**M1.**          (a)     C

*award mark if A and B identified as not filament lamp*

**1**

resistance increases

*negated by wrong statement e.g. current goes down*

**1**

as the lamp gets hot

*accept as current (through lamp)* ***or*** *voltage (across lamp) increases*

*do* ***not*** *accept non-ohmic reason independent of choice of component*

**1**

(b)     ammeter wire and battery only in series

*non standard symbols acceptable if correctly identified (labelled) for ammeter, voltmeter and battery*

**1**

          voltmeter only in parallel with wire **or** battery

*all in series* ***or*** *ammeter in parallel neither of these two marks awarded*

**1**

all symbols correct

*ignore lines drawn through centres of symbols*

**1**

          (c)     (i)      voltage = current × resistance

*accept V = I × R
accept volts = amps × ohms
do* ***not*** *accept V = C × R
accept*

*if subsequent method correct*

**1**

(ii)     30

*accept correct substitution for* ***1*** *mark (9/0.3)*

**2**

         ohms

*accept correct symbol Ω*

**1**

(iii)     goes up

*must be a comparison
accept calculation if answer is larger than c (ii)*

**1**

**[11]**

**M2.**          (a)     •        diode

•        voltmeter

•        ammeter

*for 1 mark each*

**3**

(b)     *idea that*

•        current increases or goes up (with voltage)

*gains 1 mark*

•        ‘It’ refers to current
**but** current increases steadily (with voltage)

*gains 2 marks*

•        (*allow* in proportion) – but not simply a description of the shape
of the graph

*gains 1 mark*

•        no current at first
**but** no current until voltage is more than 0.3 (volts)

*gains 2 marks*

**4**

**[7]**

**M3.**          (a)     variable resistor

*accept rheostat*

**1**

(b)     voltmeter

**1**

(c)     straight line correct between 0.2 and 0.8

*if line incorrect, or no line, and correct plots 0.2 to 0.8 award 1 mark*

**2**

(d)     diode / rectifier

**1**

**[5]**

**M4.**          (a)     current rises/starts lower/starts from zero

*for 1 mark*

          *ideas that*: \*
smaller/only 0.45 (A) change in current
quicker/only 2 (ms) for current to settle
slightly lower/0.45 (A) final current
maximum only 0.45 (A) rather than 1.5 (A)
(\*must **compare** e.g. “only...” or state figure from first graph)

*any 2 for 1 further mark each*

**3**

(b)     resistance of filament rises as temperature rises/higher at operating temperature
resistance of X falls as temperature rises/low(er) at operating temperature
total resistance stays roughly the same as temperature rises
so current stays roughly the same as temperature rises
*(must be related to previous point*)

          resistance of X falls faster at first than resistance of filament rises
so current rises (*must be related to previous point*)
operating resistance slightly increased
so operating current slightly reduced
(*must be related to previous point*)
resistance of X high at start
so current zero/low

*each gains 1 mark
(must be related to previous point)
(to a maximum of 4)*

**4**

**[7]**

**M5.**          (a)     Current = 0.4A (1)R = V/I or 240/0.4 (1)
R = 600 ohm (1)

**3**

(b)     Doubles

*gets 2 marks*

          OR gets bigger

*gets 1 mark*

**2**

(c)     P = V.I or 240 × 0.4
P = 96W

*for 1 mark each*

**2**

(d)     1 = 0.2A
P = 48W

*for 1 mark each*

*BUT may get equation mark here if not in (c)*

**2**

(e)     P = V.I.t (1)
P = 240 × 0.2 × 6 × 3600
**OR** P = 48 × 6 × 3600

*gets 1 mark*

P = 1036800 W

*gets 1 mark*

**3**

**[12]**

**M6.**          (a)     4 symbols correct accept

*(accept  for bulb; lose 1 mark if line through symbols, lose 1 mark if circuit incorrect, switch may be open or closed)*

*(allow****or*** *)*

*gains 1 mark*

**4**

          **but**all correct

*gains 2 marks*

          ammeter in series with lamp

*for one mark*

          voltmeter in parallel with lamp / lamp and switch / lamp, switch and ammeter

*for one mark*

(b)     (i)      5 points correctly plotted
*allow* (0, 0) correct if graph goes through the origin even if no × or O

*gains 1 mark*

         **but**6 points correctly plotted

*gains 2 marks*

         smooth curve through points – not straight line / curve + straight line

*for one mark*

**3**

(ii)     2 (A)

         *allow*  0.05 (½ square) from candidates’ graph

*for one mark*

**1**

(iii)     R = V / I   **or**   R = 10 / 2

*gains 1 mark*

         **but**R = 5 (Ohms)      ecf

*gains 2 marks*

**2**

(c)     (i)      resistance increases

*for one mark*

(ii)     temperature (of filament) has increased / filament gets hot

*for one mark*

**2**

**[12]**

##

          (a)     A = battery (of cells)/cells/cell
B = thermistor/temperature dependent resistor
C = transistor
D = LED/light emitting diode
E, F, G = resistors

*each for 1 mark*

**5**

(b)     *ideas that* (resistance) falls from 3000 to 200 units – ohms/Ω – referred to
at least once

*each for 1 mark*

          (*credit quickly at first then more slowly with 2 marks*) (*max 4 for part (b)*)

**4**

(c)     any figure in the range 22 – 26 (inclusive)

*gains 1 mark*

          **but** 24

*gains 2 marks*

**2**

**[11]**

**M8.**          (a)     *idea that*

          it/current increases (with voltage)

*gains 1 mark*

          **but**current increases steadily (with voltage)

*(allow in proportion)*

*gains 2 marks*

**4**

          no current at first

*gains 1 mark*

          **but**no current until voltage is more than 0.3 (volts)

*gains 2 marks*

(b)     (i)      reverse component X/power supply/change battery round

*for 1 mark*

(ii)     *idea that*X doesn’t conduct in opposite/let current through/no current
(in opposite direction)
*(credit* X is a diode*)*

*for 1 mark*

**2**

**[6]**