

MARK SCHEME for the May/June 2013 series

9702 PHYSICS

9702/22

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

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

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Page 2	Mark Scheme	Syllabus	Paper
	GCE AS/A LEVEL – May/June 2013	9702	22

- 1 (a) power = energy / time
= (force × distance / time) = kg m² s⁻² / s
= kg m² s⁻³ C1
C1
A1 [3]
- (b) (i) units of L^2 : m² and units of ρ : kg m⁻³ and units of v^3 : m³ s⁻³
($C = P / L^2 \rho v^3$) hence units of C: kg m² s⁻³ m⁻² kg⁻¹ m³ m⁻³ s³
or any correct statement of component units M1
argument /discussion / cancelling leading to C having no units A1 [3]
- (ii) power available from wind = $3.5 \times 10^5 \times 100 / 55$ (= 6.36×10^5)
 $v^3 = 3.5 \times 10^5 \times 100 / (55 \times 0.931 \times (25)^2 \times 1.3)$
 $v = 9.4 \text{ m s}^{-1}$ C1
C1
A1 [3]
- (iii) not all kinetic energy of wind converted to kinetic energy of blades
generator / conversion to electrical energy not 100% efficient / heat
produced in generator / bearings etc B1
B1 [2]
(there must be cause of loss and where located)
- 2 (a) force = rate of change of momentum A1 [1]
- (b) (i) horizontal line on graph from $t = 0$ to t about 2.0 s ± ½ square, $a > 0$ M1
horizontal line at 3.5 on graph from 0 to 2 s A1
vertical line at $t = 2.0$ s to $a = 0$ or sharp step without a line B1
horizontal line from $t = 2$ s to $t = 4$ s with $a = 0$ B1 [4]
- (ii) straight line and positive gradient M1
starting at (0,0) A1
finishing at (2,16.8) A1
horizontal line from 16.8 M1
from 2.0 to 4.0 A1 [5]
- 3 (a) the point where (all) the weight (of the body)
is considered / seems to act M1
A1 [2]
- (b) (i) vertical component of T (= $30 \cos 40^\circ$) = 23 N A1 [1]
- (ii) the sum of the clockwise moments about a point equals the sum of the
anticlockwise moments (about the same point) B1 [1]
- (iii) (moments about A): 23×1.2 (27.58) M1
= $8.5 \times 0.60 + 1.2 \times W$ M1
working to show $W = 19$ or answer of 18.73 (N) A1 [3]
- (iv) ($M = W / g = 18.73 / 9.81$) = 1.9(09) kg A1 [1]

Page 3	Mark Scheme	Syllabus	Paper
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- (c) (for equilibrium) resultant force (and moment) = 0
upward force does not equal downward force / horizontal component of T
not balanced by forces shown
- B1
B1 [2]
- 4 (a) apparatus: cell with particles e.g. smoke (container must be closed)
diagram showing suitable arrangement with light illumination and microscope
- B1
B1 [2]
- (b) specks / flashes of light
in random motion
- M1
A1 [2]
- (c) cannot see what is causing smoke to move hence molecules smaller than
smoke particles (B1)
- continuous motion of smoke particles implies continuous motion of molecules (B1)
- random motion of particles implies random motion of molecules (B1)
- max. 2 [2]
- 5 (a) (i) $v = f\lambda$
 $\lambda = 40 / 50 = 0.8(0)$ m
- C1
A1 [2]
- (ii) waves (travel along string and) reflect at Q / wall / fixed end
incident and reflected waves interfere / superpose
- B1
B1 [2]
- (b) (i) nodes labelled at P, Q and the two points at zero displacement
antinodes labelled at the three points of maximum displacement
- B1
B1 [2]
- (ii) $(1.5\lambda$ for PQ hence $PQ = 0.8 \times 1.5) = 1.2$ m
- A1 [1]
- (iii) $T = 1 / f = 1/50 = 20$ ms
5 ms is $\frac{1}{4}$ of cycle
horizontal line through PQ drawn on Fig. 5.2
- C1
A1
B1 [3]
- 6 (a) charge = current \times time
- B1 [1]
- (b) (i) $P = V^2 / R$
 $= (240)^2 / 18 = 3200$ W
- C1
A1 [2]
- (ii) $I = V / R = 240 / 18 = 13.3$ A
- A1 [1]
- (iii) charge = $It = 13.3 \times 2.6 \times 10^6$
 $= 3.47 \times 10^7$ C
- C1
A1 [2]
- (iv) number of electrons = $3.47 \times 10^7 / 1.6 \times 10^{-19} (= 2.17 \times 10^{26})$
number of electrons per second = $2.17 \times 10^{26} / 2.6 \times 10^6 = 8.35 \times 10^{19}$
- C1
A1 [2]

Page 4	Mark Scheme	Syllabus	Paper
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- 7 (a) (i) $W = 206$ and $X = 82$
 $Y = 4$ and $Z = 2$ A1
A1 [2]
- (ii) mass-energy is conserved B1
mass on rhs is less because energy is released B1 [2]
- (b) not affected by external conditions/factors/environment B1 [1]
or two examples temperature and pressure