Mark schemes

(a) electrical

chemical

light

(b) 25% or 0.25

allow 1 mark for correct substitution, i.e. 50 ÷ 200 provided no subsequent step shown

or

answers of 25 with a unit or 0.25 with a unit gain 1 mark
answers of 25 without a unit or 0.25% gain 1 mark

(c) the information board can be used anywhere it is needed

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2

Geothermal

Hydroelectric

Nuclear

Uses energy from falling water

Uses energy from inside the Earth

Is unpredictable

Produces dangerous waste

allow 1 mark for each correct line

if more than one line goes from an energy source then all lines from that energy source are wrong

3

(a) (i) changing the distance may / will affect / change the voltmeter reading

accept so only one independent variable

accept distance affects speed of wind (turbine)

accept it is a control variable

accept to give valid results

fair test is insufficient

to make the results accurate is insufficient
(ii) any sensible practical suggestions, eg

• so fan reaches a steady / full speed
  accept power for speed

• so wind (turbine) reaches a steady / full speed

• so voltmeter reaches / gives a steady reading
  accept accurate or valid reading a correct reading is insufficient
do not accept precise reading

(iii) as the number of blades increases so does the (voltmeter) reading / output / voltage

  number of blades affects the reading / output is insufficient

  further relevant detail, eg

• voltmeter increase is greatest up to 3 blades

• voltmeter reading hardly changes with 4, 5 or 6 blades
  accept does not change between 4 and 6 blades

• increase is directly proportional up to 3 blades

• it reaches a limit
  accept does not change after 4 / 5 blades

• a numerical example giving two pairs of numbers, eg 2 blades = 0.6V, 4 blades = 1V

(b) C

reason scores only if C is chosen

wind speed / strength varies

  accept wind is not constant / reliable

(a) \[E = 15000 \times 36\]

\[E = 540000\]

\[E = 540 \text{ (kJ)}\]

an answer of 540 (kJ) scores 3 marks
(b) (the motor in) scooter B has a higher power therefore 
(because both motors have the same efficiency) scooter B will have a greater kinetic energy 

(c) the battery in scooter B has a greater store of chemical energy 

(d) energy transferred = power × time 
allow \( E = P \times t \) 

(e) \( 20 \times 60 \)

\[ E = 1200 \times 700 \]

\[ E = 840000 \text{ (J)} \]

an answer of 840000 (J) scores 3 marks

(a) (i) temperature (increase) and time switched on are directly proportional

accept the idea of equal increases in time giving equal increases in temperature

answers such as:

• as time increases, temperature increases
• positive correlation
• linear relationship
• temperature and time are proportional

score 1 mark

(ii) any one from:

“it” refers to the metal block

• energy transfer (from the block) to the surroundings
accept lost for transfer
accept air for surrounding

• (some) energy used to warm the heater / thermometer (itself)
accept takes time for heater to warm up

• (metal) block is not insulated

1
(iii) 15 000
allow 1 mark for correct substitution, ie 50 \times 300 provided no subsequent step shown

(b) lead
reason only scores if lead is chosen

needs least energy to raise temperature by 1°C
accept needs less energy to heat it (by the same amount)
lowest specific heat capacity is insufficient

(a) (i) electrical
correct order only

kinetic

sound

(ii) transferred into surroundings / atmosphere
accept warms the surroundings
allow released into the environment
becomes heat or sound is insufficient

(b) 0.7 / 70%
an answer of 70 without % or with the wrong unit or 0.7 with a unit gains 1 mark

7 (a) efficiency = \frac{\text{useful output energy transfer}}{\text{total input energy transfer}} \times 100

allow efficiency = \frac{\text{useful output}}{\text{total input}} \times 100
(b) \( \text{efficiency} = \frac{1.2 \times 10^{18}}{1.3 \times 10^{18}} \times 100 \)

= 0.92 
or 
92 (%) 

allow an answer that rounds to 0.92 

or 
92 (%) 

ignore units 
an answer of 0.92 or 92 (%) scores 2 marks 

(c) at a high potential difference and a low current 

(d) \( \text{power} = \frac{\text{energy transferred}}{\text{time}} \)

allow \( P = \frac{E}{t} \) 

(e) \( 8000 = \frac{E}{1200} \)

if a conversion of 8000 has been attempted, this mark can be awarded 

\( (E =) 1200 \times 8000 \)

if a conversion of 8000 has been attempted, this mark can be awarded 

\( (E =) 9600000 \text{ (kJ)} \)

this answer only 
an answer of 9600000 (kJ) scores 3 marks
any four from:

(environmental advantages)
- renewable / sustainable (energy source)
- conserves fossil fuels
- no release of pollutant gases e.g. sulfur dioxide
- no release of greenhouse gases
  allow does not release carbon dioxide
- does not contribute to global warming

(environmental disadvantages)
- noise pollution
- visual pollution
- bird kill
- not always windy so more use of fossil fuel power stations
  ignore destruction of habitat
  max 3 marks if only refers to advantages or disadvantages
  ignore references to cost

(a) (i) 150

(ii) transferred to the surroundings by heating
  reference to sound negates mark

(iii) 0.75
  450 / 600 gains 1 mark
  accept 75% for 2 marks
  maximum of 1 mark awarded if a unit is given

(iv) 20 (s)
  correct answer with or without working gains 2 marks
  correct substitution of 600 / 30 gains 1 mark

(b) (i) to avoid bias

(ii) use less power and last longer

1 LED costs £16, 40 filament bulbs cost £80
or
filament costs (5 times) more in energy consumption
(iii) any **one** from:

- availability of bulbs
- colour output
- temperature of bulb surface

(a) conduction

(b) (i) there is a bigger temperature difference between the water and the surrounding air

  *accept the water is hottest / hotter*

  so the transfer of energy (from hot water) is faster

  *accept heat for energy*

  *ignore temperature falls the fastest*

(ii) 120

  *allow 1 mark for converting kJ to J correctly, ie 4 032 000*

  or

  correctly calculating temperature fall as 8°C

  or

  allow 2 marks for correct substitution, ie 4 032 000 = m × 4200 × 8

  answers of 0.12, 19.2 or 16.6 gain 2 marks

  answers of 0.019 or 0.017 gain 1 mark

(iii) water stays hot for longer

  so heater is on for less time

  *accept so less energy needed to heat water*

  so cost of the jacket is soon recovered from) lower energy costs / bills

  *accept short payback time*
(a) any two from:

- cost per kWh is lower (than all other energy resources)
  - allow it is cheaper
  - ignore fuel cost
  - ignore energy released per kg of nuclear fuel
- infrastructure for nuclear power already exists
  - accept cost of setting up renewable energy resources is high
  - accept many renewable power stations would be needed to replace one nuclear power station
  - accept (France in 2011 already had a) surplus of nuclear energy, so less need to develop more renewable capacity for increased demand in the future
  - accept France benefits economically from selling electricity
- more reliable (than renewable energy resources)
  - accept (nuclear) fuel is readily available
  - ignore destruction of habitats for renewables

(b) any two from:

- non-renewable
  - allow nuclear fuel is running out
- high decommissioning costs
  - accept high commissioning costs
- produces radioactive / nuclear waste
  - allow waste has a long half-life
- long start-up time
- nuclear accidents have widespread implications
  - allow for nuclear accident a named nuclear accident
  - eg Fukushima, Chernobyl
  - ignore visual pollution

(c) 0.48 (kW)

- allow 1 mark for correct substitution
- ie $0.15 = P / 3.2$
- an answer of 480 W gains 2 marks
- an answer of 48 or 480 scores 1 mark
(d) the higher the efficiency, the higher the cost (per m$^2$ to manufacture) 

   accept a specific numerical example

   more electricity could be generated for the same (manufacturing) cost using lower 
   efficiency solar panels

   or

   (reducing the cost) allows more solar panels to be bought

   accept a specific numerical example