

JUNE 2002

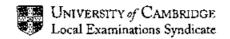
GCE Advanced Level

MARK SCHEME

MAXIMUM MARK: 60

SYLLABUS/COMPONENT:9702/4

PHYSICS (STRUCTURED QUESTIONS (A2 CORE))



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Categorisation of marks

The marking scheme categorises marks on the MACB scheme.

B marks: These are awarded as <u>independent</u> marks, which do not depend on other marks. For a B-mark to be scored, the point to which it refers must be seen specifically in the candidate's answer.

M marks: These are <u>method</u> marks upon which A-marks (accuracy marks) later depend. For an M-mark to be scored, the point to which it refers must be seen in the candidate's answer. If a candidate fails to score a particular M-mark, then none of the dependent A-marks can be scored.

C marks: These are <u>compensatory</u> method marks which can be scored even if the points to which they refer are not written down by the candidate, providing subsequent working gives evidence that they must have known it. For example, if an equation carries a C-mark and the candidate does not write down the actual equation but does correct working which shows he/she knew the equation, then the C-mark is awarded.

A marks: These are accuracy or <u>answer</u> marks which either depend on an M-mark, or allow a C-mark to be scored.

Conventions within the marking scheme

BRACKETS

Where brackets are shown in the marking scheme, the candidate is not required to give the brackets information in order to earn the available marks.

UNDERLINING

In the marking scheme, underlining indicates information that is essential for marks to be awarded.

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1	(a)	$g = GM/R^2$ $M = 9.81 \times (6.38 \times 10^6)^2 / 6.67 \times 10^{-11}$ $= 5.99 \times 10^{24} \text{ kg}$ (allow 2 marks if $g = 9.8 \text{ N kg}^{-1} \text{ used}$, I mark if $g = 10 \text{ N kg}^{-1} \text{ used}$)	C1 M1 A0	[2]
	(b)	(i) $T = 24 \text{ hours}$ $\omega = 2\pi/(24 \times 3600) \text{ or } 2\pi/T$ $= 7.27 \times 10^{-5} \text{ rad s}^{-1}$ (ii) $mr\omega^2 = GMm/r^2$ $r^3 = 7.55 \times 10^{22}$ $r = 4.23 \times 10^7 \text{ m}$	C1 C1 A1 C1 C1 A1	[3]
2	(a)	 (i) volume increases on evaporation so work done pushing back the atmosphere (ii) E_k of atoms constant (as no temperature change) E_p changes because separation of atoms changes so internal energy changes because U = E_k + E_p 	B1 B1 B1	[5]
	(b)	$\Delta U = \Delta W + \Delta Q$		[2]
3	(a)	(i) mean kinetic energy of the atoms / molecules / particles (ii) at absolute zero, atoms have no kinetic energy	Αl	[3]
	(b)	(i) $pV = nRT$ $n = (1.2 \times 10^5 \times 2.0 \times 10^{-2})/(8.31 \times 310)$ = 0.93 mol (ii) total amount = $(1.20 + 0.93)$ $(1.20 + 0.93) = (4.0 \times 10^{-2} \times p)/(8.31 \times 310)$ $p = 1.37 \times 10^5 \text{ Pa}$	C1 C1 A1 C1 C1 A1	[6]

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4	(a)		and d	straight line through origin	MI Al MI AI	[4]
	(b)		graph:	sinusoidal curve, all above t-axis correct period correct 'phase'	B1 M1 Al	[3]
	(c)		-	l shorterude larger	B1 B1	[2]
5	(a)			done in moving <u>unit</u> (positive) charge	Mi Al	[2]
	(b)	(ii)	$C = \zeta$	$/4\pi\varepsilon_0 r$ where ε_0 is permittivity (of free space) $C = 4\pi\varepsilon_0 r$	B1 B1 B1	[3]
	(c)	•	= 1. energy potenti	$\pi \times 8.85 \times 10^{-11} \times 0.15$ $67 \times 10^{-5} \mu\text{F}$ $V = \frac{1}{2}CV^2 \text{ or } \frac{1}{2}QV$ $V = \frac{1}{2} \times 1.67 \times 10^{-11} \times (1.2 \times 10^5)^2$ $V = \frac{1}{2} \times 1.67 \times 10^{-11} \times (1.2 \times 10^5)^2$ $V = 0.12 \text{J}$	B1 C1 C1	[4]
6	(a)		sketch:	peaks in opposite directions in correct regions no e.m.f. when current constant correct shape for one of the pulses	B1 B1 B1	[3]
		(ii) (iii)	V _{max} = = = capacit dischar	rrect diodes circled √2 × V _{rms} 8.48 V tor connected across SQ rges through load when p.d. / current in load reduces	C1 A1 B1 B1	[1] [2]
			thus ma	aintains p.d. across load (or other relevant comment)	B1	[3]

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7	(a)	photoelectric effect	Вl	[1]
	(b) (i)	reasonable line extrapolated		
		6.8×10^{14} Hz (allow $\pm 0.4 \times 10^{14}$ Hz)	A1	
	(ii)	attempt at finding gradient		
		working shown to give 6.6 x 10^{-34} J s Hz (allow $\pm 0.4 \times 10^{14}$ Hz)	Al	[4]
	(c)	line: same gradient	Bl	
	. ,	to the left of the line drawn by candidate	BI	[2]
		→		
	(d)	maximum corresponds to electron emitted from surface	B 1	
	-	other electrons require energy to be brought to the surface	Bi	[2]