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General Certificate of Education
2018

Physics

Assessment Unit AS 1

assessing

Forces, Energy and Electricity

[SPH11]

TUESDAY 15 MAY, MORNING

MARK SCHEME

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					AVAILABLE MARKS
1	(a)	P = VI	[1]		
		18 = 9.6 I	[1]		
		I = 1.9 (1.875) (A)	[1]	[3]	
	(b)	E = VIt or Pt	[1]		
		Conversion of t to seconds (660)	[1]		
		E = 12000 (J)	[1]	[3]	
		ecf for I			
		(SE t in minutes 198 J scores [2])			
	(c)	I = nq/t or Q = It or Q = $\frac{W}{V}$ n = $\frac{W}{eV}$ (ecf E)	[1]		
		1.9 = n(1.6 × 10^{-19})/(660) or Q = 1241(C)	[1]		
		n = 7.7 × 10^{21} or 7.8 × 10^{21}	[1]	[3]	9
		ecf for I, t			
2	(a)	I proportional to V	[1]		
		Provided temperature constant	[1]	[2]	
	(b)	(i) Lamp in series with cell	[1]		
		Variable resistor (or power pack) } symbols correct	[1]		
		Ammeter in series, } symbols correct	[1]		
		Voltmeter across lamp } symbols correct	[1]	[4]	
		(ii) Record current and voltage	[1]		
		Adjust (using variable resistor)	[1]		
		⩾ 5 sets of results	[1]	[3]	
		(iii) Curve, starting at (0,0)	[1]		
		Correct sense	[1]	[2]	
	(c)	Larger current (or V) temperature increases	[1]		
		Resistance of metal filament increases with temperature	[1]		
		R = $\frac{V}{I}$ so graph gets less steep	[1]	[3]	14
3	(a)	Calculates 13 cm } can be on diagram	[1]		
		25(9.81) } can be on diagram	[1]		
		F(22) = 25(9.81)(13)	[1]		
		F = 145 N	[1]	[4]	
	(b)	F is always to the right of (front) wheels/inside base/between wheels	[1]		
		No anticlockwise **moment**	[1]	[2]	6
4	(a)	9.4 × 10^{27} Tm^3 = 9.4 × 10^{63} m^3	[1]		
		1.8 × 10^{13} Gg = 1.8 × 10^{19} kg	[1]		
		Density = 1.9 × 10^{-45} kg m^{-3} (ecf their m and V)	[1]		
		To 2 s.f.	[1]	[4]	
	(b)	Base unit of F = kg m s^{-2}	[1]		
		Base unit of v = m s^{-1}	[1]		
		Base unit of B = s kg^{-1}	[1]	[3]	7

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							AVAILABLE MARKS
5	(a)	(i)	24.9 cos 38		[1]		
			19.6 (kN)		[1]		
			2000 kg		[1]	[3]	
		(ii)	24.9 Sin 38		[1]		
			15.3 kN		[1]	[2]	
			S.E. sin, cos reversed max $\frac{3}{5}$.				
	(b)		Momentum vector,		[1]		
			Ke scalar		[1]		
			Vectors have an associated direction		[1]	[3]	8
6	(a)		$s = ut + \frac{1}{2}at^2$	eqn	[1]		
			Either:				
			$22.5 = 2.5(7) + \frac{1}{2}(a)(7)^2$	subs	[1]		
			$a = 0.204\,km\,h^{-2}$		[1]		
			$a = \frac{0.204 \times 1000}{(3600)^2}$		[1]		
			or				
			$22\,500 = 2500(t) + \frac{1}{2}(a)(t)^2$	conv km – m and any correct subs of s, u and t	[1]		
			$22\,500 = 2500(7) + \frac{1}{2}(a)(7 \times 3600)^2$	time subs	[1]		
			$a = 1.57 \times 10^{-5}\,m\,s^{-2}$	ans	[1]	[4]	
	(b)	(i)	$v^2 = u^2 + 2as$ $0 = u^2 + 2(-1.2 \times 10^{-3})(950)$	eqn or subs	[1]		
			$u = 1.51\,m\,s^{-1}$		[1]		
			$1.51^2 + 0.49^2 = v^2$ (ecf u)		[1]		
			$v = 1.59$		[1]		
			angle = 72° (ecf v)		[1]	[5]	
		(ii)	$v = u + at$	eqn	[1]		
			$t_v = 1.26 \times 10^3\,s$	ans	[1]		
			Total time = 2 t_v (2.52×10^3)		[1]		
			$s = vt$		[1]		
			$s = 1233\,m$		[1]	[5]	14
7	(a)		$KE = 0.5mv^2$		[1]		
			$v^2 = 25^2$ $(m\,s^{-1})$ and m = 1940 (kg)	subs	[1]		
			$KE = 6.06 \times 10^5$ (J)		[1]	[3]	
	(b)	(i)	$t = 180 \times 10^3/8.3 = 2.17 \times 10^4\,s$		[1]		
			$P = 0.12(96) = 11.52(kW)$		[1]		
			$E = Pt = (11.52 \times 10^3)(2.17 \times 10^4)$		[1]		
			$E = 2.5 \times 10^8$ (J)		[1]	[4]	
		(ii)	E input = 3.3×10^8 (ecf **b(i)**) or 0.75 (3.6×10^6)		[1]		
			Units used = $(3.33 \times 10^8)/(3.6 \times 10^6) = 92.6$		[1]		
			Cost = £14.81		[1]	[3]	
	(c)		To reduce CO_2 emissions (international commitment)/harmful gas emissions/atmospheric pollution		[1]		
			To conserve supplies of fossil fuels/reduction in use		[1]	[2]	12

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					AVAILABLE MARKS
8	(a)	Statement of first law	[1]		
		Reference to 'resultant'	[1]		
		Comparison: resultant force is zero on both objects	[1]		
		Contrast: rock has no force acting on it	[1]		
		car driving force = air resistance or resistive forces	[1]	[5]	
	(b)	Statement of Newton's 3rd law e.g. $\|F_{earth}\| = \|F_{beam}\|$ or f = ma	[1]		
		1619 (N) from f = ma	[1]		
		2.71×10^{-22} ($m\,s^{-2}$)	[1]		
		Direction: upwards/towards the beam	[1]	[4]	9
9	(a)	p = mv	[1]		
		$p = (57 \times 10^{-3})(-18)$	[1]		
		$p = (-)1.03$ ($kg\,m\,s^{-1}$)	[1]	[3]	
	(b)	Impulse = area under graph	[1]		
		Impulse = $\frac{1}{2}(0.6)(8.2)$	[1]		
		Impulse = 2.46 (N s)	[1]	[3]	
	(c)	Ft = mv – mu	[1]		
		$2.46 = 0.057[(v) - (-18)]$	[1]		
		v = 25 ($m\,s^{-1}$)	[1]	[3]	9
		(using 2.5 N s gives 26 $m\,s^{-1}$)			
10	(a)	(i) Opposition to current flow within the cell		[1]	
		(ii) $1.38 = 1.52 - (0.636)r$ correct subs	[1]		
		r = 0.220 (Ω) = 220 mΩ	[1]	[2]	
	(b)	(i) $\frac{1}{R_{effective}} = \frac{1}{6} + \frac{1}{4}$	[1]		
		$R_{effective} = 2.4\ \Omega$	[1]		
		$R_{lower} = 2.4 + 4.6 = 7\ \Omega$ (ecf 2.4)	[1]		
		$R_{upper} = 4.5 + 2.5 = 7\ \Omega$	[1]		
		$R_{total} = 3.5\ \Omega$ (ecf R_{lower})	[1]	[5]	
		(ii) $R_{total} + R_{internal} = 3.8\ \Omega$ (ecf R_{total})	[1]		
		$I_{total} = \frac{V}{R} = \frac{1.52}{3.8(ecf)} = 0.4A$	[1]	[2]	
		(iii) $I_{lower} = 0.2A$ (ecf 0.5 I_{total})	[1]		
		$I_{6\,\Omega} = 0.08$ (ecf 0.4 × I_{lower})	[1]	[2]	12
				Total	**100**