Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

PHYSICS **9702/02**

Paper 2 AS Level Structured Questions **For Examination from 2016**

SPECIMEN MARK SCHEME

1 hour 15 minutes

MAXIMUM MARK: 60

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[Turn over

1 **(a)** **(i)** V units: m^3 (*allow metres cubed or cubic metres*) A1 [1]

(ii) Pressure units: $kg\,m\,s^{-2}/m^2$ (*allow use of* $P = \rho gh$) M1
Units: $kg\,m^{-1}\,s^{-2}$ A0 [1]

(b) V/t units: $m^3\,s^{-1}$ B1
Clear substitution of units for P, r^4 and l M1

$$C = \frac{\pi P r^4}{8Vt^{-1}l} = \frac{kgm^{-1}s^{-2}m^4}{m^3\,s^{-1}m}$$

Units: $kg\,m^{-1}\,s^{-1}$ A1 [3]
(*8 or* π *in final answer max. 2. Use of dimensions max. 2.*)

[Total: 5]

2 **(a)** shape and orientation correct and forces labelled and arrows correct B1
angles correct/labelled B1 [2]

(b) **(i)** $T\cos 18° = W$ C1
$T = 520/\cos 18° = 547\,N$ (Scale diagram: allow ± 20 N) A1 [2]

(ii) $R = T\sin 18°$
$= 169\,N$ A1 [1]

(c) θ is larger hence $\cos\theta$ is smaller ($T = W/\cos\theta$) M1
hence T is larger A0 [1]

[Total: 6]

3 **(a)** work done is the force × the distance moved / displacement in the direction of the force
or
work is done when a force moves in the direction of the force B1 [1]

(b) component of weight $= 850 \times 9.81 \times \sin 7.5°$ C1
$= 1090\,N$ A1 [2]
(*no credit for use of incorrect trigonometrical function*)

(c) **(i)** $\Sigma F = 4600 - 1090\ (= 3510)$ M1
deceleration $= 3510 / 850$ A1
$= 4.1\,m\,s^{-2}$ A0 [2]

(ii) $v^2 = u^2 + 2as$
$0 = 25^2 + 2 \times (-4.1) \times s$ C1
$s = 625 / 8.2$
$= 76\,m$ A1 [2]
(*allow full credit for calculation of time (6.05 s) and then s*)

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(iii) **1.** kinetic energy $= \frac{1}{2} mv^2$ C1
$= 0.5 \times 850 \times 25^2$
$= 2.7 \times 10^5$ J A1 [2]

2. work done $= 4600 \times 75.7$
$= 3.5 \times 10^5$ J A1 [1]

(iv) difference is the loss in potential energy (or equivalent wording) B1 [1]

[Total: 11]

4 **(a)** torque is the product of one of the forces M1
and the perpendicular distance between the forces A1 [2]

(b) **(i)** torque $= 8 \times 1.5 = 12$ (N m) A1 [1]

(ii) there is a resultant torque (there is no resultant force) M1
(the rod rotates) and is not in equilibrium A1 [2]

[Total: 5]

5 **(a)** **(i)** $I_1 = I_2 + I_3$ B1 [1]

(ii) $I = V / R$ or $I_2 = 12 / 10$ (= 1.2 A) C1
$R = [1/6 + 1/10]^{-1}$ [total $R = 3.75\ \Omega$] or $I_3 = 12 / 6$ (= 2.0 A) C1
$I_1 = 12 / 3.75 = 3.2$ A or $I_1 = 1.2 + 2.0 = 3.2$ A A1 [3]

(iii) power $= VI$ or I^2R or V^2 / R C1

$$x = \frac{\text{power in wire}}{\text{power in series resistors}} = \frac{I_2^2 R_w}{I_3^2 R_s} \text{ or } \frac{VI_2}{VI_3} \text{ or } \frac{V^2 / R_w}{V^2 / R_s}$$ C1

$x = 12 \times 1.2 / 12 \times 2.0 = 0.6(0)$ allow 3 / 5 or 3:5 A1 [3]

(b) p.d. BC: $12 - 12 \times 0.4 = 7.2$ (V) / p.d. AC $= 4.8$ (V) C1
p.d. BD: $12 - 12 \times 4 / 6 = 4.0$ (V) / p.d. AD $= 8.0$ (V) C1
p.d. $= 3.2$ V A1 [3]

[Total: 10]

6 **(a)** extension is proportional to force (for small extensions) B1 [1]

(b) **(i)** point beyond which (the spring) does not return to its original length
when the load is removed B1 [1]

(ii) gradient of graph $= 80\ \text{N m}^{-1}$ A1 [1]

(iii) work done is area under graph / $\frac{1}{2} Fx$ / $\frac{1}{2} kx^2$ C1
$= 0.5 \times 6.4 \times 0.08 = 0.256$ J (allow 0.26 J) A1 [2]

[Total: 5]

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7	**(a)**	**(i)**	amplitude = 7.6 mm (allow 7.5 mm)	A1	[1]
		(ii)	180° / π rad	A1	[1]
		(iii)	$v = f \times \lambda$ $= 15 \times 0.8$ $= 12\,\text{m s}^{-1}$	C1 A1	[2]
	(b)	**(i)**	zero (rad)	A1	[1]
		(ii)	antinode: maximum amplitude node: zero amplitude / displacement	A1	[1]
		(iii)	3	A1	[1]
		(iv)	horizontal line through central section of wave	B1	[1]
					[Total: 8]
8	**(a)**		the observed frequency is different to the emitted frequency when there is relative motion between the source and observer	B1	[1]
	(b)	**(i)**	$f = f_s v / (v \pm v_s)$ $= (880 \times 340) / (340 - 44) = 1010\,\text{Hz}$	C1 A1	[2]
		(ii)	$f = (880 \times 340) / (340 + 44) = 780\,\text{Hz}$	A1	[1]
					[Total: 4]
9	**(a)**		hadrons (or baryons)	B1	[1]
	(b)		${}^{1}_{1}\text{p} \rightarrow {}^{1}_{0}\text{n} + {}^{0}_{1}\beta^{+} + \nu_e$ One mark for each correct term on RHS	B3	[3]
	(c)		up up down	B1	[1]
	(d)		an up changes to a down	B1	[1]
					[Total: 6]

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Categorisation of marks

The marking scheme categorises marks on the *MACB* scheme.

B marks: These are awarded as 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: these are method marks upon which A-marks (accuracy marks) later depend. for an M-mark to be scored, the point to which it refers must be seen in the 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: these are compensatory method marks which can be scored even if the points to which they refer are not written down by the candidate, providing 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 working which shows he/she knew the equation, then the C-mark is awarded.

A marks: These are accuracy or answer marks which either depend on an M-mark, or allow a C-mark to be scored.

Conventions within the marking scheme

BRACKETS
Where brackets are shown in the marking scheme, the candidate is not required to give the bracketed information in order to earn the available marks.

UNDERLINING
In the marking scheme, underlining indicates information that is essential for marks to be awarded.

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