1) C
2) A
3) A
4) B
5) D
6)

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

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

(b) (i) energy $\propto R$ (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

7)

(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]

8)

(a) (i) resistance is ratio *V/I* (at a point) **B1**

either gradient increases or *I* increases more rapidly than V **B1** **[2]**

(If states R = reciprocal of gradient, then 0/2 marks here)

(ii) current = 2.00 mA **C1**

resistance = 2 000 Ω **A1** **[2]**

(b) (i) straight line from origin **M1**

passing through (6.0 V, 4.0 mA) (allow ½ square tolerance) **A1** **[2]**

(ii) individual currents are 0.75 mA and 1/33 mA **C1**

current in battery = 2.1 mA **A1** **[2]**

(allow argument in terms of $P = I^2R$ or IV)

(c) same current in R and in C **M1**

p.d. across C is larger than that across R **M1**

so since power = *VI*, greater in C **A1** **[3]**

(allow argument in terms of $P = I^2R$ or IV)

9)

(a) lamp C M1
lamp is shorted A1 **[2]**

(b) shorted lamp A would cause damage to the supply/lamps
/blow fuse in supply B1 **[1]**

(c) 15 Ω B1 **[1]**

(d) (i) $V = I R$ C1
$R = 30\ \Omega$ A1 **[2]**

(ii) $P = VI$ or I^2R or V^2 / R C1
$P = 1.2$ W A1 **[2]**

(e) filament is cold when measuring with ohm-meter in (b) B1
resistance of filament rises as temperature rises B1 **[2]**

10)

(a)	**(i)**	$P = VI$	C1	
		current = 60/240 = 0.25 A	A1	
	(ii)	R (= V/I) = 240/0.25	M1	
		= 960 Ω	A0	**[3]**

11)

(a)	*either* $P = VI$ and $V = IR$ *or* $P = V^2 / R$	C1	
	resistance = 38.4 Ω	A1	[2]

(b)	zero	B1	
	1.5 kW	B1	
	3.0 kW	B1	
	0.75 kW	B1	
	2.25 kW	B1	[5]

12)

(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)	$A = m^{-3}\ m^2\ A\ s\ (m\ s^{-1})^k$ e.g. for m: $0 = -3 + 2 + k$ $k = 1$	M1 A1	[2]