CAMBRIDGE INTERNATIONAL EXAMINATIONS
Cambridge International General Certificate of Secondary Education

MARK SCHEME for the October/November 2015 series

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 should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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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 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 mark.

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.

Ignore indicates that something which is not correct or is irrelevant is to be 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.

cao correct answer only

AND indicates that both answers are required to score the mark.
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. Condone wrong use of upper and lower case symbols, e.g. pA for Pa.

Fractions Only accept these where specified in the mark scheme.
1 (a) (i) (it/comet) travels in a straight line B1

(ii) area (under graph) OR \( s = vt \) in any form OR \( vt \)
\[ 220 \, 000 \, \text{m} \text{ OR } 220 \, \text{km} \] A1

(b) negative acceleration OR deceleration OR (it/the comet) is slowing down B1
acceleration/deceleration (only accept it if acc/decel already mentioned)
not constant allow either increasing or decreasing B1

(c) attempt at gradient OR \( \Delta v / \Delta t \) OR \( (0-)12000/2.0 \) OR other correct values for \( \Delta v / \Delta t \)
\[ (-)6000 \, \text{m/s}^2 \text{ tolerance } 5000 - 7000 \, \text{m/s}^2 \] C1

(d) (it/comet) hits surface (of planet)
OR stops o.w.t.t.e. B1

[Total: 8]

2 (a) \( d = m / V \) in any form OR \( (V =) m / d \) OR \( 200 / 8.4 \)
\[ 24 \, \text{cm}^3 \] A1

(b) (i) density less (than water) OR upthrust ≥ weight B1

(ii) determine any volume of any liquid \( (V_1) \)
states viable method to submerge wood B1
reads volume \( (V_2) \) from previous line and determines volume
of (wood + brass) \( (V_2 - V_1) \) B1
subtract volume of brass from above (to give volume of wood) B1

[Total: 7]

3 (a) (i) (power =) work (done)/time (taken) OR energy (supplied)/time (taken) OR rate of doing work OR rate of supplying energy B1

(ii) box 2 (force acting on the object) AND box 5 (distance moved by the object) B1

(b) (i) multiplies mass of all passengers by \( h \)
\( \text{(increase in gpe =)} \, mgh \) OR uses \( 12 \times 650 \times 150 \) C1
\( \text{(power = increase in)} \, \text{gpe/time} \)
\[ 1.8 \times 10^4 \, \text{W OR } 18 \, \text{kW} \] A1

(ii) energy to raise the lift OR weight/load/mass of lift OR more weight/load/mass B1

[Total: 7]
4 (a) 2 vectors correct direction AND relative length by eye
   correct triangle OR rectangle with resultant on correct diagonal
   7.2 kN tolerance 7.0 – 7.4 kN
   
   (b) (i) (moment =) force \times distance
        (moment = 11 000 \times 1.8 =) 20 kNm
        
        (ii) (moment of weight = 19 000 \times 1.25 =) 24 (kNm)
        correct statement based on two moments seen

   [Total: 7]

5 (a) in all parts accept by implication reference to X
      e.g. in (i) accept “it covers a greater range of temperature”

      (i) X covers greater range of temperature OR (goes to) higher temperature OR greater
          range expressed numerically

      (ii) liquid in X expands uniformly (with temperature rise)

      (iii) (for the same temperature rise,) the liquid in X expands more

   (b) (i) two junctions correctly connected to each other and to meter OR one junction between
        wires and other junction at connection to meter
        temperature difference between junctions
        two wires correctly labelled as made of different materials, accept labels metal A &
        metal B NOT 3 different metals labelled

      (ii) junction (in liquid) has low mass/small heat capacity/small size
           temperature of junction reacts quickly/quickly reaches temperature of
           liquid/heat or cools faster

   [Total: 8]

6 (a) suitable particles and fluid, and labelled, in suitable container
      e.g. pollen and water (surface), smoke in air
      microscope AND, if smoke used, illumination

   (b) movement of particles NOT atoms or molecules
       reasonable description of movement
       OR any mention/clear description of movement in different directions
       accept if diagram drawn

   (c) collisions between molecules and particles
       random movement of molecules OR causes (random) motion of particles

   [Total: 6]
7  (a) pressure high / increased OR molecules / particles close (r / st together)  B1

(b)  (i)  1.7 m  B1

(ii)  \( v = f \lambda \) in any form OR \( f = \frac{v}{\lambda} \) OR \( 5/0.025 \)  C1

200 Hz  A1

(c)  three compressions at \( 23^\circ - 33^\circ \) to wall  B1

constant and correct wavelength by eye  B1

only scored if at \( 8^\circ - 48^\circ \) to wall  B1

(d) (wavelength) greater  B1

change of speed correctly related to change of wavelength  B1

[Total: 8]

8  (a)  (i)  correct O label  B1

(ii)  correct I label  B1

(iii)  correct F label, allow correctly labelled dot to left of lens  B1

(iv)  correct arrows on both rays, anywhere on each ray  B1

(b)  \( \frac{1}{n} = \sin i / \sin r \) OR \( n = \sin i / \sin r \) in any form OR \( \sin i / n \) OR \( n \sin i \)  C1

\( r = \sin^{-1} ((\sin 35) / 1.5) = 22^\circ \)  A1

accept if in diagram  B1

emergent ray drawn with \( 27^\circ \geq r \geq 18^\circ \)  B1

[Total: 7]

9  (a)  (i)  NAND  B1

(ii)  output and one input correctly labelled  B1

(b)  rectangle with longitudinal line in middle third, no input or output wire required  B1

(c)  (i)  temperature (decreases)  B1

(ii)  correctly relates change of resistance to change of temperature  B1

voltage of mid-point (of potential divider) / left of LED increases OR higher V across thermistor  B1

current flows through / enough V to light LED  B1
(d) \( \frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} \) or \( (R_p) = \frac{R_1R_2}{R_1 + R_2} \)  
\( (R = \frac{1}{(1/4 - 1/6)} = 12 \, \Omega) \)

C1

A1

[Total: 9]

10  
(a) \( \geq 3 \) horizontal lines in gap by eye  
\( \geq 4 \) evenly spaced horizontal lines filling \( 3/4 \) of width of gap AND arrows L to R

B1

B1

(b) (i) ammeter deflects/gives a reading OR registers a current  
wire cuts the field lines o.w.t.t.e.  
e.m.f./voltage/current induced/produced/generated

B1

M1

A1

(ii) 1 reading/deflection/current increased  
2 reading/deflection/current reversed ignore magnitude

B1

B1

[Total: 7]

11  
(a) (i) 800 counts/s

B1

(ii) \( \frac{1}{4} \) of (i)

B1

(b) sample 1 \( \gamma \)  
sample 2 \( \beta \) NOT \( \gamma \) as extra  
sample 3 \( \alpha \) NOT extras

B1

B1

B1

(c) \( \alpha \)

B1

[Total: 6]