CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the May/June 2013 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.

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.

CAMBRIDGE
International Examinations

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 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, 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 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)** (density =) mass/volume OR mass per unit volume
OR m/V with symbols explained B1

(b) **(i)** (vol =) mass/density OR 60.7/2.70 C1
= 22.48 cm^3 to 2 or more sig. figs A1

(ii) $V = A \times$ (average) thickness OR thickness = V/A
OR 22.48 / (50 × 30) C1
0.01499 cm to 2 or more sig. figs. e.c.f. **(b)(i)** A1

(c) **(i)** micrometer/screw gauge / (vernier/digital) callipers B1

(ii) check zero of device used / cut sheet into several pieces / detail of how to use device / fold sheet B1

measure thickness of sheet <u>in different places</u>
OR measure thickness of several pieces together B1
calculate/obtain average thickness OR divide answer by number of measurements/ pieces/places B1

[Total 9]

2 **(a)** underline or circle force B1
underline or circle velocity B1

(b) **(i)** 4.07 – 4.1 (s) B1

(ii) $(v - u)/t$ OR $\Delta v/t$ OR in words OR use of 40 ÷ (ans. to **(b)(i)**)
OR other correct values from graph C1
answer between 9.7 and 10 m/s^2 or m/s/s A1

(iii) area under graph OR ½ $(u + v)t$ OR ½ × 40 × (ans. to **(b)(i)**) C1
OR $s = ut + ½at^2$ OR $v^2 = u^2 + 2as$ OR numbers substituted
82 m A1

(c) graph continues in straight line to 6 s B1

[Total 8]

3 **(a)** **(i)** **1.** (loss of P.E. =) mgh OR $92 \times 10 \times 1500$ C1
1.38×10^6 J A1
correct use of mgh with h = 500 or 2000 gains 1 mark only

(ii) **2.** (K.E. =) ½ mv^2 OR ½ $\times 92 \times 52^2$ C1
1.244×10^5 J at least 2 sig. figs A1

(a) **(ii)** difference is due to:
(work done in overcoming) air resistance/drag
OR energy converted to/lost as heat (by air resistance/drag) B1

(b) **(i)** increases B1

(ii) 920 N B1

[Total 7]

4 **(a)** **(i)** mention of vacuum OR glass is a poor conductor
OR vacuum/gap between walls has no molecules/atoms/particles B1

(ii) surface/silver (of walls) is good reflector/poor absorber (of radiation) B1
surface/silver (of walls) is poor emitter (of radiation) B1

(b) add a stopper/lid/bung/cover/top to reduce/prevent (loss of heat by) convection/ conduction/radiation/evaporation OR to prevent steam/hot vapour leaving M1 B1

made of insulator OR example of insulator to reduce/prevent (loss of heat by) convection/radiation/evaporation OR to prevent steam/hot air leaving B1

[Total 6]

5 **(a)** **(i)** and **(ii)** marked together to maximum of 3 marks
(i) molecules escape/leave the liquid/form gas or vapour B1

(ii) evaporation OR heat/(thermal) energy needed for evaporation leaves sweat cooler B1
fast(er) molecules/high(er) energy molecules escape
OR slow(er) molecules left behind B1
heat flows from body to warm the sweat (so body cools) B1

(b) **(i)** (Q =) $mc\Delta\theta$ OR mcT OR $60 \times 4000 \times 0.50$ C1
1.2×10^5 J / 120 kJ A1

(ii) $Q = mL$ in any form OR (m =) Q/L OR either with numbers C1
($m = 1.2 \times 10^5 / 2.4 \times 10^6$ =) 0.05 kg e.c.f from **(b)(i)** A1

[Total 7]

6 (a) (i) (pressure =) force/area OR force per unit area OR (P =) F/A with symbols explained B1

(ii) molecules collide with/hit walls/surface (of box) B1
molecule(s) exert force on wall B1
pressure is total force / force of all molecules divided by (total) area of wall B1

(b) (i) (P =) $h\rho g$ OR in words OR $0.25 \times 13\,600 \times 10$ C1
34 000 Pa OR N/m^2 A1
allow 1 mark for h = 250 used and 3.4×10^7 Pa obtained

(ii) ($P = 1.02 \times 10^5 - 34\,000$)
68 000 Pa or N/m^2 B1
e.c.f. from **(b)(i)** only if **(b)(i)** is less than 1.02×10^5

[Total 7]

7 (a) two of:
ray <u>through</u> centre of lens undeviated
ray parallel to axis refracted to right hand focus B2
rays through left hand focus refracted parallel to axis

rays extrapolated to a point B1

accuracy marks: image 6 cm from lens B1
image 6 cm high B1

(b) image is virtual/not real <u>AND</u>
cannot be seen on screen OR no rays come from (position of) image B1

[Total 6]

8 **(a)** 15–25 Hz to 15 000–25 000 Hz / 15–25 kHz B1

(b) **(i)** (region) where air layers/molecules/particles are pushed together/moved together/ closer (than normal)
OR (region) where (air) pressure raised/air (more) compressed/more dense B1

(ii) (region) where air layers/molecules are pushed apart/far(ther) apart (than normal)
OR (region) where (air) pressure reduced/air expanded B1

(c) **(i)** (sound is) loud(er) OR volume (of sound is) increased B1

(ii) sound has a higher frequency/pitch OR higher note (heard) B1

(d) 3.5 – 1.9 OR 1.6 (s) seen OR $v = 2d/1.9$ C1
250 × 2 OR 500 (m) seen OR $v = (2d + 500)/3.5$ C1
(speed = 500 / 1.6 =) 312.5 m / s at least 2 sig. figs A1

[Total 8]

9 **(a)** **(i)** all lamps off

(ii) 12 Ω lamps (only) on B1

(iii) 4 Ω lamps (only) on

(b) **(i)** 12 V B1

(ii) $I = V/R$ in any form OR V/R OR 12/12 C1
1.0 A OR 1 A A1
e.c.f. from **(b)(i)**

(c) current in 4 Ω lamp = 3 (A) (current in 12 Ω lamp is in **(b)(ii)**) C1
(P =) IV OR I^2R C1
(P =) 36 W for 4 Ω lamp; P = 12 W for 12 Ω lamp A1
e.c.f. from **(b)(ii)**
OR
(P =) V^2/R (C1)
(P =) $12^2/4$ = 36 W for 4 Ω lamp OR $12^2/12$ = 12 W for 12 Ω lamp (C1)
(P =) $12^2/4$ = 36 W for 4 Ω lamp AND $12^2/12$ = 12 W for 12 Ω lamp (A1)
OR
(P =) V^2/R (B1)
Same V for all lamps (M1)
4 Ω lamp has higher power / 12 Ω has lower power (A1)

[Total 7]

10 (a) at least 3 concentric circles centred on wire B1
arrows clockwise on each circle / at least one circle B1
spacing of circles increasing as radius increases B1

(b) (i) arrow pointing down on side AB, up on side CD B1

(ii) forces on AB and CD are opposite OR up and down and separated / not in same line (so cause rotation)
OR have moments in same sense / direction
OR cause couple / torque B1

(iii) to reverse current in loop or keep current in AB or CD in the same direction
OR keep current on side near a pole in the same direction when (plane of) coil is vertical
OR every half turn
OR when AB and CD swap sides B1
so that:
rotation continues (in same direction)
OR so that rotation doesn't reverse its direction
OR to maintain sense/direction of moments/couple
OR coil turns more than half a revolution B1

[Total 7]

11 (a) (i) 2 protons B1
2 neutrons B1

(ii) a (fast moving) electron B1

(b) electron/electrons removed from/gained by the molecule B1

(c) (i) force because particle is charged
OR the force on the particles is perpendicular to their paths
OR direction of force changes as direction of motion changes B1

(ii) α-particle curve up the page in at least half of width of field B1

β-particle curve opposite to α-particle curve OR down page if α line has no curvature anywhere B1
smaller radius of β path clear B1

[Total 8]