examiners

None.

SESSION 2

Question 4

Principal Requirements

Spring balance (range to 10 N)
 Graduated cylinder (200 cm³ in 2 cm³ intervals)
 Slotted masses (50 g, diameter < 30 mm)
 Thread (~ 0.5 m)
 Retort stand
 Boss head
 Clamp
 Tape (e.g. insulating tape)

Preparation

Stack the six 50 g masses and tape tightly together into a cylinder shape.
 Ensure the masses are completely covered in tape.
 Securely attach the thread to the mass cylinder, using more insulating tape, so that a loop exists see **Fig. 5.1** below (to facilitate adding the cylinder to the spring balance).

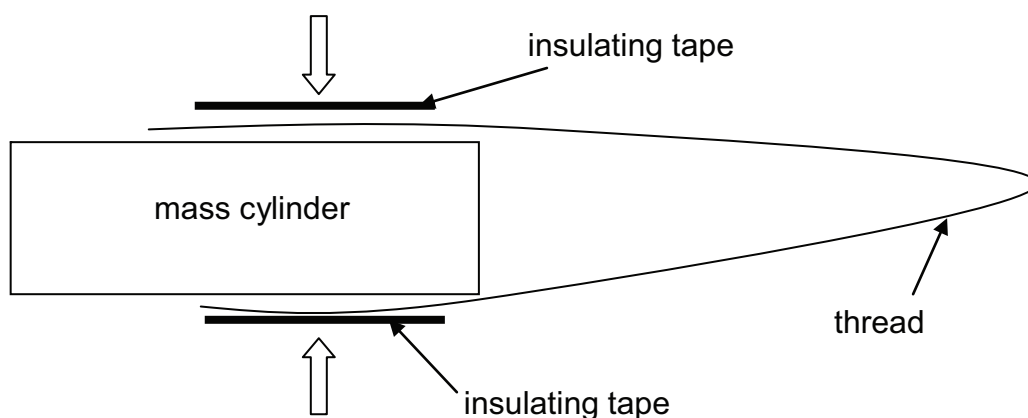


Fig. 5.1

Before Examination

Setup the retort stand, boss head and clamp.
 Adjust the spring balance so that it reads +0.5 N with no load (zero error).
 Fill the graduated cylinder with water to the 94 cm³ mark.
 Place the spring balance on the clamp.
 Adjust the height of the clamp so that the mass when suspended from the spring balance will be immersed in the water in the graduated cylinder.
 Leave the stack of six 50 g masses on the bench beside the other apparatus.

Action at changeover

Place the spring balance on the clamp.
 Ensure the spring balance has a zero error of +0.5 N.
 Ensure the water level in the graduated cylinder is 94 cm³.
 Leave the stack of six 50 g masses on the bench beside the other apparatus.

Information required by examiners

None.
 7616.06

SESSION 2

Question 5

Apart from the provision of a suitable working area, no apparatus is required for this Data Analysis Question.

Information required by examiners

None.



Rewarding Learning

**ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2012**

Physics

Assessment Unit AS 3

assessing

**Practical Techniques
Sessions 1 and 2**

[AY131] [AY132]

FRIDAY 11 MAY AND MONDAY 14 MAY



AY131 AY132

**APPARATUS
AND
MATERIALS
LIST**

PHYSICS UNIT 3 (AS 3)

APPARATUS AND MATERIALS REQUIRED FOR PRACTICAL ASSESSMENTS

CONFIDENTIAL

Information about the apparatus and materials required for the AS Practical Assessments **must not** be communicated to candidates sitting the examination.

This document gives preliminary information on the apparatus and materials required for the AS Practical Assessments. The Practical Assessments will be marked by teachers as part of the internal assessment requirements for the GCE Physics Specification.

Teachers will be given detailed instructions for setting up the experiment in the *Confidential Instructions for Physics (Advanced Subsidiary) Practical Tests*, to which they will have confidential access from March 2012.

Teachers will have confidential access to a copy of the experimental tests two working days (48 hours) before the start of the assessment.

The AS 3 Practical Techniques Assessment is a test of practical skills consisting of Section A and Section B. Section A is comprised of 4 short experimental tests (20 marks) and Section B consists of one question requiring the analysis of experimental results (20 marks). The duration of the assessment is 1 hour 30 minutes. Some of this time will be set aside for supervisors to re-set the apparatus ready for the next candidates. **All** candidates should attempt Section A of the AS 3 assessment first followed by Section B. Section A of the assessment should be run as a circus of experiments with candidates moving to the next experiment at the designated time. The assessment should be timed as follows:

Section A	Time
Q1 (Short practical test)	13 minutes
Changeover and practical write-up	2 minutes
Q2 (Short practical test)	13 minutes
Changeover and practical write-up	2 minutes
Q3 (Short practical test)	13 minutes
Changeover and practical write-up	2 minutes
Q4 (Short practical test)	13 minutes
Changeover and practical write-up	2 minutes
Section B	Time
Question on the analysis of experimental results	30 minutes

In Section A, at the end of each 13 minute period, candidates must stop using the apparatus. During each 2 minute changeover period candidates may write up anything they have not completed however they will not have access to the apparatus.

The apparatus in the following list will allow for **one experiment** to be set up for each of the short practical tests which make up questions 1–4. In other words, each set of apparatus (as listed on pages 4 and 5) will accommodate four candidates when doing part A as a circus of experiments.

The apparatus can be used for alternative sessions according to the following schedule:

Friday 11 May 2012 Physics AS 3A (AY131)

(Main Session) **9.15 a.m. – 10.45 a.m.**

(First Alternative) **11.00 a.m. – 12.30 p.m.**

(Second Alternative) **1.15 p.m. – 2.45 p.m.**

(Third Alternative) **3.00 p.m. – 4.30 p.m.**

Monday 14 May 2012 Physics AS 3B (AY132)

(Main Session) **9.15 a.m. – 10.45 a.m.**

(First Alternative) **11.00 a.m. – 12.30 p.m.**

(Second Alternative) **1.15 p.m. – 2.45 p.m.**

(Third Alternative) **3.00 p.m. – 4.30 p.m.**

One set of apparatus for AS 3A (AY131) will therefore be sufficient for sixteen candidates on **11 May** if the Main Session and all three alternatives are used. Similarly, one set of apparatus for AS 3B (AY132) will be sufficient for sixteen candidates on **14 May** if the Main Session and all three Alternatives are used. A laboratory may contain one, two, three or more sets of apparatus. This means that four, eight, twelve or more candidates can be accommodated in the same session. **When alternative sessions are used care must be taken to segregate candidates who have taken the examination from those who have still to sit the examination.**

IMPORTANT NOTICE

Centres are urged to order items needed for the Physics Practical Tests from the suppliers as soon as possible.

Session 1

The following list of apparatus for Questions 1–4 is sufficient to equip one experimental station.

	Session 1	Session 2
Question 1		
1.1 Golf ball (new and R&A and USGA approved)	1	X
1.2 Table tennis ball (new and ITTF approved)	X	1
1.3 Vernier callipers (analogue, accurate to 0.01 cm)	1	1
1.4 Scales (electronic, accurate to 0.01 g)	1	1
1.5 Glass beaker (100 ml)	1	1
1.6 Wooden block (straight edges; bigger in size than 1.1 or 1.2)	2	2
Question 2		
2.1 Cell (providing ~1.5 V)	1	1
2.2 Cell holder (suitable for cell)	1	1
2.3 Push-to-make switch (e.g. Philip Harris B8H30798)	1	1
2.4 4 mm sockets (single colour)	6	6
2.5 Component channels (boxes)	3	3
2.6 Diode (e.g. Rapid 47-3154)	1	1
2.7 75 Ω resistor (1% tolerance, 0.6 W, e.g. Rapid 62-2044)	1	1
2.8 150 Ω resistor (1% tolerance, 0.6 W, e.g. Rapid 62-2058)	2	1
2.9 330 Ω resistor (1% tolerance, 0.6 W, e.g. Rapid 62-2074)	1	2
2.10 4 mm leads (4 mm plug at each end)	9	9
2.11 Voltmeter (digital, range to ~ 5 V in intervals of 0.01 V)	1	1
2.12 Ammeter (digital, range to 100 mA in intervals of 0.1 mA)	1	1
2.13 Masking tape	✓	✓

Session 1

Session 2

Question 3

3.1 Retort stand	1	1
3.2 Boss head	1	1
3.3 Clamp	1	1
3.4 Split cork	1	1
3.5 Pendulum bob	1	1
3.6 String/thread (~1 m)	✓	✓
3.7 Stopwatch/stopclock (accurate to 0.01 s)	1	1
3.8 Metre rule	1	1
3.9 Metre rule support (to hold metre rule vertically)	1	1
3.10 90° set square	1	1
3.11 G-clamp	1	1

Question 4

4.1 Spring balance (range to 10 N in intervals of 0.1 N with zero adjustment facility)	1	1
4.2 Graduated cylinder (200 cm ³ in 2 cm ³ intervals)	1	1
4.3 Slotted masses (50 g, diameter < 30 mm so as to fit inside graduated cylinder)	4	6
4.4 Thread (~ 0.5 m)	✓	✓
4.5 Retort stand	1	1
4.6 Boss head	1	1
4.7 Clamp	1	1
4.8 Tape (opaque and waterproof, e.g. insulating tape)	✓	✓

Question 5

Apart from the provision of a suitable writing area, no apparatus is required for this Data Analysis Question.

