CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the October/November 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 October/November 2013 series for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level components and some Ordinary Level components.

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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 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. However, do not allow ambiguities, 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. 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 e.c.f. may be awarded, provided the subsequent working is correct.

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.

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 Only accept these where specified in the mark scheme.

1 **(a)** extension (of spring) proportional to load / force (applied)
OR load / force (applied) proportional to extension
OR force = constant × extension
OR extension = constant × force
OR $F = kx$ in any form with symbols explained — B1

(b) **(i)** graph is through the origin AND is a straight line / has a constant gradient — B1

(ii) $F = kx$ in any form OR (k =) F/x — C1
use of a point anywhere on graph e.g. 50 / 20 — C1
2.5 N / mm OR 2500 N / m — A1

(iii) from 50 mm extension, graph curves with no negative gradient — B1

(iv) straight line through origin with smaller gradient than graph shown finishing at more than 50 mm — B1

[Total: 7]

2 **(a)** **(i)** $v = u + at$ OR (a =) $(v - u)/t$ OR $24 = a \times 60$ OR $24/60$ — C1
$0.4(0)\ m/s^2$ — A1

(ii) (F =) ma OR $7.5 \times 10^5 \times 0.40$ — C1
300 000 N OR 300 kN — A1

(b) **(i)** in words or symbols (P =) W/t OR F x d / t OR Fv
OR $7.2 \times 10^4 \times 24 / 1$ OR OR $7.2 \times 10^4 \times 24$ — C1
1.7×10^6 W — A1

(ii) gravitational/potential energy of train has to be increased
OR force acts down the slope / backward force acts (on train) — B1

(for the same distance moved) more work done has to be done OR energy has to be provided (by the engine) — B1
in the same time (so needs more power) — B1

[Total: 9]

3 **(a)** **(i)** 3 appropriate examples: e.g. spanner, scissors, tap etc. –1e.e.o.o. — B2

(ii) there is a resultant force OR more force down than up — B1
there is a resultant moment OR clockwise moment is not equal to anticlockwise moment — B1

(b) **(i)** $F \times 0.5 = 12 \times 0.3$ — C1
7.2 N — A1

(ii) weight has no moment about centre of rod / has no perpendicular distance from centre of rod
OR weight acts at centre of rod / pivot / centre of mass — B1

[Total: 7]

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

(ii) chemical energy to (gravitational) potential energy B1

reference in **(i)** or **(ii)** to heat / thermal / internal energy produced OR work done against air resistance or friction B1

(b) **(i)** (K.E. =) $\frac{1}{2}mv^2$ OR $0.5 \times 940 \times 16^2$ C1
1.2×10^5 J A1

(ii) in words or symbols $Q = mc\theta$ OR $\theta = Q/mc$ C1
$1.203 \times 10^5 = 4.5 \times 520 \times \theta$ OR $\theta = 1.203 \times 10^5 / (4.5 \times 520)$ C1
51 °C or K A1

[Total: 8]

5 **(a)** **(i)** heated air / warm air rises / moves up (not sideways) B1

(ii) air (between plate and hands) is a poor conductor / does not conduct B1

(b) left hand / palm (facing matt black side gets hotter)
OR hand facing matt black side (gets hotter) B1
matt black side is a better emitter / radiator (of heat than shiny side) B1

(c) conduction takes place B1
copper a good conductor / conduction is rapid / heat flows to equalise temperature B1

[Total: 6]

6 **(a)** molecules OR atoms OR particles
speed OR velocity OR kinetic energy
molecules OR atoms OR particles
(Surface) area B2
any four correct gains 2 marks, two or three correct gains 1 mark

(b) **(i)** (when cap is screwed on) at top of mountain:
pressure of air in bottle = the low pressure of the air outside
OR is less than pressure at bottom of mountain
OR is low B1

(at bottom of mountain) bottle collapses because pressure outside (bottle) is greater than pressure inside B1

(ii) Boyle's law applies OR PV = constant OR $P_1V_1 = P_2V_2$ C1
$9.2 \times 10^4 \times V = 4.8 \times 10^4 \times 250$ C1
130 cm^3 A1

[Total: 7]

7 **(a)** **(i)** diffraction B1

(ii) waves travel slow(er)/water is shallow(er) B1

(iii) angular spread of wavefronts increases o.w.t.t.e.
OR amplitude of waves is smaller B1

(b) **(i)** oscillation/up and down motion (of rope) is at right angles to the direction of the wave
OR motion of rope/particles is at right angles to the direction of the wave B1

(ii) λ = 2.4/2 = 1.2 m C1
$v = f\lambda$ in any form OR (f =) v/λ OR 3.2/1.2 C1
2.7 Hz A1
OR
t = 2.4/3.2 (C1)
f = 2 × 3.2/2.4 (C1)
2.7 Hz (A1)

[Total: 7]

8 **(a)** circuit with solenoid AND galvanometer or ammeter or voltmeter B1

magnet labelled OR poles shown, with any orientation, near solenoid OR inside solenoid B1
appropriate action described e.g. move magnet/solenoid B1

(b) **(i)** magnetic field (in core) M1
(magnetic field is) alternating/changing/reversing A1

(ii) same frequency a.c. ticked B1

(iii) $V_S/V_P = N_S/N_P$ in any form OR (V_S =) 12 × 200/50 OR 48 (V) C1
$V_S I_S = V_P I_P$ in any form OR with numbers C1
(I_S =) 12 × 0.50/48 = 0.12 A OR 0.13 A A1
OR
$I_S/I_P = N_P/N_S$ in any form (C2)
(I_S =) 0.5 × 50/200 = 0.12 A OR 0.13 A (A1)

[Total: 9]

9 **(a)(i)(ii)** $R \propto L$ in words or symbols

(ii) AND $R \propto 1/A$ in words or symbols B1

(b) $P = IV$ OR (I =) P/V OR 60/230 C1
0.26 A A1

(c) length change divides resistance by 2 / multiplies current by 2 — C1
cross-section change multiplies resistance by 3 / divides current by 3 — C1
(overall) resistance of Y is 3/2 times bigger / 3/2 × 885 Ω / 1327 Ω
OR current in Y 2/3 of 0.26 A = 0.17 A — C1
current in Y / Current in X = 2/3 — A1

[Total: 7]

10 (a) between plates path curves upwards continuously — B1
continuation in straight line in space beyond plates — B1

(b) (i) in range 7.0 to 7.5 V — B1

(ii) use of the number 4 (as a distance or a time) — C1
$f = 1/T$ OR ¼ OR 1/0.004 but NOT if $f = v/\lambda$ used — C1
250 Hz — A1

[Total: 6]

11 (a) (i) input high / on / 1, output low / off / 0
input low / off / 0, output high / on / 1
OR reverses / inverts state of input OR output opposite to input — B1

(a) (ii) resistance changes as temperature changes — B1

(i) at low temperature resistance of thermistor is high
OR when temperature falls resistance of thermistor rises — B1
p.d. across thermistor is high OR p.d. across R is low — B1
(voltage) input to gate is low — B1
output of gate is high (and warning light is on) — B1

(ii) changes the temperature / set value at which the lamp comes on — B1

[Total: 7]