UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the October/November 2011 question paper

for the guidance of teachers

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

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

Cambridge is publishing the mark schemes for the October/November 2011 question papers for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.

NOTES ABOUT MARK SCHEME SYMBOLS & OTHER MATTERS

M marks — are method marks upon which further marks depend. For an M mark to be sc the point to which it refers **must** be seen in a candidate's answer. If a candida 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 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.

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.

<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.

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.

ecf	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 ecf.
Sig. figs.	Answers are normally acceptable to any number of significant figures ≥ 2. Any exceptions to this general rule will be specified in the mark scheme. In general, accept numerical answers, which, if reduced to two significant figures, would be right.
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.
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	These are only acceptable where specified.

1 **(a)** acceleration = $\frac{v-u}{t}$ OR $\frac{\Delta v}{t}$ (symbols used to be explained)
OR change of velocity ÷ time
OR rate of change of velocity
OR change of velocity per second / in 1 sec (allow 'in a certain time') — B1
accept speed for velocity

(b) **(i)** use of any area under graph — C1
750 m — A1

(ii) time = change of speed ÷ acceleration OR 30/0.60 — C1
= 50 (s) — A1
if working for t = 50 s not shown, allow 2 marks for correct use of 50 s
graph: along y-axis to 180 s / rise starts at 180 s — B1
from x-axis rises to 30 m/s at 230 s / candidate's calculated time — B1
horizontal from top of slope to 280 s — B1 [8]
allow ½ square tolerance at 180 s where relevant
allow ecf from wrong t

2 **(a)** two processes from:
vapour rising
condensation
rain falling
water falling from lake / through pipes
water turns turbine / generator
electricity generated. — max B2

energy changes:
PE to KE matched to a process — B1
KE to electricity energy for turbine / power station — B1

(b) **(i)** (PE =) mgh OR $2 \times 10^5 \times 10 \times 120$ allow g = 9.8 or 9.81 — C1
2.4×10^8 J — A1

(ii) (KE of water =) $\frac{1}{2}mv^2$ OR $\frac{1}{2} \times 2 \times 10^5 \times 14^2$ — C1
1.96×10^7 J OR 2.0×10^7 J — A1 [8]

3 **(a)** 1. no resultant force acts / no net force acts
OR total force up / in any direction = total force down / in opposite direction — B1
allow sum of forces or resultant force for total force

2. no resultant moment / couple / torque acts
OR (sum of) clockwise moments and (sum of) anti-clockwise moments (about any point / axis) balance — B1

(b) **(i)** (anti-clockwise moment =) $F \times 2$ — C1
(total clockwise moment =) $(120 \times 33) + (20 \times 15) = 4260$ (N cm) — C1
2130 N — A1

(ii) 1990 N OR candidate's **(b)(i)** – 140 N — B1
force is downwards — B1 [7]

4 **(a)** surfaces shown at realistic levels in dish and tube AND vertical height *h* between levels clearly shown — B1
top label: vacuum / mercury vapour — B1
bottom label: mercury — B1

(b) $(P =)\ hdg$ OR $0.73 \times 13600 \times 10$ — C1
99280 Pa at least 2 s.f. — B1

(c) one from:
abnormal weather / atmospheric conditions o.w.t.t.e.
air in space above mercury in tube
barometer is in a high altitude location o.w.t.t.e.
space above mercury is not a vacuum — B1 [6]
ignore atmospheric pressure varies ignore temperature

5 **(a)** **(i)** most: gas
least: solid both required — B1

(ii) because change of pressure (also) causes volume change (in a gas) — B1
NOT 'gas can be compressed'

(b) **(i)** two from:
expands uniformly (over required range)
remains liquid over required range
expands more than glass / has high expansivity / expansion
has (reasonably) low specific heat capacity.
has low freezing point / lower freezing point than mercury — max B2

(ii) make (capillary) tube narrower (and longer) / thinner / smaller diameter — B1
make bulb larger (and tube longer) — B1
allow 'bore' for tube ignore 'smaller' ignore narrow <u>thermometer</u>

(c) allows fast(er) flow of heat to / from alcohol
OR allows fast response (to temperature change)
OR because glass is a poor conductor / good insulator (so needs to be thin for fast response)
OR heat transfer more efficient / faster
OR glass takes up less heat — B1 [7]
ignore reference to sensitivity ignore 'easier'

6 (a) (i) 1. compressions and/or rarefactions closer together
OR more compressions and/or rarefactions — B1
ignore wavelength shorter

2. layers closer together at compressions — B1
layers farther apart at rarefactions — B1
OR
compressions narrower — (B1)
rarefactions wider — (B1)
ignore wavelength shorter ignore 'amplitude greater' ignore 'maximum displacement greater'

(ii) distance between 2 compressions or 2 rarefactions shown with reasonable accuracy — B1

(b) time taken by sound in air = 200 / 343 = 0.583 s — C1
time taken by sound in steel = 0.583 – 0.544 = 0.039 s — C1
5128 m/s — A1 [7]

7 (a) (i) light of a single wavelength / frequency ignore 'one colour' — B1

(ii) $n = \sin i / \sin r$ OR $1.52 = \sin 50 / \sin r$ OR $\sin r = \sin 50/1.52$ — C1
30.26° at least 2 s.f. — A1

(iii) ray closer to normal in block — B1
ray parallel to incident ray emerging from block — B1

(b) (i) $n = v_A / v_G$ OR $n = 1.54/v_G$ OR $v_G = 3 \times 10^8/1.54$ — C1
1.948×10^8 m/s — B1

(ii) ray with smaller angle of refraction than red in block i.e. violet ray under red ray — B1
emerging ray parallel to incident ray — B1 [9]

8 **(a)** any three from:
use a strong(er) magnet
increase the number of coils in the solenoid / turns of solenoid closer together
move the magnet fast(er).
place iron core in the solenoid
use thick(er) wire / low(er) resistance wire for solenoid — max B3

(b) **(i)** $N_P/N_S = V_P/V_S$ OR $200/800 = V_P/24$ OR $V_P = N_PV_S/N_S$
OR $V_P = 200 \times 24/800$ — C1
6.0 V — A1

(ii) $I_pV_p = I_sV_s$ OR $I_pN_p = I_sN_s$ OR $I_P = I_SV_S/V_P$ OR $I_P = I_SN_S/N_P$
OR $I_P = (0.5 \times 24)/6$ OR $I_P = (0.5 \times 800)/200$ — C1
2(.0) A
allow ecf from **(b)(i)** — A1 [7]

9 **(a)** **(i)** **1.** resistance is constant / doesn't vary — B1
2. resistance increases — B1

(ii) 7 V — B1

(b) resistance of resistor = 4/2.6 (= 1.54 Ω) — C1
resistance of lamp = 4/3.6 (= 1.11 Ω) — C1
$1/R = 1/R_1 + 1/R_2$ OR $(R =)\ R_1R_2/(R_1 + R_2)$ OR either eq. with numbers — C1
0.645 or 0.65 Ω — A1
OR
current through resistor = 2.6 A — (C1)
current through lamp = 3.6 A — (C1)
total current = 2.6 + 3.6 = 6.2 A — (C1)
0.645 Ω OR 0.65 Ω OR R = 4/sum of candidate's currents — (A1) [7]
accept R value based on no. of sig. figs. for resistors used by candidate

10 **(a)** **(i)** thermistor — B1

(ii) lamp is ON at 20 °C / low temperature <u>and</u> OFF at 100 °C / high temperature — B1

p.d. across B is high at 20 °C / low temperature — B1
p.d. across B is low at 100 °C / high temperature — B1
OR as temperature rises, p.d. across B falls — (B2)

transistor acts as a switch for the lamp at a certain temperature
OR lamp is ON if there is current in base / collector
OR potential of base is high
OR lamp is OFF if there is no current in base / collector
OR potential of base is too low — B1

(b) to switch on a warning light when temperature (required for a process) becomes too low
OR to switch off a warning light when temperature (required for a process) becomes high enough B1 [
example (e.g. freezer or incubator) not needed, but if given, explanation required

11 (a) (i) to heat the cathode / C B1

(ii) to emit electrons / to undergo thermionic emission (when heated) B1

(iii) to attract / accelerate electrons B1
to allow the electrons / beam to pass through to the screen / to focus the beam / to direct the beam / produce a straight beam / to fix the beam current B1

(b) (i) p.d. / voltage / battery / power supply applied between / across plates B1
upper plate positive and lower plate negative B1

(ii) sketch showing: straight vertical lines from top plate to bottom plate B1
arrows pointing downwards / from + to – B1 [8]