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

0625/32 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.

- Cambridge will not enter into discussions or correspondence in connection with these mark schemes.

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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 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.

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 against friction
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 potential 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
perpendicular 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]

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 $300\,000 \times 0.12$
OR any other recognisable pressure × area
= 36 kN / 36 000 N A1

(b) **(i)** $p_1V_1 = p_2V_2$ / 300×0.1 ($\times 0.12$) = $p_2 \times 0.05$ ($\times 0.12$)
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]

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 Ω — 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]

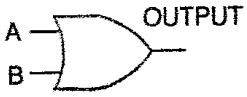
9 **(a)** **(i)** arrow pointing vertically downwards — B1

(ii) magnetic fields due to current and magnet interact with each other
OR current produces magnetic field.
OR wire contains moving charges which experience a force in a magnetic 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) switches 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]

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]