CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International General Certificate of Secondary Education

MARK SCHEME for the May/June 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.

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 which can be scored even if the points 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 working which shows he knew the equation, then the C mark is scored.

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.

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.

c.a.o. means "correct answer only".

e.c.f. means "error carried forward". This indicates that if a candidate has made an earlier mistake and has carried his incorrect value forward to subsequent stages of working, he may be given marks indicated by e.c.f. provided his subsequent working is correct, bearing in mind his earlier mistake. This prevents a candidate being penalised more than once for a particular mistake, but **only** applies to marks annotated "e.c.f."

e.e.o.o. means "each error or omission".

owtte means "or words to that effect".

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.

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

Spelling Be generous with spelling and use of English. However, do not allow ambiguities, e.g. spelling which suggests confusion between reflection / refraction / diffraction or thermistor / transistor/ transformer.

Sig. figs. On this paper, answers are generally acceptable to any number of significant figures $\geqslant 2$, except where the mark scheme specifies otherwise or gives an answer to only 1 significant figure.

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**.

Fractions Fractions are only acceptable where specified.

Extras If a candidate gives more answers than required, irrelevant extras are ignored; for extras which contradict an otherwise correct response, or are forbidden by the mark scheme, use right plus wrong = 0.

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

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.

1 (a) (i) acceleration OR increasing speed C1

constant acceleration OR constant rate of increase in speed A1

(ii) decreasing acceleration OR decreasing rate of increase in speed
NOT deceleration B1

(b) mention of air resistance AND weight (of object) / force due to gravity B1

acceleration at start (of fall) is acceleration of gravity / 10 m / s^2 / a maximum / g
OR acceleration decreases (as it falls) B1

air resistance increases as speed increases/as it accelerates B1

acceleration zero/terminal velocity/constant speed/maximum speed when
air resistance = weight B1

[Total: 7]

2 (a) (i) (P =) $F \div A$ OR $3.5 \times 10^4 \div 0.25$ C1
$= 1.4 \times 10^5$ Pa ecf **(i)** A1

(ii) ($1.4 \times 10^5 - 1.0 \times 10^5$ =) $4(.0) \times 10^4$ Pa ecf **(ii)** B1

(iii) $P = h\rho g$ in any form OR (h =) $P \div \rho g$ OR $4.0 \times 10^4 \div (1020 \times 10)$ C1
= 3.9 m OR 4 m A1

(b) any 2 from: max. B2
- weight of block
- upward force of water (on block) / upthrust (of water on block)
- weight of cable

(c) (tension force) becomes smaller or zero B1

[Total: 8]

3 (a) $W = mg$ in any form OR (m =) $W \div g$ OR $80\,000 \div 10$ C1
8000 kg A1

(b) $\rho = m \div V$ in any form OR (V =) $m \div \rho$ OR $8000 \div 1000$ C1
= 8.0 m^3 ecf **(a)** A1

(c) mgh OR weight $\times h$ OR $8000 \times 10 \times 4$ C1
= 320 000 J OR 320 kJ ecf **(a)** A1

(d) (efficiency =) output (energy) ÷ input (energy) (× 100)
OR 96 ÷ 320 (× 100) C1

= 0.30 OR 30% ecf **(c)** A1

[Total: 8]

4 (a) (i) any 2 from: max. B2
- liquid molecules not in fixed positions / can move about / move past each other OR solid molecules have a fixed position
- liquid molecules have random arrangement OR solid molecules arranged regularly / in patterns / layers / lattice
- liquid molecules are (slightly) further apart (than solid molecules) OR reverse argument

(ii) energy / work / thermal energy / (latent) heat required
AND
to break bonds (between molecules) / to overcome attractive forces (between the molecules) / to increase the potential energy of the molecules B1

(b) (i) $E = ml$ in any form OR ml OR $1.65 \times 330\,000$ C1
= 540 000 J OR 544 500 J A1

(ii) chemical (energy in body) converted to thermal / internal (energy) B1

[Total: 6]

5 (a) energy/heat required to increase temperature
- of 1 kg / 1 g / unit mass (of the substance) B1
- by 1 °C / 1 K / unit temperature B1

(b) $E = mc\Delta\theta$ in any form OR (c =) $E \div m\Delta\theta$ C1
$E = Pt$ in any form OR 420 × 95 (= 39 900) C1
$\Delta\theta$ = [40.5 – 19.5] OR 21 C1
(c = 39 900÷42 =) 950 J/(kg °C) A1

(c) any two separate points from: max. B2
- lagging / insulation (around block) OR insulate (the block)
- raise temperature of block by a smaller amount OR heat for a shorter time OR use lower power heater for same time OR higher power for same temperature rise / shorter time
- polish the surface of the block OR wrap the block in shiny material OR paint (shiny) white
- reduce initial temperature of block (to below room temperature) OR raise temperature of room
- reduce draughts

[Total: 8]

6 **(a)** **(i)** any value between 6 and 7 mm seen C1

26 ± 2 mm OR 2.6 ± 0.2 cm A1

(ii) $v = f\lambda$ in any form OR $(f =)\ v \div \lambda$ OR $0.39 \div 0.026$ C1
= 15 Hz ecf **(i)** A1

(b) at least 4 wavefronts showing refraction in correct direction B1
7 parallel wavefront lines continuous with those in fast region B1

(c) unchanged / nothing B1

[Total: 7]

7 **(a)** **(i)** all three of: max. B2
- virtual,
- upright / erect / same way up,
- magnified / large(r) (than object)

award 1 mark for one or two correct description(s) which are not contradicted

(ii) RS B1

(iii) eye placed to right of lens B1

(b) any two correct rays from: max. B2
- ray parallel to axis refracted through F
- ray passing through centre of lens undeflected
- ray through added focus to left of lens refracted parallel to axis

image from intersection of rays clearly shown as inverted B1

3 correct rays drawn on Fig. 7.2, from tip of O to intersection of other two rays and refracted correctly at lens
note: the third ray does not have to be one of those listed above B1

[Total: 8]

8 **(a)** **(i)** (magnetic) field (lines) of magnet cut by turns / coil / wire
OR (magnetic) field linked with coil changes B1

(ii) **1** (needle of meter) deflects to the left (and returns to zero) B1

2 (needle of meter) deflects to right and left (alternately) B1
OR to and fro

(b) (i) $N_p/N_s = V_p/V_s$ in any form OR (N_s =) $N_p V_s/V_p$ OR $8000 \times 6/240$ C1
OR (V_p/V_s =) 40
(N_S =) 200 A1

(ii) **1** ($P = IV = 0.050 \times 240$ =) 12 W B1

2 0.9×12 OR 10.8 OR $I_s V_s = 0.9\ I_p V_p$ OR $I_s = 0.9\ I_p V_p / V_s$ C1
OR $0.9 \times 0.05 \times 240/6$
(I_s =) 1.8 A ecf **1.** A1

[Total: 8]

9 (a) (i) $1/R = 1/R_1 + 1/R_2$ OR $R = R_1R_2/(R_1 + R_2)$ OR with numbers C1
(R =) 500 Ω A1

(ii) I = (12 ÷ 1000) = 0.012 A ecf **(i)** B1

(iii) (V =) IR OR 0.012×500 OR $12 \times 500 \div 1000$ C1
= 6.0 V ecf **(i)(ii)** A1

(b) (more current in circuit so) current (in 500 Ω resistor) increases B1

resistance of parallel combination decreases
OR total resistance (of circuit) decreases B1

[Total: 7]

10 (a) (i) at least three horizontal, parallel lines evenly spaced (ignore edge effects) B1

arrows pointing left to right B1

(b) right hand half of ball has more + signs than – signs
AND left hand half of ball has more – signs than + signs M1

equal numbers of + and – signs A1

(c) $Q = I\,t$ in any form OR (I =) $Q \div t$ OR $2.8 \times 10^{-8} \div 0.05$ C1
5.6×10^{-7} A OR C/s A1

[Total: 6]

11 (a) electromagnetic (waves / radiation / rays / spectrum) B1
OR (high energy) photons

(b) α and β deflected in opposite directions B1

any 1 from: B1
- β deflected more (than α)
- deflections perpendicular to field direction and to paths of particle
- paths (of particles) are curves / circular / arcs

(c) curved path B1

(deflected/attracted) towards positively charged plate B1
OR in opposite direction to field

(d) **(i)** α-particle OR helium nucleus OR 2 protons + 2 neutrons B1

(ii) A = 210 Z = 84 B1

[Total: 7]