UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the October/November 2010 question paper for the guidance of teachers

0625 PHYSICS

0625/32 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 must be read in conjunction with the question papers and the report on the examination.

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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 marks 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.

<u>underlining</u> indicates that this <u>must</u> 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, but rarely, 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.

c.a.o meaning "correct answer only"

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 exceptions

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.

Arithmetic errors Deduct one mark if the **only** error in arriving at a final answer is clearly an arithmetic one.

Fractions e.g. ½, ¼, 1/10 etc are only acceptable where specified.

1 **(a)** all points plotted correctly ±½ small square B1
smooth curve through points, by eye B1

(b) **(i)** decreasing OR idea of greater at greater heights NOT decelerating B1

(ii) increasing OR idea of slower at greater heights NOT accelerating B1

(c) idea of resultant force becomes zero B1

(d) decreasing/slowing down, ignore deceleration NOT accelerating B1

(e) $F = ma$ in any form, letters, words, numbers C1
(a =) 3.6 (m/s^2) c.a.o. C1
(F =) 216 N / 220 N A1

[Total: 9]

2 **(a)** mgh OR 0.15 × 10 × 0.3 C1
0.45 J A1

(b) **(i)** idea of max KE at lowest point OR h = 0.1 C1
idea of PE lost = KE gained C1
0.15 × 10 × 0.1 OR 0.15 × 10 × 0.2 C1
0.15 J c.a.o. A1

(ii) (KE =) ½mv^2 OR 0.15 = ½ × 0.15 × v^2 e.c.f.
OR gh = ½v^2 OR 10 × 0.1 = ½v^2 e.c.f. C1

(v =) 1.4 m/s e.c.f. as long as mass correct A1

(iii) 0.3 m B1

(iv) cord straight B1
bob at same height as original M1
straight cord at approx 30° to vertical, by eye A1

[Total: 12]

3 **(a)** **(i)** 120 Ncm OR 1.2 Nm B1

(ii) 60 Ncm OR 0.6 Nm B1

(iii) idea of CW moments = ACW moments C1
$60 + 20F = 120$ OR $0.6 + 0.2F = 1.2$ e.c.f. C1
3.0 N OR 3 N e.c.f. A1

(b) $1.2 \times 20 = 2.0 \times d$ OR $1.2 \times 0.2 = 2.0 \times d$ C1
(d =) 12 OR 0.12 C1
18 c.a.o. OR special case (30 – his 12) correctly evaluated B1 A1

[Total: 8]

4 **(a)** **(i)** good conductor (of heat) B1
(ignore electricity)

(ii) black is good absorber/bad reflector B1
(ignore emitter)

(iii) reduce heat lost/conducted away (from pipes/sheet) B1
NOT prevents heat loss o.w.t.t.e.

(iv) air heated OR glass reduces/prevents convection
OR greenhouse effect OR reference to far and near I.R.
OR glass prevents warm air being blown away OR traps air B1
Ignore traps heat

(b) 38 – 16 OR 22 C1
$mc\theta$ OR $250 \times 4200 \times$ his 22 C1
2.31×10^7 (J) e.c.f from previous line C1
9.24×10^7 J OR e.c.f from previous line × 4 correctly evaluated A1
No unit penalty if J seen anywhere in **(b)** clearly applied to an energy

[Total: 8]

5 **(a)** racing car + 1 correct reason M1
2nd correct reason A1
correct reasons:
- wider (car)
- lower (centre of mass/gravity) NOT wider tyre/surfaces o.w.t.t.e.

(b) larger/wider tyres/area (of contact) ignore base area B1

(c) F/A OR 9600/0.012 OR 9600/0.048 OR 9600/(4 × 0.012)
OR 800,000 C1
2×10^5 Pa OR 200 000 Pa (accept N/m^2) c.a.o. A1

[Total: 5]

6 (a) analogue any reading possible/idea of continuous variation of value of quantity B1

digital idea of two states only B1

(b) if both inputs are 1/high, the output is 1/high B1
only added to previous line
OR if either or both inputs are 0/low, then output is 0/low B1
(accept both answers in form of a truth table)

[Total: 4]

7 (a) (E =) Pt symbols or numbers OR 100 × 13 × 3600 OR 0.1 × 13
OR 3 960 000 OR 4 320 000 C1
4 680 000 J OR 4.68 MJ OR 1.3 kWh OR 1300 Wh A1

(b) EITHER

$I = P/V$ in any form OR P/V OR 100/250 OR 0.4 A C1
$Q = It$ OR 0.4 × 13 × 3600 OR candidate's current × 13 × 3600
OR candidate's current × candidate's time in s C1

18 720 C e.c.f A1

OR

volts = joules/coulombs in any form C1
4680000/250 OR candidate's E/250 C1
18 720 C e.c.f A1

(c) (lost as/changed to) heat/light OR lost to air/surroundings B1

[Total: 6]

8 **(a)** a.c./changing current (in primary))
magnetic flux/field/force in core)
alternating/changing magnetic field) any 3 B1 × 3
accept without magnetic if used in previous line
field cuts secondary)
changing flux linkage in (secondary))
induces emf/current in (secondary))

(b) more/increasing turns on secondary OR less/decreasing turns on primary
OR step up B1

(c) $V_1I_1 = V_2I_2$ in any form OR $24\,000 \times 12\,000 = 400\,000 \times I_2$ C1
720 A A1

(d) less heat/energy/power loss OR more efficient energy transfer)
thinner/smaller cables)
less metal used) any 2 B1+B1
less massive pylons)
ignore less electricity loss

[Total: 8]

9 **(a)** refracts/bends/changes direction NOT curves
Ignore converges/reflection)
downwards/inwards/towards F_1/focal point/normal)
speed change/reduces on entering glass OR change of n) any 3 B1 × 3
OR change of density)
idea of meets surface at an angle/one part of wave hits surface first)
splits into colours)

(b) **(i)** all 3 rays through F_1 M1
all refractions correct
and either all at lens centre line or all at both surfaces A1

(ii) straight line through F_1 and F_2 B1

(c) **(i)** X between vertical line through F_1 and vertical line through F_2 B1

(ii) virtual)
upright)
enlarged) any 3 B2
same side (of lens as object)) - 1 e.e.o.o.
further from lens (than object))

[Total: 9]

10 (a) **top** bent down to R of layer B1
middle straight on B1
bottom deflected back to left B1
for all 3 ignore subsequent curving away from layer of nuclei

(b) (i) deflection > 90°/the bottom one B1

(ii) positive ignore numbers B1

(iii) nothing/vacuum/space/electrons B1

[Total: 6]

11 (a) 11 protons, 11 electrons -1 e.e.o.o. B2

(b) 24 B1

(c) same/identical ignore (very) similar B1

(d) 14 B1

[Total: 5]