UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the October/November 2009 question paper for the guidance of teachers

0625 PHYSICS

0625/31 Paper 31 (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.

- CIE will not enter into discussions or correspondence in connection with these mark schemes.

CIE is publishing the mark schemes for the October/November 2009 question papers for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.

NOTES ABOUT MARK SCHEME SYMBOLS AND OTHER MATTERS

B marks are independent marks, which do not depend on any other marks. For a B mark to be scored, the point to which it refers must actually be seen 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 method 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. e.g. 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.

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".

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.

Spelling Be generous about spelling and use of English. If an answer can be understood to mean what we want, give credit.

Significant Figures Answers are acceptable to any number of significant figures ≥ 2, except if specified otherwise, or if only 1 sig.fig. is appropriate.

Units It is expected that all final answers will have correct units. Deduct one unit penalty for each incorrect or missing unit, maximum 1 per question. No unit penalty if unit is missing from final answer but is shown correctly in the working. No unit penalty for incorrect answer.

Fractions These are only acceptable where specified.

Extras Ignore extras in answers if they are irrelevant; if they contradict an otherwise correct response or are forbidden by mark scheme, use right + wrong = 0

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

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.

Work which has been crossed out, but not replaced, should be marked as if it had not been crossed out.

1 **(a)** micrometer OR screw gauge OR vernier scale NOT vernier callipers — B1

(b) 2.73 mm — B1

(c) check/set zero)
close instrument on to paper)
not too tight/use ratchet) any 3 — B1 × 3
take reading of both scales)
use several sheets)
divide reading by no. of sheets)

[5]

2 **(a)** measuring cylinder with liquid — B1
immerse statue — B1
volume from difference of readings from measuring cylinder — B1
OR
displacement can/equivalent/beaker, filled to overflowing with liquid — (B1)
immerse statue — (B1)
measure volume displaced with measuring cylinder — (B1)

(b) (D =) M/V OR 600/65 — B1
9.23 g/cm^3 (minimum 2 s.f.) N.B. unit penalty applies — B1
OR
(For gold) (M =) V × D OR 65 × 19 — (B1)
1235 g (minimum 2 s.f.) N.B. unit penalty applies — (B1)
OR
(For gold) (V =) M / D OR 600/19 — (B1)
31.6 cm^3 (minimum 2 s.f.) N.B. unit penalty applies — (B1)

'NO' ticked if justified by previous work in **(a)** or **(b)**.
e.c.f from wrong values above — B1

[6]

3 **(a)** 5 points correctly plotted ±½ small square –1 e.e.o.o. (ignore 0,0) — B2

(b) 3 N one, however identified OR 3rd value OR 4th value — B1

(c) good straight line through origin and candidate's remaining points — B1

(d) straight line / constant gradient — M1
does obey Hooke's Law — A1
OR
special case: obeys Hooke's law because force ∝ extension or wtte — B1

(e) graph becomes non-linear / curves / bends B1
Ignore reference to direction of curve or bend.

(f) will have exceeded / reached proportional / elastic limit
OR permanently deformed or equiv OR staightened
OR will have broken OR no longer elastic or wtte B1

[8]

4 **(a)** in direction of the force Do not accept forward on is own. B1

(b) changes direction / causes acceleration / stops straight line motion / keeps object from leaving circle / keeps path circular / pulls object into circle B1

(c) **(i)** 1. 600 N B1
2. same as his 1. accept 600 N if no value given in **(c) (i)** 1. B1

(ii) ma OR 60 × 2.5 C1
150 N A1

(iii) 750 N e.c.f. from **(c) (i)** 2 and/or **(c) (ii)** B1

(iv) same as his **(c) (i)** 2 accept 600 N if no value given in **(c) (i)** 2. B1

[8]

5 **(a)** (P.E.) = mgh C1
12 × 10 × 3 Accept g = 9.8 or 9.81 C1
360 J g = 9.8 gives 352.8 J (minimum 2 s.f.) A1
g = 9.81 gives 353.16 J (minimum 2 s.f.)

(b) (P =) E/t C1
360/60 C1
6 W 352.8 J gives 5.88 W 353.16 J gives 5.886 W (minimum 2 s.f.) A1

[6]

6 **(a)** **(i)** increases B1

(ii) pV = const in any form C1
1.05 (× 10^5) × 860 (× 10^{-6}) = p × 645 (× 10^{-6}) C1
1.4 × 10^5 Pa A1

(iii) F = pA in any form accept weight for F C1
EITHER increase in pressure = 0.35×10^5 (Pa) C1
$0.35 \times 10^5 \times 5.0 \times 10^{-3}$ C1
175 N (minimum 2 s.f.) c.a.o. A1
OR $1.05 \times 10^5 \times 5.0 \times 10^{-3}$ or 525 N or $1.4 \times 10^5 \times 5.0 \times 10^{-3}$ or 700 N (C1)
700 – 525 N e.c.f. from **(a) (ii)** (C1)
175 N (minimum 2 s.f.) c.a.o. (A1)

(b) (i) increases B1

(ii) no change B1

(iii) extra weight (on tray/piston) B1

(iv) increases B1

[12]

7 (a)

EITHER	OR
copper	constantan
copper	constantan
constantan	copper

B1

(b) galvanometer OR <u>milli</u>voltmeter OR <u>milli</u>ammeter OR <u>digital</u> ammeter OR <u>digital</u> voltmeter B1

(c) rapid response)
small area)
can measure high / low temperatures)
small thermal capacity (idea of)) any 1 B1
remote reading)
large range)
data logging / continuous monitoring possible)
takes temperature of a surface)
N.B. (very) sensitive not accepted

[3]

8 (a) 2 cm (by eye) vertical object somewhere between F_2 and lens (condone no O, if clear) B1

(b) any two standard rays correctly drawn (no extrapolation needed) B1
correct rays extrapolated <u>back</u> to intersect B1
virtual image drawn at candidate's intersection of extrapolated rays (condone no I, if clear) B1

[4]

9 **(a)** (quantity of) heat/energy to raise temp by 1 °C/1degC/1K/unit temp rise M1
1 kg OR 1 g OR unit mass (Mention of change of state gets M0 A0) A1

(b) long time to heat up/cook)
long time to cool down) any 1 B1
expensive to heat)
takes a lot of energy to heat up)

(c) **(i)** 1.8 degC OR 1.8 °C OR 1.8 K
AND 77.1 degC OR 77.1 °C OR 77.1K B1

(ii) (Q =) mcT in any form, seen anywhere B1
0.2 × 4200 × 1.8 e.c.f. from **(c) (i)** C1
1512 J (minimum 2 s.f.) c.a.o. A1

(iii) 1512 = 0.05 × c × 77.1 in any form e.c.f. from **(c) (i)** and/or **(c) (ii)** C1
392 J/kg K (N.B. must be to 3 sf ; A0 for wrong s.f.) e.c.f. A1

(iv) heat lost during transfer)
boiling water not at 100 °C / reason for not boiling
at 100 °C e.g. water not pure/ not standard pressure)
energy lost to cup etc. / surroundings) any 1 B1
thermometer not accurate / sensitive enough)
temperature / mass(es) not accurately measured)

[10]

10 **(a)** **(i)** <u>step-up</u> transformer B1

(ii) less heat/energy/power loss (from lines) / thinner wires (possible) B1
OR lower current NOT more efficient

(b) P = V × I in any form, figures or symbols / (P =) VI C1
2.5 A A1

(c) P = I^2R in any form, figures or symbols / (P =) I^2R C1
18.75 W e.c.f. from **(b)** A1

(d) V = IR in any form, figures or symbols OR (V =) IR OR
P = V^2 / R in any form, figures or symbols OR (P =) V^2 / R OR V = $(PR)^{1/2}$ C1

7.5 V e.c.f. from **(b)** or **(c)** A1

(e) 22,000 – 7.5 – 7.5 OR 22,000 – 7.5 ecf C1
21,985 V e.c.f. (minimum 4 s.f.in this case) A1
OR
55,000 – 37.5 = 54962.5 (C1)
54962.5 / 2.5 = 21985 V (minimum 4 s.f. in this case) (A1)

[10]

11 **(a)** A NOT or inverter B1
B AND B1

(b) (accept 1 or ON for HIGH, and 0 or OFF or NOT HIGH for LOW throughout)

(i) A – HIGH and B – LOW (both) no e.c.f. B1

(ii) A – HIGH and B – HIGH (both) no e.c.f. B1

(iii) A – LOW and B – LOW (both) no e.c.f. B1

(c) **(i)** B cannot provide enough power / current for lamp, or equiv.
OR allows remote lamp B1

(ii) the second one / dark and warm / HIGH, HIGH e.c.f. from **(b)** B1

(iii) warning if temperature in a closed / dark space (e.g. refrigerator, kiln) reaches too high a value
N.B. "to switch on a lamp when it is dark and warm" not accepted B1

[8]