

New
Specification



Rewarding Learning
ADVANCED SUBSIDIARY
General Certificate of Education
2017

Centre Number

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Candidate Number

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Physics

Assessment Unit AS 3A
assessing
Practical Techniques
and Data Analysis



SPH31

[SPH31]

THURSDAY 4 MAY, MORNING

TIME

1 hour.

INSTRUCTIONS TO CANDIDATES

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

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 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.

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 |
| 1 | |
| 2 | |
| 3 | |
| 4 | |

| | |
|-------------|--|
| Total Marks | |
|-------------|--|

(c) Use your results to determine a value for the resistivity, in $\Omega \text{ m}$, of metal S.

Resistivity = _____ $\Omega \text{ m}$

[3]

| Examiner Only | |
|---------------|--------|
| Marks | Remark |
| | |

(c) Use your results to confirm if Snell's law is verified. You **must** show the calculations used to justify your answer.

Snell's law is verified because: _____

_____ [3]

| Examiner Only | |
|---------------|--------|
| Marks | Remark |
| | |

3 Determine the mass of the metre rule using the principle of moments.

(a) Consider the experimental arrangement set up for you. Outline how you will use it to obtain data from which the mass of the metre rule can be determined.

[3]

(b) Take sufficient readings from which you can determine a reliable value for the mass of the metre rule.

[4]

| Examiner Only | |
|---------------|--------|
| Marks | Remark |
| | |

(c) Use your results to determine the mass of the metre rule.

| Examiner Only | |
|---------------|--------|
| Marks | Remark |
| | |

Mass of metre rule = _____ g

[3]

- 4 A spring is suspended from a fixed point and a mass attached to the other end, as shown in **Fig. 4.1**. Displace the mass a small vertical distance downward and release it. The time taken for one oscillation is called the periodic time. One oscillation is when the mass moves from position A to B and back to A again.

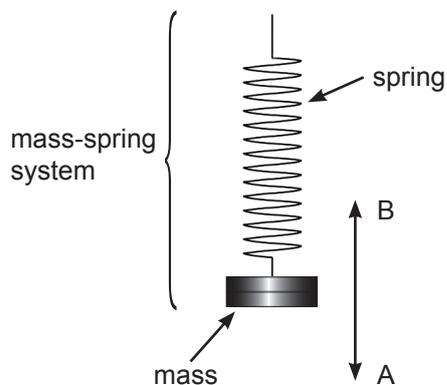


Fig. 4.1

You are to deduce which of the equations below best describes the relationship between the periodic time, T , of an oscillating mass-spring system and the suspended mass, m ,

$$T = km \quad \text{Equation 4.1}$$

$$T = k\sqrt{m} \quad \text{Equation 4.2}$$

$$T = \frac{k}{m} \quad \text{Equation 4.3}$$

where k is a constant.

- (a) Tabulate sufficient data for the two masses provided from which a deduction can be made.

[5]

| Examiner Only | |
|---------------|--------|
| Marks | Remark |
| | |

- (b) For each equation, give a justification for whether or not it is the best equation to describe the relationship.

Equation 4.1: _____

Equation 4.2: _____

Equation 4.3: _____

[3]

- (c) Calculate the value of k for the equation that best describes the relationship.

$k =$ _____ unit

[2]

THIS IS THE END OF THE QUESTION PAPER

Examiner Only

Marks

Remark

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Physics

Assessment Unit AS 3A

Practical Techniques and Data Analysis

[SPH31]
THURSDAY 4 MAY

APPARATUS AND MATERIALS LIST

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

CONFIDENTIAL

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

Information about the apparatus and materials required for this assessment must NOT be communicated to students. If apparatus/materials have their serial code and/or manufacturer specified then it is essential that centres use this exact apparatus/material.

On receipt of this APPARATUS AND MATERIALS LIST, centres must contact Gavin Gray, ggray@ccea.org.uk immediately if they have difficulty in sourcing the specified apparatus or materials.

Teachers will be given detailed instructions for setting up the experiment in the *Confidential Instructions for Physics (Advanced Subsidiary) Practical Test*, to which they will have confidential access from April 2017.

Teachers will have confidential access to a copy of the experimental test 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 4 short experimental tests (40 marks). The duration of the assessment is 1 hour. Some of this time will be set aside for supervisors to re-set the apparatus ready for the next candidates. 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 (<i>Short practical test</i>) | 13 minutes |
| Changeover and practical write-up | 2 minutes |
| Q2 (<i>Short practical test</i>) | 13 minutes |
| Changeover and practical write-up | 2 minutes |
| Q3 (<i>Short practical test</i>) | 13 minutes |
| Changeover and practical write-up | 2 minutes |
| Q4 (<i>Short practical test</i>) | 13 minutes |
| Changeover and practical write-up | 2 minutes |

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 the practical test which makes up questions 1–4. In other words, each set of apparatus (as listed on **pages 4 and 5**) will accommodate four candidates when doing the circus of experiments.

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

4 May 2017 Physics AS 3A (SPH31)

(Main Session) **9.15 am–10.15 am**

(First Alternative) **10.30 am–11.30 am**

(Second Alternative) **11.45 am–12.45 pm**

(Third Alternative) **1.15 pm–2.15 pm**

(Fourth Alternative) **2.30 pm–3.30 pm**

One set of apparatus for AS 3A (SPH31) will therefore be sufficient for twenty candidates on **4 May** if the Main Session and all four 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.

Question 1

| Ref | Component | Number |
|------|--|--------|
| 1.1 | ~ 300 mm length of 26 SWG constantan | 1 |
| 1.2 | crocodile clip | 2 |
| 1.3 | battery pack (3V or 4.5V: AA, C etc) (must connect to 4 mm connecting wire) | 1 |
| 1.4 | multimeter (with resistance facility) | 1 |
| 1.5 | ammeter < 5 A in 0.01 A | 1 |
| 1.6 | voltmeter < 20V in 0.01V | 1 |
| 1.7 | 4 mm plug connecting wire | 5 |
| 1.8 | half-metre rule/30cm rule (accurate to 1 mm) | 1 |
| 1.9 | micrometer screw gauge (accurate to 0.01 mm) | 1 |
| 1.10 | push to make switch (e.g. Philip Harris B8H30798) | 1 |

Question 2

| Ref | Component | Number |
|-----|---|--------|
| 2.1 | Rectangular transparent block | 1 |
| 2.2 | Semicircular transparent block | 1 |
| 2.3 | Ray box (single slit) with power supply | 1 |
| 2.4 | A4 paper unlined | 2 |
| 2.5 | Protractor (to $\pm 1^\circ$) | 1 |

Question 3

| Ref | Component | Number |
|-----|--|--------|
| 3.1 | Metre rule (mass between 80g and 120g) | 1 |
| 3.2 | ~ 40cm string/thread | 1 |
| 3.3 | 50g mass hanger | 1 |
| 3.4 | Retort stand, boss & clamp | 1 |

Question 4

| Ref | Component | Number |
|-----|--|--------|
| 4.1 | Expendable spring (~ 20mm long (coiled length) dia ~ 15mm) e.g. Philip Harris B8G87194 | 1 |
| 4.2 | 100g mass hanger | 2 |
| 4.3 | 100g slotted masses | 4 |
| 4.4 | Stopwatch/clock (accurate to 0.01 s) | 1 |
| 4.5 | Retort stand, boss and clamp | 1 |
| 4.6 | G-clamp | 1 |
| 4.7 | Tape | 1 |

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Physics

Assessment Unit AS 3A

Practical Techniques and Data Analysis

[SPH31]
THURSDAY 4 MAY

CONFIDENTIAL
INSTRUCTIONS
TO
TEACHERS

PHYSICS UNIT 3 (AS 3A)
CONFIDENTIAL INSTRUCTIONS FOR PHYSICS AS PRACTICAL TEST

1 General

The confidential instructions will give detail as to how the apparatus and materials should be assembled in preparation for the practical test.

2 Final Apparatus Testing

The practical assessment question paper will be made available to the Head of Physics **two** working days before the timetabled starting time so that teachers and technicians can carry out a final test on the experiments. If on checking the apparatus gives unexpected results, the CCEA Physics Subject Officer should be contacted immediately (ggray@ccea.org.uk). If the problem cannot be resolved, then the centre must e-mail the CCEA Physics Subject Officer stating the centre name and number, the specific nature of the problem and the range of anomalous results produced. CCEA will respond by acknowledging receipt of the e-mail. If you do not receive a response within 24 hours, please contact the CCEA Physics Subject Officer by telephone (028 90261200 Ext 2270) to confirm that CCEA has received your e-mail.

3 Practical Assessment AS 3A

The AS 3A Practical Techniques Assessment is a test of practical skills comprised of 4 short experimental tests. The duration of the assessment is 1 hour. Some of this time will be set aside for supervisors to re-set the apparatus ready for the next candidates. 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:

| Questions | 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 |

At the end of the 13 minute period, candidates must stop using the apparatus. During each 2 minute changeover period candidates may continue with their write up, however they will not have access to the apparatus.

4 After the Practical Assessments

When the individual exam sessions have finished, please return the AS 3A practical scripts together with the corresponding advice notes to the examinations officer (EO). We will collect these by the day after the examination. If we don't, please contact us immediately to arrange another time for collection.

Where the centre finds that a candidate may have been disadvantaged because the apparatus did not function as intended, the supervising teachers should make a report to the EO. The EO will forward the confidential report on the issue and the candidates affected to the centre support section at CCEA for special consideration. Candidates should be identified by their examination number.

IMPORTANT NOTICE

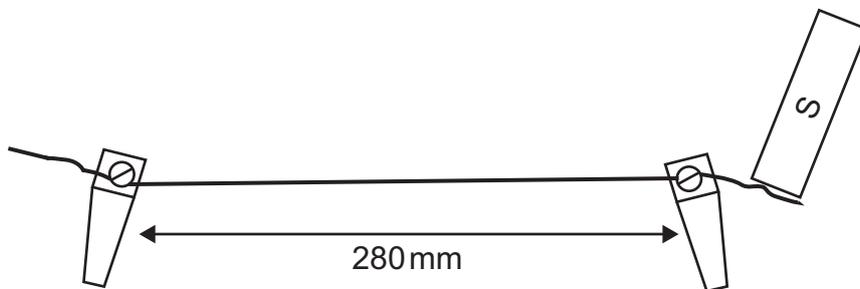
Centres are urged to order items needed for the Physics Practical Tests from the suppliers as soon as possible.

Question 1

| Ref | Component | Number |
|------|--|--------|
| 1.1 | ~ 300 mm length of 26 SWG constantan | 1 |
| 1.2 | crocodile clip | 2 |
| 1.3 | battery pack (3V or 4.5V: AA, C etc) (must connect to 4 mm connecting wire) | 1 |
| 1.4 | multimeter (with resistance facility) | 1 |
| 1.5 | ammeter < 5 A in 0.01 A | 1 |
| 1.6 | voltmeter < 20V in 0.01V | 1 |
| 1.7 | 4 mm plug connecting wire | 5 |
| 1.8 | half-metre rule/30cm rule (accurate to 1 mm) | 1 |
| 1.9 | micrometer screw gauge (accurate to 0.01 mm) | 1 |
| 1.10 | push to make switch | 1 |

Preparation

Secure a 280 mm length between the screws of two crocodile clips.



Label the wire/crocodile component 'S'.

Ensure the push to make switch is incorporated with the battery pack so that there is no prolonged period of current flow causing the wire to heat up.

Before the examination

Place the following on the bench: micrometer screw gauge, rule, meters, battery pack with switch and S.

Action at changeover

Check there is a 280 mm length between crocodile clips in S.
Return the apparatus to the original arrangement on the bench.

Information required by examiners

None

Question 2

| Ref | Component | Number |
|-----|---|--------|
| 2.1 | Rectangular transparent block | 1 |
| 2.2 | Semi-circular transparent block | 1 |
| 2.3 | Ray box (single slit) with power supply | 1 |
| 2.4 | A4 paper unlined | 2 |
| 2.5 | Protractor (to $\pm 1^\circ$) | 1 |

Preparation

None

Before the examination

Place all the components on the bench.

Action at changeover

Bin any used A4 paper and replace.

Return the apparatus to the original arrangement on the bench.

Information required by examiners

None

Question 3

| Ref | Component | Number |
|-----|--|--------|
| 3.1 | Metre rule (mass between 80g and 120g) | 1 |
| 3.2 | ~ 40cm string/thread | 1 |
| 3.3 | 50g mass hanger | 1 |
| 3.4 | Retort stand, boss head & clamp | 1 |

Preparation

- A Ensure the metre rule's centre of mass is at 500 ± 2 mm position
- B Tie one end of about 25cm of string to the metre rule securely but the knot must be able to slide along the rule; move the knot to the 40cm position.
Tie a loop at the other end of the string.
Slip the loop over the clamp so when horizontal the rule would sit ~ 20cm above the bench. Use the rest of the string to attach the 50g hanger to the metre rule securely but the knot must be able to slide along the rule, move the knot to the 25cm position.
See **Fig. 3.1**.

Before the examination

Place all the components on the bench.

Action at changeover

Return the apparatus to the original arrangement on the bench.

Information required by examiners

None

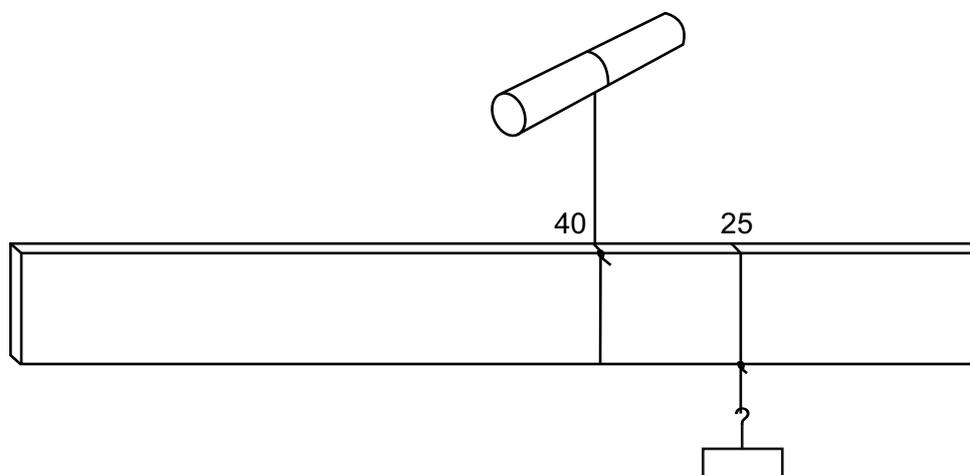


Fig. 3.1

Question 4

| Ref | Component | Number |
|-----|---|--------|
| 4.1 | Expendable spring (~ 20mm long, dia ~ 15mm) e.g. Philip Harris B8G87194 | 1 |
| 4.2 | 100g mass hanger | 2 |
| 4.3 | 100g slotted masses | 4 |
| 4.4 | Stopwatch/clock (accurate to 0.01 s) | 1 |
| 4.5 | Retort stand, boss and clamp | 1 |
| 4.6 | G-clamp | 1 |
| 4.7 | Tape | 1 |

Preparation

Secure the retort stand, boss and clamp to the bench using the G-clamp.

Suspend the spring from the clamp.

Ensure the spring is sufficiently high to prevent oscillating masses hitting the bench.

Tape together a mass hanger and 1 slotted mass – label as 200g.

Tape together a mass hanger and 3 slotted masses – label as 400g.

Before the examination

Set the stopwatch/clock to zero.

Leave the 200g and 400g masses adjacent to the stopwatch.

Action at changeover

Return the apparatus to the original arrangement on the bench.

Information required by examiners

None