

M1. (a) weight (lifted)

or

height (lifted)

1

(b) any **two** from:

- calculate a mean
- spot anomalies
- reduce the effect of random errors

2

(c) as speed increases, the efficiency increases

1

(but) graph tends towards a constant value

or

appears to reach a limit

accept efficiency cannot be greater than 100%

1

(d) heating the surroundings

1

(e) 0 (%)

1

[7]

- M2.** (a) (i) 150 1
- (ii) transferred to the surroundings by heating
reference to sound negates mark 1
- (iii) 0.75
450 / 600 gains 1 mark
accept 75% for 2 marks
maximum of 1 mark awarded if a unit is given 2
- (iv) 20 (s)
correct answer with or without working gains 2 marks
correct substitution of 600 / 30 gains 1 mark 2
- (b) (i) to avoid bias 1
- (ii) use less power and last longer 1
- 1 LED costs £16, 40 filament bulbs cost £80
- or**
- filament costs (5 times) more in energy consumption 1
- (iii) any **one** from:
- availability of bulbs
 - colour output
 - temperature of bulb surface
- 1

[10]

M3. (a) any **two** from:

- black is a good emitter of (infrared radiation)
accept heat for radiation
ignore reference to absorbing radiation
- large surface (area)
- matt surfaces are better emitters (than shiny surfaces)
accept matt surfaces are good emitters
ignore reference to good conductor

2

(b) 90% or 0.9(0)

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

allow 1 mark for correct substitution, ie $\frac{13.5}{15}$
provided no subsequent step shown
an answer of 90 scores 1 mark
an answer of 90 / 0.90 with a unit scores 1 mark

2

(c) (producing) light

allow (producing) sound

1

(d) any **two** from:

- wood is renewable
accept wood grows again / quickly
accept wood can be replanted
- (using wood) conserves fossil fuels
accept doesn't use fossil fuels
- wood is carbon neutral
accept a description
cheaper / saves money is insufficient

2

(e) $E = m \times c \times \theta$

2 550 000

*allow 1 mark for correct substitution
ie $100 \times 510 \times 50$
provided no subsequent step shown
answers of 1 020 000, 3 570 000 gain 1 mark*

2

joules /J

*accept kJ / MJ
do **not** accept j
for full credit the unit and numerical answer must be
consistent*

1

[10]