Cambridge O Level

Cambridge International Examinations
Cambridge Ordinary Level

PHYSICS **5054/21**

Paper 2 Theory **October/November 2016**

MARK SCHEME

Maximum Mark: 75

Published

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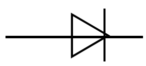
Section A

1	**(a)**		velocity / it has a direction / is a vector	B1	
	(b)	**(i)**	(F =)ma **or** 800 × 1.5	C1	
			1200 N	A1	
		(ii)	friction / air resistance acts on car	B1	
			opposes force due to engine	B1	
		(iii)	(Δv =)at **or** 1.5 × 4.0 **or** 6.0	C1	
			31 m / s	A1	[7]
2	**(a)**		260 N	B1	
	(b)	**(i)**	for a body in equilibrium	B1	
			(total) clockwise moment = (total) anticlockwise moment	B1	
		(ii)	$F_1d_1 = F_2d_2$ **or** 260 × 0.35 **or** 91 **or** F × 0.65	C1	
			260 × 0.35 = F × 0.65 **or** 260 × 0.35/0.65 **or** 91 = F × 0.65 **or** 91/0.65	C1	
			140 N	A1	[6]
3	**(a)**		chemical (potential energy)	B1	
	(b)	**(i)**	non-renewable **and** oil / it is not replaced / will run out	B1	
		(ii)	acid rain **or** produces CO_2 **or** warms lakes / rivers / sea **or** global warming **or** greenhouse effect	B1	
	(c)	**(i)**	useful energy output / (total) energy input **or** power for energy twice	B1	
		(ii)	**1** $1.9 \times 10^9/0.38$ **or** $1.9 \times 10^9 \times 100/38$	C1	
			5.0×10^9 W	A1	
			2 (E =)Pt **or** $0.62 \times 5.0 \times 10^9 \times 2.0$ (× 3600) **or** $(5.0 - 1.9) \times 10^9$ etc.	C1	
			2.2×10^{13} J	A1	[8]
4	**(a)**		smallest angle for total internal reflection **or** angle for refraction along surface	B1	
			angle of incidence in (optically) denser medium	B1	
	(b)		vertical ray continues undeviated	B1	
			second ray (60° to horizontal) refracts away from normal into the air	B1	
			third ray reflects internally **and** $i = r$ by eye **not** if any refracted ray	B1	[5]

5	(a)			number of oscillations / vibrations / wavelengths / compressions / rarefactions / cycles per second / unit time	B1	
	(b)	(i)		(λ =) c / f **or** 330 / 2200	C1	
				0.15 m	A1	
		(ii)	1	no change **and**		
			2	increases	B1	
	(c)	(i)	1	loudspeaker vibrates / oscillates / moves to and fro (and collides with molecules)	B1	
			2	compressions **and** rarefactions / molecules vibrate / longitudinal wave	B1	
				vibration / oscillation / energy passed on	B1	
		(ii)		fewer / no molecules / particles **and** less / no energy / vibration transferred	B1	[8]
6	(a)	(i)		X N-pole	B1	
				Y S-pole **and** Z N-pole	B1	
		(ii)		they touch / move towards each other **and** opposite poles attract	B1	
	(b)			any sensible use: starting-motor circuit; with a logic gate; nuclear power station	B1	
				corresponding explanation: current too large for dash-board switch; current too small to power device; too dangerous to reach switch	B1	[5]
7	(a)	(i)		supplies the (mains) e.m.f. / voltage	B1	
		(ii)		to complete the circuit / is at 0 V	B1	
	(b)	(i)		the circuit / supply is cut / broken **or** current stops	B1	
				fuse melts / blows / burns	B1	
		(ii)		live wire	B1	
				when it cuts the circuit / melts no part of the appliance is live / no shock	B1	[6]

[45]

Section B

8	**(a)**	**(i)**	11 protons **and** 11 electrons 13 neutrons electrons in orbit / surrounding nucleus **or** neutrons **and** protons in nucleus	B1 B1 B1	
		(ii)	**one** more neutron (in sodium-24) **or** one fewer neutron in sodium-23	B1	[4]
	(b)	**(i)**	electron	B1	
		(ii)	$^{0}_{-1}(\beta)$ **cao** $^{24}_{\dots\dots}(\mathrm{Mg})$ $^{\dots\dots}_{12}(\mathrm{Mg})$	B1 B1 B1	[4]
	(c)		electromagnetic (radiation / rays / waves) (very) high frequency / energy **or** (very) short wavelength	M1 A1	[2]
	(d)	**(i)**	path curving upwards	B1	
		(ii)	path continues in straight line	B1	
		(iii)	beta-particle charged **or** gamma-ray uncharged	B1	[3]
	(e)		long enough to take measurements **or** short enough so the body is not irradiated for long	B1 B1	[2] **[15]**
9	**(a)**	**(i)**	magnetic field mentioned alternating / changing magnetic field current / voltage / e.m.f. <u>induced</u> (in secondary coil)	B1 B1 B1	
		(ii)	 diode	B1 B1	[5]
	(b)	**(i)**	work done / energy transferred per unit charge electrical energy to other forms **or** for whole circuit **or** property of supply	M1 A1	

		(ii)	**1** 1.3 V	B1	
			2 (I =)V/R **or** 1.3/5.2	C1	
			0.25 A	A1	
			3 (Q =)It **or** 0.25 × 1.5 × 3600 **or** 0.25 × 1.5	C1	
			0.25 × 1.5 × 3600 **or** 0.37/0.375/0.38	C1	
			1300 / 1350 / 1400 C	A1	[8]
	(c)		plastic / casing is an (electrical) insulator	M1	
			no shock possible	A1	[2]
					[15]
10	**(a)**	**(i)**	molecules / they close together **or** small gaps between molecules	B1	
		(ii)	molecules / they exert large (repulsive) forces	B1	[2]
	(b)	**(i)**	(V =)m/ρ **or** 680 / 0.85	C1	
			800 cm^3 **or** 8.0×10^{-4} m^3	A1	
		(ii)	**1** molecules vibrate **or** molecules vibrate	B1	
			collide with neighbours **or** collide with electrons	B1	
			transfer vibration / energy **or** electrons travel through metal	B1	
			2 heated / hot oil expands / less dense	B1	
			rises	B1	
			convection current/circulation established	B1	
			3 any suitable named insulator **and** it is a poor conductor	B1	[9]
	(c)	**(i)**	temperature at which (liquid) vaporises / becomes gas / steam	B1	
		(ii)	(Q =)$mc\,\Delta T$ **or** 680 × 2.0 × (260 – 20) **or** 680 × 2.0 × 240	C1	
			3.3×10^5 J	A1	
		(iii)	heat supplied to pan **or** heat lost to air / surroundings	B1	[4]
					[15]