Mark schemes

Q1.

(a) energy is transferred to the surroundings

1

work is done against air resistance

1

[2]

Q2.

(a) the total energy will be greater

1

[1]

Q3.

(a) thermal / internal (energy)
or
kinetic (energy of the water particles)

ignore heat

allow E_k

1

(b) gravitational potential (energy)

allow E_p / GPE

allow kinetic / E_k

1

(c) **Level 2:** Scientifically relevant features are identified; the way(s) in which they are similar / different is made clear and (where appropriate) the magnitude of the similarity / difference is noted.

3–4

Level 1: Relevant features are identified and differences noted.

1–2

No relevant content

0

Indicative content

Method A:

- heated water needs insulating (to maintain high temperature)
- energy stored by heating water is much greater (per 100 kg)
- useful energy from heating 100 kg of water = 20 160 (kJ)
- energy wasted (per 100 kg) = 13 440 (kJ)
- efficiency = 60 %

Method B:
- suitable location needed to pump water uphill
- pumping water efficiency is higher
- useful energy from pumping 100 kg of water = 367.5 (kJ)
- energy wasted (per 100kg) = 122.5 (kJ)
- efficiency = 75 %

A level 2 answer should use the data in a relevant calculation that compares the two methods.

(d) **Transport examples:**
don't use (petrol / diesel) cars (for transport)
or
don't burn petrol / diesel (for transport)

allow don't use other transport methods e.g. (diesel) buses

allow fossil fuels for petrol / diesel

1

(instead) use electric cars
or
(instead) use hydrogen-fuelled cars
or
(instead) use a bicycle
or
(instead) use public transport
or
(instead) walk

1

Generating Electricity examples:
don't use coal / oil / gas (to generate electricity)

allow fossil fuels for coal / oil / gas

1

(instead) use renewable methods
or
(instead) use nuclear power

OR

don't use (electrical) appliances when not needed

to reduce the demand for electricity (generated) using coal / oil / gas

allow specific examples of renewable energy resources

allow specific examples e.g. lights

allow fossil fuels for coal / oil / gas

accept other reasonable changes with valid alternative for 2 marks each

1

[10]

Q4.

(a) using the funnel was a safety precaution

1

(b) bottle **A** was the control

1

(c) stopclock / stopwatch

allow clock / watch ignore timer

1

(d) **Level 2:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.

3-4

Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.

1-2

No relevant content

0

Indicative content

- use the same (start) temperature for each experiment
- use the same number of layers of insulation
  or
  use the same thickness of insulation
- so that temperature difference can be compared

- use the same volume of water
- so (total thermal) energy of water is the same (each time)
  or
  so the same area of the bottle surface is heated by the water

- use a lid for each bottle
- so evaporation is reduced / stopped
  or
  so energy loss from the water (surface) is reduced / stopped

- repeat the investigation and calculate mean values
- so anomalous results can be identified
  or
  so the effect of random errors is reduced

(e) bar (chart / graph)

1

(type of) insulation is not numerical values

allow one variable is not numerical values

allow one variable is not continuous

allow (type of) insulation is not continuous

or

(type of) insulation is labels / categories

allow one variable is labels / categories

allow one variable is categoric allow (type of) insulation is categoric

1

MP2 dependent on scoring MP1

[9]

Q5.

(a) $\text{efficiency} = \dfrac{\text{useful energy output}}{\text{total energy input}}$

or

efficiency = $\dfrac{\text{useful output energy transfer}}{\text{total input energy transfer}}$

1

(b) $0.992 = \dfrac{\text{useful energy output}}{34.2}$

1

useful energy output = 0.992 × 34.2

1

useful energy output = 33.9 (GJ)

allow a correct answer given to more than 3 s.f.

1

[4]

Q6.

(a) energy is transferred to the surroundings

1

[1]

Q7.

(a) P = 696 000 000 (W)

1

P = 1200 (W)

allow an answer consistent with their incorrectly / not converted value of P

1

(b) the efficiency would increase

1

because the percentage / proportion / amount of energy usefully transferred would increase

ignore more electricity generated

or

because the percentage / proportion / amount of energy wasted would decrease

allow less energy wasted

1

(because) less (work is done against) friction

1

(c) more efficient devices waste less energy

or

more efficient devices need a lower energy input (for the same energy output)

ignore use less electricity

1

which would minimise the electricity / energy demand

allow less electricity needs to be generated

allow lower energy / electricity bill

or
which would minimise the environmental impact
from (fossil fuel) electricity generation

allow examples of environmental impact e.g. lower CO_2 emissions

ignore 'better for the environment' unless qualified

ignore answers that discuss 'saving energy' unless qualified

ignore answers that discuss alternative methods of generating electricity

1

[7]

Q8.

(a) $\text{efficiency} = \dfrac{\text{useful power output}}{\text{total power input}}$

1

(b) $0.85 = \dfrac{P}{4.0}$

1

$P = 0.85 \times 4.0$

1

$P = 3.4$ (W)

1

[4]