MARK SCHEME for the October/November 2012 series

9702 PHYSICS

9702/23

Paper 2 (AS Structured Questions), maximum raw mark 60

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 October/November 2012 series for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level components and some Ordinary Level components.



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| | | | | GCE AS/A LEVEL – October/November 2012 | 9702 | 23 | |
| 1 | (a) | spa | cing : | = 380 or 3.8 × 10 ² pm | | B1 | [1] |
| | (b) | time = 24 time = 0.0 | | 4 × 3600 086 (0.0864)Ms | | B1 | [1] |
| | (c) | time | e = di | stance / speed = $\frac{1.5 \times 10^{11}}{3 \times 10^8}$ | | C1 | |
| | | | = 5 | 00 (s) = 8.3 min | | A1 | [2] |
| | (d) | mor | nentı | um and weight | | B1 | [1] |
| | (e) | (i) | arro | w to the right of plane direction (about 4° to 24°) | | B1 | [1] |
| | | (ii) | or us | e diagram drawn se of cosine formula $v^2 = 250^2 + 36^2 - 2 \times 250 \times 36 \times co$ solving $v = [(36\cos 45^\circ)^2 + (250 - 36\sin 45^\circ)^2]^{1/2}$ | s 45° | C1 | |
| | | | allov | Itant velocity = 226 (220 – 240 for scale diagram) m s ⁻¹ v one mark for values 210 to 219 or 241 to 250 m s ⁻¹ se of formula (v^2 = 51068) v = 230 (226) m s ⁻¹ | | A1 | [2] |
| 2 | (a) | (i) | | elerations (A to B and B to C) are same magnitude elerations (A to B and B to C) are opposite directions | | B1 | |
| | | | or both accelerations are toward B (A to B and B to C) the component of the weight down the slope provides the acceleration | B1 B1 | [3] | | |
| | | (ii) | | eleration = $g \sin 15^{\circ}$ 0 + $\frac{1}{2} at^2$ s = 0.26 / sin 15° = 1.0 | | C1 C1 | |
| | | | <i>t</i> ² = | $\frac{1.0 \times 2}{9.8 \times \sin 15^{\circ}}$ $t = 0.89 \mathrm{s}$ | | A1 | [3] |
| | | (iii) | v = 2 | 0 + gsin15 <i>t</i> or v ² = 0 + 2gsin15 × 1.0 2.26 m s ^{−1} ng loss of GPE = gain KE can score full marks) | | C1 A1 | [2] |
| | (b) |) loss of GPE at A = gain in GPE at C or loss of KE at B = gain in GPE at C | | | | B1 | |
| | | | _ | $h_2 = 0.26 \text{ m or } \frac{1}{2} mv^2 = mgh$ $h_2 = 0.5 \times (2.26)^2 / 9.81 = 0.26 \text{ m}$ / sin 30° = 0.52 m | ôm | A1 | [2] |
| 3 | (a) | | | the rate of doing work or power = work done / time (take energy transferred / time (taken) | en) or | B1 | [1] |
| | (b) | (i) | resu cons | ne speed increases drag / air resistance increases Itant force reduces hence acceleration is less stant speed when resultant force is zero w one mark for speed increases and acceleration decre | ases) | B1 B1 B1 | [3] |
| | | | | • | ases) | 2. | |

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| | | | GCE AS/A L | EVEL – Octo | ber/November 2012 | 9702 | 23 | |
| | (ii) force from cyclist = drag force / resistive force $P = 12 \times 48$ P = 576 W | | | | B1 M1 A0 | [2] | | |
| | (iii) | (iii) tangent drawn at speed = $8.0 \mathrm{m s^{-1}}$ gradient values that show acceleration between 0.44 to 0.48 m s ⁻² | | | M1 A1 | [2] | | |
| | (iv) | 600 | R = ma / 8 - R = 80 ? = 75 - 40 = 3 | | [using <i>P</i> = 576] 576 / 8 <i>R</i> = 72 – 40 = 32 N | – <i>R</i> = 80 × 0.5 | C1 C1 A1 | [3] |
| | (v) | R/v | 2 m s ^{−1} drag is 48 ⁄ calculated as 4 consistent respo | and 4 or 4.4 | rag is 35 or 32N er <i>R</i> is proportional to <i>v</i> o | r not | B1 | [1] |
| 4 | (a) e.m.f. = chemical energy to electrical energy p.d. = electrical energy to thermal energy idea of per unit charge | | | | M1 M1 A1 | [3] | | |
| | (b) | I (R | + <i>r</i>) or <i>I</i> = <i>E</i> / (<i>R</i> | + <i>r</i>) (any su | bject) | | B1 | [1] |
| | (c) (i) | E = : | 5.8V | | | | B1 | [1] |
| | (ii) | (ii) evidence of gradient calculation or calculation with values from graph e.g. $5.8 = 4 + 1.0 \times r$ $r = 1.8 \Omega$ | | | C1 A1 | [2] | | |
| | (d) (i) | | VI 2.9 × 1.6 = 4.6 (4 | I.64)W | | | C1 A1 | [2] |
| | (ii) power from battery = 1.6 × 5.8 = 9.28 or efficiency = VI / EI efficiency = (4.64 / 9.28) × 100 = 50 % or (2.9 / 5.8) × 100 = 50% | | | 50% | C1 A1 | [2] | | |
| 5 | (a) trav | vel thr | ough a vacuum / | free space | | | B1 | [1] |
| | (b) (i) | C : r | name: name: name: | microwaves ultra-violet / X –rays | wavelength: 10 ⁻⁴ to UV wavelength: 10 ⁻⁷ to wavelength: 10 ⁻⁹ to | 10 ⁻⁹ m | B1 B1 B1 | [3] |
| | (ii) | f = | $\frac{3 \times 10^8}{500 \times 10^{-9}}$ | | | | C1 | |
| | | f = 6 | 6(.0) × 10 ¹⁴ Hz | | | | A1 | [2] |

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| | | | | GCE AS/A LEVEL – October/November 2012 | 9702 | 23 | |
| | (c) | | rations are in one direction pendicular to direction of propagation / energy transfer | | | M1 | |
| | | or good sketch showing this | | | A1 | [2] | |
| 6 | (a) | (i) | elec | tron | | B1 | [1] |
| | | (ii) any two: can be deflected by electric and magnetic fields or negatively charged / absorbed by few (1 – 4) mm of aluminum / 0.5 to 2 m or metres for range ir speed up to 0.99c / range of speeds / energies | | | air / | | |
| | | | · | | | B2 | [2] |
| | | | | ay occurs and cannot be affected by external / environm vo stated factors such as chemical / pressure / temperat | | B1 | [1] |
| | (b) | | | for superscript numbers for subscript numbers | | B1 B1 | [2] |
| | (c) | ene | ergy = | $5.7 \times 10^3 \times 1.6 \times 10^{-19} (= 9.12 \times 10^{-16} \text{ J})$ | | C1 | |
| | | v ² = | = <mark>2 ×</mark> 9. | $\frac{9.12 \times 10^{-16}}{11 \times 10^{-31}}$ | | C1 | |
| | | v = | = 4.5 > | $\times 10^7 \mathrm{ms^{-1}}$ | | A1 | [3] |
| | (d) | 1 n (sp | eutroi ecial | re 1 proton and 1 electron n in hydrogen-2 and 2 neutrons in hydrogen-3 case: for one mark 'same number of protons / atomic nu number of neutrons') | ımber | B1 B1 | [2] |