| Question | Answer | Mark |
|---|---|---|
| 1(a)(i) | 12 Ω | **B1** |
| (a)( (ii) | /R = 1/$R_1$ + 1/$R_2$ OR 1/R = 1/12 + 1/6<br>OR (R = ) $R_1R_2$/($R_1$ + $R_2$) OR (12 × 6)/(12 + 6)<br>4 Ω | **C1**<br>**A1** |
| (a)(iii) | 4 + 6 = 10 Ω | **B1** |
| (b)(i) | (I = 12/10 = ) 1.2 A | **B1** |
| (b)(ii) | (E =) IVt OR 1.2 × 12 × 50 OR $I^2$Rt OR $1.2^2$ × 10 × 50<br>OR $V^2$t/R OR $12^2$ × 50/10<br>720 J | **C1**<br>**A1** |
| | | **Total: 7** |

2 **(a (i)** P = IV OR 40 = 220 × I OR (I =) P/V OR 40/220
0.18 A A1

**(ii)** [3 × 0.18(2)] = 0.54 A OR 0.55 A B

**(iii)** 2/0.182 = 10.99 OR 2/0.18 = 11.1 C1
10 lamps OR 11 lamps A1

**(b) (i)** Resistance <u>increases</u> B1

**(ii)** Power (of lamp) decreases B1
P = IV <u>and</u> current in lamp decreases. OR $P = V^2/R$ B1

**[Total: 8]**

3 **(a** rheostat/<u>variable</u> resistor AND
control/vary/change/ limit the current /resistance/power/ voltage <u>across heater</u> [1]

**(b)** (*I* =) *P*/*V* any form, words or numbers [1]
(*I* =) 1.25 (A) seen anywhere [1]
(*V* =) 6.0 – 3.6 OR 2.4 seen anywhere [1]
(*R* =) *V*/*I* in any form words or numbers [1]
1.92 Ω (2 or 3 sig. figs.) [1]
note: credit will also be given for alternative approaches

**(c)** battery running down/going flat/energy <u>of battery</u> used up OR V or e.m.f. less
OR more/increasing resistance (of heater) NOT resistance of X increases [1]
use of relationship between *I* and *V* or *R* OR the current decreases [1]

4 **(a (i)** $1/R = 1/R_1 + 1/R_2$ OR $R = R_1R_2/(R_1 + R_2)$ OR with numbers C1
($R$ =) 500 Ω A1

**(ii)** $I$ = (12 ÷ 1000) = 0.012 A ecf **(i)** B1

**(iii)** ($V$ =) $IR$ OR 0.012 × 500 OR 12 × 500 ÷ 1000 C1
= 6.0 V ecf **(i)(ii)** A1

**(b)** (more current in circuit so) current (in 500 Ω resistor) increases B1

resistance of parallel combination decreases
OR total resistance (of circuit) decreases B1

**[Total: 7]**

5 **(a (i)** ammeter symbol in series with wire B1

**(ii)** different results OR graph can be plotted OR to ensure wire does not overheat B1

**(b) (i)** ($P$ = ) $VI$ OR $V = IR$ OR 250 × 1.2 OR 300 (V)
($P$ = ) $I^2R$ OR $250^2$ × 1.2 OR 300 × 250 C1
75 000 W OR 75 kW

**(ii)** power loss reduced C1
resistance reduced C1
power lost decreases to a quarter OR ($P$ =) 19 kW / 18.75 kW

**[Total: 8]**

6 **(a** (nuclear) fusion B1

**(b) (i)** charges are moving (and current is the (rate of) flow of charge) B1

**(ii)** $Q = It$ AND $t$ is time B1

**(c) (i) 1.** (they are) perpendicular OR at right angles OR at 90° B1

**2.** (they are) perpendicular OR at right angles OR at 90° B1

**(ii)** arrow (labelled $F$) perpendicular to direction AND pointing
towards the bottom right of the page B1

**[Total: 6]**

| | | | | |
|---|---|---|---|---|
| 7 | **(a)** | **(i)** | diode | B1 |
| | | **(ii)** | **1.** 0.7 V | B1 |
| | | | **2.** $I = V \div R$ in any form OR ($I$ =) $V \div R$ OR 11.3÷4 | C1 |
| | | | 2.8 A | A1 |
| | **(b)** | **(i)** | **1.** (12÷8 =) 1.5 A | B |
| | | | **2.** (1.5 + 2.825 =) 4.3 A ecf **(a)(ii)2.** and **(b)(i)1.** | B1 |
| | | **(ii)** | 1.5 A ecf **(b)(i)1.** | B1 |

**[Total: 7]**