M1. (a) (i) temperature (increase) and time switched on are directly proportional

accept the idea of equal increases in time giving equal increases in temperature

answers such as:

- *as time increases, temperature increases*
- *positive correlation*
- *linear relationship*
- *temperature and time are proportional*

*score **1** mark*

2

(ii) any **one** from:

"it" refers to the metal block

- energy transfer (from the block) to the surroundings

accept lost for transfer

accept air for surroundings

- (some) energy used to warm the heater / thermometer (itself)

accept takes time for heater to warm up

- (metal) block is not insulated

1

(iii) 15 000

*allow **1** mark for correct substitution, ie 50 × 300 provided no subsequent step shown*

2

(b) lead

reason only scores if lead is chosen

1

needs least energy to raise temperature by 1°C

accept needs less energy to heat it (by the same amount)
lowest specific heat capacity is insufficient

1

[7]

M2. (a) (i) 0.2 **or** 1/5

accept 20% for both marks
*allow **1** mark for correct substitution answer of 0.2%*
***or** 20 gains **1** mark*
ignore units

2

(ii) wasted

accept transformed to heat / other forms
accept transferred to the air / surroundings sound = neutral

1

(b) (i) any **one** from:

- can fly at night

  accept can fly when it is cloudy
  accept as a back-up

- can stay in the air for longer
- can fly in the winter
- can fly faster

  increases power is neutral

1

(ii) any **one** from:

- produces no (pollutant) gases

or no greenhouse gases

accept named gas
accept no air pollution
*do **not** accept no pollution*
accept less global warming
accept harmful for pollutant
accept produces no carbon
*do **not** accept environmentally friendly*

- produces no / less noise

- less demand for fuels

  accept any other sensible environmental advantage

1

(iii) accept any sensible suggestion eg, map the Earth's surface / weather forecasting / spying / monitoring changes to the Earth's atmosphere, etc

*do **not** accept ideas in terms of transporting*

accept use as a satellite

1

[6]

M3. (a) electrical

1

chemical

1

light

1

(b) 25% **or** 0.25

*allow **1** mark for correct substitution, ie 50 ÷ 200 provided no subsequent step shown**or**answers of 25 with a unit **or** 0.25 with a unit gain **1** mark*
*answers of 25 without a unit **or** 0.25% gain **1** mark*

2

(c) the information board can be used anywhere it is needed

1

[6]

M4. (a) generator

accept dynamo
accept alternator

1

(b) (i) 1400

ignore units

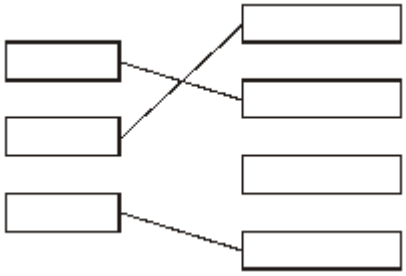
1

(ii) 0.3 or 30%

*any incorrect unit penalise **1** mark*
*allow **1** mark for the correct use of 600*
***or** 0.3% **or** 30*

2

(c) **1** mark for each correct link



if more than 3 lines are drawn, mark only
3 lines starting with those that are incorrect

3

(d) (i) 110

no tolerance

1

(ii) 12

no tolerance

1

(iii) wind speed may be too low to operate the generator

accept wind may not always blow
accept power depends on wind speed
accept does not generate if wind speed is too high
accept does not generate if wind speed is above 12 (m/s)
accept does not generate if wind speed is below 1.6 (m/s)
accept it is unreliable
*do **not** accept answers referring to cost only*

1

[10]

M5. (a) heat / thermal
or / and
sound

*do **not** accept noise*
other forms of energy eg light negates answer

1

(b) 0.4
or
40 %

*allow **1** mark for* $\frac{2000}{5000}$
or
equivalent fraction
*an answer 0.4 % gains **1** mark*
*answers 0.4 or 40 given with any unit gains **1** mark*
*40 without % gains **1** mark*

2

[3]