UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the May/June 2011 question paper

for the guidance of teachers

0625 PHYSICS

| 0625/33 | 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 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 <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.

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   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.

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.

1 (a) scalar, vector, scalar, vector, scalar **B3**

   (b) (i) (average speed) = distance / time OR 18/1.2 **C1**
         = 15 m/s **A1**

     (ii) (time =) (total) distance / speed OR 21/15 **C1**
         = 1.4 s **A1**

    (iii) air resistance / friction / force opposing motion **B1**

    (iv) velocity changes because direction changes **B1** [9]

2 (a) kinetic energy (of the package / belt / motor)
      heat / thermal / internal energy / work done <u>against friction</u>
      sound energy **B2**

   (b) *mgh* OR 36 × 10 × 2.4 **C1**
      = 864 J OR N m **A1**

   (c) *P = E/t* in any form: words, symbols or numbers
      OR *E/t* OR 864 / 4.4 **C1**
      = 196 W OR J/s **A1**

   (d) *P = E/t* in any form, words or symbols
      OR mass is increased AND power is constant **B1**

      increase in <u>potential</u> energy of mass is greater
      OR work done / energy used (to raise mass) is greater **B1**

      speed reduced / time taken is longer **B1** [9]

3 (a) force AND
      <u>perpendicular</u> distance (of force) from the point. **B1**

   (b) (i) downward arrow at centre of bar **B1**

     (ii) 0.5(0) m / 50 cm **B1**

    (iii) 40 × 1.2 OR 48 seen anywhere **C1**
          (+) 30 × 0.5 0R 15 seen anywhere **C1**
          = 63 N m **A1**

    (iv) *F* × 0.2 = 63 **C1**
         F = 63/0.2 = 315 N **A1**

     (v) make bar / B longer
         OR move pivot / stone to the left
         OR increase distance between force and pivot (by moving pivot to left)
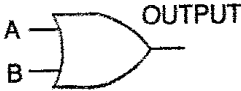   OR increase mass of the bar / B **B1** [9]

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4 (a) 330 J of heat / energy required to change 1 g of ice to water at constant temperature / at melting point / at 0 degrees C   B1

    (b) (i) (B to C ice is) changing to water / melting / changing to liquid / changing state   B1

        (D to E water is) changing to steam / vaporising / boiling / changing to gas   B1

      (ii) Sp. latent of vaporisation of water is greater than sp. latent of fusion of ice   B1

     (iii) s.h.c. of ice is less than s.h.c. of water   B1

        more heat required to raise temperature of water
        OR rate of temperature rise of water is slower
        OR temperature rise of water takes longer   B1   [6]

5 (a) (i) (Molecules) move randomly / in random directions
        (Molecules) have high speeds
        (Molecules) collide with each other / with walls   B1

      (ii) (Force is caused by) collision (and rebound) of molecules (with the walls) o.w.t.t.e   C1

     (iii) $p = F/A$ OR (force =) pA OR 300 × 0.12   C1
                    OR 300 000 × 0.12
        OR any other recognisable pressure × area
        = 36 kN / 36 000 N   A1

    (b) (i) $p_1V_1 = p_2V_2$ / 300 × 0.1 (× 0.12) = p_2 × 0.05 (× 0.12)
        OR if V is halved, p is doubled OR vice versa   C1

        p_2 = 600 kPa   A1

      (ii) (molecules) collide <u>with walls</u> more often o.w.t.t.e.
        OR more collisions <u>with walls</u> per second or per unit time o.w.t.t.e   B1   [7]

6 (a) (i) shake end of rope (e.g. from side to side / up and down)   B1

    (ii) distance from crest to crest / trough to trough / any 2 adjacent points in phase, labelled λ B1

        distance from central horizontal line to peak or trough, labelled A   B1

    (iii) increase rate of shaking end of rope (to increase frequency) / shake faster / move more quickly   B1

(b) in shallow water wavelength is smaller OR waves / lines are closer together   B1
frequency is constant   B1
(slower because) speed = frequency × wavelength   B1
OR
lines / waves closer together in shallow water / waves in shallow water lag behind   B1
smaller distance travelled in same time by waves in shallow water o.w.t.t.e.   B1
(slower because) speed = distance / time   B1   [7]

7 (a) distance from (principal) focus/focal point to (the centre of) the lens   B1

(b) (i) image can be formed on a screen
        OR is formed by rays of light meeting
        OR is formed on the opposite side of the lens from the object   B1

    (ii) 1. straight line ray from point A to point B
           AND lens at intersection of ray and axis.   B1
       2. ray from A parallel to axis, bent at lens to pass through B. <u>F at intersection of ray and axis</u>.
           OR Ray from point A through nearer focus, <u>labelled F</u>, to lens, bent at lens, then parallel to axis, to point B   B1
       3. any third ray from A to B, bent at lens   B1

    (iii) (distance from image to lens is) reduced   B1
        (image is) smaller   B1   [7]

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8 **(a)** energy supplied / work done (per unit charge) to   B1
drive charge round a (complete) circuit   B1
OR
p.d. / voltage across battery / power source   B1

    (b) **(i)** $P = IV$ OR $(I =) P/V$ OR $(I =) 60/240$ C1
             = 0.25 A OR ¼ A   A1

        (ii) $I = V/R$ OR other version OR $(R =)V/I$ C1
            OR $(R =)240/0.25$
            OR $P=V^2/R$ or other version e.g. $(R=) V^2/P$
            OR $(R=) 240^2/60$
            $R= 960\ \Omega$ A1

    (c) current in series circuit = 240 / 972 =0.247 A   B1

       current suits both bulbs, (so both light up so Y is correct)   B1
       OR
       p.d. across bulb A = 240 × (960/972) = 237 V
       p.d. across bulb B = 240 × 12/972 = 2.96 V   B1
       p.d. suits both bulbs, (so both light up so Y correct)   B1   [8]

9 **(a)** **(i)** arrow pointing vertically downwards   B1

        (ii) <u>magnetic</u> fields due to current and magnet interact with each other
            OR current produces <u>magnetic</u> field.
            OR wire contains moving charges which experience a force in a <u>magnetic</u>
            field   B1

       (iii) direction of force unchanged   B1

    (b) arrow at P pointing down the page   B1
       curved path   B1   [5]

10 **(a)** correct symbol for OR gate

                                                                B1

    (b) output is low / zero / off if both inputs are low / zero / off   B1

       output is high / one / on if one input is high / one / on
       BUT this mark is not scored if candidate puts output low when both inputs high   B1

    (c) <u>switches</u> in doors are on if doors are open or vice versa   B1
       (switches in) doors provide inputs (to gate)   B1
       output (of gate) is connected to buzzer / warning light / alarm   B1   [6]

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11 (a) (i) proton   B1

    (ii) proton and neutron   B1

  (b) number of protons = 47   B1
      number of neutrons = 60   B1

  (c) (i) 8 hrs +/– 0.25 hrs   B1

    (ii) first point plotted is half the count-rate of a point on the curve, and 8 hours
       after that point (ecf from **(c)(i)**)   B1

       second point plotted same as above or with respect to first point plotted   B1

       possible points include:
       16 hrs,   80 counts/s
       24 hrs,   40 counts/s
       13.5 hrs, 100 counts/s
       21.5 hrs,   50 counts/s
       16.5 hrs,   75 counts/s   [7]