Please return to filing cabinet drawer.
Thanks

Oxford Cambridge and RSA Examinations

OCR
RECOGNISING ACHIEVEMENT

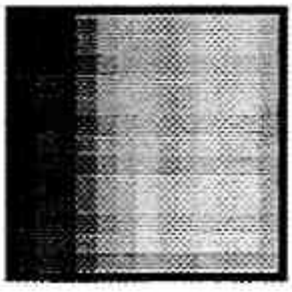
ADVANCED SUBSIDIARY GCE

AS 3888

PHYSICS B (ADVANCING PHYSICS)

PHYSICS IN ACTION

AS



MARK SCHEME FOR UNIT 2860

JANUARY 2001

2860/MS/01J

Abbreviation, Annotations and Conventions used in the Mark Scheme	/	= alternative and acceptable answers for the same marking point
	;	= separates marking points
	NOT	= answers which are not worthy of credit
	( )	= words which are not essential to gain credit
	____	= (underlining) key words which **must** be used to gain credit
	ecf	= error carried forward
	AW	= alternative wording
	Ora	= or reverse argument

Question	Expected Answers	Marks
	Section A	
1. (a)	Conductance G = 0.60 S ✓	1
(b)	$I = GV$ (words / formula) ✓ m; = 0.6 x 1.5 = 0.90 A ✓ e ecf from (a)	2
2. (a)	Scattered dark and / or light pixels / random single or odd pixels not matching original signal level (accept colour) / surrounding pixels AW ✓	1
(b)(i)	Averaging/ smoothing/ accept median/ rank filtering ✓ NOT sharpening/ edge/ Laplace detection	1
(ii)	Any two correct points: Noise is spread to neighbouring pixels (averaging) / Blurring of detail / looks out of focus / loses contrast AW ✓ ; ✓	2
3.	$n = I / e$ (words/formula) ✓ m; = 0.30 x 10^{-12} / 1.6 x 10^{-19} C = 1.9 x 10^{6} ✓e	2
4. (a)	$f = v / \lambda$ (words/formula) ✓ m; = 1500 / 0.50 x 10^{-3} = 3.0 x 10^{6} Hz ✓e	2
(b)	Size of smallest detail that could be resolved/ seen in final image/ the size represented by one pixel in the image AW ✓ NOT size / number of pixels in the image	1
5.	Number of atoms = width / diameter (implied by numbers OK) ✓ m = 0.040 x 10^{-3} / 0.10 x 10^{-9}; = 4 x 10^{5} ✓e	2
6. (a)	$Q = I t$ = 2.5 x (2 x 3600) ✓ m = 18 kC	1
(b)	$E = W / Q$ = 108 kJ / 18 kC (numbers/formula) ✓ m; =6.0 V ✓e ecf	2
7. (a)	3 separate frequencies ✓ ; higher frequencies have decreasing amplitude/ loudness ✓ OR A fundamental / (300 Hz) ✓ ; and higher harmonics / (600 & 900 Hz) ✓ AW NOT 3 notes (One mark maximum for a correct general definition of what a frequency spectrum shows, without specific reference to this spectrum.)	2
(b)	Fundamental frequency = 300 Hz ✓	1

Section B

8. (a) Motor drawn in parallel with supply after switch ✓ dot connections NOT needed 1

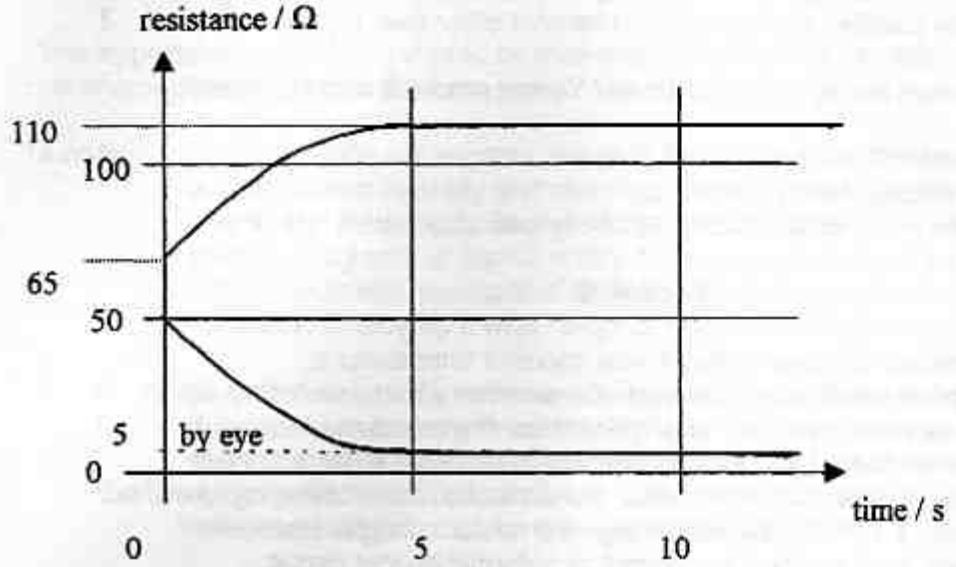
(b)(i) R rises at first ✓; then levels out / R becomes constant ✓; AW 2

(ii) R increases because element starts to heat up AW ✓ NOT R thermistor 1

(c)(i) The resistance of the thermistor needs to decrease ✓ 1

(ii) $R = V / I = 230 / 2$ ✓; $=115\Omega$ ✓; R thermistor = $(115 - 110) = 5\ \Omega$ 3
OR Heater Voltage = $I R = 2 \times 110 = 220$ V ✓;
Thermistor drops $(230 - 220) = 10$ V ✓;
Thermistor $R = V / I = 10 / 2 = 5\ \Omega$ ✓ ora

(iii) Any 2 correct features: starts 50 Ω / decreasing gradient / levels at 5Ω ✓; ✓ 2



9. (a) Converging/ convex lens/ positive lens/ drawing OK NOT magnifying lens 1

(b) Slide is inserted upside down ✓ 1

(c) M = image width / object width ✓ m = 1.75 / 0.035; = 50 ✓e (allow ± ans) 2

(d) $u = v / M$ ✓ m; = 4.0 / 50 = 0.080 m **UP** ✓e ecf (allow ± answers) 2

(e) P = 1 / f ✓ m; = ¼ - (-1/0.08) ✓ s; = 12.8 D ✓e ecf 3

(f) Relative lens movement e.g. towards slide / away from screen/ to the left AW ✓ 1

10 (a)(i) Two sensible estimates:
10 < words per line < 20 ✓; 100's pages per book ✓ 2

(ii) Correct arithmetic for product of estimates allow ecf ✓
(Expect answers in the range 240 000 to 4 300 000 letters per book) 1

(b) Same as (a)(ii) in bytes ✓ 1

(c)(i) 8M / (b) ✓m; = evaluation allow ecf ✓e (expect between 33 and 2) 2

(ii) Time = bits / bit rate (words / numbers) ✓m; = ((b) x 8) / 14k ✓s;
= evaluation ecf ✓ penalise **SF>3** 3
(expect answers in range 130 to 2500 second lose 1 mark for missing x 8)

(d) A sensible comment making physics connect, e.g.
saving trees/ energy/ psycho factors/ decline in publishers or bookshops etc ✓ 1

11 (a) So that it doesn't break on impacts with grass or stones AW ✓ 1

(b)(i) *Tough*: resilience to fracture / energy to create new surface / not brittle / doesn't crack AW ✓;
Yield stress: at which plastic deformation starts / beyond elastic limit AW ✓; NOT stress at which it yields
Hard: resilience to identation / scratching AW ✓ NOT resistance to impact 3

(ii) Nylon 6 ✓ 1

(iii) Three reasons for their choice / against other two ✓✓✓ allow ecf wrong material
Nylon is: hardest/ good toughness/ good stiffness/ highest yield stress/ highest density
Polypropylene is: toughest/ least stiff (easily coiled)/ lowest density
Polystyrene is stiffest/ good hardness/ good density etc.
allow correctly justified statements for material other than Nylon6 ecf 3

(iv) Nylon maximum strain = ½ yield stress/ Young modulus ✓m (½ missing OK);
= (½ x 48 Mpa) / (1.8 Gpa) = 0.013 ✓e 2
allow ecf on wrong choice of material
Polypropylene max. strain = 0.010 / Polystyrene max. strain = 0.0067

Section C

12 (a)(i) Purpose of sensor system stated ✓ e.g. monitor temperature;
more descriptive detail ✓ e.g. as part of a weather station recording device 2

(ii) Suitable component chosen ✓ e.g. thermistor/ thermocouple etc. 1

(b) *Physical change* stated ✓; suitable quantity identified e.g. temperature detected sensor *detection* explained ✓; electrical quantity changing identified/ details of potential divider operation e.g. thermistor changes resistance/ thermistor and fixed resistor are placed in potential divider circuit
measurement explained ✓ instrument to measure ΔR or ΔV identified / other detail about measured change e.g. DVM / V datalogger / identify sense of Δ 3

(c) Response time stated ✓ e.g. a few (numerical reference) seconds for a small thermistor implication for system clear ✓ e.g. this would not be serious problem in a data logging system, for data to be "late" by a few seconds

(d) Circuit diagram expect potential divider for passive sensor ✓✓✓ 1/2/3 style OR active sensor and suitable meter gain full credit 3

(e) *Two* relevant details of circuit operation ✓✓
e.g. when temperature rises, resistance of thermistor drops;
and output across fixed resistor rises 2

13 (a)(i) Example of transmission system given; e.g. CD rom laser read head
information type named e.g. digital information coding for music ✓✓✓ 1/2/3 style

(ii) Diagram and text to show how information is: produced; e.g. laser optics - pits how (in what medium) it is transmitted; air/ glass lenses/ prisms
how it is delivered to the receiver falls onto photodiode
OR based on other parts of system – electrical signal / D to A / amplifier / speaker ✓✓✓ 1/2/3 style up to max of 5 marks for part (a) 5

(b)(i) Approximate signal speed given ✓ e.g. a little less than light speed or light speed

(ii) Expect: a distance estimate ✓; time calculated using t = s / v ✓ m; evaluation ✓ ecf 4

(c)(i) Two factors affecting rate of transfer identified ✓; ✓
e.g. frequency of carrier/ bit rate selected/ pauses for other users etc.

(ii) Any estimate made that is relevant to calculating the rate ✓;
Leading to a reasonable estimate of the rate ✓ 4
OR appropriate unit; sensible rate estimate plus

QWC 4

QoWC Marking quality of written communication

The appropriate mark (0-4) should be awarded based on the candidate's quality of written communication in Section C of the paper.

4 max The candidate will express complex ideas extremely clearly and fluently. Answers are structured logically and concisely, so that the candidate communicates effectively. Information is presented in the most appropriate form (which may include graphs, diagrams or charts where their use would enhance communication). The candidate spells, punctuates and uses the rules of grammar with almost faultless accuracy, deploying a wide range of grammatical constructions and specialist terms.

3 The candidate will express moderately complex ideas clearly and reasonably fluently. Answers are structured logically and concisely, so that the candidate generally communicates effectively. Information is not always presented in the most appropriate form. The candidate spells, punctuates and uses the rules of grammar with reasonable accuracy; a range of specialist terms are used appropriately.

2 The candidate will express moderately complex ideas fairly clearly but not always fluently. Answers may not be structures clearly. The candidate spells, punctuates and uses the rules of grammar with some errors; a limited range of specialist terms are used appropriately.

1 The candidate will express simple ideas clearly, but may be imprecise and awkward in dealing with complex or subtle concepts. Arguments may be of doubtful relevance or obscurely presented. Errors in grammar, punctuation and spelling may be noticeable and intrusive, suggesting weakness in these areas.

0 The candidate is unable to express simple ideas clearly; there are severe shortcomings in the organisation and presentation of the answer, leading to a failure to communicate knowledge and ideas. There are significant errors in the use of language which makes the candidate's meaning uncertain.

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RECOGNISING ACHIEVEMENT

ADVANCED SUBSIDIARY GCE

AS 3888

PHYSICS B (ADVANCING PHYSICS)

UNDERSTANDING PROCESSES

AS

MARK SCHEME FOR UNIT 2861

JANUARY 2001

2861/MS/01J

Abbreviation, Annotations and Conventions used in the Mark Scheme	/	= alternative and acceptable answers for the same marking point
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Question	Expected answers	Marks
	Section A	
1	(i) 3×10^{1} ✓ (ii) 3×10^{2} ✓ (iii) 3×10^{6} ✓	3
2 (a)	use $W = Fd$ ✓ = 300 J ✓	2
(b)	movement horizontal ✓ weight down, owtte ✓	2
3	1500 N balances 2 components of T ✓ T cos 20° = 750 N, ✓ T = 800 N ✓	3
4 (a)	ultra-violet ✓	1
(b)	1.5 to 4 eV or 2.0 to 5.0 $\times 10^{-19}$ J ✓	1
5 (a)	A is ↓ ✓ and B is ← ✓	2
(b)	A: sine wave, zero at t = 0 going negative ✓ B: sine wave, +a at t = 0 going negative ✓ (do not mark for amplitude)	2
6 (a)	use $E = hf$ ✓ = 3.3×10^{-19} J ✓	2
(b)	n per second = power/(E) ✓ = 6×10^{15} ✓	2
	Total on section A = 20	
	Section B	
7 (a) (i)	read off graph ✓	
(ii)	gradient ✓ shown to be 10 m s^{-2} ✓	
(iii)	area between graph and axis ✓ shown to be 0.8 m ✓ (give credit for calculations as alternative)	5
(b) (i)	$E_K = \frac{1}{2} mv^2$ ✓ halve E, halve v^2 owtte ✓, show v = 2.8 m s^{-1} ✓	
(ii)	line from + 2.8 m s^{-1} ✓ with gradient –10 m s^{-2} ✓	5
	Total = 10	
8 (a) (i)	use $F = ma$ ✓ a = 3.6 m s^{-2} ✓	
(ii)	use $v^2 = 2as$ ✓ s = 1.0 km ✓	4
(iv)	e.g. including air resistance ✓ would reduce acceleration ✓ so longer runway needed ✓ or other good physics scenario	3
(b)	vertical component of thrust ✓ x sin 25° ✓ = 6.8×10^{4} N ✓	3
	Total = 10	

9 (a) (i)	(progressive) sound wave moving down tube ✓ is reflected from end. ✓ reflected and original waves interfere ✓ to give standing wave in tube owtte		
(ii)	e.g. cork dust collects at nodes; much louder sound in pipe, microphone + CRO etc. ✓		4
(b) (i)	use $c = f\lambda$ ✓ $\lambda = 0.20$ m ✓		
(ii)	antinodes at ends, two nodes in tube, suitable sketch✓		3
(c)	for CO_2 λ will be 0.14 m ✓ so new tube length is 0.14 m ✓		
	because tube is one wavelength long. ✓		3
		Total =	10
10 (a)	radio waves ✓		1
(b)	for distant object, distance to all detectors is the same. ✓ path difference between adjacent detectors = 0 or zero phase difference ✓		
	constructive interference or phasors add up to give a maximum✓		3
(c) (i)	path difference = $d \sin\theta$ ✓ (accept $n\lambda = d \sin\theta$ quoted)		
(ii)	min signal with two detectors when path diff = $\lambda/2$ ✓ must be seen		
	d = 100 m ✓ θ = 0.060° ✓		4
(d)	e.g. stronger total signal; better resolution etc. ✓✓		2 1/ 2
		Total =	10

Section C

11 (a)	correct amplitude ✓ phase ✓ shape ✓		
	key points plotted or identified ✓ (incorrect period; no marks)		4
(b) (i)	suitable example ✓		1
(ii)	description/diagram of apparatus ✓✓		1 / 2
	observations to be made ✓✓		4 1 / 2
(iii)	application of idea of superposition of waves ✓✓✓		1/2/3
	to specified examples described in (i) ✓		4
		Total =	13
12 (a)	suitable situation ✓		1
(b)	1. Description/diagram of apparatus ✓✓		1 / 2
	2. Description of measurements ✓✓✓		1/2/3
	3. Description of data analysis to determine acceleration ✓✓✓		1/2/3
	(e.g. finding values of Δv, Δt and a)		8
(c)	description of **two** procedures to improve accuracy ✓✓ each		max 4
		Total =	13
		QoWC =	4