Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

PHYSICS **0625/42**

Paper 4 Extended Theory **March 2017**

MARK SCHEME

Maximum Mark: 80

Published

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.

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This syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

NOTES ABOUT MARK SCHEME SYMBOLS AND OTHER MATTERS

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 answer.
M marks	are method marks upon which accuracy marks (A marks) later depend. For an M mark to be scored, the point to which it refers **must** be seen in a 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	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.
A marks	A marks are accuracy or answer marks which either depend on an M mark, or which are one of the ways which allow a C mark to be scored. A marks are commonly 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. An A mark following an M mark is a dependent mark.
Brackets ( )	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.
<u>Underlining</u>	Underlining indicates that this <u>must</u> be seen in the answer offered, or something very similar.
OR / or	This indicates alternative answers, any one of which is satisfactory for scoring the marks.
e.e.o.o.	This means "each error or omission".
o.w.t.t.e.	This means "or words to that effect".
Ignore	This indicates that something which is not correct or irrelevant is to be disregarded and does not cause a right plus wrong penalty.
Spelling	Be generous about spelling and use of English. If an answer can be understood to mean what we want, give credit. However, do not allow ambiguities, e.g. spelling which suggests confusion between reflection / refraction / diffraction or thermistor / transistor / transformer.
Not/NOT	This 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.

ecf	meaning “error carried forward” is mainly applicable to numerical questions, but may in particular circumstances be applied in non-numerical questions. This indicates that if a candidate has made an earlier mistake and has carried an incorrect value forward to subsequent stages of working, marks indicated by ecf may be awarded, provided the subsequent working is correct, bearing in mind the earlier mistake. This prevents a candidate from being penalised more than once for a particular mistake, but **only** applies to marks annotated ecf. **For the ecf mark to be awarded, the carried forward quantity must be seen in the working.**
Significant figures	Answers are normally acceptable to any number of significant figures $\geqslant 2$. Any exceptions to this general rule will be specified in the mark scheme.
Units	Deduct one mark for each incorrect or missing unit from an answer that would otherwise gain all the marks available for that answer: maximum 1 per question. No deduction is incurred if the unit is missing from the final answer but is shown correctly in the working. Condone wrong use of upper and lower case symbols, e.g. pA for Pa.
Arithmetic errors	Deduct one mark if the **only** error in arriving at a final answer is clearly an arithmetic one. Regard a power-of-ten error as an arithmetic error.
Transcription errors	Deduct one mark if the only error in arriving at a final answer is because previously calculated data has clearly been misread but used correctly.
Fractions	Allow these only where specified in the mark scheme.
Crossed out work	Work which has been crossed out **and not replaced but can easily be read,** should be marked as if it had not been crossed out.

Question	Answer	Marks
1(a)(i)	Constant positive or negative gradient, labelled A	**B1**
1(a)(ii)	Decreasing positive or negative gradient, labelled B	**B1**
1(b)(i)	Constant positive or negative gradient, labelled S	**B1**
1(b)(ii)	Increasing positive or negative gradient, labelled T	**B1**
1(c)	F = ma in any form OR (a =) F / m OR 56 000 / 16 000	**C1**
	3.5 (m/s^2)	**C1**
	a = (v – u) / t in any form OR v – u = at OR v = at OR at OR 3.5 × 16	**C1**
	56 m / s	**A1**
	Total:	**8**

Question	Answer	Marks
2(a)	(Momentum) has direction OR Momentum depends on velocity and velocity is a vector	**B1**
2(b)(i)	(Change of momentum =) mv – mu OR m Δv OR (-) mu OR (–)1200 $\times$ 7.5	**C1**
	(–) 9000 kg m / s or N s	**A1**
2(b)(ii)	(F =) change of momentum / time OR m(v – u) / t OR mΔv / t OR 9000 / 0.36	**C1**
	25 000 N	**A1**
	OR	
	a = (v – u) / t OR (0 – 7.5) / 0.36 OR (–) 20.8 m / s^2	(C1)
	F = (ma OR 200 $\times$ 20.8 =) 25 000 N	(A1)
2(c)(i)	½ m v^2 = 4.3 $\times$ 10^5	**C1**
	v^2 = 2 $\times$ 4.3 $\times$ 10^5 / 1500 OR v = (2 $\times$ 4.3 $\times$ 10^5 / 1500)$^{1/2}$	**C1**
	24 m / s	**A0**
2(c)(ii)	Other parts of the car will deform / bend / break etc. OR more damage	**B1**
	Total:	**8**

Question	Answer	Marks
3(a)(i)	No resultant force / net force OR Forces are balanced OR Forces in opposite directions are equal OR Forces cancel	**B1**
3(a)(ii)	no resultant / net moment / torque / turning effect OR (Sum of) clockwise moments = (sum of) anticlockwise moments	**B1**
3(b)(i)	$24 \times 0.4 = 9.6$ kN m OR $24\,000 \times 0.4 = 9600$ N m	**B1**
3(b)(ii)	$T_1 \times 1.6$	**B1**
	= 9.6 OR = 9600	**C1**
	(T_1 =) 6 kN OR (T_1 =) 6000 N	**A1**
3(b)(iii)	$T_1 + T_2 = 24\,000$ OR $6000 + T_2 = 24\,000$	**C1**
	(T_2 =) 18 000 N	**A1**
	OR	
	$T_1 + T_2 = 24$ OR $6.0 + T_2 = 24$	(C1)
	(T_2 =) 18 kN	(A1)
	OR	
	$T_2 \times 0.40 = 6000 \times 1.2$	(C1)
	(T_2 =) 18 000 N	(A1)
	OR	
	$T_2 \times 0.40 = 6.0 \times 1.2$	(C1)
	(T_2 =) 18 kN	(A1)
	Total:	**8**

Question	Answer	Marks
4(a)	Density of bulb A greater than the density of the water (and sinks)	**B1**
	Density of other bulbs less than the density of water (and float)	**B1**
4(b)(i)	Glass is a poor conductor of heat OR glass conducts heat at a slow rate OR water has a high (specific) heat capacity	**B1**
4(b)(ii)	The water expands OR separation of water molecules increases	**B1**
	The water becomes less dense	**B1**
	Bulb B now has a greater density than the water (and sinks) OR Weight of bulb B more than buoyancy forces / upthrust	**B1**
4(c)	24 °C – 26 °C	**B1**
	Total:	**7**

Question	Answer	Marks
5(a)(i)	Two of: Evaporation takes place at any temperature Evaporation takes place at the surface Evaporation takes thermal energy / heat from liquid OR Evaporation lowers temperature of liquid No bubbles (rise to surface during evaporation) Evaporation lowers temperature of liquid	**B2**
5(a)(ii)	e.g. condensation / change from gas to liquid OR freezing or solidification / change from liquid to solid OR melting / change from solid to liquid OR sublimation / change from solid to gas	**B1**

Question	Answer	Marks
5(b)(i)	Point A: liquid cooling / temperature of liquid falling	**B1**
	Point B: (liquid) freezing / changing (from liquid) to solid	**B1**
	Point C: solid cooling / temperature of solid falling	**B1**
5(b)(ii)	Specific heat capacity of liquid greater than specific heat capacity of solid	**B1**
	Total:	**7**

Question	Answer	Marks
6(a)	Visible / light and infra-red	**B1**
6(b)	Any 4 of: Level of water in left-hand tube falls and level of water in right-hand rises Matt black bulb is a good absorber OR is better absorber than shiny bulb Shiny bulb is a good reflector OR is better reflector than matt black bulb Temperature rises more in left-hand tube OR less in right-hand tube Pressure rises more in left-hand tube OR less in right-hand tube Air expands more in left-hand hand tube OR less in right-hand tube	**B4**
	Total:	**5**

Question	Answer	Marks
7(a)	Diminished, inverted and real ticked. All correct = 2 marks; 1 or 2 correct = 1 mark; contradiction loses 1 mark.	**B2**
7(b)	Incident ray parallel to axis from tip of object to centre line of lens. Refracted ray from centre line of lens to tip of image OR: Refracted ray parallel to axis from tip of image to centre line of lens. Incident ray from tip of object to meet refracted ray at centre line of lens Principal focus to right or left of lens marked	**B1**
7(c)	Candidate's distance from centre of lens to point marked F (even if clearly in wrong position) OR candidate's distance from centre of lens to correct point even if not marked F	**B1**
7(d)	Any straight-line ray from tip of object to tip of image, not passing through a principal focus of the lens, that changes direction at centre line of lens	**B1**
	Total:	**5**

Question	Answer	Marks
8(a)(i)	Copper	**B1**
	Copper has (very) low resistance OR is a (very) good (electrical) conductor	**B1**
8(a)(ii)	(Soft) iron / mu metal	**B1**
	(Soft) iron / mu metal) can be easily magnetised and demagnetised	**B1**
8(b)(i)	X is step-up (transformer) Y: is step-down (transformer)	**B1**
8(b)(ii)	High voltage means low current OR high voltage lowers current	**B1**
	Power / heat / energy / voltage loss is less	**B1**
	Thinner cables / wires suitable for low current	**B1**
8(b)(iii)	240 V safe / safer (for use by consumers)	**B1**
	Total:	**9**

Question	Answer	Marks
9(a)(i)	Resistance constant	**B1**
9(a)(ii)	Resistance increases	**B1**
9(b)(i)	I = V/R in any form OR (R=) V/I	**C1**
	8.0/0.72	**C1**
	11 Ω	**A1**
9(b)(ii)	(P =) IV OR 0.72 × 8.0	**C1**
	5.8 W	**A1**
	OR I^2R OR 0.72^2 × candidate's **(b)(i)** OR V^2/R OR 8^2 / candidate's **(b)(i)**	(C1)
	5.7 W or 5.8 W (dependent on exact data used)	(A1)
9(c)(i)	8.0 V	**B1**
9(c)(ii)	(5 × 0.72 =) 3.6 A	**B1**
	Total:	**9**

Question	Answer	Marks
10(a)	Electrons / negative particles	**B1**
	Move (in circuit) from negative (terminal) to positive (terminal of battery)	**B1**
10(b)(i)	(I =) Q / t OR 0.60 / 0.000050	**C1**
	12 000 A	**A1**
10(b)(ii)	(E=) I V t OR 12 000 × 2.5 × 10^8 × 0.000050	**C1**
	1.5 × 10^8 J	**A1**
	OR	
	(E=) Q V OR 0.60 × 2.5 × 10^8	(C1)
	1.5 × 10^8 J	(A1)
10(b)(iii)	Converted to any two of: thermal energy / heat, light and sound	**B1**
	Total:	**7**

Question	Answer	Marks
11(a)	α-particles and β-particles are both present, stated or implied	**B1**
	α-particles: stopped by / absorbed by paper	**B1**
	β-particles: deflected by (magnetic) field	**B1**
	γ-rays: absent	**B1**
	with paper and magnetic field count falls to background / 20 counts / s.	**B1**
11(b)	α-particles: (150 – 60 =) 90 counts / s β-particles: (60 – 20 =) 40 counts / s γ-rays: zero All 3 correct = 2 marks; 1 or 2 correct = 1 mark.	**B2**
	Total:	**7**