

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS**GCE Advanced Subsidiary Level and GCE Advanced Level****MARK SCHEME for the May/June 2008 question paper****9702 PHYSICS****9702/02**

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

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All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

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- 1 (a) allow anything in range 20 Hz → 20 kHz B1 [1]
- (b) allow anything in range 10 nm → 400 nm B1 [1]
- (c) allow anything in range 10 g → 100 g B1 [1]
- (d) allow anything in range 0.1 kg m⁻³ → 10 kg m⁻³ B1 [1]
- 2 (a) (i) k is the reciprocal of the gradient of the graph
 $k = \{32 / (4 \times 10^{-2})\} = 800 \text{ N m}^{-1}$ C1
A1 [2]
- (ii) *either* energy = average force × extension *or* $\frac{1}{2}kx^2$
or area under graph line C1
energy = $\frac{1}{2} \times 800 \times (3.5 \times 10^{-2})^2$ *or* $\frac{1}{2} \times 28 \times 3.5 \times 10^{-2}$ M1
energy = 0.49 J A0 [2]
- (b) (i) momentum before cutting thread = momentum after C1
 $0 = 2400 \times V - 800 \times v$ M1
 $v / V = 3.0$ A0 [2]
- (ii) energy stored in spring = kinetic energy of trolleys C1
 $0.49 = \frac{1}{2} \times 2.4 \times (\frac{1}{3}v)^2 + \frac{1}{2} \times 0.8 \times v^2$ C1
 $v = 0.96 \text{ m s}^{-1}$ A1 [3]
(if only one trolley considered, or masses combined, allow max 1 mark)
- 3 (a) (i) $v^2 = 2as$
 $1.2^2 = 2 \times a \times 1.9$ M1
 $a = 0.38 \text{ m s}^{-2}$ A1 [2]
- (ii) $F = ma$
 $= 42 \times 0.38$ M1
 $= 16 \text{ N}$ A0 [1]
- (b) $\text{power} = Fv$ C1
 $= 16 \times 1.2$
 $= 19 \text{ W}$ A1 [2]
- (c) (i) component = $42 \times 9.8 \times \sin 2.8$ C1
 $= 20.1 \text{ N}$ A1 [2]
- (ii) accelerating force = $20.1 - 16 = 4.1 \text{ N}$ C1
acceleration of trolley = $4.1 / 42 = 0.098 \text{ m s}^{-2}$ C1
 $s = \frac{1}{2}at^2$
 $3.5 = \frac{1}{2} \times 0.098 \times t^2$ C1
 $t = 8.5 \text{ s}$ A1 [4]

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- (d) *either* allows plenty of time to stop runaway trolley
or speed of trolley increases gradually
or trolley will travel faster
(answer must be unambiguous when read in conjunction with question) B1 [1]
- 4 (a) (i) 1. stress = force / (cross-sectional) area B1 [1]
2. strain = extension / original length B1 [1]
3. Young modulus = stress / strain B1 [1]
(ratios must be clear in each answer)
- (ii) *either* fluids cannot be deformed in one direction / cannot be stretched
or fluids can only have volume change
or no fixed shape B1 [1]
- (b) *either* unless Δp is very large *or* 2.2×10^9 is a large number M1
 ΔV is very small *or* $\Delta V/V$ is very small, (so 'incompressible') A1 [2]
- (c) $\Delta p = h\rho g$
 $1.01 \times 10^5 = h \times 1.08 \times 10^3 \times 9.81$ C1
 $h = 9.53 \text{ m}$ C1
 $\Delta h / h = 0.47 / 10$ *or* $0.47 / 9.53$
error = 4.7% *or* 4.9% *or* 5% A1 [3]
- 5 (a) (i) frequency: number of oscillations per unit time M1
of the source / of a point on the wave A1 [2]
- (ii) speed: speed at which energy is transferred / speed of wavefront B1 [1]
- (b) (i) does not transfer energy (along the wave) B1 [1]
(ii) position (along wave) where amplitude of vibration is a maximum B1 [1]
(iii) all three positions marked B1 [1]
- (c) wavelength = $2 \times 17.8 = 35.6 \text{ cm}$ C1
 $v = f\lambda$ C1
 $v = 125 \times 0.356$
 $= 44.5 \text{ m s}^{-1}$ C1
 $44.5^2 = 4.00 / m$ C1
 $m = 2.0 \times 10^{-3} \text{ kg m}^{-1}$ A1 [5]

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- 6 (a) *either* $P = VI$ and $V = IR$ *or* $P = V^2 / R$ C1
 resistance = 38.4 Ω A1 [2]
- (b) zero B1
 1.5 kW B1
 3.0 kW B1
 0.75 kW B1
 2.25 kW B1 [5]
- 7 (a) α -particle: *either* helium nucleus *or* contains 2 protons + 2 neutrons
or ${}^4_2\text{He}$ B1
- β -particle: *either* electron *or* ${}^0_{-1}\text{e}$ B1
- α speed < β speed (1)
 α discrete values of speed/energy, β continuous spectrum (1)
either α ionising power $\gg$ β ionising power
or α range $\ll$ β range (1)
 α positive, β negative (*only if first two B marks not scored*) (1)
 α mass > β mass (*only if first two B marks not scored*) (1)
 (any two sensible pairs of statements relevant to differences,
 – do not allow statements relevant to only α or β , 1 each, max 2) B2 [4]
- (b) (i) ${}^{236}_{92}\text{U} \rightarrow {}^{232}_{90}\text{Th}$ M1
 $+ {}^4_2\text{He}$ A1 [2]
- (ii) 1. correct position for U at $Z = 92$, $N = 145$ B1
 2. correct position for Np relative to U i.e. $Z + 1$ and $N - 1$ B1 [2]