M1. (a) any two from:
• nuclear
• oil
• (natural) gas

(b) 4 (hours)

(c) a system of cables and transformers

(d) The power output of wind turbines is unpredictable

(e) $1500 / 0.6$

$2500$ (wind turbines)

*allow $2500$ with no working shown for 2 marks*

(f) Most energy resources have negative environmental effects.
M2. (a) iron

hairdryer

kettle

*answers can be in any order*

(b) (i) \( Y \)

(ii) bar drawn with any height greater than \( Y \)

*ignore width of bar*

(c) (bigger volume) takes more time (to boil)

*accept explanation using data from graph*

(so) more energy transferred

*do not accept electricity for energy*

(and) this costs more money

*ignore reference to cost of water*

*wasting more money because heating more water than needed is insufficient*
M3. (a) there is a magnetic field (around the magnet) 

(this magnetic field) changes / moves 

and cuts through coil 
accept links with coil 

so a p.d. induced across coil 

the coil forms a complete circuit 

so a current (is induced) 

(b) ammeter reading does not change 
must be in this order 
accept ammeter has a small reading / shows a current 

zero 

greater than before 
accept a large(r) reading 

same as originally but in the opposite direction 
accept a small reading in the opposite direction
(c) 0.30

allow 1 mark for correct substitution, ie \(0.05 = \frac{Q}{6}\)

C / coulomb

allow A s

[13]
M4.(a) (i) any six from:

- switch on
- read both ammeter and voltmeter
- adjust variable resistor to change the current
- take further readings
- draw graph
- (of) V against I
- \( R = \frac{V}{I} \)

(ii) resistor would get hot if current left on

so its resistance would increase

(iii) 12 (V)

\[ 0.75 \times 16 \text{ gains 1 mark} \]

(iv) 15 (Ω)

16 is nearer to that value than any other

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

fuse melts

\( \text{allow blows / breaks} \)

\( \text{do not accept exploded} \)
breaks circuit
M5. (a) he may receive an electric shock

or

he may be electrocuted

if he touches the live wire

(b) \[ 10 690 = I \times 230 \]

\[ I = \frac{10 690}{230} \]

46.478(260) (A)

46

allow 46 (A) with no working shown for 4 marks

(c) cost is higher

more energy is used (per second)
M6.
(a) current that is always in the same direction 

(b) total resistance = 30 (Ω)

\[ V = 0.4 \times 30 \]

12 (V)

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

(c) \[ P = 0.4 \times 12 = 4.8 \]

5 (W)

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

[6]