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 May/June 2014 series for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level components and some Ordinary Level components.
| 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 | 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 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 ( ) | 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, do not allow ambiguities, e.g. spelling which suggests confusion between reflection/refraction/diffraction or 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, but rarely, 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. Any exceptions to this general rule will be specified in the mark scheme.

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
Allow these only where specified in the mark scheme.
1 (a) (i) A marked between \( t = 0 \) and \( t = 6.0 \) s \( \text{B1} \)
(ii) B marked between \( t = 6.0 \) s and \( t = 7.0 \) s \( \text{B1} \)
(iii) C marked on clearly curved section before \( t = 14 \) s \( \text{B1} \)

(b) (i) \((a =)\Delta v / t \text{ OR } 30 / 1 \text{ OR } 15 / 0.5 \text{ etc. OR triangle on graph/tangent} \) \( \text{C1} \)
\( \text{(ignore – sign) } 25 \text{ m/s}^2 < a < 35 \text{ m/s}^2 \) \( \text{A1} \)
(ii) \((F =)ma \text{ OR } 750 \times 30 \text{ e.c.f. from (b)(i)} \) \( \text{C1} \)
\[ 2.2 / 2.25 / 2.3 \times 10^4 \text{ N e.c.f. from (b)(i)} \] \( \text{A1} \)

(c) acceleration/rate of change of speed is zero \text{ OR } speed is constant \text{ OR } air resistance/backwards force equal and opposite to driving/forwards force \( \text{B1} \)

[Total: 8]

2 (a) (if no diagram, max. mark is 3)
measuring/graduated cylinder \( \text{B1} \)

water AND initial reading OR known volume
alternative method: water AND filled eureka can owtte \( \text{B1} \)

immerse stone AND final reading
alternative method: immerse stone AND catch overflow \( \text{B1} \)

final reading – initial reading
alternative method: reading on measuring cylinder \( \text{B1} \)

(b) (i) mass, NOT with other quantity \( \text{B1} \)
(ii) \((\rho =)m/V \text{ in symbols or words} \) \( \text{B1} \)

(c) attach weight to wood
OR different liquid
OR push down with stick \( \text{M1} \)

accuracy mark must match method
subtract volume of weight from total volume
OR new liquid less dense than wood
OR no part of stick in water/thin stick \( \text{A1} \)

[Total: 8]

3 (a) (immediately below/above the/at) 50 cm mark OR at pivot \( \text{B1} \)
(b) (i) anticlockwise moment = clockwise moment OR \(45 \times 0.40 = 25 \times W\)  
\[0.72 \text{ N}\]  
(ii) 0.072 kg OR 72 g e.c.f from (b)(i)  
\[B1\]

(c) (i) no net moment OR two moments cancel  
moment due to weight of rule cancels moment due to weight of apple  
(ii) weight of the rule / it is bigger  
\[B1\]

[Total: 7]

4 (a) (i) molecules in random arrangement  
molecules similar distance apart  
(ii) molecules in random arrangement AND further apart  
\[B1\]

(b) (i) gas ringed / indicated  
(ii) more room for molecules OR molecules fit into gaps OR there are gaps between molecules  
no repulsive forces between molecules OR (repulsive) forces between molecules smaller OR pressure on walls smaller OR only small force / pressure required  
\[B1\]

[Total: 6]

5 (a) \((m =) \frac{Pt}{l} \text{ OR } 460 \times 180/2.3 \times 10^6 \text{ OR } 82,800/2.3 \times 10^6\)  
0.036 kg OR 36 g  
\[C1\]

(b) (i) any two from:  
(surface) area  
draught  
temperature (of water / room)  
humidity of air  
\[B2\]

(ii) any two from:  
evaporation at any temperature / below boiling point  
evaporation (only) at the surface  
evaporation influenced by surface area / draught / temperature / humidity (not if given in (b)(i))  
\[B2\]

[Total: 6]
6 (a) (i) A OR left hand thermometer B1

(ii) E AND longest length and smallest range/more length per degree/liquid moves more per degree/increases the most per degree B1

(b) any two from: narrow bore/tube
large amount of liquid/mercury/ethanol/alcohol/bulb
liquid with large expansivity OR ethanol instead of mercury B2

(c) 80 (°C) OR 80/120 OR 18/120 C1
12 cm A1

[Total: 6]

7 (a) vibrations OR compressions AND rarefactions M1

vibrations parallel to direction of travel (of wave energy) OR compressions move in direction of travel (of wave energy) A1

(b) (i) \( \lambda = \frac{v}{f} \) OR 6100/7500 OR 6100/7.5 C1
0.81(33333) m OR 813(33333) mm A1

(ii) 1. decreases B1
2. same answer as 1. B1

[Total: 6]

8 (a) (i) two rays from lamp to mirror AND one good \((i \approx r)\) reflected ray B1

two good reflected rays AND rays traced back above mirror B1

(labelled/clear image located at intersection AND in correct position B1

(ii) any two from: virtual (longitudinally) inverted same size (as lamp) OR same distance (from mirror) B2

(b) light reflected back/down OR not wasted OR room brighter OR more light etc. B1

[Total: 6]
9 (a) at least three vertical lines between the plates equally spaced OR some curvature at the ends at least one correct (upwards) arrow AND none wrong B1

(b) (i) \( (I=) \frac{Q}{t} \ OR \ 0.000 \ 000 \ 042/0.000 \ 000 \ 035 \ OR \ 4.2 \times 10^{-8}/3.5 \times 10^{-8} \) C1

\[ 1.2 \times 10^n \text{ for any } n \] C1

\[ 1.2 \ \text{A} \] A1

(ii) contains electrons electrons are free to move C1 A1

[Total: 8]

10 (a) \( (P=)VI \ OR \ 230 \times 3.5 \) C1

\[ \frac{805}{810} \ \text{W} \] A1

(b) \( (I_Y=)7.0 \ (\text{A}) \) alternative method: \( (R_X=)\frac{V}{I} \ OR \ 230/3.5 \ OR \ 66/65.7(1429) \) C1

\( (I_{\text{Tot}}=)10.5 \ (\text{A}) \) alternative method: \( ((R_Y=) \ 230/7.0 \ OR \ 66/2 \ OR \ 65.7(1429)/2 \ OR \ 33/32.9/32.85714) \) C1

\( (R=)\frac{V}{I} \ OR \ 230/10.5 \) alternative method: \( (R=)R_1R_2/(R_1 + R_2) \ OR \ 2159/98.57 \ OR \ 1/R= 1/R1 + 1/R2 \ OR \ 1/R= 1/65.7+1/32.9 \) C1

\[ \frac{22}{21.9(0476)} \ \Omega \] A1

[Total: 6]

11 (a) (i) \( (V_2=)\frac{V_1N_2}{N_2} \ OR \ 230 \times 2000/40000 \) C1

\[ \frac{11}{11.5/12} \ \text{V} \] A1

(ii) any three from:
alternating / changing magnetic field (in core)
(magnetic field) transferred (allow conducted) to coil Q
changing flux linkage / in Q
e.m.f. / voltage induced in Q B3
(b) (i) diode

(ii) it conducts in (only) one direction

[Total: 7]

12 (a) (high voltage allows) low/less reduced current

\( P = I^2R \) OR \( IV \) OR \( (E=)I^2Rt \) OR \( IVt \) OR depends on current heating effect ouwte

low/less/reduced heating effect/heat generated (allow lost)/more efficient/cheaper etc.

(NOT with reduced resistance)

(b) (i) (cross-sectional) area 4x larger OR resistance inversely proportional to area

OR smaller resistance

reduced to \( \frac{1}{4} \)

(ii) cables heavier OR more/stronger pylons or more material in cable

[Total: 6]