Energy F

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Q1.

There are many different energy resources.

(a) Which **two** energy resources are renewable?

Tick **two** boxes.

Biofuel	☐
Coal	☐
Gas	☐
Geothermal	☐
Nuclear fuel	☐

(2)

(b) Some non-renewable energy resources are more reliable than others.

Which statement correctly describes a reliable resource?

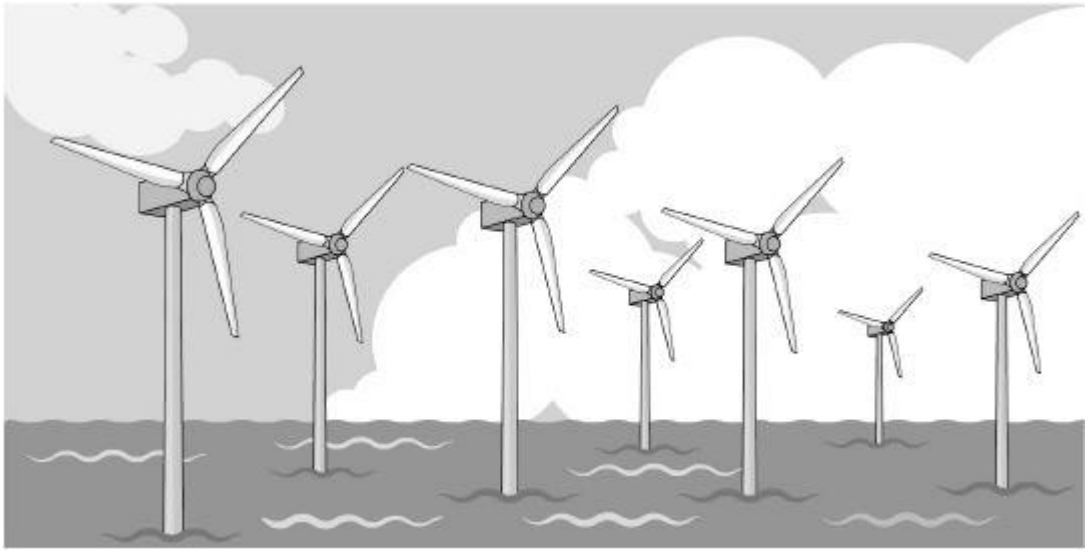
Tick **one** box.

It does not burn fuel.	☐
It is predictable.	☐
It will never run out.	☐
It is cheap to use.	☐

(1)

(c) **Figure 1** shows a wind farm.

Figure 1



The total power output of the wind farm is 19.6 MW

All of the wind turbines have the same power output.

What is the power output of **one** wind turbine?

Tick **one** box.

2.7 MW ☐

2.8 MW ☐

2.9 MW ☐

3.2 MW ☐

3.3 MW ☐

(1)

(d) Give **two** reasons why people might **not** like having wind turbines near their homes.

1. _____

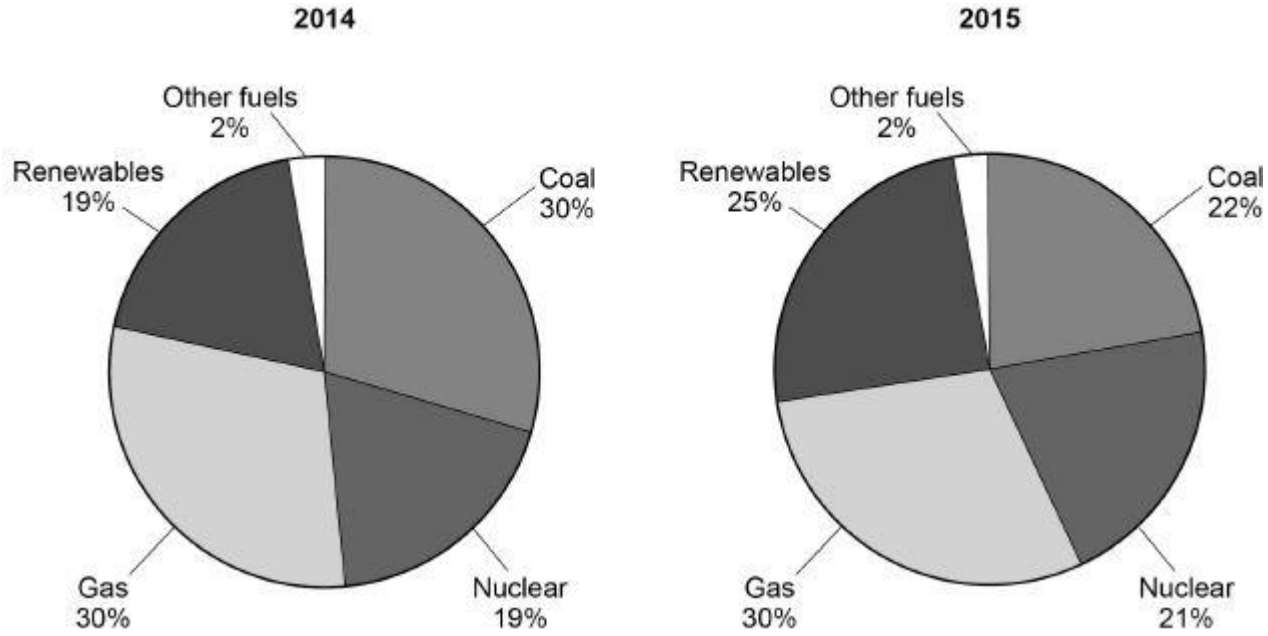
2. _____

(2)

(e) **Figure 2** shows the electricity generated by different energy resources in the UK.

The total amount of electricity generated was the same in 2014 and in 2015

Figure 2



There are changes in the amounts of different energy resources used between 2014 and 2015

Explain the environmental impacts of the changes.

(4)

(Total 10 marks)

Q2.

The image shows a girl riding a self-balancing scooter.

(a) The scooter has an electric motor powered by a battery.

During the ride the battery transfers 15 000 C of charge.

The potential difference across the battery is 36 V

Calculate the energy transferred by the battery.

Use the equation:

energy transferred = charge flow × potential difference

Give your answer in kJ

Energy transferred = _____ kJ

(3)

The table gives data for two scooters with different motors.

Both motors have the same efficiency.

	Power of motor in W	**Mass in kg**
Scooter A	500	10.5
Scooter B	700	14.0

(b) Explain why scooter **B** has a higher maximum speed.

(2)

(c) Both scooters can be ridden for 20 minutes before the battery needs recharging.

Compare the amount of chemical energy stored in the batteries of each scooter.

(1)

(d) Write the equation that links energy transferred, power and time.

(1)

(e) Calculate the energy transferred by the motor in scooter **B** in 20 minutes.

Energy transferred = _____ J

(3)

(Total 10 marks)

Q3.

An energy input of 1.3×10^{18} J is supplied each year by power stations to the National Grid.

Not all of this energy is supplied to consumers. Some of the energy is wasted in the distribution process.

(a) Write the equation which links efficiency, total input energy transfer and useful output energy transfer.

(1)

(b) The energy supplied each year to consumers is 1.2×10^{18} J

Calculate the efficiency of the distribution process.

Efficiency = _____

(2)

(c) How is electrical power transmitted across the National Grid to make the process as efficient as possible?

Tick **one** box.

- At a high potential difference and a high current ☐
- At a high potential difference and a low current ☐
- At a low potential difference and a high current ☐
- At a low potential difference and a low current ☐

(1)

(d) Write the equation which links energy transferred, power and time.

(1)

(e) A wind turbine supplies a power output of 8000 kW for 1200 seconds.

Calculate the energy transferred by the wind turbine in kJ

Energy transferred = _____ kJ

(3)

(f) Describe the environmental advantages and disadvantages of using wind turbines to generate electricity in the UK.

(4)

(Total 12 marks)

Q4.

A student investigated the specific heat capacity of metals.

(a) Describe an experiment the student could do to measure the specific heat capacity of a metal.

(6)

(b) The student calculated the specific heat capacity of four metals.

The table below shows the student's results.

Metal	Mass of material in kg	Time in minutes	Temperature in °C	Change in thermal energy in J	Calculated specific heat capacity of material in J / kg °C
Aluminium	1	10	2	4 780	2 390
Brass	1	10	4	4 660	1 165
Copper	1	10		4 600	657
Steel	1	10	5	4 690	938

Use data from the table above to calculate the temperature change for copper.

Use the correct equation from the Physics Equation Sheet.

Temperature change = _____ °C

(3)

(c) What is the independent variable in the student's investigation?

Tick **one** box.

- Mass of material ☐
- Power used ☐
- Time in minutes ☐
- Type of material ☐

(1)

(d) The student calculated the specific heat capacity of aluminium to be 2390 J / kg °C.

The 'true' specific heat capacity of aluminium is 900 J / kg °C.

Suggest why the student's result for aluminium is different from the 'true' value.

_____

_____

(2)

(e) The teacher suggested that putting bubble wrap round the metal block would change the results.

How would using bubble wrap change the results?

Give a reason for your answer.

_____

_____

_____

_____

(2)

(Total 14 marks)

Q1.

(a) biofuel

1

geothermal

1

(b) it is predictable

1

(c) 2.8 MW

1

(d) any **two** from:

- visual pollution
- noise pollution
- dangerous to birds
- may lower house prices

2

(e) **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

- less fossil fuel burnt
- more nuclear fuel used
- more renewables used
- gas remained the same
- less carbon dioxide released
- less greenhouse gases
- less global warming
- less acid rain
- less environmental pollution
- more hazardous waste produced (nuclear)
- the percentage generated by coal has decreased 8%
- the percentage generated by renewables has increased by 6%
- the percentage generated by nuclear has increased by 2%

[10]

Q2.

(a) E = 15 000 × 36

1

E = 540 000

1

E = 540 (kJ)

*an answer of 540 (kJ) scores **3** marks*

1

(b) (the motor in) scooter **B** has a higher power

1

therefore

(because both motors have the same efficiency) scooter **B** will have a greater kinetic energy

1

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

1

(d) energy transferred = power × time

allow E = P × t

1

(e) 20 × 60

1

E = 1 200 × 700

1

E = 840 000 (J)

*an answer of 840 000 (J) scores **3** marks*

1

[10]

Q3.

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

allow $\textit{efficiency} = \frac{\textit{useful output}}{\textit{total input}} (\times 100)$

1

(b) $(\text{efficiency} =) \frac{1.2 \times 10^{18}}{1.3 \times 10^{18}} (\times 100)$

1

= 0.92
or
92 (%)

allow an answer that rounds to 0.92

or
92 (%)

1

ignore units

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

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

1

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

allow $P = \frac{E}{t}$

1

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

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

1

(E =) 1200 × 8000

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

1

(E =) 9 600 000 (kJ)

this answer only

1

*an answer of 9 600 000 (kJ) scores **3** marks*

(f) 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

4

[12]

Q4.

(a) **Level 3 (5–6 marks):**
A full, detailed and coherent plan covering all the major steps is provided, which outlines what needs to be measured to calculate specific heat capacity. The steps are set out
in a logical manner that could be followed by another person to calculate the specific heat capacity.

Level 2 (3–4 marks):
The substantive content of a plan is present but may be missing some steps. The plan
may not be in a completely logical sequence but leads towards the calculation of the specific heat capacity.

Level 1 (1–2 marks):
Simple statements relating to relevant apparatus or steps are made but they may not be
in a logical order. The plan would not allow another person to calculate specific heat capacity.

0 marks:
No relevant content.

Indicative content

- measure the mass of metal
- correct use of balance
- description of how work is done or energy transferred to metal
  eg electrical work, mechanical work (eg dropping lead shot)
- how energy transfer or work done is measured
  eg electrical using joulemeter, mechanical decrease in potential energy store of falling lead shot
- equate work done / energy transferred = increase in thermal energy store of the
  metal
- calculate specific heat capacity

6

(b) 4 600 = 1 × 657 × temperature change

1

temperature change = 4 600 / 657

1

= 7 (°C)

*allow 7 with no working shown for **3** marks*

1

(c) Type of material

1

(d) heat loss

1

then any **one** from:

- turned off the power supply too early
- incorrectly measured mass of material
- incorrectly measured temperature
- incorrectly read the change in thermal energy

1

(e) would give a more accurate value **or** the calculated specific heat capacity will be smaller

1

because the bubble wrap insulates the material **or** prevents heat loss

1