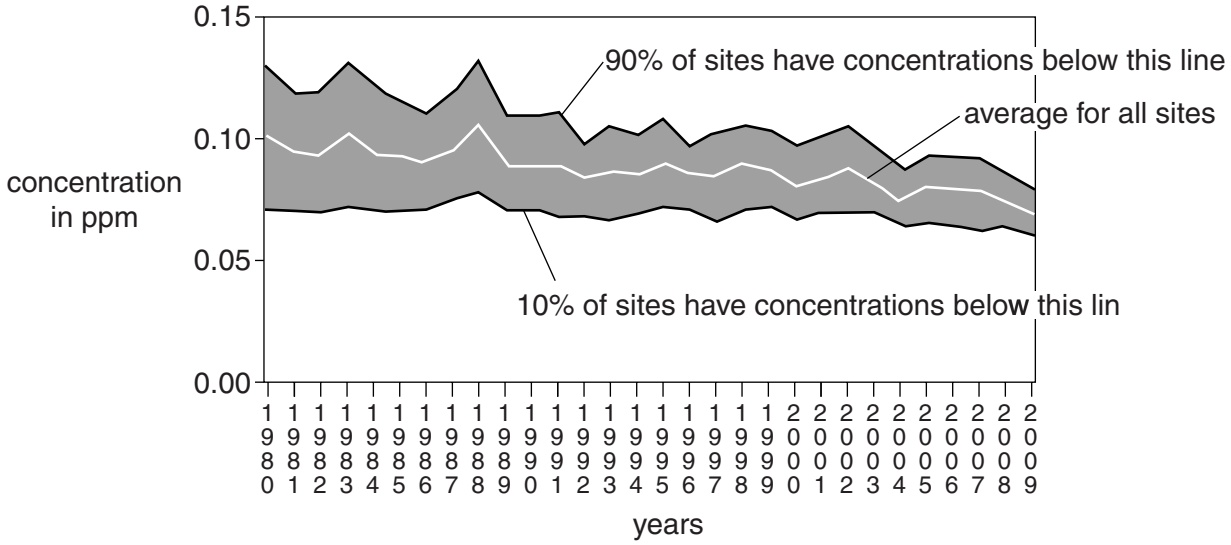
1 The ozone layer protects us from harmful UV radiation.

This radiation can cause health problems.

(a) Data on ozone concentration in parts per million (ppm) is displayed using deciles.

Look at the graph of ozone concentration in the USA from 1980 to 2009.

The data was collected from 255 different sites.



Using data from the graph describe the trends in the data from 1980 to 2009.

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(b) The Antarctic **ozone hole** was discovered in 1985 by British scientists.

This led to changes in people's behaviour across many countries.

Describe and explain these changes.

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(c) Skin cancers have increased since 1984.

Some scientists think that this is due to the depletion of the ozone layer.

Other scientists think that there may be other factors involved.

(i) Suggest another factor which could have led to this increase in skin cancer.

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(ii) People from hot countries such as India, have a **lower** risk of skin cancer.

Explain how **darker** skins can reduce cancer risk.

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[Total: 7]

2 **Analogue** and **digital** signals are used for communications.

(a) Analogue radios have been used for many years.

DAB radios have become more popular. They use digital signals.

(i) Each analogue radio station in a town must broadcast at a different frequency.

Several DAB radio stations in the town can broadcast at the same frequency.

Explain why these DAB radio stations do not need to broadcast at different frequencies.

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(ii) Digital and analogue signals become weaker the further they travel and therefore need to be amplified.

Explain why the **amplified** signals remain high quality for digital signals, but decrease in quality for analogue signals.

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(b) Mike has a TV which is controlled using a remote control handset.

On the handset, each button controls a different function on the TV.

Explain how each button controls a different function.

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[Total: 5]

3 Over twenty years ago scientists working in Antarctica discovered that a deterioration in part of the Earth's atmosphere had led to an increased level of UV reaching the Earth's surface.

Jane is concerned that the increased UV levels put her more at risk when sunbathing.

Explain how human activity has increased the threat from UV, why Jane is concerned and how internationally, **governments** took action to reduce the risk.

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

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[Total: 6]

4 Phone masts send and receive microwave signals for mobile phones.

(a) Some people are concerned about having a phone mast near to their house.

Suggest whether or not having a mast near someone's house can be dangerous. Explain your answer.

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(b) It is difficult to make conclusions about the danger of microwaves to people using mobile phones.

Suggest reasons why.

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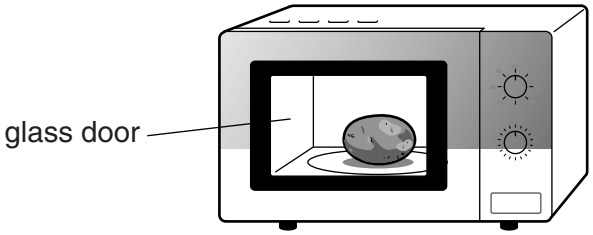
[Total: 4]

5 Sam puts a potato into her microwave oven.



She heats the potato for 8 minutes.

It is cooked through to the centre.

Sam also uses a **convection** oven to cook a potato of the same size.

This method, using infrared radiation, takes more than one hour to cook potatoes through to the centre.

Sam's microwave oven cooks food differently and wastes less energy than her convection oven.

Explain why.

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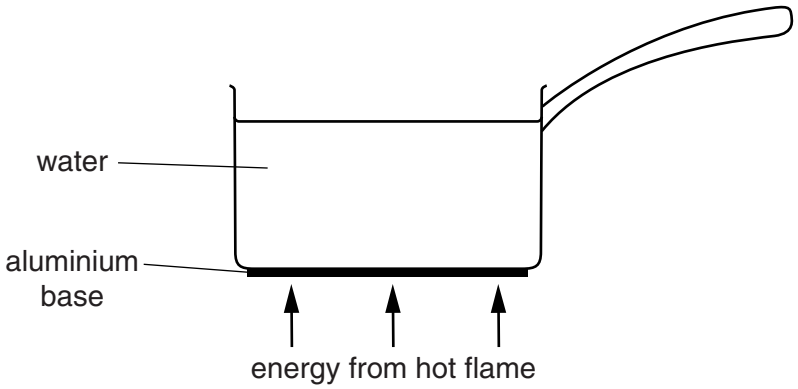
[Total: 3]

6 This question is about energy transfer and how it is used in cooking.

(a) Steve heats a pan of water on his cooker.
Look at the diagram.



(i) Explain how the particles in the aluminium base conduct energy through the bottom of the pan.

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(ii) There is a convection current in the water in the pan.
Steve starts to describe the convection current.
Look at his description.

The water is heated and it contracts.

This makes the water more dense so it rises.

His description is wrong.
Rewrite his description correctly.

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(b) Steve has a combination microwave oven.
It can cook food using microwaves or infrared waves.

Microwaves and infrared waves cook food in different ways.

(i) What is **different** about the way microwaves and infrared waves heat food?

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(ii) What is **similar** about the way microwaves and infrared waves heat food?

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7 Rene researches the range of sounds that different people can hear.

(a) Rene's research shows that

'The average person has a hearing range from 20 Hz up to 20 000 Hz'.

Rene tests the hearing range of a group of people.
Look at the data she collects.

Person	Age	Lower frequency limit of hearing in Hz	Upper frequency limit of hearing in Hz	Frequency range of hearing in Hz
Jane	16	22	19 000	18 978
Alec	16	19	20 000	19 981
Dionne	16	24		
Niamh	16	16	21 000	20 984
Evangelos	16	15	20 000	19 985
average	16	19.2	19 800	19 780.8

(i) Rene's original research showed a lower frequency limit of human hearing of 20 Hz.
The data she collects shows an average lower frequency limit of 19.2 Hz.
Suggest reasons for this difference.

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(ii) Rene has not completed her table. She has lost some of her results.
Calculate the upper frequency limit of hearing for Dionne.

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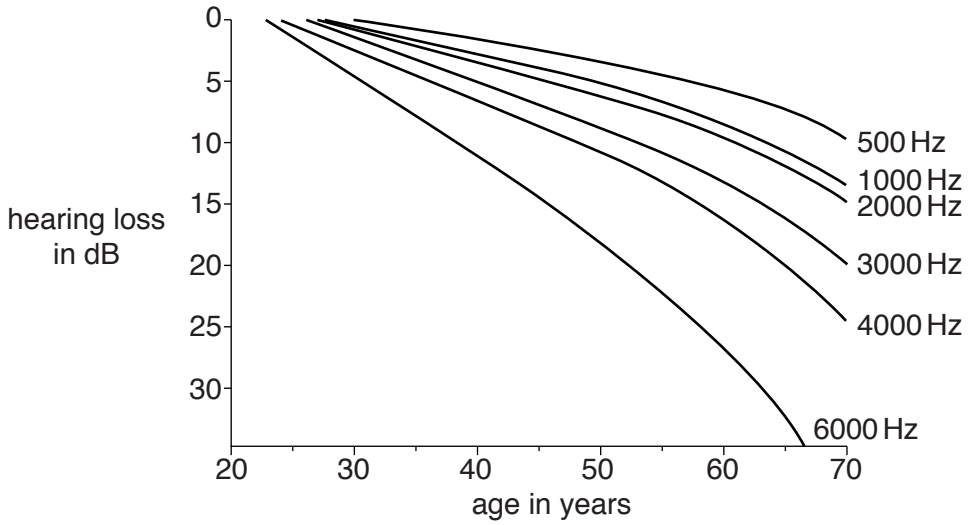
answer .....Hz **[2]**

(b) Look at the data on hearing level loss at different ages.
It shows the hearing loss in dB for different ages at six different frequencies.



(i) Describe the trends shown by the graph.

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(ii) Scientists are developing hearing aids to help people hear high frequency sounds.
These hearing aids can detect sounds of frequency 6000 Hz and above and change them to sounds of half that frequency.

60 year olds can have difficulty hearing sounds above 6000 Hz.
Explain how these hearing aids can improve their hearing.
Use the data from the graph in your answer.

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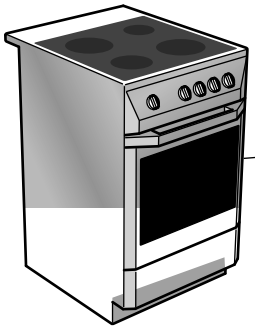
8 **(a** Damien wants to cook a curry he bought at the supermarket.

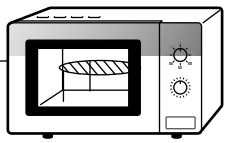
He looks at the label on the packaging of the meal.



Uses infrared radiation to cook the meal. Energy used = 5400 000 J

Place the meal in a glass dish.
Cook in either:
Conventional electric oven;
cook at 190 °C for 36 minutes.

or
Microwave oven;
cook for 6 minutes.



Uses microwave radiation to cook the meal. Energy used = 270 000 J

Explain in detail the mechanisms for both cooking methods and link these to the data for the energy used and cooking times needed.

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

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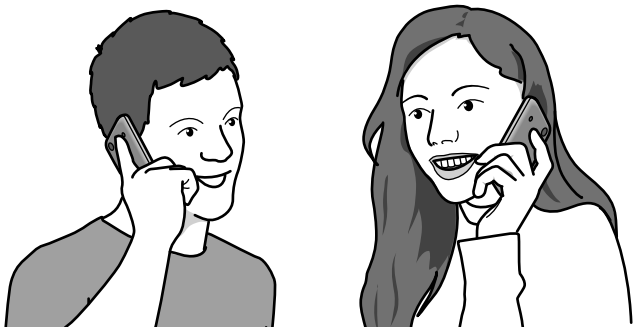
(b) Microwaves are also used for mobile phone messages.

Damien is worried about allowing his children to use mobile phones.



He finds evidence in some reports about possible dangers. Look at the notes he makes about the reports from three different years.

A: 2005 Studied phone use for 4000 people. Concluded that the risk of a cancerous tumour was not increased, at least in the first ten years.	**B**: 2007 Scientists exposed rat and human cells to microwave radiation and found this caused biological changes to the cells that could lead to tumours developing.	**C**: 2011 35 800 people aged 30 or over studied for 13 years of phone use. Study concluded that there was no increased risk of brain cancer or any other types of cancer.

Damien decided to allow his children to use mobile phones after considering the evidence from these reports.

Suggest reasons why he did this.

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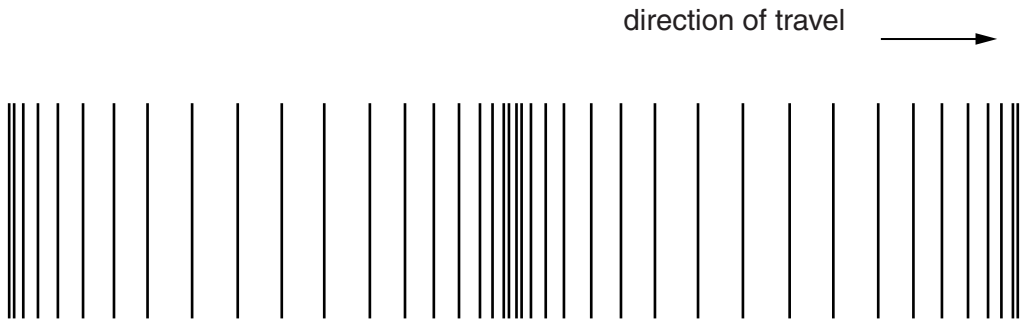
[Total: 8]

Ultrasound is a longitudinal wave.

9 **(a)** Look at the diagram of an ultrasound wave in air.



Use the diagram to describe the differences between a region of compression and a region of rarefaction.

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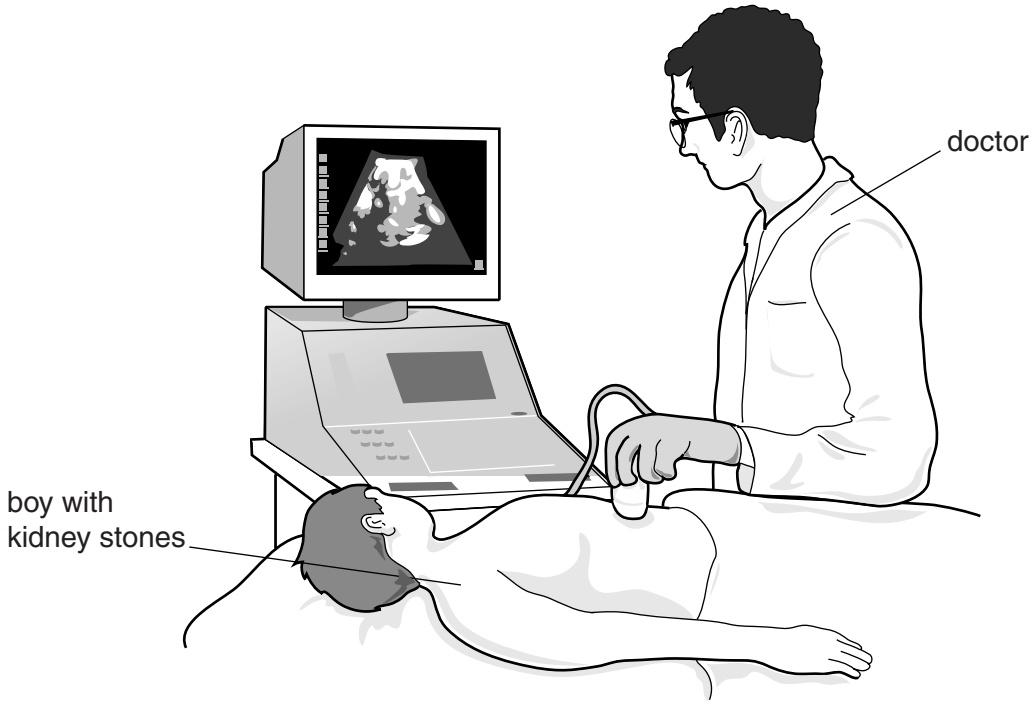
(b) Ultrasound can be used to scan the kidney and to break down kidney stones.



(i) Explain how ultrasound breaks down kidney stones.

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(ii) Explain why ultrasound is used rather than X-rays to scan the kidney.

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[Total: 4]