1 Look at the advert about double glazing.

> *Buy **Evercosy** double glazing.*
>
> *Fitting double glazing to your house will save up to 18% on your energy costs.*
>
> *Spend a little and save a lot. Choose Evercosy.*

Simon has double glazing fitted in his house. He thinks it saves him money.
Look at the data.

Year	Double glazing	Annual energy cost in £
2009	none	1200
2010	none	1040
2011	none	1010
2012	fitted	950
2013	fitted	1020
2014	fitted	790

Before he fitted double glazing, Simon's average annual energy cost was £1083.

With an 18% saving the average annual energy cost should be £888.
How do Simon's actual annual energy costs from 2012 onwards compare to this figure?

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Suggest reasons for this difference.

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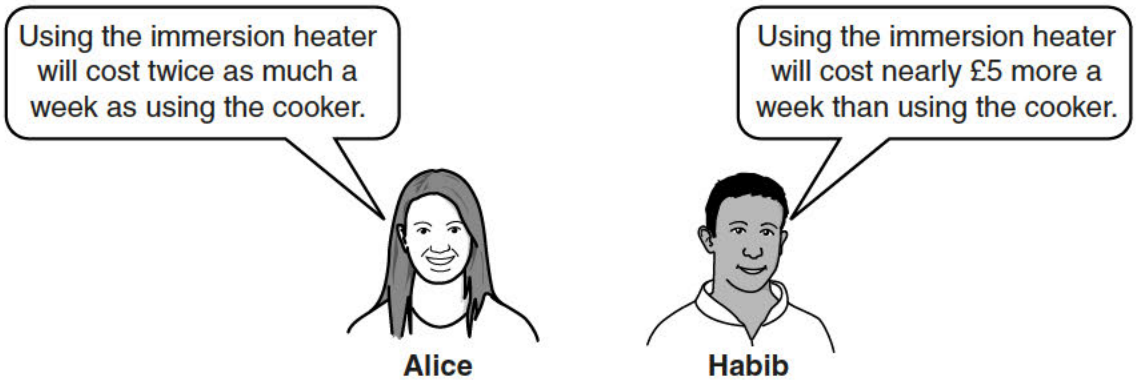
2 This question is about paying for electricity.

(a) Alice checks the information on her electricity bill.
She also looks at information about some of her appliances.

Appliance	Average power in kW	Time used per week in hours
cooker	2.0	6
immersion heater	3.0	12
central heating	6.0	18

Habib also looks at the information.

He sees from the bill that the price of a unit of electricity is 20p.



Complete calculations to show who is correct.

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Who is correct? ..... **[3]**

(b) The electricity that Alice and Habib use comes from the National Grid.

The National Grid has many power lines at high voltage.

The National Grid uses two high voltages.

- 4.00×10^5 V
- 2.75×10^5 V

Both voltages are used to transfer 2.0×10^9 W of electrical power.

Calculate the current in the power lines at each voltage and explain why the higher voltage is better for power transmission through the National Grid.

At a voltage of 4.00×10^5 V .....

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answer ..... A

At a voltage of 2.75×10^5 V .....

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answer ..... A

Explanation .....

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3 Nuclear power stations have benefits and risks.

(a) Davinder is worried because he lives near a nuclear power station.

Write about **one risk** of living near a nuclear power station.

Explain how **this** risk is reduced for people living nearby.

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(b) The nuclear power station produces electricity.

The electrical output of the power station is connected to transformers.

The outputs of these transformers are connected to the National Grid.

Why are these transformers used and how is this important for the National Grid?

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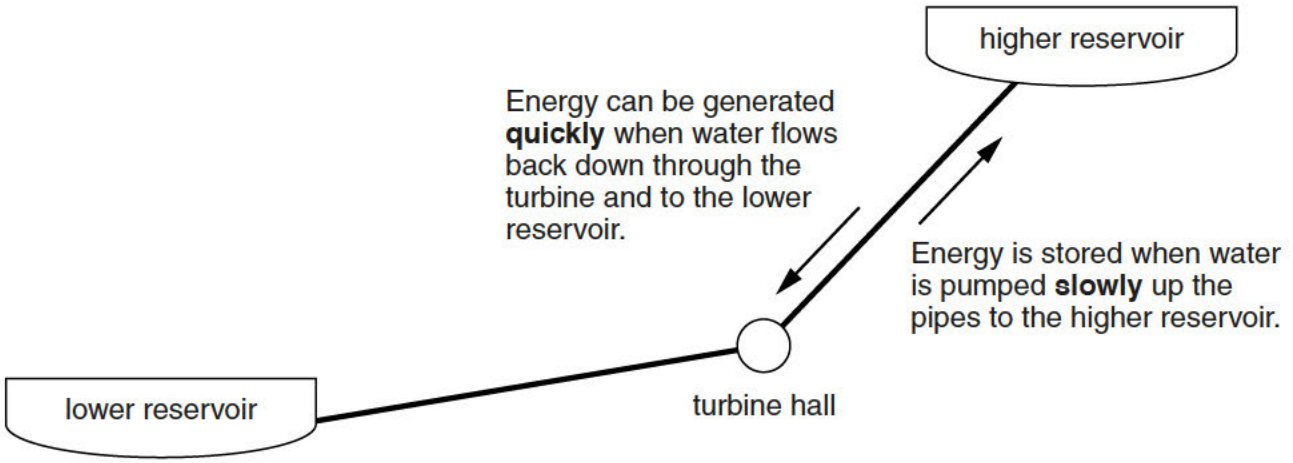
[Total: 5]

4 Fuel power stations produce electricity **steadily**, 24 hours a day.

Some fuel power stations make use of a pumped storage system to help meet the demand for electricity.

At night, the pumped storage system is used to store surplus energy from the fuel power station.

Look at the diagram of a pumped storage system which uses water.



Explain how the pumped storage system can benefit suppliers and consumers of electricity during a 24 hour period.

The quality of written communication will be assessed in your answer to this question.

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..... **[6]**

[Total: 6]

5 Electrical power can be generated in many ways.

Look at the data on different types of power generation.

Power generator	% Efficiency
Wind turbine farm	30
Coal power station	34
Nuclear power station	35
Oil power station	32
Gas power station	45

(a) Coal, oil, gas and nuclear are all types of **thermal** power station.

Why are all these called thermal power stations?

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..... **[1]**

(b) Thermal power stations are more efficient than wind turbine farms.

Suggest why wind turbine farms are often preferred to thermal power stations.

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..... **[1]**

(c) The coal power station has an input power of 500 MW.

Using information in the table, calculate the energy in MJ wasted each **minute** in this power station.

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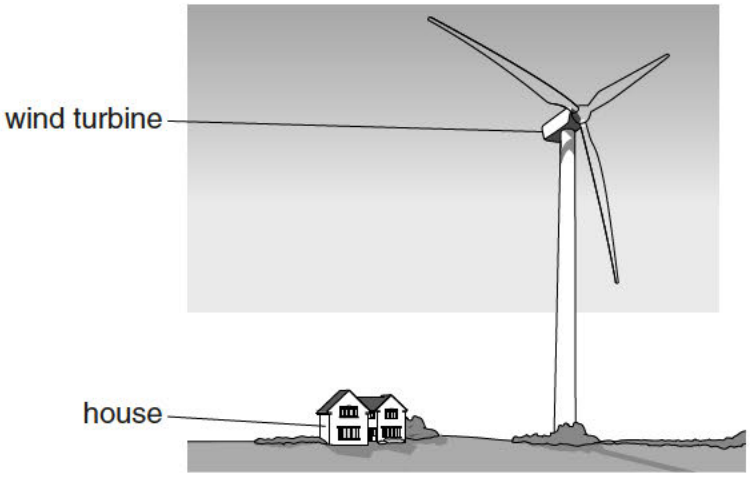
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[Total: 5]

6 The Sun's energy produces convection currents that cause wind.

Wind is used to drive turbines.



(a) Describe the **advantages** of wind turbines compared to a conventional coal power station.

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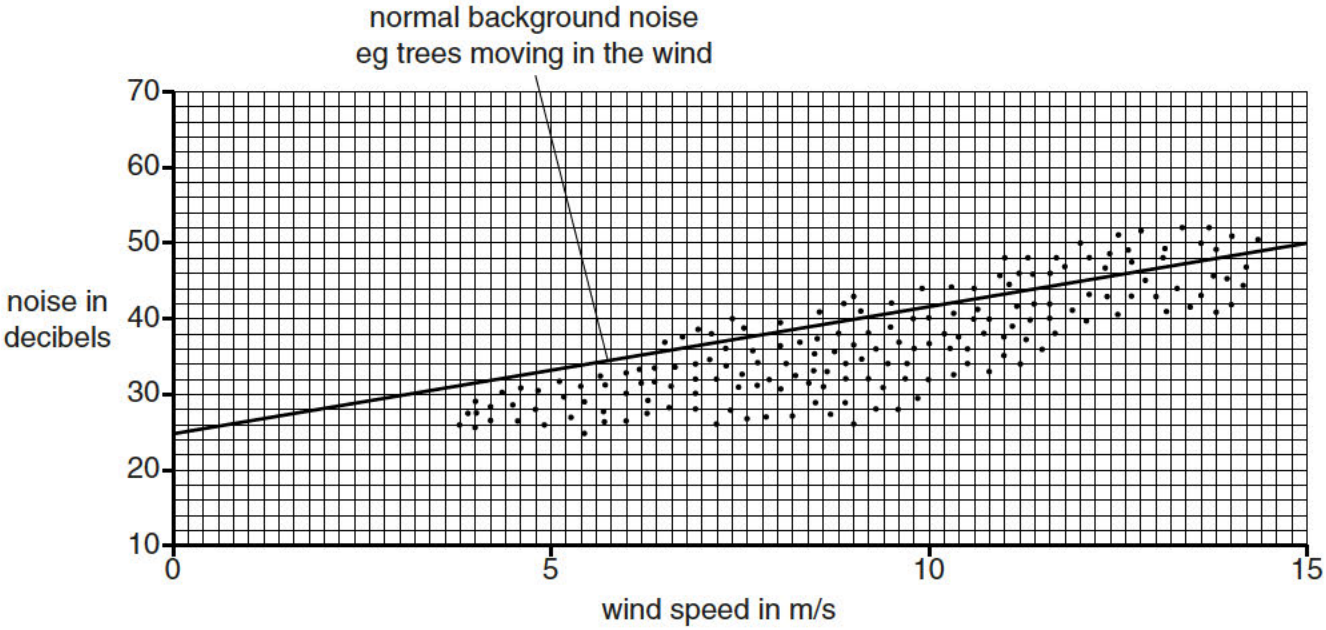
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..... **[2]**

(b) The people in the house are concerned about noise from the turbine.

Look at the graph.

Each dot shows a measurement of the noise from the wind turbine.



(i) Use the graph to describe how the wind turbine noise is affected by wind speed.

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..... **[1]**

(ii) The mean wind speed in this area is 5 m/s.

The maximum wind speed in this area is usually less than 15 m/s.

Explain, using data from the graph, why the people in the house **do not** normally need to worry about the noise from the turbine.

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[Total: 5]

7 Aditi looks at the table of stopping distances for a car.

Speed in m/s	Thinking distance in m	Braking distance in m	Stopping distance in m
4.5	3	1.5	4.5
9	6	6	12
18			
27			

The thinking, braking and stopping distances change with speed.

(a) The thinking time for the driver does not change with speed.

Calculate the thinking time for the driver in seconds.

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answer ..... s [2]

(b) Aditi says that at 18 m/s the thinking distance is 9 m.

Is she correct? .....

Explain your answer.

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..... [2]

(c) Aditi says that at 27 m/s the braking distance is 18 m.

Is she correct? .....

Explain your answer using the data in the table and ideas about energy.

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(d) Complete the sentences.

Stopping distances increase with speed and depend on thinking and braking.

The thinking distance is the ..... while the driver is reacting.

Thinking distance increases with speed but also increases if this driver is .....

..... .

Braking distance increases with speed but also increases if the road .....

or the tyres ..... . [3]

[Total: 10]

8 Modern cars have many safety features.

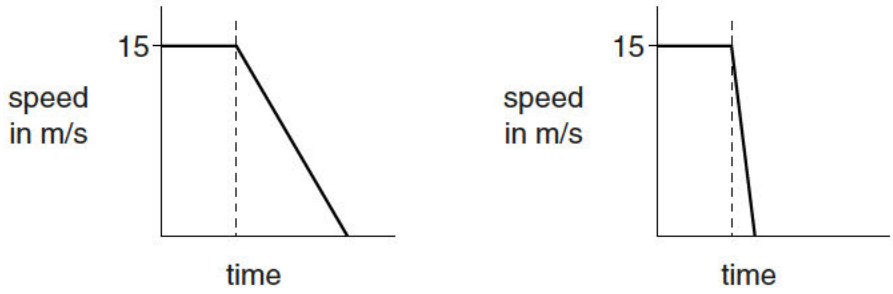
Some features protect people in a crash.

Scientists use crash dummies inside real cars to determine their safety ratings.

(a) Look at the data from two crash tests at 15 m/s.

One is for a **modern** car.

The other is for an **old** car.



modern car **old car**

The forces on the crash dummies in the old car are much higher.

Old cars do not have crumple zones.

Use the information in the graphs to explain why crumple zones in modern cars reduce forces on crash dummies.

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(b) More effort is now being made to keep pedestrians safer in car crashes.

(i) Scientists use dummies and cars in tests to improve pedestrian safety.

Describe the steps that scientists take when carrying out these tests.

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(ii) These scientists will publish their results.

Why is it important to publish these results?

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[Total: 6]