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 2014 series for most Cambridge IGCSE®, Cambridge International A and AS Level components and some Cambridge O Level components.
NOTES ABOUT MARK SCHEME SYMBOLS AND OTHER MATTERS

B marks  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 answer.

M marks  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  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.

A marks  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. A marks are commonly 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. An A mark following an M mark is a dependent mark.

Brackets ( )  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  Underlining indicates that this must be seen in the answer offered, or something very similar.

OR / or  This indicates alternative answers, any one of which is satisfactory for scoring the marks.

e.e.o.o.  This means "each error or omission".

O.w.t.t.e.  This means "or words to that effect".

Ignore  This indicates that something which is not correct or irrelevant is to be disregarded and does not cause a right plus wrong penalty.

Spelling  Be generous about spelling and use of English. If an answer can be understood to mean what we want, give credit. However, do not allow ambiguities, e.g. spelling which suggests confusion between reflection / refraction / diffraction or thermistor / transistor / transformer.

Not / NOT  This 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.
**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 from 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. Rounding errors in the second or third significant figure will be penalised.

**Arithmetic errors**

Deduct one mark if the only error in arriving at a final answer is clearly an arithmetic one. Regard a power-of-ten error as an arithmetic error.

**Transcription errors**

Deduct one mark if the only error in arriving at a final answer is because previously calculated data has clearly been misread but used correctly.

**Fractions**

Allow fractions only where specified in the mark scheme.

**Units**

Deduct one mark for an incorrect or missing unit, but only if the answer would otherwise have gained all the marks available for that answer. Maximum one unit penalty per question.
1 (a) no resultant/net force (acting)  
   no resultant/net moment (acting)  
   OR clockwise moment = anticlockwise moment  
   B1

(b) (i) $W = P + Q$ in any form  
   OR (total) upward force = (total) downward force  
   $P = W - Q$ so $P$ must be less than $W$  
   OR $P$ is not the only upward force  
   B1

   (ii) $P \times$ its distance (from C) = $W \times$ its distance (from C)  
   OR $P$ and $W$ have equal moments (about C)  
   OR clockwise moment = anticlockwise moment  
   $P$ is farther from C/pivot (than $W$ so $P$ must be less than $W$)  
   B1

(c) clockwise moment = $75 \times 0.24$  
   anticlockwise moment = $F \times 0.75$  
   (moments equated gives $F = 24$ N)  
   A1

   [Total: 9]

2 (a) (i) less (1st box ticked)  
   B1

   (ii) any mention of mass/inertia  
   well-reasoned explanation involving less mass  
   special case B2: more weight/heavier AND more friction  
   B1

   (b) (resultant force =) 4000 N  
   $(M = 50000/10 =) 5000$ kg  
   $(a = 4000/5000 =) 0.80 \text{ m/s}^2$ e.c.f previous lines, accept 1 sig. fig.  
   A1

   [Total: 6]

3 (a) (i) $10 \text{ m/s}^2$ ignore sign  
   B1

   (ii) (same as) acceleration (of rocket at B) OR gravitational acceleration  
   B1

   (b) same area  
   area represents distance travelled  
   B1

   distance up = distance down  
   OR overall displacement = 0  
   OR area above = distance up AND area below = distance below  
   B1
(c) any three from:
  • all of graph below x-axis after B
  • final section horizontal and above CD AND gradient always \( \leq 0 \)
  • continuous graph from B until time > at DE
  • new area not clearly different from old  
  
  \[ \text{[Total: 8]} \]

4 (a) (i) \( KE = \frac{1}{2} mv^2 \) in any form OR \( \frac{1}{2} mv^2 \)  
(KE = 24.5 \times 6.7 =) 164 J OR 160 J   

(ii) efficiency = output (power) ÷ input (power)  
OR useful power ÷ input (power)  

\( 0.08 \times \text{candidate's (a)(i) correctly evaluated} \)  

(b) use of \( \rho = \frac{m}{V} \) in any form OR \( \frac{m}{V} \)  
(\( \rho = \frac{6.72}{5.6} = \) 1.2 kg/m\(^3\)  

(c) rotation/movement of wire/coil OR rotation/movement of magnet  
consistent with above mark: in magnetic field / between magnetic poles / cutting magnetic field OR in coil/near wire  

\[ \text{[Total: 8]} \]

5 (a) diagram shows (molecules) randomly positioned  

diagram shows most (molecules) touching/very closely spaced  

(b) (i) (temperature) decreases  

(ii) more energetic/faster molecules escape from surface/overcome forces of attraction  

(iii) \( E = ml \) in any form OR \( ml \)  

\( 2900 \text{ J} \)  

(iv) any two from:  
  • cover/decrease surface area  
  • reduce temperature  
  • reduce draught owtte  
  • increase humidity of air  

\[ \text{[Total: 8]} \]
6 (a) (i) 1. range \( \text{M1} \)
2. correct link between stem length and range/top temperature/expansion \( \text{A1} \)

(ii) 1. sensitivity \( \text{M1} \)
2. correct link between capillary diameter and sensitivity/movement of thread \( \text{A1} \)

(b) (i) (coloured) alcohol (note: no mark for this point, but must be present for subsequent marks to be awarded) \( \text{M0} \)

(ii) any two from:
- water will freeze/alcohol doesn’t freeze
- coloured alcohol (clearly) visible
- alcohol has even expansion/water has uneven expansion
- alcohol expands more/water expands less
- alcohol has lower SHC/thermal capacity
- alcohol does not stick to glass \( \text{B2} \)

[Total: 6]

7 (a) longitudinal (2\textsuperscript{nd} box) \( \text{B1} \)
frequency 100 – 10000 Hz (6\textsuperscript{th} box) \( \text{B1} \)

(note: –1 for e.e.o.o)

(b) (i) reflection \( \text{B1} \)

(ii) any two from:
- new wave(fronts/lets) generated
- same speed \( \text{OR} \) frequency
- angle of incidence = angle of reflection \( \text{OR} \) wavefronts make same angle (with boundary) \( \text{B2} \)

(iii) no change \( \text{B1} \)

(iv) \( \nu/\lambda \text{ OR } \nu = f \lambda \text{ in any form} \) \( \text{C1} \)
\( (f = 3.0/0.07 =) 43 \text{Hz} \) \( \text{A1} \)

[Total: 8]
8 (a) one mark for each correct entry in table:  

<table>
<thead>
<tr>
<th>resistor</th>
<th>resistance</th>
<th>current</th>
<th>potential difference</th>
<th>power</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$IR$</td>
</tr>
<tr>
<td></td>
<td>$I$</td>
<td></td>
<td></td>
<td>$2I^2R$</td>
</tr>
</tbody>
</table>

(b) (i) \( P = IV = 750 \times 11000 = 8.3 \times 10^6 \text{W (8300 kW)} \)  

(ii) \( V = IR = 750 \times 1.5 = 1100 \text{V} \)  

(iii) (voltage to factory = 11000 – 1125 =) 9875V  

(power supplied to factory =) 9875 \times 750  

\( 7.4 \times 10^6 \text{W OR 7400 kW} \)  

(power loss in cables = \( I^2R \) OR \( 750^2 \times 1.5 \) \( = 8.44 \times 10^5 \text{W} \))  

(power to factory = \( 8.25 \times 10^6 - 8.44 \times 10^5 = 7.4 \times 10^6 \text{W OR 7400 kW} \))

[Total: 8]

9 (a) changing (magnetic) flux  

induces e.m.f. in secondary IGNORE induces current  

no change of flux with constant supply voltage/d.c.  

(b) (i) \( I_1V_1 = I_2V_2 \) in any form OR \( I_2V_2/V_1 \)  

\( (I_2 = 1.2 \times 12/120 =) 0.12 \text{A} \)  

(ii) transformer 100% efficient OR has no (heat/energy) losses OR output power = input power

[Total: 6]

10 (a) (i) 1. electron  

2. sensible mention of decay (of source) NOT decay of something inappropriate  

half-life mentioned sensibly OR activity decreases OR fewer (radioactive/unstable) atoms/nuclei present

(ii) \( \alpha \)-particles range < 10cm OR short owtte  

\( \alpha \) more ionising (than \( \beta \)) OR have more mass/charge/size/collisions OR shorter range than \( \beta \) OR reading is background radiation

© Cambridge International Examinations 2014
(b) no part of electron path from R to L (note: no mark for this point, but must be present for subsequent marks to be awarded)  
\[ \text{curve starts at end of plates AND curve up and only up OR down and only down OR 3 or more curves, all up or all down} \]
\[ \text{deflection down AND only down} \]

B1

[Total: 7]

11  (a) internal reflection AND \( i = r \) for 1st reflection  
\[ \text{NOT any ray emerges from sides} \]
\[ \text{ray reaches end of tube after 1 or 2 reflections only} \]

A1

(b) \( \sin^{-1} \frac{1}{n} \) OR Snell’s Law in any form  
\( (c = \sin^{-1} \frac{1}{1.52} =) 41^\circ \)

B1

(c) (i) total internal reflection  

B1

(ii) angle of incidence > c  
\[ \text{OR light must reach end of fibre with small losses o.w.t.t.e.} \]

B1

[Total: 6]