CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International General Certificate of Secondary Education

MARK SCHEME for the May/June 2015 series

0443 PHYSICS (US)

0443/33   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 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 2015 series for most Cambridge IGCSE®, Cambridge International A and AS Level components and some Cambridge O Level components.

NOTES ABOUT MARK SCHEME SYMBOLS & OTHER MATTERS

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 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. For example, 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.

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.

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".

owtte means "or words to that effect".

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 mark.

AND indicates that both answers are required to score the mark.

Spelling Be generous with spelling and use of English. However, do not allow ambiguities, e.g. spelling which suggests confusion between reflection / refraction / diffraction or thermistor / transistor / transformer.

Sig. figs. On this paper, answers are generally acceptable to any number of significant figures $\geqslant 2$, except where the mark scheme specifies otherwise or gives an answer to only 1 significant figure.

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**.

Fractions Fractions are only acceptable where specified.

Extras   If a candidate gives more answers than required, irrelevant extras are ignored, which contradict an otherwise correct response, or are forbidden by the mark scheme, use right plus wrong = 0.

Ignore   indicates that something which is not correct is disregarded and does not cause a right plus wrong penalty.

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) (i) horizontal line at $10\,\text{m/s}$

    (ii) straight line from origin to (5.0, 25)

  (b) (i) $50\,\text{m}$ **B1**

    (ii) area of triangle OR $\frac{1}{2} \times 25 \times 5.0$ **C1**

       $62.5\,\text{m}$ OR $63\,\text{m}$ **A1**

    (iii) when areas under graphs are equal   **C1**
       $4.0\,\text{s}$ **A1**

[Total: 7]

2 (a) kinetic (energy)   **B1**

  (b) (i) (work done =) $F \times x$ in any form: words, symbols, numbers   **C1**
       $1.4 \times 10^9\,\text{J}$ **A1**

    (ii) work done = kinetic energy OR $\frac{1}{2}mv^2$ seen   **C1**
       $(v^2 =) 2WD \div m$ OR $2 \times 1.4\,(4) \times 10^9 \div 4.5 \times 10^5$ OR 6400 **C1**
       $80\,\text{m/s}$ ecf **(i)**   **A1**

    (iii) (work done against) friction / (air) resistance / drag   **B1**
       ACCEPT energy converted to thermal energy

  (c) perpendicular (to curved path) OR centripetal OR towards centre (of circle)   **B1**

[Total: 8]

3 (a) lines from solar energy to boxes 1 AND 4 only   **B1**

    lines from natural gas to boxes 2 AND 3 only   **B1**

  (b) (relatively) cheap OR widely available OR can be used on a large scale
    OR always available   **B1**

  (c) (i) $2.05 \times 10^9\,\text{N}$ **B1**

    (ii) use of mgh OR weight $\times h$ **C1**
       $1.03 \times 10^{12}\,\text{J}$ NOT ecf from **(i)**   **A1**

    (iii) output energy $\div$ input energy OR $6.2 \times 10^{11} \div 1.2 \times 10^{12}$ **C1**
       0.52 OR 52% **A1**

[Total: 8]

4 (a) same distance moved (by thread) for same temperature change

(b) $-10\,°C$

(c) any two from: max. B2
- longer stem
- bigger bulb OR more liquid
- narrower bore OR thinner thread
- liquid with greater expansivity

(d) (i) falls from $100\,°C$ with a decreasing gradient AND at a faster rate   B1

finishes horizontal along $20\,°C$ line   B1

(ii) **only** bottom box ticked   B1

[Total: 7]

5 (a) energy/heat needed to change state of substance/melt   B1

(from solid to liquid at constant temperature / melting point) per kg / per unit mass   B1

(b) (i) $(l_f=)\ Q \div m$ in any form: words, symbols, numbers   C1

$340\,J/kg$ OR $336\,J/g$ OR equivalent in J/kg A1

(ii) $(c =)\ Q \div [m\,\Delta T]$ in any form: words, symbols, numbers   C1
$4.1\,J/(g\,°C)$ OR $4100\,J/(kg\,°C)$ A1

(iii) cold water denser AND sinks   B1
convection (current) OR circulation OR warmer water rises   B1

[Total: 8]

6 (a) (i) A (on principal axis) between the lens and one focal point   B1
AND E somewhere on other side of lens

(ii) on same side as A **and** further than the principal focus from lens   B1

(iii) **virtual** underlined   B1
upright underlined   B1

(b) (i) **1.** decreases/becomes smaller   B1
2. stays the same/unchanged   B1

(ii) smaller   B1

[Total: 7]

7 (a) (i) (compression is a) region of higher pressure
OR region where air layers/particles/molecules are closer

(ii) **1.** distance between (two successive / adjacent) compressions   B1

2. number of compressions (passing a point) per second / unit time
OR number of compressions emitted per second/unit time   B1

(b) (i) $(f =) v / \lambda$ OR $340 / 0.0085$ C1
$40\,000\,\text{Hz}$ OR $40\,\text{kHz}$ A1

(ii) frequency/pitch is above the upper threshold for human hearing / 20 kHz
OR it is ultrasound   B1

(iii) $(d =) vt$ in any form: words, symbols, numbers   C1
$41\,\text{m}$ **or** $40.8\,\text{m}$ A1

[Total: 8]

8 (a) (i) ammeter symbol in series with wire   B1

(ii) different results OR graph can be plotted OR to ensure wire does not overheat   B1

(b) (i) $(P =) VI$ OR $V = IR$ OR 250×1.2 OR $300\,(\text{V})$ C1
$(P =) I^2 R$ OR $250^2 \times 1.2$ OR 300×250 C1
$75\,000\,\text{W}$ OR $75\,\text{kW}$ A1

(ii) power loss reduced   C1
resistance reduced   C1
power lost decreases to a quarter OR $(P =) 19\,\text{kW} / 18.75\,\text{kW}$ A1

[Total: 8]

9 (a) (nuclear) fusion   B1

(b) (i) charges are moving (and current is the (rate of) flow of charge)   B1

(ii) $Q = It$ AND t is time   B1

(c) (i) **1.** (they are) perpendicular OR at right angles OR at 90°   B1

2. (they are) perpendicular OR at right angles OR at 90°   B1

(ii) arrow (labelled F) perpendicular to direction AND pointing
towards the bottom right of the page   B1

[Total: 6]

10 (a) (magnetic) field (lines) of magnet cuts coils (of solenoid)
OR (magnetic) field in solenoid changes

   (b) meter deflects in opposite direction   B1

       deflection is greater (than initially) OR for shorter time   B1

       magnet moving faster   B1

       more field lines cut per second OR
opposite pole **and** direction **and** end of solenoid   B1

   (c) any two from: max. B2
- stronger magnet
- use a solenoid (of same length) with more turns
- use a more sensitive meter
- use wires of smaller resistance for solenoid or connecting wires
- drop from further up

                              [Total: 7]

11 (a) (i) gamma emitter used   B1

          can penetrate ground to surface/for several metres   B1

      (ii) long enough to find leak   B1

          short enough to disappear quickly   B1

   (b) proton number and electron number: tick for both in box 3, equal   B1
       nucleon number: tick in box 5, 2 fewer   B1

                              [Total: 6]