CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the May/June 2013 series

0443 PHYSICS (US)

0443/33 Paper 3 (Extended Theory), maximum raw mark 80

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge will not enter into discussions about these mark schemes.

Cambridge is publishing the mark schemes for the May/June 2013 series for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level components and some Ordinary Level components.

NOTES ABOUT MARK SCHEME SYMBOLS & OTHER MATTERS

M marks are method marks upon which further marks depend. For an M mark to be scored, point to which it refers **must** be seen in a candidate's answer. If a candidate fails to sc a particular M mark, then none of the dependent marks can be scored.

B marks are independent 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 answers.

A marks In general A marks are awarded for final answers to numerical questions.
If a final numerical answer, eligible for A marks, is correct, with the correct unit and an acceptable number of significant figures, all the marks for that question are normally awarded.
It is very occasionally possible to arrive at a correct answer by an entirely wrong approach. In these rare circumstances, do not award the A marks, but award C marks on their merits. However, correct numerical answers with no working shown gain all the marks available.

C marks are compensatory marks in general applicable to numerical questions. These can be scored even if the point to which they refer are not written down by the candidate, **provided 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 substitution or working which shows he knew the equation, then the C mark is scored. A C mark is not awarded if a candidate makes two points which contradict each other. Points which are wrong but irrelevant are ignored.

brackets ( ) around words or units in the mark scheme are intended to indicate wording used to clarify the mark scheme, but the marks do not depend on seeing the words or units in brackets, e.g. 10 (J) means that the mark is scored for 10, regardless of the unit given.

underlining indicates that this must be seen in the answer offered, or something very similar.

OR / or indicates alternative answers, any one of which is satisfactory for scoring the marks.

e.e.o.o. means 'each error or omission'.

o.w.t.t.e. means 'or words to that effect'.

Spelling Be generous about spelling and use of English. If an answer can be understood to mean what we want, give credit. However, beware of and do not allow ambiguities, accidental or deliberate: e.g. spelling which suggests confusion between reflection / refraction / diffraction / thermistor / transistor / transformer.

Not/NOT Indicates that an incorrect answer is not to be disregarded, but cancels another otherwise correct alternative offered by the candidate, i.e. right plus wrong penalty applies.

Ignore Indicates that something which is not correct or irrelevant is to be disregarded and does not cause a right plus wrong penalty.

e.c.f. meaning 'error carried forward' is mainly applicable to numerical questions, b particular circumstances be applied in non-numerical questions.
This indicates that if a candidate has made an earlier mistake and has carrie incorrect value forward to subsequent stages of working, marks indicated by ecf may awarded, provided the subsequent working is correct, bearing in mind the earlier mistake. This prevents a candidate being penalised more than once for a particular mistake, but **only** applies to marks annotated e.c.f.

Significant Figures

Answers are normally acceptable to any number of significant figures ù 2. Accept answers that round to give the correct answer to 2 s.f. Any exceptions to this general rule will be specified in the mark scheme.

Units Deduct one mark for each incorrect or missing unit from a final answer that would otherwise gain all the marks available for that answer: maximum 1 per question.

Arithmetic errors

Deduct one mark if the **only** error in arriving at a final answer is clearly an arithmetic one.

Transcription errors

Deduct one mark if the only error in arriving at a final answer is because given or previously calculated data has clearly been misread but used correctly.

Fractions e.g. ½, ¼, 1/10 etc. are only acceptable where specified.

1	**(a)**	**(i)**	constant/uniform gradient/slope OR straight line		
		(ii)	($a = \Delta$) $v \div t$ OR $36 \div 48$	C1	
			$0.75\,m/s^2$ (NOT 0.76)	A1	
	(b)	**(i)**	horizontal line from (48, 36) to (120, 36)	B1	
		(ii)	area under graph (mentioned **or** implied)	B1	
			864 OR 2592	C1	
			3500/3460/3456 m	A1	[7]
2	**(a)**	**(i)**	($m =$) ρV OR $1000 \times 1.8 \times 10^6$	C1	
			1.8×10^9 kg	A1	
		(ii)	(g.p.e. =)mgh OR $1.8 \times 10^9 \times 10 \times 350$ (e.c.f. from **(a)(i)**)	C1	
			6.3×10^{12} J (e.c.f. from **(a)(i)**)	A1	
		(iii)	($P =$)E/t OR $6.3 \times 10^{12}/7$ OR $6.3 \times 10^{12}/(7 \times 60)$ OR $6.3 \times 10^{12}/(7 \times 3600)$ (ecf from **(a)(i)(ii)**)	C1	
			2.5×10^8 W (e.c.f. from **(a)(i)(ii)**)	A1	
	(b)	**(i)**	continuously regenerated / not used up / everlasting supply IGNORE used again / recycled / can be renewed	B1	
		(ii)	any **two** of: biomass/geothermal/solar/ tidal/wave/wind energy/wood (NOT nuclear/light)	B2	[9]
3	**(a)**		velocity has direction/is a vector AND speed doesn't/isn't/is a scalar	B1	
	(b)	**(i)**	horizontal arrow to right AND touching parachutist (when extended)	B1	
			arrow/line horizontal AND arrow / line vertical AND making two sides of triangle OR rectangle	B1	
		(ii)	correct diagonal (i.e. top left to bottom right)	B1	
			10.4 – 10.5 m/s	B1	
			51–55° to horizontal OR 35 – 39° to vertical (NOT more than 2 sig.figs.)	B1	
		(iii)	$\frac{1}{2}mv^2$ OR $0.5 \times 85 \times 10.5^2$ (e.c.f. from **(b)(ii)**)	C1	
			$0.5 \times 85 \times 10.5^2$ (e.c.f. from **(b)(ii)**)	C1	
			$4.7/4.69/4.685625 \times 10^3$ J (e.c.f. from **(b)(ii)**)	A1	[9]

4 **(a)** 85 000 N (accept 83 300 N)

(b) **(i)** (P =)F/A OR 85 000/3.4 OR 85 000/3.4 × 2 OR 85 000/6.8 (e.c.f. from **(a)(i)**) C1
1.2/1.25/1.3 × 10^4 Pa (e.c.f. from **(a)(i)**) A1

(ii) larger area M1
smaller pressure A1

(c) **(i)** (measure of) turning effect OR $F \times x$ B1

(ii) no resultant/net force B1
no resultant/net turning effect/moment B1 [8]

5 **(a)** any two of:
boiling throughout liquid (evaporation at surface),
boiling at one temperature (evaporation at any / all temperature / below boiling point),
boiling not affected by draught/area (evaporation is),
boiling produces bubbles (evaporation does not). B2

(b) (thermal energy) does work against intermolecular forces / breaks bonds B1
molecules separated/moved apart OR becomes PE B1

(c) apparatus: e.g. kettle AND balance / scales OR steam condensing in water with measuring cylinder / scales AND thermometer B1
two masses determined OR volume/mass condensed B1
determine energy input: e.g. VIt **or** Pt **or** $mc\Delta T$ B1
(l_e =)Q/m B1 [8]

6 **(a)** **(i)** any two of:
(gas) molecules further apart
greater PE
move singly / in straight lines
OR vice versa for. liquid molecules
(allow faster) B2

(ii) gases compressible OR liquids incompressible B1
forces between gas molecules weaker OR vice versa for liquid molecules B1

(b) **(i)** pV = constant OR $p_1V_1 = p_2V_2$ OR 2.6 × 10^6 × 0.035 OR 91 000 C1
2.6 × 10^6 × 0.035/1.0 × 10^5 OR 91 000/1.0 × 10^5 C1
0.91 m^3 A1

(ii) slower / less KE B1 [8]

7 **(a)** **(i)** (only) one frequency (accept wavelength)

(ii) 4.7×10^{14} Hz OR the same as before OR unchanged B1

(b) **(i)** (n =)c/v OR $3.0 \times 10^8 / 2.0 \times 10^8$ M1
1.5 A1

(ii) (λ =)c/f OR $2.0 \times 10^8 / 4.7 \times 10^{14}$ C1
$4.3/4.26/4.255319 \times 10^{-7}$ m A1 [6]

8 **(a)** in copper/metals/conductors, electrons (free to move) B1
in nylon/insulators electrons fixed/not free (to move) B1

(b) (negatively charged nylon) rod near to sphere B1
earth/touch (with hand) the sphere B1
remove earth/hand (and remove rod) B1

(c) <u>at least four</u> equally spaced, radial lines from surface M1
<u>at least one</u> outward arrow AND none wrong A1 [7]

9 **(a)** **(i)** same number of / 92 protons (in nucleus) (IGNORE electrons) B1

(ii) different number of neutrons B1

(b) most α-particles travel straight (through the foil) M1
nucleus small / atom mostly empty space A1
small number deflected (through large angles) M1
most of mass in nucleus ACCEPT nucleus positive/charged A1 [6]

10 **(a)** in order downwards: 1 1 1 0 c.a.o. B1

(b) **(i)** 1 AND 0 (e.c.f. from **(b)(i)**) B1

(ii) NOT (gate) (**allow** NOR (gate)) B1

(c) R = 1 AND S = 0 (e.c.f. from **(b)(i)**) B1
T = 1 B1 [5]

11 (a) (i) (I =)P/V OR 18 000/120 OR 18/120
150 A A1

(ii) (E =)Pt OR $18\,000 \times 30 \times 60$ OR $18\,000 \times 1800$ OR $18\,000 \times 30$ OR 5.4×10^5 C1
3.2×10^7 J OR 9.0 kW h A1

(b) any three of:
(high voltage means) low(er) current
for given supply power
(low(er) current means) less heat/thermal energy (generated in cables) OR $P = I^2R$
for given resistance (of cables)
cables heated by current B3 [7]