CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International General Certificate of Secondary Education

MARK SCHEME for the March 2016 series

0625 PHYSICS

0625/42 Paper 4 (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.

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NOTES ABOUT MARK SCHEME SYMBOLS & OTHER MATTERS

M marks — are method marks upon which further marks 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 marks can be scored.

B marks — are independent marks, which do not depend on other marks. For a B mark to 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 marks 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".

Ignore — 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, 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.

ecf	means "error carried forward" This is mainly applicable to numerical questions, but may occasionally be applied in non-numerical questions if specified in the mark scheme. 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.
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 in symbols, e.g. pA, PA or 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 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	Only accept these 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.
Use of **NR**	(# key on the keyboard) Use this if the answer space for a question is completely blank or contains no readable words, figures or symbols.

1 **(a)** **(i)** 18 m / s B1

(ii) (0.90 s is) driver's time to react B1

(b) **(i)** (a =) (v – u) / t OR Δv / t OR either in words OR (18 – 0) / 3.1 OR 18 / 3.1 C1
5.8 m / s^2 A1
OR
Values from any correct points on graph (C1)
Answer dependent on accuracy of chosen points (A1)

(ii) Evidence of use of: (distance =) area under graph e.g. 1 / 2bh C1
(18 × 0.9) + (0.5 × 3.1 × 18) C1
44 m A1

(c) (Without seat belt, driver:) e.g. keeps moving (forwards) / does not stop / has inertia / has momentum B1

(Driver) hits steering wheel / windscreen / dashboard B1

[Total: 9]

2 **(a)** mv – mu OR m(v – u) OR mv OR 0.15 × 8.0 C1
1.2 N s or kg m / s A1

(b) 1.2 N s or kg m / s B1

(c) F = (mv – mu) / t OR F = mv / t OR impulse / t OR 1.2 / 0.0015 C1
800 N A1
OR
(F =) ma OR m[(v – u) / t] OR 0.15 × 8 / 0.0015 (C1)
800 N (A1)

[Total: 5]

3 **(a)** **(i)** Straight line through origin B1

(ii) Strain (energy) OR elastic (energy) B1

(b) Use of 1 / 2mv^2 C1
0.5 × 2.5 × v^2 = 0.48 C1
v^2 = 0.48 / (0.5 × 2.5) OR v^2 = 0.384 C1
v = 0.62 m / s A1

[Total: 6]

4 **(a)** Coal, hydroelectric and wind boxes ticked B2

(b) **(i)** Copper is a good conductor of thermal energy / heat B1
Black surface is a good / the best absorber of radiation / infra red B1

(ii) (Temp rise =) 72 – 20 = 52 (°C) C1
(Q =) $mc\Delta\theta$ OR $0.019 \times 4200 \times 52$ C1
4100 J A1

(iii) Efficiency = (power) output / (power) input ($\times$ 100)
OR $70 = \frac{(4100/5)\times 100}{\text{power input}}$ OR $\frac{(4100\times 100)}{\text{power input}}$ OR rearranged C1
Power input = 1200 W A1

[Total: 9]

5 **(a)** **(i)** P $\times$ V values are 7500 or about 7500
OR If P / pressure doubles, V / volume halves OR vice versa B1
(so) PV = constant OR P α 1 / V OR either in words B1

(ii) temperature B1

(b) **(i)** P = hdg OR $5.0 \times 10 \times 1000$ C1
50 000 Pa or 50 kPa A1

(ii) Volume of bubble increases
Mass of gas stays the same B2
Density of gas decreases

[Total: 7]

6 **(a)** **(i)** **1.** Mark amplitude with **X** B1
2. Mark wavelength with **Y** B1

(ii) **1.** Amplitude increases and wavelength stays the same B1
2. Amplitude stays the same and wavelength decreases B1

(b) v = (total) distance / time OR d / t OR 2d / t in any form C1
d = $1500 \times 0.054 / 2$ C1
40 m OR 41 m A1

[Total: 7]

7 (a) (i) Reflection <u>in a more dense material</u> where there is no refracted ray or wtte
OR All light <u>in a more dense material</u> is reflected or wtte B1

(ii) e.g. The greatest angle of incidence (in the material) at which refraction occurs
OR The angle of incidence (in the material) at which the refracted ray travels along the boundary / angle of refraction is 90° B1
OR The angle of incidence / (in the material) above which total internal reflection occurs

(b) (i) (refractive index =) speed of light in air / speed of light in glass
OR $3.0 \times 10^8 / 2.0 \times 10^8$ M1
= 1.5 A1

(ii) sin c = 1 / n OR 1 / 1.5 seen
(c = 42°) B1

(iii) No change of direction at first face B1
Total internal reflection at hypotenuse with i = r by eye B1
Refraction with r greater than i at lower face B1

[Total: 8]

8 (a) (i) P = IV OR 40 = 220 × I OR (I =) P / V OR 40 / 220 C1
0.18 A A1

(ii) [3 × 0.18(2)] = 0.54 A OR 0.55 A B1

(iii) 2 / 0.182 = 10.99 OR 2 / 0.18 = 11.1 C1
10 lamps OR 11 lamps A1

(b) (i) Resistance <u>increases</u> B1

(ii) Power (of lamp) decreases B1
P = IV <u>and</u> current in lamp decreases. OR $P = V^2 / R$ B1

[Total: 8]

9 (a) (i) . . . . .direction of the force on a positive charge B1

(ii) Straight parallel lines from upper to lower plate B1
At least 3 lines drawn. All lines drawn equally spaced, approximately symmetrical with respect to plates B1
Arrows downwards B1

(b) (i) Upward force (on drop) due to electric field / charge on plates B1
= weight of drop B1
Upward force on drop = downward force on drop
OR no resultant / net force on drop
OR forces are balanced (B1)

(ii) Drop moves upwards B1
Weight / mass of drop decreases OR downward force decreases
OR Upward force (due to electric field) > weight of drop B1

[Total: 8]

10 (a) (i) Protons: 53 neutrons: 78 electrons: 53 B2

(ii) $^{131}_{54}Xe$ B1
B1

(b) Points plotted at 3 of: 0 s, 50 s, 100 s, 150 s B1

3 corrected counts/minute plotted at any from :
(0, 280)
(50, 140)
(100, 70)
(150, 35) M1
Graph drawn as curve through correct points A1

[Total: 7]

11 (a) AND (gate) B1

(b) 0 0 1
1 0 0
0 1 0
1 1 0 B2

(c)

A	B	C	D	E	F
1	1	0	1	1	1

B3

[Total: 6]