

Efficiency

Mark Scheme

Level	GCSE (9-1)
Subject	Combined Science: Trilogy - Physics
Exam Board	AQA
Topic	6.1 Energy
Sub-Topic	Efficiency
Difficulty Level	Gold Level
Booklet	Mark Scheme

Time Allowed: 38 minutes

Score: /37

Percentage: /100

Grade Boundaries:

M1.(a) $600 \text{ kg} = 5880 \text{ N}$

1

$$\text{power} = \frac{5880 \times 35}{45}$$

1

$$= 4573.3 \text{ (W)}$$

this step without the previous steps stated gains 3 marks

1

$$\% \text{ Eff.} = \frac{4573.3 \times 100}{8000}$$

1

$$= 57.17 \text{ (\%)}$$

allow 57.17 with no working shown for 5 marks

1

(b) $\text{gpe} = 600 \times 9.8 \times 35$

1

$$= 205\,800$$

1

$$\text{gpe} = \text{KE} = \frac{1}{2} m v^2$$

1

$$v = \sqrt{\frac{2 \times \text{KE}}{m}}$$

1

$$= \sqrt{\frac{411\,600}{600}}$$

1

$$= 26.2 \text{ (m / s)}$$

allow 26.2 with no working shown for 6 marks

1

[11]

M2.(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]

M3. (a) (i)

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

1.6 (W)

$$\frac{0.2}{100} = \frac{\text{output}}{8}$$

allow **1** mark for correct substitution ie

2

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

32 (%) / 0.32

or

their (a)(i) ÷ 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]

M5. (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]