Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2019

Physics

Assessment Unit AS 1

assessing

Forces, Energy and Electricity

[SPH11]

TUESDAY 14 MAY, MORNING

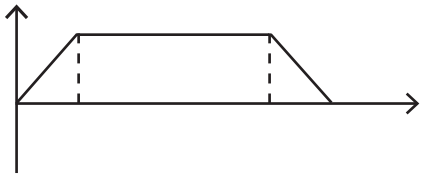
MARK SCHEME

						AVAILABLE MARKS
1	(a)	(i)	Units from which all other units are derived		[1]	
		(ii)	Metre [1], kelvin [1], mole [1], candela [1] (Any three) (Accept symbols)		[3]	
		(iii)	Valid equation	[1]		
			Base units of 2 terms correct	[1]		
			kg m^2 s^{-2}	[1]	[3]	
	(b)	(i)	G = 1×10^9	[1]		
			1 hour = 3600 s	[1]	[2]	
		(ii)	energy of each = $84700 \times 3.6 \times 10^{12}/32$	[1]		
			$p = \frac{E}{t}$ or power = $\frac{9.53 \times 10^{15}}{31536000}$	[1]		
			Power of each = 3.02×10^8 W	[1]	[3]	12
2	(a)		Energy cannot be created or destroyed but can be changed from one form to another		[1]	
	(b)	(i)	$KE = \frac{1}{2}mv^2$	[1]		
			$KE = \frac{1}{2} \times 0.156 \times 19.6^2$	[1]		
			KE = 30.0 J	[1]	[3]	
		(ii)	$\frac{1}{2}mv^2 - \frac{1}{2}mu^2 = Fs$			
			$30.0 - 0 = 80 \times s$	[1]		
			s = 0.375 m	[1]	[2]	
			(SE: 0.75 [1]/[2])			
		(iii)	P = Fv	[1]		
			P = 80 × (19.6/2)	[1]		
			P = 784 W	[1]		
			SE = 1568 W scores [2]/[3]			
			Alternative **(iii)**:			
			$P = F \times \frac{s}{t}$	[1]		
			Time = 38.3 ms	[1]		
			784 W	[1]	[3]	9

						AVAILABLE MARKS
3	(a)	(i)	The acceleration of a body is proportional to the (resultant) force and inversely proportional to the mass	[1]		
			and acts in the same direction as the (resultant) force	[1]		
			Resultant included	[1]		
			Alternative:			
			Force proportional to (or equal to) rate of change of momentum	[1]		
			Resultant force	[1]		
			Direction	[1]	[3]	
		(ii)	Resultant force is up	[1]		
			so reaction is larger than (normal) weight	[1]	[2]	
	(b)	(i)	Total m of lift and passengers = 1200 or W = 11772N	[1]		
			T = 11260N	[1]		
			512 N	[1]		
			Downward	[1]	[4]	
		(ii)	$F_{resultant}$ = ma or subs	[1]		
			correct subs, correct combination of F and M.	[1]		
			a = 0.427 m s^{-2}	[1]	[3]	12
4	(a)		Constant velocity/zero force/zero acceleration in one plane and	[1]		
			constant acceleration/force in a perpendicular plane	[1]	[2]	
	(b)	(i)	vertical component = 7.91 m s^{-1}	[1]		
			horizontal component = 9.42 m s^{-1}	[1]	[2]	
			(if left as Sin and Cos [1]/[2])			
		(ii)	$v^2 = u^2 + 2as$	[1]		
			$0 = 7.91^2 - 2 \times 9.81 \times s$	[1]		
			s = 3.19 m	[1]	[3]	
		(iii)	v = u + at	[1]		
			0 = 7.91 – 9.81 t	[1]		
			t = 0.806 s	[1]	[3]	
		(iv)	s = ut	[1]		
			s = 9.42 × 1.612	[1]		
			s = 15.2 m	[1]	[3]	13
			(SE 7.6m [2]/[3])			
5	(a)	(i)	impulse = mv – mu	[1]		
			= 0 – 87 × 7.92	[1]		
			= 689 N s	[1]	[3]	
		(ii)	impulse = Ft	[1]		
			$689 = F \times 4.8 \times 10^{-3}$	[1]		
			$F = 1.44 \times 10^5$ N	[1]	[3]	
	(b)		bend legs/crumple	[1]		
			Increase (impact) time	[1]		
			Decrease impact/force	[1]	[3]	9

AVAILABLE MARKS

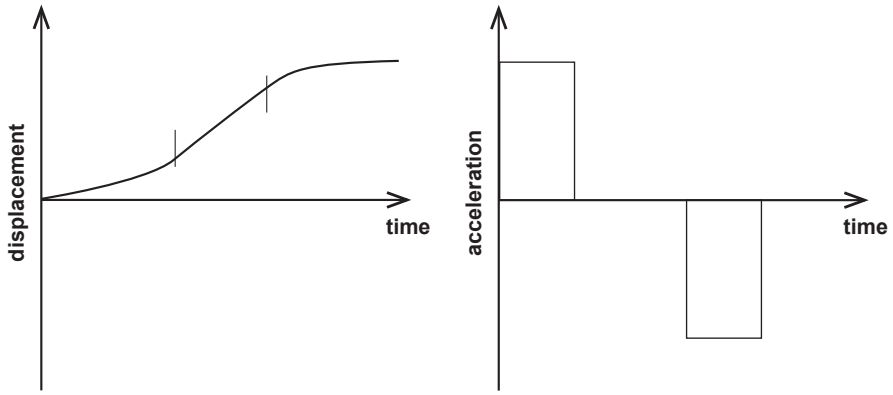
6 **(a)** **(i)**



[1]

(ii) Dist = area [1]
Dist = 49.08 [1]
Area = $(\frac{1}{2} \times v \times 5) + (8.2 \times v) + (\frac{1}{2} \times v \times 5)$ or $13.2v$ [1]
$v = 3.72\ m\,s^{-1}$ [1] [4]
(SE $3.41\ m\,s^{-1}$ [3]/[4])

(b)

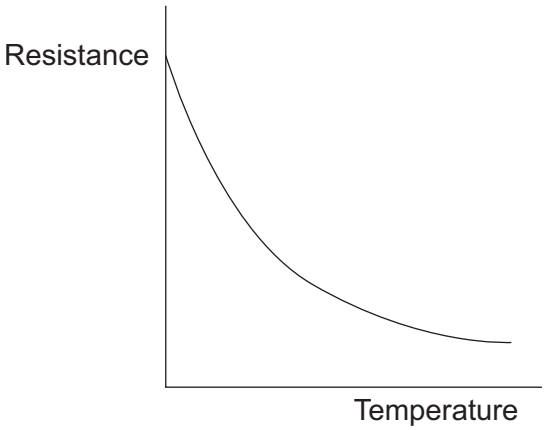


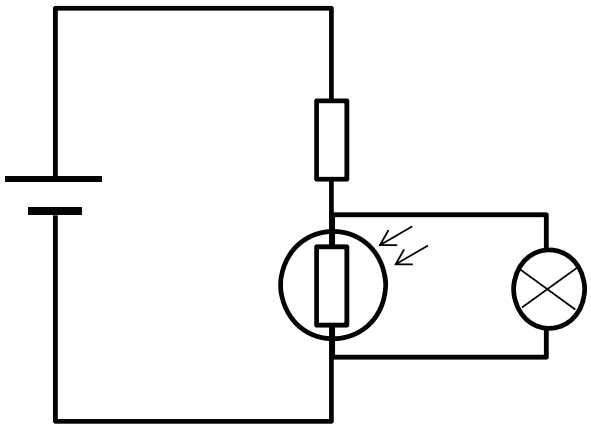
[1] for straight section
[1] for 1st curve increasing gradient
[1] for 2nd curve decreasing to horizontal
[1] for constant acceleration positive
[1] for zero acceleration
[1] for constant deceleration, back to zero same size approx [6] 11

7 **(a)** $Q = 18 \times 10^{19}\,(1.6 \times 10^{-19}) = 28.8\,C$ [1]
$I = \frac{Q}{t}$ [1]
$I = 0.48\,A$ [1] [3]

(b) Addition of resistors in series [1]
$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2}$ for resistors in parallel [1]
Total R at LHS = $3\,\Omega$ [1]
R_T circuit = $9\,\Omega$ ecf from their parallel value [1]
$V = 4.32\,V$ ecf R_T [1] [5]

(c) Ratio of currents 2 : 1 : 1 or V across parallel part = $1.44\,V$ [1]
$I = 0.24\,A$ ecf **(a)** [1] [2] 10

					AVAILABLE MARKS
8	(i)	water (bath), thermometer (must have labels)	[1]		
		thermistor, ohmmeter (or voltmeter, ammeter, power supply) (correct electrical symbols)	[1]	[2]	
	(ii)	Record the reading on the ohmmeter (or voltmeter and ammeter)	[1]		
		Record temperature			
		Repeat for 5 sets of valid results	[1]		
		Changing the temperature of the water bath each time	[1]	[4]	
	(iii)			[1]	
	(iv)	As the temperature increases, more electrons break free	[1]		
		The current increases so resistance decreases	[1]		
		This is greater than the increase in resistance of the metal due to greater vibration of ions within the metal	[1]	[3]	10
9	(a)	**Chemical energy** converted into **electrical energy**	[1]		
		per coulomb of charge passing **through the battery** (allow unit charge)	[1]	[2]	
	(b)	$\frac{1}{R} = \frac{1}{230} + \frac{1}{25}$	[1]		
		$R = 22.5\ \Omega$	[1]		
		$\frac{V}{R}$ = I subs $\frac{5.88}{22.5}$ = 0.26A	[1]		
		$5.88 = 6 - 0.26r$	[1]		
		$r = 0.46$	[1]	[5]	7

					AVAILABLE MARKS
10	**(a)**	$V_{out} = R_1V_{in}/(R_1 + R_2)$ used with sub	[1]		
		= (0.8/1.9) × 12	[1]		
		= 5.05	[1]	[3]	
	(b)	**(i)** 			
		Input power supply, resistor, LDR in series, symbols correct	[1]		
		bulb across LDR	[1]	[2]	
		(ii) As **light** level **reduces** the **resistance of the LDR increases**	[1]		
		There is a **larger $V_{(out)}$** and the **lighting** circuit **switches on**	[1]	[2]	7
				Total	**100**