



*Rewarding Learning*

**ADVANCED SUBSIDIARY (AS)  
General Certificate of Education  
2015**

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**Physics**  
**Assessment Unit AS 3**  
*assessing*  
**Practical Techniques**  
**Session 2**  
**[AY132]**  
**MONDAY 18 MAY, MORNING**

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**MARK  
SCHEME**

### Subject-specific Instructions

In numerical problems, the marks for the intermediate steps shown in the mark scheme are for the benefit of candidates who do not obtain the final correct answer. A correct answer and unit, if obtained from a valid starting-point, gets full credit, even if all the intermediate steps are not shown. It is not necessary to quote correct units for intermediate numerical quantities.

Note that this “correct answer” rule does not apply for formal proofs and derivations, which must be valid in all stages to obtain full credit.

**Do not reward wrong physics.** No credit is given for consistent substitution of numerical data, or subsequent arithmetic, **in a physically incorrect equation.** However, answers to subsequent stages of questions that are consistent with an earlier incorrect numerical answer, and are based on physically correct equation, must gain full credit. Designate this by writing **ECF** (Error Carried Forward) by your text marks.

The normal penalty for an arithmetical and/or unit error is to lose the mark(s) for the answer/unit line. Substitution errors lose both the substitution and answer marks, but  $10^n$  errors (e.g. writing 550 nm as  $550 \times 10^{-6}$  m) count only as arithmetical slips and lose the answer mark.

## Section A

AVAILABLE  
MARKS

- 1 (a) (i) Length = 15.0 cm approx given to  $\pm 1$  mm [1]

(ii) typical results

Mass/g	New length/cm	Increase in length/cm consistent with their values
200	18.6	3.6
400	21.0	6.0
500	27.9	7.9

[1]

[-1] not increasing

- (b) (i) Yes/No plus explanation consistent with **results**. [1]

- (ii) Uncertainty =  $\pm 0.2$  cm (or 0.4 cm)  
(Uncertainty in each reading is 0.1 cm (or 0.05 cm [1])).  
Therefore the uncertainty in extension is addition of two  
measurement uncertainties. } [1]  
Accept larger  $\leq \pm 2$  uncertainties with parallax  
explanation/holding rule. [2]

5

- 2 (a) (i) 

	Focal length/cm
lens/mirror combination	15.0 $\pm 0.1$ mm

 [1]

- (ii) u and v value recorded,  $u < v$  [1]  
f consistent with u and v (ignore sig. fig.) [1] [2]  
(first value in equation assumed to be u unless stated otherwise)

- (b) % difference = difference/either focal length  $\times 100$  [1]  
e.g.  $0.2/15.1 \times 100 = 1.3$  consistent substitution [1] [2]

5

- 3 (a) 

Mass/g	Time for 10 oscillations/s			T/s
	1	2	tav	
200	5.72	5.68	5.70	0.57
400	8.05	8.22	8.14	0.81
500	8.85	8.95	8.90	0.89

- (i) Headings – multiple oscillation  $\rightarrow$  times  $\geq 5$  s  
units – for one heading only [1]

- (ii) Repetition [1]

- (iii) Values of T given to 0.01 s [1] [3]

- (b) (i)  $T = Am$  eqn 1   
 $T = \frac{A}{m}$  eqn 2   
 $T = Am^{\frac{1}{2}}$  eqn 3  [1]

- (ii) Can't be eqn 1 as m doubles T does not  
Can't be eqn 2 as m increases so does T  
Therefore must be eqn 3 [1]  
or calculation to support

5

- 4 (a) (i) Workable circuit with voltmeter, ammeter and power supply and correct PSU polarity [1]

(ii)

Voltage/V	Current/mA
0	0
0.2	0
0.6	0
1.0	0
1.3	0
1.8	19.6

} 0  
values increasing  
[2]

- (b) (i) Need to take more readings just before first non-zero reading to find exact voltage (at which the led switches on or current  $\neq$  0) [1]

- (ii) Switch on voltage = 1.75V (typical) – consistent with Table 4.1 [1]

**Section A**

**AVAILABLE  
MARKS**

5

**20**

## Section B

5 (a) (i)

Rear Gear R	G when F = 44	G when F = 52
14	2.2	2.6
17	1.8	2.1
20	1.5	1.8
24	1.3	1.5
28	1.1	1.3

Penalty [-1]  
dp violation

[1]

[1]

[2]

(ii) Mention of at least one set of doubles

or 2.6,(2.2,2.1), 1.8, 1.5, 1.3, 1.1

[1]

There are **three sets** of double readings and **one set** which is very close.

[1]

[2]

Allow ECF for wrong data\*

(b) (i) Scales

[2]

Points plotted 9 ([-1] for each error)

[2]

Straight line

[1]

[5]

(ii) Gradient =  $40/2.7 = 14.8 \pm .2$ Large  $\Delta$  + subs  
Value

[1]

[1]

[2]

(iii)  $\omega = 14.8 \times 16.94/\pi$  (consistent with their  
= 79.8 slope value)

[1]

[1]

[2]

(c) (i)  $G = \frac{0.48 \times 52}{14}$  subs

[1]

G = 1.8

[1]

[2]

(ii) 26.4 (km h<sup>-1</sup>) approx consistent with their values

[1]

(iii)  $38.1 = \frac{\pi}{16.94} (1.8) \omega$  subs

[1]

 $\omega = 114$  (rev min<sup>-1</sup>)

[1]

[2]

(use of values from table 5.2, max [1])

(d) 0.042 h 0.065

[1]

3.9 min

[1]

[2]

AVAILABLE  
MARKS

Section B

20

Total

40