**M1.**      (a)     current that is always in the same direction

**1**

       (b)     total resistance = 30 (Ω)

**1**

             V = 0.4 × 30

**1**

             12 (V)

**1**

                       *allow 12 (V) with no working shown for **3** marks*
                       *an answer of 8 (V) or 4 (V) gains **2** marks only*

       (c)     P = 0.4 × 12 = 4.8

**1**

             5 (W)

**1**

                       *allow 5 (W) with no working shown for **2** marks*
                       *allow 4.8 (W) with no working shown for **1** mark*

**[6]**

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**M2.** (a) (i) 15

**1**

     (ii) 4.5 or their (a)(i) x 0.3 correctly calculated

*allow **1** mark for correct substitution, ie 0.3 x 15/their (a)(i), provided no subsequent step*

**2**

     (ii) decrease

**1**

(b) **Y**

*accept any correct indication*
*reason only scores if **Y** is chosen*
*accept voltage for p.d.*

**1**

(only one that) shows a direct current / p.d.
**or**
a battery / cell gives a direct current

*accept both **X** and **Z** are a.c.*

**or**
a battery/cell gives a constant current/p.d.

*accept it's a constant current/p.d.*
*it is not changing is insufficient*

**1**

**[6]**

**M3.** (a) (i) 50 (Hz)

**1**

(ii) 2760 (W)

**1**

(b) 12

*allow **1** mark for correct substitution, ie 2400/200*
*or*
*allow **1** mark for 2760/230 provided no subsequent step shown*

**2**

amps

**1**

(c) the charge is <u>directly</u> proportional to the time switched on for

*accept for **1** mark the longer time (to boil), the greater amount of charge*
*or positive correlation*
*or they are proportional*

**2**

**[7]**

**M4.**        (a)    25(Ω)

**1**

(b)    (i)    2(V)
                    *allow **1** mark for showing a correct method, ie 6 / 3*

**2**

(ii)    equal to

**1**
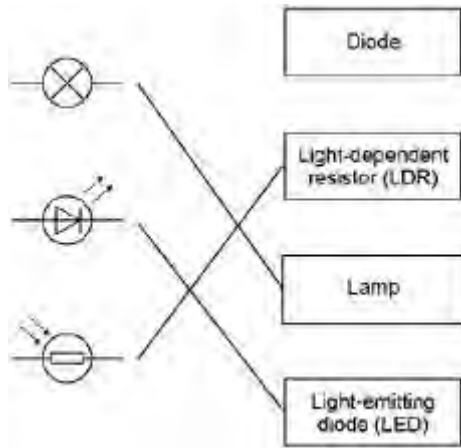                                                                                    **[4]**

**M5.**(a)



*allow **1** mark for each correct line if more than one line is drawn from any symbol then all of those lines are wrong*

**3**

   (b)   (i)    half

**1**

         (ii)   3(V)

**1**

         (iii)  $V_1$

**1**

   (c)   (i)    potential difference / voltage of the power supply

> *accept the power supply*
> *accept the voltage / volts*
> *accept number of cells / batteries*
> *accept (same) cells / batteries*
> *do not accept same ammeter / switch / wires*

**1**

         (ii)   bar drawn – height 1.(00)A

> *ignore width of bar*
> *allow **1** mark for bar shorter than 3rd bar*

**2**

         (iii)  as the number of resistors increases the current decreases

**1**

**[10]**

**M6.**(a)    battery, lamp and ammeter connected in series with variable resistor

**1**

voltmeter in parallel with (filament) lamp

**1**

(b)    **Level 2 (3–4 marks):**
A detailed and coherent description of a plan covering all the major steps is
provided.
The steps are set out in a logical manner that could be followed by another person
to
obtain valid results.

**Level 1 (1–2 marks):**
Simple statements relating to relevant apparatus or steps are made but they may
not be in a logical order. The plan would not allow another person to obtain valid
results.

**0 marks:**
No relevant content

**Indicative content**
- ammeter used to measure current
- voltmeter used to measure potential difference
- resistance of variable resistor altered to change current in circuit **or**
  change potential difference (across filament lamp)
- resistance (of filament lamp) calculated **or** R=V / I statement
- resistance calculated for a large enough range of different currents that
  would allow a valid conclusion about the relationship to be made

**4**

(c)    (as current increases) resistance increases (at an increasing rate)

**1**

(d)    any value between 6.3 and 6.9 (Ω)

**1**

(e)    **A**: Filament lamp

**1**

**B**: Resistor at constant temperature

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**1**

**C**: Diode

**1**

**[11]**

**M7.**(a)  (i)  any **six** from:

- switch on
- read both ammeter and voltmeter
  *allow read the meters*
- adjust variable resistor to change the current
- take further readings
- draw graph
- (of) V against I
  *allow take mean*
- R = V / I
  *allow take the gradient of the graph*

**6**

(ii)  resistor would get hot if current left on

**1**

so its resistance would increase

**1**

(iii)  12 (V)
  *0.75 × 16 gains **1** mark*

**2**

(iv)  15 (Ω)

**1**

16 is nearer to that value than any other

**1**

(b)  if current is above 5 A / value of fuse

**1**

fuse melts
  *allow blows / breaks*
  *do **not** accept exploded*

**1**

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breaks circuit

1

**[15]**