Assessment Schedule – 2005

Physics: Demonstrate understanding of electricity and electromagnetism (90257)

Evidence Statement

Q	Evidence	Evidence contributing to Achievement	Evidence contributing to Achievement with Merit	Evidence contributing to Achievement with Excellence
1(a)	Right to left (chair to spray gun).	[1] Correct answer.		
1(b)	Charge = no. of electrons × charge of each electron $= 3.0 \times 10^{6} \times 1.60 \times 10^{-19}$	[2] Correct factors using data are shown (ignore presence or absence of –ve sign on charge).		
1(c)	$F = Eq \qquad E = \frac{V}{d}$ $F = \frac{Vq}{d}$ $F = \frac{110 \times 10^{3} \times 4.8 \times 10^{-13}}{0.65}$ $F = 8.1 \times 10^{-8}$ N	[2] Evidence of electric field calculation and a substitution $E = \frac{V}{d} = \frac{110 \times 10^{3}}{0.65}$ (ignore $\times 10^{-3}$)	[2] Equations are combined correctly. [2] Force is calculated using correct E or q $F = Eq$ $F = 1.69 \times 10^{5}$ $\times \ -4.8 \times 10^{-13}$ ($q = -1.6 \times 10^{-19}$)	[2] Merit ***plus*** correct answer.
1(d)	The force will increase. If the length of the field decreases, and the voltage remains the same, the field strength will increase. ($E = \frac{V}{d}$) A stronger field causes a greater force. ($F = Eq$)	[1] Force increases. [1] Electric Field increases [1] $F = \frac{V}{d}q$ given.	[1] TWO correctly linked ideas [1] Electric field correctly linked to distance [1] Force vs $\frac{1}{d}$ given.	[1] THREE ideas linked correctly. Correct statement linking less distance, more Electric Field and more Force. [1] Force increases as distance decreases if V & q constant.
1(e)	$V = \frac{\Delta E_p}{q} \qquad \Delta E_p = Eqd$ $\Delta E_p = F.d$ $\Delta E_p = Vq$ $= 110 \times 10^{3} \times 4.8 \times 10^{-13}$ $= 5.28 \times 10^{-8}$ J $= 5.3 \times 10^{-8}$ J	[2] Valid equation and a substitution (ignore $\times 10^{3}$) (force from 1c)	[2] Correct answer.	
1(f)	**Rate** of flow of charge / electrons.	[1] Correct answer, or indication of Coulomb per second.		
1(g)	$I = \frac{Q}{t}$ $I = \frac{6.5 \times 10^{5}}{60}$ drops / s $\times 8.0 \times 10^{-13}$ C / drop $= 8.7 \times 10^{-9}$ C/s (A)	[2] $\frac{8 \times 10^{-13}}{60}$ [2] $\frac{6.5 \times 10^{5} \times 8 \times 10^{13}}{1}$ (Ignore presence or absence of –ve sign on charge).	[2] Correct equation, substitution and answer. (Ignore presence or absence of –ve sign on charge).	

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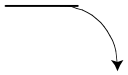
1(h)	$F = Bvq$ $= 7.10 \times 10^{-5}\text{T} \times 12.1 \times 4.8 \times 10^{-13}$ $= 4.1 \times 10^{-16}$ N	[2] Correct formula and substitution. (ignore $\times 10^{-3}$, mT)	[2] Correct answer.	
	Answer to 2 significant figures.	[1] Answer to 2 significant figures.		
1(i)	Clockwise circular path. 	[1] Correct direction (downwards).	[1] Correct direction and continuous shape (curved).	
2(a)	$I = \frac{V}{R}$ $= 6.0/1.2$	[2] Correct substitution.		
2(b)	$P = V \times I$ $= 6.0 \times 5.0$ $= 30$ W	[2] Correct answer.		
		[1] Correct unit.		
2(c)	When the switch is closed, the current quickly increases, the lamp filament quickly heats up, the resistance increases, so the current will decrease to a steady value. (Must discuss the headlamp only.)	[1] Current increases. [1] Reaches a steady value. [1] Bulb heats up. [1] Resistance increases. [1] Current decreases.	[1] Correctly links TWO ideas. (Changing current qualified.)	[1] Correctly links THREE connected ideas in a clear explanation.

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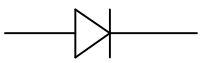
2(d)	The headlamp draws 5.0 A. The tail lamps are in parallel so must draw 1 A. Therefore their combined resistance is: $R = \frac{V}{I}$ $= \frac{6.0}{1}$ $= 6.0\ \Omega$ each tail lamp is therefore 3.0 Ω. **ALTERNATIVELY** $I = 6.0$ A $V = 6.0$ V $R = \frac{V}{I} = \frac{6}{6} = 1.0\ \Omega$ For parallel resistors : $\frac{1}{R_1} = \frac{1}{R_1} + \frac{1}{R_2} = \frac{1}{R_{\text{headlamp}}} + \frac{1}{R_{\text{taillamps}}}$ $\Rightarrow \frac{1}{1.0} = \frac{1}{1.2} + \frac{1}{R_{\text{TLS}}}$ $\Rightarrow \frac{1}{R_{\text{TLS}}} = \frac{1}{1.0} - \frac{1}{1.2} = \frac{1.2 - 1.0}{1.2} = \frac{0.2}{1.2}$ $\Rightarrow R_{\text{TLS}} = \frac{1.2}{0.2} = 6.0$ Each lamp is therefore 3.0 Ω	[2] Resistance of each tail light is $\frac{1}{2}$ total resistance of the branch [2] Calculation of correct current (1A) [2] 3 V across each tail light [2] 3 (unjustified) [2] Calculation of total resistance as 1.0 Ω. [2] Currrent ratio 5:1	[2] TWO correct calculations. [2] Calculation of total R in the tail light branch as 6.0 Ω. [2] Correct use of $^{V}/_{I}$ to find $R_{\text{Tail light}}$ [2] Correct substitution in parallel resistors formula. [2] $R_{\text{Tail light}}$ 1:5 1.2 : 6 □	[2] Correct answer. [2] $^{6}/_{2} = 3\ \Omega$
3(a)	$V = BvL \times 2 \times 45$ $= 0.070 \times 12 \times 0.085 \times 90$ $= 6.4$ V	[2] Correct equation and substitution of correct side. (Ignore length unit)	[2] Calculates voltage using the correct side. (Forgets to multiply by 45 turns **or** by 2 sides).	[2] Correct answer.
3(b)	V = 0 Coil is moving parallel to the field.	[1] V=0 [1] Parallel to magnetic field	[1] Correct answer **and** reason.	
3(c)		[1] Correct symbol (ignore polarity).		
3(d)	• The generator produces an alternating current. • The battery needs a current in one direction to charge it. • The diode only allows current to flow one way.	[1] The generator produces an alternating current. [1] The battery needs a current in one direction to charge it. [1] The diode only allows current to flow one way.	[1] Correctly links TWO ideas.	[1] All THREE ideas linked correctly in a clear explanation.

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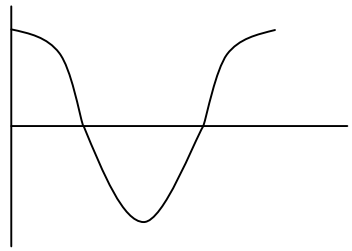
3(e)		[1] Sinusodial [1] Starts at max./min. V.	[1] Cosine or negative cosine graph. [1] Correctly draws graph showing effect of the diode (above or below axis). (Ignore period.)	

Judgement Statement

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Criterion 1

Achievement	Achievement with Merit	Achievement with Excellence
FIVE opportunities answered at Achievement level or higher. 5 × A1	SIX opportunities answered with TWO at Merit level or higher, and FOUR at Achievement level. 2 × M1 *plus* 4 × A1	SEVEN opportunities answered with ONE at Excellence level and TWO at Merit level and FOUR at Achievement level. 1 × E1 *plus* 2 × M1 *plus* 4 × A1

Criterion 2

Achievement	Achievement with Merit	Achievement with Excellence
FIVE opportunities answered at Achievement level or higher. 5 × A2	SEVEN opportunities answered with THREE at Merit level or higher, and FOUR at Achievement level. 3 × M2 *plus* 4 × A2	EIGHT opportunities answered with ONE at Excellence level and THREE at Merit level and FOUR at Achievement level. 1 × E2 *plus* 3 × M2 *plus* 4 × A2