

M1. (a) (i) replaced faster than it is used
accept replaced as quick as it is used
accept it will never run out
*do **not** accept can be used again*

1

(ii) any **two** from:
***two** sources required for the mark*

- wind
- waves
- tides• fall of water
*do **not** accept water / oceans*
accept hydroelectric
- biofuel
accept a named biofuel eg wood
- geothermal

1

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

- increases from 20° to 30°
- reaches maximum value at 30°
- then decreases from 30°
- same pattern for each month
*accept peaks at 30° for **both** marks*
*accept goes up then down for **1** mark*
ignore it's always the lowest at 50°

2

(ii) 648
*an answer of 129.6 gains **2** marks allow **1** mark for using 720*
value only from table
*allow **2** marks for answers 639, 612, 576, 618(.75)*
*allow **1** mark for answers 127.8, 122.4, 115.2, 123.75*

3

- (c) (i) (sometimes) electricity demand may be greater than supply (of electricity from the system)

accept cloudy weather, night time affects supply

or

can sell (excess) electricity (to the National Grid)

1

- (ii) decreases the current

accept increases the voltage

1

reducing energy loss (along cables)

accept less heat / thermal energy lost / produced

1

[10]

M2. (a) (i) 0.75

*allow 1 mark for correct transformation and substitution
ie $0.15 = 5$*

2

(ii) 2

accept $1.5 \div$ their (a)(i) correctly calculated

1

(b) any **one** from:

- seasonal changes
*accept specific changes in conditions
eg shorter hours of daylight in winter*
- cloud cover
*accept idea of change
must be stated or unambiguously implied
eg demand for water will not (always) match supply of solar energy
do **not** accept figures are average on its own
do **not** accept solar panels are in the shade*

1

[4]

M3. (a) (i)
$$\text{efficiency} = \frac{\text{useful energy out } (\times 100\%)}{\text{total energy in}}$$

1.6 (W)

allow **1** mark for correct substitution ie $\frac{0.2}{100} = \frac{\text{output}}{20}$

2

(ii)
$$\text{efficiency} = \frac{\text{useful energy out } (\times 100\%)}{\text{total energy in}}$$

32 (%) / 0.32

or

their (a)(i) \div 5 correctly calculated

ignore any units

1

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

- comparison over same period of time of relative numbers of bulbs required eg over 50 000 hours 5 CFL's required to 1 LED
accept an LED lasts 5 times longer
- link number of bulbs to cost eg 5 CFL's cheaper than 1 LED
an answer in terms of over a period of 50 000 hours CFLs cost £15.50 (to buy), LED costs £29.85 (to buy) so CFLs are cheaper scores both marks
an answer in terms of the cost per hour (of lifetime) being cheaper for CFL scores 1 mark if then correctly calculated scores both marks
- over the same period of time LEDs cost less to operate (than CFLs)

2

(ii) any **one** from:

- price of LED bulbs will drop
*do **not** accept they become cheaper*
- less electricity needs to be generated
accept we will use less electricity
- less CO₂ produced
- fewer chips needed (for each LED bulb)
- fewer bulbs required (for same brightness / light)

- less energy wasted
do not accept electricity for energy

1

[6]

M4. (a) (i) 4

allow 1 mark for correct transformation and substitution

$$\text{ie } \frac{0.6}{0.15}$$

substitution only scores if no subsequent steps are shown

2

- (ii) diagram showing two output arrows with one arrow wider than the other with the narrower arrow labelled electrical / electricity / useful

1

(b) any **one** from:

- to check reliability / validity / accuracy
- to avoid bias

1

(c) any **two** from:

- produce no / less (air) pollution
accept named pollutant
accept produces no waste (gases)
- energy is free
accept it is a free resource
*do **not** accept it is free*
- (energy) is renewable
- conserves fossil fuel stocks
- can be used in remote areas
- do not need to connect to the National Grid

2

[6]