CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the October/November 2012 series

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 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 2012 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 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.

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. 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.

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.

Significant Figures
           Answers are normally acceptable to any number of significant figures ≥ 2. Accept answers that round to give the correct answer to 2 s.f. Any exceptions to this general rule will be specified in the mark scheme.

Units   Deduct one mark for each incorrect or missing unit from a final 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 orpreviously calculated data has clearly been misread but used correctly..

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

Crossed out work
           Work which has been crossed out and not replaced but can easily be read, should be marked as if it had not been crossed out.

Use of NR   (# key on the keyboard) Use this if the answer space for a question is completely blank or contains no readable words, figures or symbols, or statements such as 'I don't know'.

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1 **(a)** $\frac{1}{2}mv^2$ C1
correct rearrangement to find v/v^2 C1
23 m/s   A1   [3]
bald 0.73 scores first two marks

    (b) use of mgh (= 160 000 – 40 000 = 120 000 J)   C1
$h = 20$ m   A1   [2]

    (c) any three points from:
KE of <u>water</u>
PE of <u>water</u>
sound
heat/friction
Award one mark for each correct point   B3   [3]

2 **(a)** horizontal by eye   M1
arrow to left   A1
idea of airliner accelerating/changing direction <u>AND</u> caused by force <u>in that direction o.w.t.t.e.</u> OR centripetal force
OR force/acceleration towards centre of circle   B1   [3]

    (b) 2 lines approximately length ratio 1.16:1 at 30°/150° to each other   M1
parallelogram with line across short diagonal/triangle with original lines at 30°   M1
resultant to the left, horizontal by eye   A1   [3]
for first two marks ignore arrows, ignore labels unless they clarify an otherwise confusing diagram

         calculation route
both forces used in cosine rule   (M1)
3rd force from previous line and correct angle used in sine rule   (M1)
calculation shows horizontal resultant   (A1)

    (c) <u>direction</u> changing   B1
(therefore) velocity changing or speed/magnitude constant   B1   [2]

3 **(a)** sensitive   to box 5   B1
linear   to box 3   B1
wide range to box 2   B1   [3]

    (b) **(i)** 2 <u>different</u> metals (need not be named but must be identified as different)   M1
volt/millivolt/am/milliammeter/galvanometer/display reading V/mV/A/mA/°C
AND circuit would work   A1   [2]
do not allow unlabelled box/meter
ignore hot/cold junction labels

        (ii) **1.** metals will not melt/gives p.d. at high temperature/remote sensing
Ignore can withstand/will not be damaged by high temperature   B1
2. small heat capacity/mass   B1   [2]

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4 (a) (i) piston lower than original/single line below original lower face   B1   [1]

     (ii) three points from:
         they OR air/gas molecules/particles move/collide   ignore faster   B1
         they OR air/gas molecules/particles collide with <u>piston/walls</u>
         ignore collisions between molecules   B1
         force exerted on <u>piston</u>   B1
         greater force/pressure on top (than bottom initially)
         number of collisions of <u>gas</u> molecules with piston increases
         piston moves until <u>pressures/forces</u> equal   [3]

   (b) (i) piston higher than original/single line below above original lower face   B1   [1]

     (ii) two points from:
         molecules of <u>gas</u> moving <u>faster</u> OR more momentum/KE   B1
         more/harder collisions of gas molecules with piston/walls   B1
         greater force/pressure on bottom (than top initially)
         piston moves <u>up</u> until <u>pressures/forces</u> equal   [2]

5 (a) double cup not so hot (to hold)   B1
     less heat transfer/sensible comment about air gap/more or better insulation
     ignore any explanation involving vacuum   B1   [2]

   (b) starts at (0,80) always above original line and below 80°C, reaches 5 min   M1
      always descends, straight or concave up, reaches 10 min   A1   [2]

   (c) two points from:
     reduces/stops (energy losses by) convection   B1
     reduces/stops (energy losses by) evaporation   B1
     reduces/stops (energy losses by) radiation
     explanation of mechanism of heat loss (by convection, evaporation or radiation)
     explanation plus something like "which reduces heat losses" scores 2/2 on this
     part but must do more than restate question   [2]

6 (a) $Q = mc\Delta T$ in any form or $mc\Delta T$ C1
     $\Delta T = 50$ C1
     $Q = 798\,000$ J   A1   [3]

   (b) use of $E = Pt$ OR 170×8 OR see 1 360   OR see 81 600 (= 1 360 $\times$ 60)   C1
     energy = ($170 \times 8 \times 3\,600$) = 4 896 000 J   A1   [2]

   (c) efficiency = output(energy)/input (energy) OR his **(a)** ÷ his **(b)**
     accept power for energy but not wrong/mixed quantities. Accept useful for output,
     ignore total for input   C1
     efficiency = 0.16 or 16%   ecf from **6(a)** and **6(b)**   A1   [2]

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(d) source not finite/will not run out   ignore can be re-used/replaced
Give for right idea   e.g. accept sun always shines   B1   [1]

(e) one point from:
doesn't work at night/cloud cover/no sun/variable output
high (initial) cost (of panels)
do not accept too low unless appropriate for a clearly stated context   B1   [1]

7 (a) ignore arrows on rays
if no scale quoted, mark as if drawn full size; accept scale diagram if clearly
stated
one correct ray   B1
second correct ray   B1
basically correct rays extended back meet 5–7 cm from lens
AND some indication that this is image e.g. arrow/label I or image   B1   [3]

(b) (i) cannot be formed on a screen/rays diverge away <u>from the image</u>/
do not meet to form <u>image</u>   B1   [1]

(ii) magnifying glass/lens/magnifier   do not accept converging lens   B1   [1]

8 (a) ignore moving positive charge
<u>electrons/negative charges</u> removed from balloon   NOT attracted to hair   M1
moved to hair/hair becomes negatively charged/idea of <u>net</u> positive charge on
balloon   A1   [2]

(b) charge on left: positive/neutral   B1
charge on right: negative   B1   [2]

(c) stream deflected to right <u>in diagram</u>   M1
(negative) charges in water stream attracted by (charges on) balloon   A1   [2]

(d) metal (good) conductor/has free electrons   o.w.t.t.e.   B1   [1]

9 (a) α deflected   NOT tick in 'no deflection' box   C1
α deflected into paper   NOT more than one tick   A1
γ no deflection   NOT more than one tick   B1   [3]

(b) α will be stopped by <u>air</u>/won't move far   B1
γ will continue   OR <u>air</u> ionised by α
do not give the ionisation mark if it is unclear whether the air or α is ionised   B1   [2]
NB air is underlined but accept it/which etc. if clearly refers to air

(c) only particles/rays in line with hole can pass through
OR lead absorbs radiation(α or γ or unspecified   ignore β)   B1
to produce a (thin) beam of α or γ or particles or rays or radiation   B1   [2]

10 (a) $1/R = 1/R_1 + 1/R_2$ or $R = R_1 R_2/(R_1 + R_2)$ or $R_1 R_2/(R_1 + R_2)$ or use of   C1
  $1/8 = 1/24 + 1/X$ OR $8 = 24R/(24 + R)$ or calculations/clear logic to eliminate
  wrong values   C1
  12 Ω   A1 [3]

(b) (i) battery and resistors correct, condone twin small circles, cell, zig-zag
  resistors   B1
  ammeter correct position   B1
  ignore switches, condone breaks in circuit ≤ 1 mm   condone wrong symbols
  if clear
  two resistors in series scores 0/2 as ammeter cannot be in right place   [2]

(ii) use of $I = V/R$ in any form or V/R   B1
  24 Ω resistor: $I = (6/24=)$ 0.25 A   B1
  other resistor: $I = 6$/his **(a)** correctly evaluated (6/12 = 0.5A)   accept 1 s.f. if
  exact
  if contradiction between answer of **(a)** in working and answer in answer line,
  base marking on answer line   B1 [3]

11 (a) triangle with bar at apex, pointing either way   NOT circle at apex   B1 [1]
  condone:
  enclosing circle (but must have horizontal lines to/from triangle), no line through
  triangle, triangle filled in

(b) (i) deflection/reasonable value/no deflection
  must be <u>consistent</u> with direction of recognisable arrow   B1 [1]
  if no recognisable direction in symbol of **(a)**, assume arrow L to R

(ii) his **(i)** <u>different way round</u>
  i.e. if deflection in **(i)** must be no deflection in **(ii)**;
  if no deflection in **(i)** must be deflection in **(ii)**;   B1 [1]

(c) half waves up or down on alternate half cycles   B1
  reasonable shapes of correct frequency AND amplitude 2.5–3V AND flats 0V
  (±1 small square)   B1 [2]

(d) (i) transistor   B1 [1]

(ii) 1ˢᵗ line of table : both off   B1
  2ⁿᵈ line of table : both on   B1 [2]
  give one compensatory mark : 1ˢᵗ line both on AND 2ⁿᵈ line both off
  accept HIGH/LOW or 1/0 for on/off   ignore ticks/crosses/yes/no