CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the May/June 2014 series

0625 PHYSICS

0625/31 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 2014 series for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level components and some Ordinary 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 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 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) (liquid) has a uniform expansion / expands at a constant rate / expands evenly / expands linearly B1

(ii) any two from:
larger bulb / wider / longer bulb
more liquid
narrower capillary / tube
use liquid with greater expansion B2

(iii) thermometer must be longer B1

(b) any 2 from:
resistance / conductance of a metal / wire / conductor / thermistor
voltage / current of a thermocouple
volume / pressure / expansion / contraction of a gas
colour of a metal
amount of radiation OR frequency OR wavelength of radiation from a metal / furnace
colour / arrangement of liquid crystals
expansion of a solid / any dimension of a solid
bending of a bimetallic strip B2

[Total: 6]

2 (a) (density =) mass / volume B1

(b) water used in measuring / graduated cylinder B1

volume of water known or read / recorded / taken B1

place the coins in the water and read / record / take new level of water in cylinder B1

subtract readings B1

OR ALTERNATIVE METHOD:
pour water into displacement can to level of spout (B1)

place the coins / several coins in the water (B1)

collect overflow (B1)

measure volume of overflow water using measuring graduated cylinder (B1)

measure mass / weigh the coins used with balance / spring balance B1

(c) one from:
read measuring cylinder levels at bottom of meniscus
repeat volume measurement and find average
place eye level with surface in measuring cylinder (to avoid parallax error)
place coins one at a time to avoid air bubbles between coins
avoid splashing when adding coins to water
make sure coins are dry / clean
use narrow / small measuring cylinder
place containers on horizontal surface
check zero of balance / spring balance / scales
displacement can method: make sure dripping finishes before and after adding coins B1

[Total: 7]

3 **(a)** *Fd* OR weight × *d* OR *mgh* OR 30 000 × 10 × 140 OR 4.2×10^7 seen anywhere C1

(*P* =) *E* / *t* OR *W* / *t* OR *mgh* / *t* symbols or words C1

$4.2 \times 10^7 / 60$ C1

7.0×10^5 W / 700 kW / 0.7 MW A1

(b) efficiency = output / input OR (P_{in} =) 100 × P_{out} / efficiency C1

(P_{in} =) $100 \times 7 \times 10^5 / 70$ C1

1.0×10^6 W OR 1 000 000 W OR 1.0 MW A1

(c) (horizontal) wind has no effect on P.E gained / vertical force on water
OR same upward / vertical force acts on water
OR force from wind is horizontal B1

[Total: 8]

4 **(a)** 2 lines at 90 ° to each other of same length labelled 30 N or 6 cm B1

both lines 6.0 ± 0.2 cm. B1

arrows on the two lines drawn, either head to tail B1
OR a complete square shown with diagonal and arrows on adjacent sides

resultant in range 40–45 N B1

(b) (vertically) upwards B1

(c) same as value in **(a)**, only if answer to **(a)** is a force
OR 40–45 N B1

[Total: 6]

5 **(a)** **(i)** ($W = mg$ =1440 × 10 =) 14 400 N B1

(ii) (P =) F/A OR 14 400 / (1.5 × 1.2) C1

8000 Pa OR N / m^2 A1

(b) **(i)** (P =) $h\rho g$ OR 1.4 × 1000 × 10 C1

14 000 Pa OR N / m^2 A1

(b) **(ii)** pressure on base of **P** smaller / **Q** greater M1

(with same volume removed) smaller decrease in depth in Q
OR height in **Q** is greater A1

[Total: 7]

6 **(a)** (molecules) move in random directions / randomly / with constant random motion / zig-zag motion / in all directions B1

(molecules) have random speeds OR a range of speeds OR move (very) fast / at (very) high speed B1

any 1 from:
(molecules) collide with each other
(molecules) move in straight lines between collisions
(molecules) change direction in collisions
(molecules) collide with walls (of cylinder) B1

(b) **(i)** pressure increases M1

more <u>frequent</u> collisions between molecules and <u>walls</u>
OR molecules collide with <u>walls</u> more often / at greater rate A1

(ii) pV = constant
OR $p_1V_1 = p_2V_2$ in any form
OR $1.0 \times 10^5 \times 500 = p_2 \times 240$ C1

2.1×10^5 Pa to 2 or more sig. figs A1

[Total: 7]

7 **(a)** (a liquid evaporates) at any temperature / below the boiling point / over a range of temperatures / below 100 °C / at different temperatures / not at a fixed temperature B1

(during evaporation) vapour forms at / escapes from the surface of the liquid B1

(without a supply of thermal energy,) evaporation continues / occurs / doesn't stop
OR causes liquid to cool / is slower / reduces B1

(b) **(i)** (Q =) mL C1
OR $0.075 \times 2.25 \times 10^6$

1.7×10^5 J A1

(ii) (E =) VIt OR $240 \times 0.65 \times (20 \times 60)$ C1
OR $P = IV$ and $P = E/t$ OR energy / time

1.9×10^5 J A1

(iii) energy is transferred to the surroundings
OR in heating the surroundings / air / atmosphere / hot-plate B1

[Total: 8]

8 **(a)** speed of sound in gas: 300 m / s B1

speed of sound in solid: 3000 m / s B1

(b) particles / molecules / atoms oscillate / vibrate
OR pressure variation / compressions / rarefactions / displacements move B1

in the direction of travel (of the wave / sound) B1

(c) **(i)** two complete wavelengths / cycles with shorter wavelength B1

wave drawn has greater amplitude B1

(ii) higher frequency / pitch B1

louder / higher volume B1

[Total: 8]

9 **(a)** **(i)** (I =) V/R OR 6 / (12 + 4) OR 6 / 16 C1

0.38 A / 0.37 A A1

(ii) $1/R = 1/R_1 + 1/R_2$
OR (R =) $R_1 R_2/(R_1 + R_2)$
OR above with numbers substituted C1

R = 3 (Ω) C1

(I = 6 / 3 =) 2(.0) A A1

OR ALTERNATIVE METHOD:
6 / 12 (C1)

+ 6 / 4 (C1)

2(.0) A (A1)

(b) (i) $R \propto l$ (in words or symbols)
OR directly proportional OR e.g. R doubles when l doubles B1

(ii) $R \propto 1/A$ (or with words)
OR inversely proportional OR e.g. R doubles when A halves B1

(c) 4 / 12 OR 4:12 OR 1 / 3 OR 1:3 OR 0.33 B1

[Total: 8]

10 (a) slip-rings (and brushes) B1

(b) (i) sinusoidal curve, any value at t = 0 B1

(ii) appropriate T value indicated on graph B1

(iii) smaller T / time of one cycle OR higher frequency B1

higher <u>maximum</u> current / greater amplitude / higher peaks / higher peak-to-peak B1

(c) diode / rectifier B1

[Total: 6]

11 (a) γ: none / zero / 0 / neutral AND
2 cm (or more) of lead / thick lead / 50 cm (or more) of concrete B1

β: particle / electron AND
any named metal / glass / concrete OR 1 m of air B1

α: particle / helium nucleus / 2 protons + 2 neutrons / $^4_2$He / $^4_2\alpha$ AND
positive OR + OR +2 B1

(b) (i) 38

(ii) 90

(iii) 52

(iv) 38 B3

(c) 36 hours = 3 half-lives
OR halving in steps from 4800 to 600 seen C1

half-life = 12 hours OR 3 half-lives OR 2 / 3 of 36 C1

(further time to reduce to 150 Bq =) 24 (hours) A1

[Total: 9]