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

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.

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.

Mark schemes must be read in conjunction with the question papers and the report on the examination.

- CIE will not enter into discussions or correspondence in connection with these mark schemes.

CIE is publishing the mark schemes for the May/June 2008 question papers for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.

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	C1	
			$k = \{32 / (4 \times 10^{-2}) = \}$ 800 N m^{-1}	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 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 m s^{-2}	A1	[2]
		(ii)	$F = ma$		
			$= 42 \times 0.38$	M1	
			= 16 N	A0	[1]
	(b)		*power* = Fv	C1	
			$= 16 \times 1.2$		
			= 19 W	A1	[2]
	(c)	**(i)**	component = $42 \times 9.8 \times \sin 2.8$	C1	
			= 20.1 N	A1	[2]
		(ii)	accelerating force = 20.1 – 16 = 4.1 N	C1	
			acceleration of trolley = 4.1 / 42 = 0.098 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 s	A1	[4]

	(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 *(ratios must be clear in each answer)*		B1	[1]
	(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	
		$h = 9.53$ 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 × 17.8 = 35.6 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]

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* $^{4}_{2}He$	B1	
		β-particle: *either* electron *or* $^{0}_{-1}e$	B1	
		α speed < β speed (1)		
		α discrete values of speed/energy, β continuous spectrum (1)		
		either α ionising power >> β ionising power		
		or α range << 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)** $^{236}_{92}U \rightarrow ^{232}_{90}Th$	M1	
		$+ ^{4}_{2}He$	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]