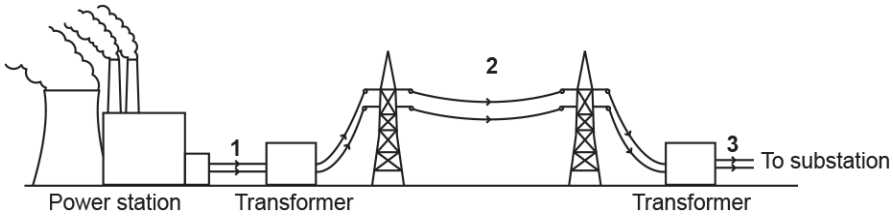
Powering Earth (H)

1. The diagram shows a simplified version of the national grid.



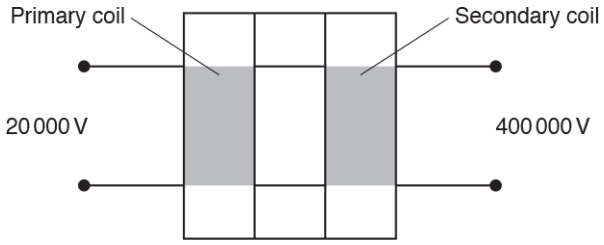
The potential difference (p.d.) is different at each point in the national grid.

Which row in the table is correct?

	p.d. at position 1 (V)	p.d. at position 2 (V)	p.d. at position 3 (V)
A	230	5 000	11 000
B	25 000	450 000	11 000
C	450 000	150	230
D	450 000	5 000	230

Your answer ☐ **[1]**

2. This is a diagram of a transformer used in the national grid.



Why is this transformer used in the national grid?

A To decrease the power in the national grid by a factor of 20.
B To decrease the power loss in the national grid by a factor of 400.
C To increase the power in the national grid by a factor of 20.
D To increase the power loss in the national grid by a factor of 400.

Your answer ☐ **[1]**

3. Which statement shows energy resources that are **all renewable?**

A Bio-fuel, wind, hydro-electricity and tides.
B Fossil fuels, bio-fuel, wind and hydro-electricity.
C Fossil fuels, nuclear fuel, hydro-electricity and tides.
D Nuclear fuel, bio-fuel, wind and tides.

Your answer ☐ **[1]**

4. Which of the following correctly describes the domestic electricity supply in the UK?

A 230 V a.c. at 50 Hz
B 230 V a.c. at 60 Hz
C 230 V d.c. at 50 Hz
D 230 V d.c. at 60 Hz

Your answer ☐ **[1]**

5. The National Grid transfers energy efficiently using high voltages.

Why are high voltages more efficient?

A. High voltages produce a high current which heats wires less.
B. High voltages produce a low current which heats wires more.
C. High voltages produce a high current which heats wires more.
D. High voltages produce a low current which heats wires less.

Your answer ☐

[1]

6. Which row correctly describes the domestic electricity supply in the UK?

	a.c. or d.c.	frequency (Hz)	voltage (V)
A	a.c.	50	230
B	a.c.	230	50
C	d.c.	50	230
D	d.c.	230	50

Your answer ☐

[1]

7. Voltage is increased before transmission through the National Grid.

It is increased from 25 000 V up to 400 000 V. This increases the voltage 16 times.

i. How much would this increase in voltage affect the current?

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[2]

ii. Use the formula: **power = current^2 × resistance**

to explain why this voltage increase is important to power loss in transmission cables.

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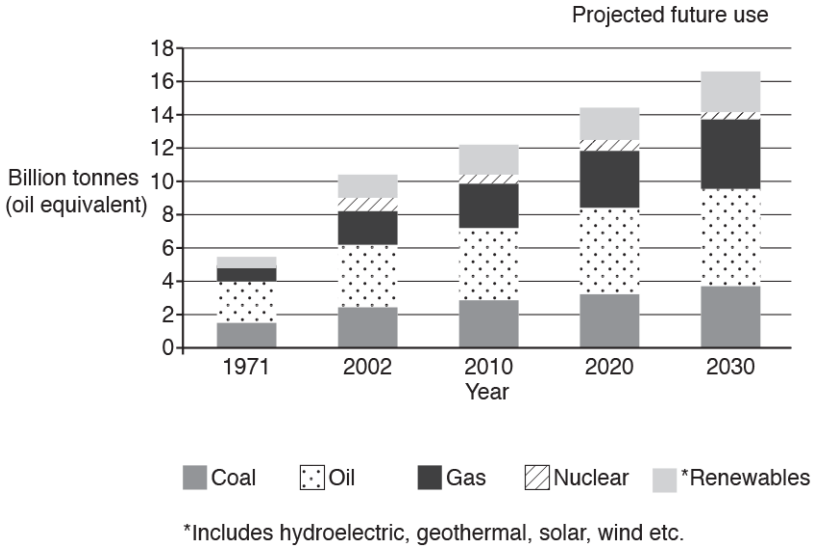
[2]

8(a). Scientists are researching the World's energy use for the future.

The graph shows some of their research.



i. The future demand for fossil fuels is expected to increase.

Give two reasons why scientists are worried about this increase in demand.

1 ---

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2 ---

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[2]

ii. In the UK the government is closing coal fired power stations and planning for new nuclear power stations to be built.

Suggest why the government wants more nuclear power stations.

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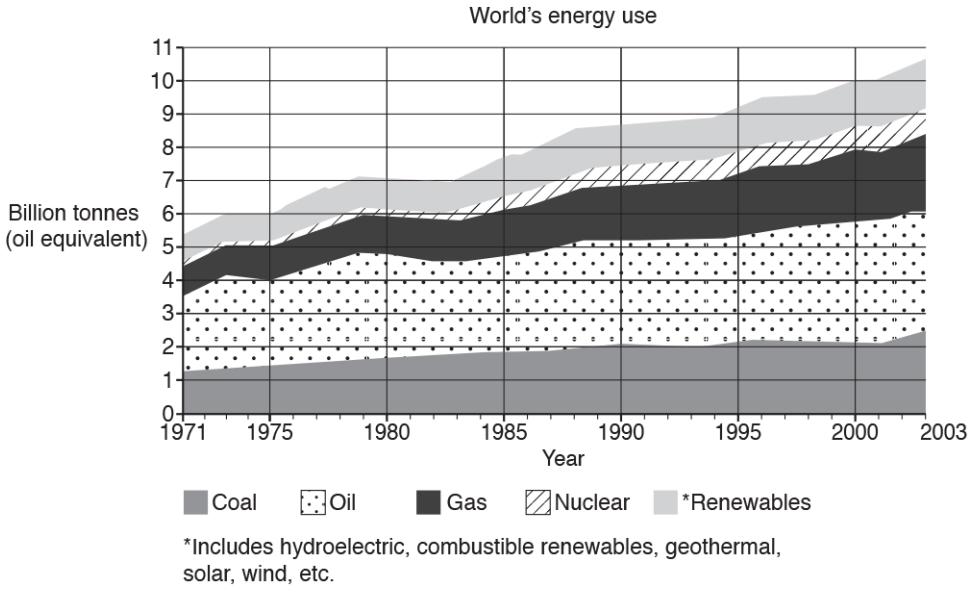
[2]

(b). The graph shows how the World's energy use has changed from the year 1971 to the year 2003.

It also shows the amount of different energy sources used.



i. Approximately how much did the total World's energy use increase from the year 1971 to the year 2003?

Answer = _____ billion tonnes (oil equivalent) **[1]**

ii. Which energy source had the **greatest** use in the year 2003?

_____ **[1]**

iii. The total energy use in the year 2003 was 10.6 billion tonnes (oil equivalent).

Approximately what percentage of this amount was due to fossil fuel use?

Answer = _____ % **[2]**

(c). A domestic wind turbine has a power rating which varies from 1.0 kW to 3.0 kW.

i. The domestic wind turbine has an electrical resistance of 23 Ω.

It generates a current of 11 A on a windy day.

Calculate the power output in kW of the turbine on this day.

Answer = _____ kW **[4]**

i. Suggest why the manufacturer gives a range for the power rating of the wind turbine.

_____

_____ **[1]**

ii. Using just **one** domestic wind turbine may be an unreliable source of power for a house.

State a reason why.

_____

_____ **[1]**

(d). Power stations in the UK generate electricity at 25 kV a.c.

The voltage is then increased to 400 kV a.c. and distributed by power lines.

i. Write down the full name of the device used to **increase** the voltage.

_____ **[1]**

ii. Why is it important to increase the voltage in these power lines?

_____ **[1]**

iii. The high voltages across the power lines are reduced to 230 V a.c. for use in the home.

A phone charger changes the 230 V a.c. to a 5 V d.c.

Explain the difference between d.c. and a.c.

_____

_____

_____ **[2]**

9(a). Energy is transferred at high voltages in the national grid.

This house is near to a transmission line.

Explain why radio waves may be produced by the transmission line.

_____

_____

_____ **[2]**

(b). Explain why it is more efficient to transfer energy at high voltages.

_____

_____

_____ **[2]**

(c). The transmission line has a power loss of 6.156 kW.

Its resistance is 15.39 Ω.

Calculate the current in the transmission line.

Current = ... A **[5]**

10. Nuclear fission can be used as a power source to produce electricity.

Give one **advantage** and one **disadvantage** of using nuclear power to produce electricity.

advantage

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disadvantage

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[2]

11. A projector is used to create a larger image of an object.

i. The projector is connected to the mains power supply. The projector has an earth wire.

State the potential difference between the earth wire and the live wire in normal use.

Potential difference = ...V **[1]**

ii. A projector with a plastic case does not need an earth wire.
A projector with a metal case needs an earth wire.

Explain why.

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[2]

12. * The UK generates some of its electrical power from wind turbines.

Fig. 18.1 shows the total electrical power generated by wind turbines in the UK.

The graph is for a single day in December which had very strong winds.

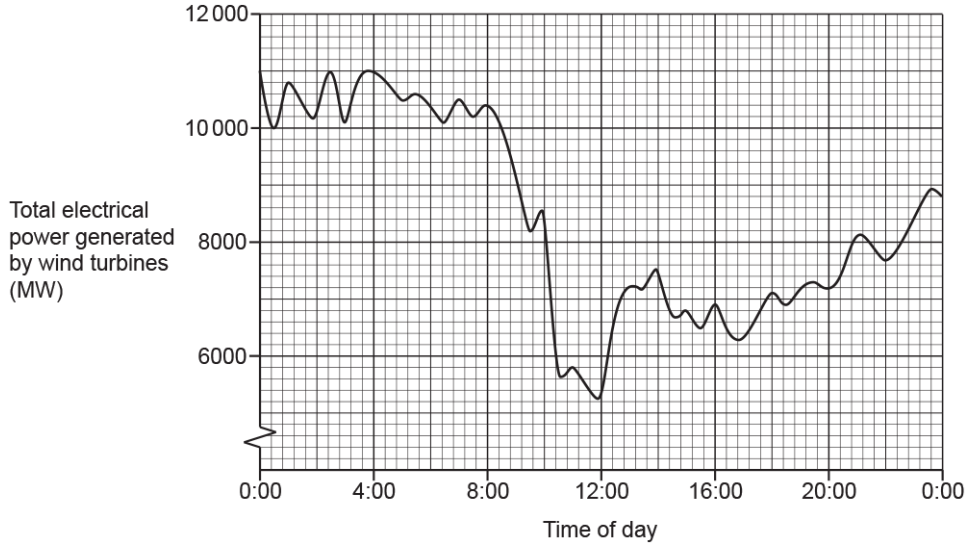

Fig. 18.1

Fig. 18.2 shows the total demand for electrical power in the UK on the same day.

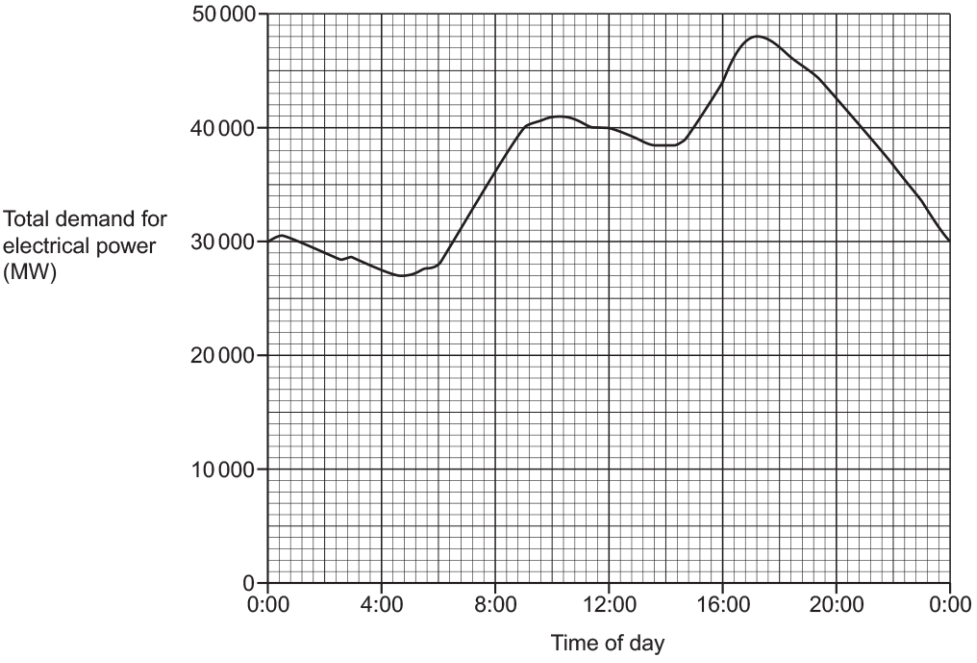

Fig. 18.2

Some experts believe the UK should generate most of its electrical power from wind.

Evaluate the advantages and disadvantages of this idea.

Use the graphs in **Fig. 18.1** and **Fig. 18.2** and your own ideas about wind turbines to support your answer.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____ **[6]**

13. Water can be heated using a 12 V heater.

A transformer is used to change a 120 V supply into 12 V.
The current in the secondary coil is 9.0 A.

Calculate the current in the primary coil.

Use an equation from the data sheet.

Current = ... A **[2]**

END OF QUESTION PAPER