CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International General Certificate of Secondary Education

MARK SCHEME for the October/November 2015 series

0625 PHYSICS

0625/33 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.

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NOTES ABOUT MARK SCHEME SYMBOLS & 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 ( ) 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 mark.

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, do not allow ambiguities, e.g. spelling which suggests confusion between reflection / refraction / diffraction or thermistor / transistor / transformer.

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

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.

AND indicates that both answers are required to score the mark.

cao correct answer only.

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 being penalised more than once for a particular mistake, but **only** applies to marks annotated ecf.

Significant Figures — Answers are normally acceptable to any number of significant figures ≥ 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.

Fractions — Only accept these where specified in the mark scheme.

1 **(a)** speed is constant / uniform / unchanging OR terminal velocity / speed B1
no net / resultant force OR air resistance cancels / equals weight B1

(b) P between 0.25 s and 1.90 s (inclusive) B1

(c) **(i)** (a =) $\Delta v / t$ OR 2.5 / 0.25 OR other point on correct section of line B1
9.6 to 10 m / s^2 (inclusive) B1

(ii) area under graph OR attempt at counting squares OR between 16.2 and 17.5 m (inclusive) C1
between 16.5 and 17.1 m (inclusive) A1

[Total: 7]

2 **(a)** **(i)** 5.0(4) $\times$ 10^{-3} OR 0.0050(4) kg OR 5.0(4) g B1

(ii) (ρ =) m / V OR 0.00504 / (0.30 $\times$ 0.21 $\times$ 0.048) OR 0.080 / (1 $\times$ 0.048) C1
0.00504 $\times$ 500 / (0.30 $\times$ 0.21 $\times$ 0.048) OR 0.080 / (1 $\times$ 0.048 / 500)) C1
8.3(3333) $\times$ 10^2 kg / m^3 A1

(b) micrometer OR screw gauge OR digital / electronic caliper B1
practical detail of use of micrometer OR micrometer (much) more precise than rule OR repeat and average OR measure mass with balance / scale B1

OR
tear into 500 pieces (B1)
pile up **and** press down OR measure mass with balance / scale (B1)

[Total: 6]

3 **(a)** **(i)** straight line between A and B B1

(ii) limit of proportionality B1

(b) (WD =) $\frac{1}{2}$ $F \times d$ OR $F_{ave} \times d$ OR 6.0 $\times$ 0.030 OR 18 (J) C1
0.18 J A1

(c) **(i)** (x =) 2.0 (cm) OR 6.0 – 4.0 OR $F = kx$ OR 4.0 (N / cm) C1
12.0 $\times$ 2.0 / 3.0 OR 4.0 $\times$ 2.0 OR 8.0 (N) C1
0.80 kg OR 800 g A1

(ii) (e =) 1.0 (cm) OR (Δe = –)1.0 (cm) C1
4.0 N OR 4.0 N A1

[Total: 9]

4 **(a)** **(i)** gravitational (potential energy) to kinetic (energy) B1

(ii) kinetic (energy) to elastic / strain (potential energy) B1

(iii) elastic / strain (potential energy) to kinetic (energy) B1

(b) mgh OR $0.15 \times 10 \times 2.0$ OR 3(.0 J) C1
$\frac{1}{2}\ mv^2$ OR $v^2 = 2gh$ C1
$v^2 = 2 \times 3.0 / 0.15$ OR 40 C1
6.3(24555) m / s A1

(c) heat / thermal / internal energy lost OR ball / surface gains heat / thermal / internal energy B1

[Total: 8]

5 **(a)** any **two** from:
volume (of a liquid / gas); resistance (of a metal);
voltage (of a thermocouple); other appropriate examples; B2

(b) **(i)** **1** place bulb in ice and water mixture AND mark liquid level B1
2 place bulb in steam from boiling water AND mark liquid level B1
pure ice OR pure water mentioned in **1** OR at normal atmospheric pressure mentioned in **2** B1

(ii) **1** liquid expands uniformly (as temperature rises) OR capillary / tube has uniform diameter / cross-sectional (area) B1
2 glass expands much less than the liquid **or** (also) expands linearly B1

[Total: 7]

6 **(a)** (region of) low(er) pressure OR where molecules are further apart B1

(b) **(i)** 0.19 m B1

(ii) $v = f\lambda$ OR $7\,800 \times 0.19$ OR $1\,500 / 1\,480 / 1\,482$ (m / s) OR $0.76 / 1\,500$ OR $1 / 7\,800$ OR $4 / 7\,800$ etc. ecf from **(i)** C1
$5.1(28205) \times 10^{-4}$ s ecf from **(i)** A1

(c) **(i)** unchanged / stays the same / constant OR 7 800 Hz B1

(ii) increases B1

(d) three wavefronts (rarefactions) joined to those below B1
three wavefronts with their upper ends further to the right AND parallel B1

[Total: 8]

7 **(a)** (α =) $\sin^{-1}(1/n)$ OR $\sin \alpha = 1/n$ OR $\sin 90(°)/\sin \alpha = n$ C1
(C =) $\sin^{-1}(1/1.6)$ C1
39° OR 38.7(38.682)° A1

(b) any **four** from:
(initially / θ C) refracted ray / ray in air / ray emerges
(initially / $\theta \leq C$) refracted ray / ray in air / ray emerges AND reflected ray
(initially / θ C) angle of refraction increasing
(initially / θ C) refracted ray gets weaker OR reflected rays gets stronger
($\theta = C$) refracted ray along surface
(eventually / $\theta > C$ / $r > 90°$) refracted ray disappears OR no more refraction OR does not emerge OR total internal reflection
(description of) angle of reflection increasing OR always equals angle of incidence B4

[Total: 7]

8 **(a)** coulomb B1

(b) **(i)** negative charge(s) on left AND positive charge(s) on right M1
equal number of positive and negative charges AND number of each ≤ 7 A1

(ii) electrons / negative charges flow from Earth / on to sphere (NOT protons / positive charges / positive electrons move) B1
total charge negative OR (some) protons / positive charges cancelled B1

(c) metal contains free (delocalised) electrons OR electrons can move about B1
electrons in plastic not free to move / fixed B1

[Total: 7]

9 **(a)** tick for thermistor under: heat detector B1
tick for transistor under: switch B1

(b) increase light intensity / brightness / illuminate B B1
resistance (of B) decreases cao B1
voltage at mid-point increases OR greater (share of) voltage M1
(more) current flows (through lamp) A1

[Total: 6]

10 (a) less power / energy lost OR heat generated (in cables) B1
smaller current B1
$P = VI$ OR $P = I^2R$ B1

(b) (i) (laminated) iron core B1

(ii) (connected to) primary (coil) B1

(iii) (N_S =) $N_P V_S / V_P$ OR 400 × 115 000 / 5 000 C1
9 200 (turns) A1

(c) less insulation needed OR safer OR devices designed for 230 V B1

[Total: 8]

11 (a) (i) number of / more neutrons B1
4 more neutrons B1

(ii) same number of protons / proton number / atomic number / chemical reactions / number of electrons (in neutral atom) B1

(b) any **two** lines from:
larger charge
slower moving
more massive
greater volume / more chance of collision
more energy B2

(c) (i) <u>atom</u> is mostly empty space OR nucleus very small OR mass concentrated at centre / nucleus OR greater distance between nuclei B1

(ii) charge concentrated at centre / nucleus B1

[Total: 7]