Current, Potential Difference & Power

Mark Scheme 2

Level	International A Level
Subject	Physics
Exam Board	CIE
Topic	Current of Electricity
Sub Topic	Current, Potential Difference & Power
Paper Type	Theory
Booklet	Mark Scheme 2

Time Allowed: **81 minutes**

Score: **/67**

Percentage: **/100**

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

1	**(a)**	**(i)**	$P = VI$	C1	
			$60 = 12 \times I$		
			$I = 5.(0)$ A	A1	[2]
		(ii)	*either* $V = IR$ *or* $P = I^2R$ or $P = V^2 / R$	C1	
			either $12 = 5 \times R$ *or* $60 = {}^2 \times R$ or ${}^2/R$		
			$R = 2.4\ \Omega$	A0	[2]
	(b)		$R = \rho L/A$	C1	
			$A = \pi \times (0.4 \times 10^{-3})^2$ $(= 5.03 \times 10^{-7})$	C1	
			$L = (2.4 \times 5.03 \times 10^{-7})/(1.0 \times 10^{-6})$		
			$= 1.2$ m	A1	[3]
	(c)		resistance is halved	M1	
			either current is doubled *or* power $\propto 1/R$	M1	
			power is doubled	A1	[3]

CHEMISTRY ONLINE
— TUITION —

2	**(a**	**(i)**	movement/flow of charged particles	B1	[1]
		(ii)	work done per unit charge (transferred)	B1	[1]
	(b)		straight line through origin	B1	
			resistance = V/I , with values for V and I shown	M1	
			= 20 Ω	A0	[2]
			(using the gradient loses the last mark)		
	(c)	**(**	0.5 A	A	[1]
		(ii)	*either* resistance of each resistor is 20 Ω *or* total current = 0.8 A	C	
			either combined resistance = 10 Ω *or* $R = E/I$ = 10 Ω	A1	[2]
	(d)	**(i)**	10 V	A	[1]
		(ii)	power = EI	C1	
			= 10 × 0.2 = 2.0 W	A	[2]

3	**(a)**	**(i)**	$P = Vi$	C1	
			1200 = 240 x i	M1	
			i = 5.0 A	A0	
		(ii)	$V = iR$		
			240 = 5.0 x R	C1	
			R = 48Ω	A1	[4]
	(b)	**(i)**	p.d. = (5.0 x 4.0 =) 20 V	A1	
		(ii)	mains voltage = (240 + 20 =) 260 V	A1	
		(iii)	P = (20 x 5.0 =) 100 W	A1	[3]
	(c)		power input = 1200 + 100 = 1300 W	C1	
			efficiency = 1200/1300 = 0.92	A1	[2]

4 (a) (i) e.m.f. = energy / charge C1
= $(1.6 \times 10^5) / (1.8 \times 10^4)$
= 8.9 V A1

(ii) current = AQ / At C1
= $(1.80 \times 10^4) / (1.3 \times 10^5)$
= 0.14 A ..... A1 [4]

(b) (i) energy ex: R (or formula) C1
energy = $(15 / 45) \times 1.14 \times 10^5$ C1
= 3.7×10^4 J A1

(ii) energy dissipated in internal resistance (of battery) ..... B1 [4]
OR in extra resistance in circuit

5 (a $R = \rho l / A$ C1

$= (5.1 \times 10^{-7} \times 0.50) / \pi(0.18 \times 10^{-3})^2 = 2.5\ (2.51)\,\Omega$ M1 [2]

(b) (i) resistance of CD = 8 × resistance of AB = 20 (Ω) C1

circuit resistance = $[1/5.0 + 1/20]^{-1} = 4.0\,(\Omega)$ C1

current = V/R = 6.0/4.0 C1

= 1.5 A A1 [4]

(ii) power in AB = I^2R or power = V^2/R C1

$= (1.2)^2 \times 2.5 = 3.6$ W $= (3.0)^2/2.5 = 3.6$ W A1 [2]

(iii) potential drop A to M = 1.25 × 1.2 = 1.5 V M1

potential drop C to N = 3.0 V
p.d. MN = 1.5 V A1 [

6	**(a**	**(i)** $Q = It$ (*allow any subject for the equation*)	B1	[1]
		(ii) I	B1	
		t	B1	[2]
		(*allow 1 mark only if all three quoted*)		
	(b)	**(i)** base unit of I is A		
		base unit of n is m^{-3} (*not* $/m^{-3}$)		
		base unit of S is m^2		
		base unit of q is A s (*not C*)		
		base unit of v is $m\ s^{-1}$		
		(*–1 for each error or omission*)	B3	[3]
		(ii) $A = m^{-3}\ m^2\ A\ s\ (m\ s^{-1})^k$	M1	
		e.g. for m: $0 = -3 + 2 + k$		
		$k = 1$	A1	[2]
7	**(a**	power = VI	C1	
		current = $10.5 \times 103 / 230$	M1	
		= 45.7 A	A0	[2]
	(b)	p.d. across cable = 5.0 V	C1	
		$R = 5.0 / 46$	C1	
		$= 0.11\ \Omega$	A1	[3]
		(ii) $R = \rho L / A$	C1	
		$0.11 = (1.8 \times 10^{-8} \times 16 \times 2) / A$	C1	
		$A = 5.3 \times 10^{-6}\ m^2$	A1	[3]
		(*wires in parallel, not series, allow max 1/3 marks*)		
	(c)	*either* power = V^2 / R *or* power $\propto V^2$	C1	
		ratio = $(210 / 230)^2 = 0.83$	A1	[2]
		(ii) resistance of cable is greater	M1	
		greater power loss/fire hazard/insulation may melt		
		wire may melt/cable gets hot	A1	[2]