CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International General Certificate of Secondary Education

MARK SCHEME for the October/November 2015 series

0625 PHYSICS

0625/31 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.

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NOTES ABOUT MARK SCHEME SYMBOLS AND 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 be scored, the point to which it refers must be seen specifically in the candidate's answer.

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.

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 mark.

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, e.g. spelling which suggests confusion between reflection / refraction / diffraction or 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.

cao correct answer only.

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

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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.

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1 **(a)** point marked P (on line or time axis) at $t \geq 2.0$ s B1

(b) **(i)** attempt at gradient OR ($a =$) $\Delta v / t$ OR $(v - u)/t$ OR $240\ (-0)/2.0$
OR division of correct points on graph C1
$120\ m/s^2$ A1

(ii) suggestion of area (under graph) in words or formula or numbers
OR $0.5\ (120 + 240) \times 1.0$ OR $[(120 \times 1.0) + (0.5 \times 120 \times 1.0)]$ C1
180 m A1

(c) mass of sled changes / decreases OR fuel used up B1

[Total: 6]

2 **(a)** **(i)** any scalar quantity other than mass B1

(ii) any vector quantity other than force B1

(b) $F = ma$ in any form OR ($a =$) F/m C1
50 000 / 290 000 OR 50 / 290 C1
$a = 0.17\ m/s^2$ A1

(c) **(i)** 1 cm: 20 000 N / 20 kN B1

(ii) triangle completed B1
230 000 N OR 230 kN in range 220 000 N – 240 000 N / 220 kN – 240 kN B1

by calculation: 110^o
OR by measurement: 108^o – 112^o B1

[Total: 9]

3 **(a)** (g.p.e.=) mgh OR $75 \times 10 \times 880$ C1
$= 6.6 \times 10^5$ J / Nm OR 660 kJ / kNm A1

(b) **(i)** (work =) Fs / Fd OR 220×2800 C1
$= 6.2 \times 10^5$ J / Nm OR 620 kJ / kNm A1

(ii) answer to **(a)** – answer to **(b)(i)** C1
e.g. (k.e.=) $6.6 \times 10^5 - 6.2 \times 10^5 = 4.0 \times 10^4$ J OR 44 kJ
OR $6.6 \times 10^5 - 6.16 \times 10^5 = 4.0 \times 10^4$ J OR 44 kJ A1

(c) (to go faster by) reduced air resistance / drag / resistive force
OR to lower centre of mass OR increase stability / balance B1

[Total: 7]

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4 **(a)** $c = Q/(m\Delta\theta)$ B1

(b) **(i)** $d = m/V$ in any form OR $(m =) Vd$ OR 0.0036×1000 C1
3.6 kg A1

(ii) $(E =) Pt$ OR 8500×60 OR 510 000 J OR 5.1×10^5 J C1
$\Delta\theta = Q/mc$ OR $\Delta\theta = Pt/mc$ in any form OR $5.1 \times 10^5/(3.6 \times 4200)$ C1
$= 34\,(^oC)$ A1

OR $\Delta\theta = P/(\text{mass per second} \times c)$ (C1)
$= 8500/[(0.0036/60) \times 4200$ (C1)
$= 34\,(^oC)$ (A1)

outflow temp = 15 + 33.73 = 49 °C B1

[Total: 7]

5 **(a)** any **two** of motion of smoke particles:
random / haphazard / unpredictable movement;
sudden changes of direction / zig-zag motion;
appear / disappear from view OR go out of / come into focus; B2

any **two** of conclusions about air molecules:
collide with smoke particles OR smoke particles collide with / moved by air molecules;
air molecules fast(er);
air molecules small(er) / light(er);
move randomly; B2

(b) **(i)** **1** (the piston) moves to the right / out(wards) / is pushed away B1
2 (the pressure of the gas) remains constant B1

(ii) (pressure of the gas) increases B1
more frequent collisions (of gas molecules) with piston / walls / container
OR (gas molecules) collide with piston / walls / container with great(er) force B1

[Total: 8]

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6 **(a)** (in compressions) pressure higher OR molecules / atoms / particles close(r) together / (more) tightly packed B1

(b) **(i)** $v = f\lambda$ in any form OR (λ =) v / f OR 340 / 850 C1
= 0.40 m A1

(ii) distance (of compression A from barrier) = 2.5×0.40 OR 1.0 m C1
time (to reach barrier) = $1 / 340 = 2.9 \times 10^{-3}$ s OR 2.9 ms A1

OR T (= 1 / f) = 1 / 850 OR 0.4 / 340 OR 1.2×10^{-3} (C1)
(moves 2.5 wavelengths:) time = $2.5 / 850 = 2.9 \times 10^{-3}$ s OR 2.9 ms (A1)

(c) two circular arcs centred on mid-point of gap in barrier <u>by eye</u> B1
along centre line, arcs separated by the same distance as adjacent compressions approaching barrier B1

(d) (speed in water) greater OR numerical value greater than 340 m / s B1

[Total: 8]

7 **(a)** **(i)** boxes ticked:
enlarged
upright
virtual B3

(ii) E marked anywhere to right of lens B1

(iii) magnifying glass(es) or lens / eyepiece of telescope / microscope / binoculars B1

(b) object in correct position and correct size and F in correct position from label or correct ray intersection with axis B1
two correct rays M1
image between 28 mm and 38 mm from lens and labelled as word or letter A1

[Total: 8]

8 **(a)** (Q =) It OR $4.1 \times 10^{-5} \times 1.6 \times 10^{7}$ C1
= 660 C A1

(b) (R =) V / I OR $1.3 / 4.1 \times 10^{-5}$ C1
= 32 000 Ω OR 32 kΩ A1

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(c) 1st method: (P =) IV OR $4.1 \times 10^{-5} \times 1.3$
OR 2nd method: (P =) I^2R OR $(4.1 \times 10^{-5})^2 \times 32\,000$
OR 3rd method: (P =) V^2/R OR $1.3^2/32\,000$
OR 4th method: (P =) QV / t OR $660 \times 1.3 / 1.6 \times 10^7$ C1

1st and 3rd methods: 5.3×10^{-5} W / 0.000053 W
2nd and 4th methods: 5.4×10^{-5} W / 0.000054 W A1

[Total: 6]

9 **(a)** (step-down) transformer B1

(b) (alternating current causes) magnetic field in core / iron B1
magnetic field changes / alternates B1
field cuts / links with secondary coil OR secondary coil cuts field B1
e.m.f. / voltage **induced** (and current flows in lamp)
OR **induced** current (in lamp) B1

(c) **(i)** $V_1/V_2 = N_1/N_2$ in any form OR $(N_1 =) N_2 \times V_1/V_2$ OR $450 \times 240/12$ C1
= 9000 A1

(ii) tick 4th box B1

[Total: 8]

10 **(a)** **(i)** OR (gate) B1

(ii) 1 input and 1 output labelled <u>with words</u> B1

(iii) correct symbol



B1

(b) **(i)** needle not deflected B1

(ii) needle not deflected B1

(iii) needle deflected either way B1

[Total: 6]

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11 (a) different number of neutrons (in the nucleus) OR different neutron number B1

(b) (i) 1 letter Q at nucleon number = 208 B1
proton number = 81 B1

2 letter R at nucleon number = 212 B1
proton number = 84 B1

(ii) evidence of dividing original number by 2 C1
75 (counts) / min OR 1.25 (counts) / s OR 4500 (counts) / hr A1

[Total: 7]

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