Mark schemes

Q1.

(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]

Q2.

(a) other energy resources = 95 (%)

1

hydroelectric = 5 (%)

1

(b) $E_p = 2\,500\,000 \times 9.8 \times 15$

1

$E_p = 367\,500\,000$ (J)
or
$E_p = 3.675 \times 10^8$ (J)

allow 370 000 000 (J)
or
$E_p = 3.7 \times 10^8$ (J)

1

(c) energy = power × time
or
$E = P \times t$

1

(d) $t = 3600$ (s)

1

$E = 3000 \times 3600$

allow a correct substitution using an incorrectly/not converted value for t

1

$E = 10\,800\,000$ (J)
or
$E = 1.08 \times 10^7$ (J)

allow an answer consistent with their incorrectly/not converted value for t

allow a correct answer given to 2 s.f.

1

(e) the level of the water in the river varies
or
the amount of rainfall varies

1

and is lower in the summer months

allow specified months or range of months eg April to September

1

MP2 dependent on scoring MP1

[10]

Q3.

(a)

Energy resource	Renewable	Non-renewable
biofuel	✓	
coal		✓
nuclear		✓
tides	✓	

*4 correct scores **2** marks*

*3 correct scores **1** mark*

2

[2]

Q4.

(a) *P* = 696 000 000 (W)

1

P = 1200 (W)

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

1

(b) any **2** from:

- wind is unreliable

  allow it was not windy (on that day)

- wind turbines don't turn when the wind is too strong/weak
- there are not enough wind turbines (in the UK)

  allow some wind turbines may be offline for maintenance

  allow energy from wind may not be enough (to generate 34 000 MW)

  ignore weather conditions unqualified

2

(c) 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

(d) 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

[9]