# GCSE

# B711/02

## GATEWAY SCIENCE
## SCIENCE B

Science modules B1, C1, P1
(Higher Tier)

**WEDNESDAY 25 MAY 2016 – Afternoon**

**DURATION: 1 hour 15 minutes**
plus your additional time allowance
**MODIFIED ENLARGED 24pt**

| Candidate forename | | Candidate surname | |
|---|---|---|---|
| | | | |

| Centre number | | | | | Candidate number | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |

**Candidates answer on the Question Paper.
A calculator may be used for this paper.**

**OCR SUPPLIED MATERIALS:**

**A copy of the Periodic Table
Loose sheet Question 2(c) and Question 3**

**OTHER MATERIALS REQUIRED:**

Pencil
Ruler (cm/mm)

**READ INSTRUCTIONS OVERLEAF**

## INSTRUCTIONS TO CANDIDATES

Write your name, centre number and candidate number in the boxes on the first page. Please write clearly and in capital letters.

Use black ink. HB pencil may be used for graphs and diagrams only.

Answer ALL the questions.

Read each question carefully. Make sure you know what you have to do before starting your answer.

Write your answer to each question in the space provided. If additional space is required, you should use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.

## INFORMATION FOR CANDIDATES

The quality of written communication is assessed in questions marked with a pencil (✏).

A list of equations can be found on pages 4–5.

The number of marks is given in brackets [ ] at the end of each question or part question.

The total number of marks for this paper is 75.

Any blank pages are indicated.

# EQUATIONS

energy = mass × specific heat capacity × temperature change

energy = mass × specific latent heat

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

wave speed = frequency × wavelength

power = voltage × current

energy supplied = power × time

$$\text{average speed} = \frac{\text{distance}}{\text{time}}$$

distance = average speed × time

$$s = \frac{(u + v)}{2} \times t$$

$$\text{acceleration} = \frac{\text{change in speed}}{\text{time taken}}$$

force = mass × acceleration

weight = mass × gravitational field strength

work done = force × distance

$$power = \frac{work\ done}{time}$$

power = force × speed

$$KE = \frac{1}{2}mv^2$$

momentum = mass × velocity

$$force = \frac{change\ in\ momentum}{time}$$

GPE = mgh

$$mgh = \frac{1}{2}mv^2$$

$$resistance = \frac{voltage}{current}$$

**Answer ALL the questions.**

**SECTION A – Module B1**

1   Jim is a 14 year old boy who has Type 1 diabetes.

   (a)  Jim needs medical treatment to control his condition.

   He injects insulin into his body.

   Describe how insulin travels around the body.

   _____ [1]

   (b)  The more carbohydrate Jim eats, the more insulin he needs.

   Explain why.

   _____

   _____

   _____ [2]

**(c) Describe where and how carbohydrates are stored in the body.**

_____

_____

_____ **[2]**

**(d)** Jim thinks he inherited diabetes.

Inherited characteristics are controlled by genes.

Cystic fibrosis is another inherited disorder.

Cystic fibrosis is caused by a recessive allele.

Complete the table below to describe the phenotypes of different individuals.

| Genotype | Phenotype |
|---|---|
| FF | |
| Ff | |
| ff | |

[2]

[TOTAL: 7]

**2** **This question is about alcohol.**

**(a) Explain why alcohol slows down transmission along nerve pathways.**

_____

_____

_____

_____ **[3]**

(b) **Women are advised to drink no more than 14 UNITS of alcohol each week.**

**Look at the table.**

| DRINK | AMOUNT | UNITS OF ALCOHOL |
|---|---|---|
| beer | one pint | 2.3 |
| gin and tonic | one measure | 1.0 |
| cider | one pint | 2.6 |
| wine | one glass | 3.0 |
| whisky | one measure | 1.0 |

**Connie writes down all the alcoholic drink she has in one week.**

Monday – one glass of wine
Tuesday – none
Wednesday – none
Thursday – two glasses of wine
Friday – two glasses of wine, one
        measure of whisky
Saturday – two gin and tonics
Sunday – one glass of wine

**Connie has drunk more than the advised amount.**

**Calculate by how much she is over the advised amount.**

**answer** _____ **units   [2]**

(c) Connie is concerned about drinking alcohol.

She researches the effects of alcohol and finds the graph shown on the loose sheet.

It shows the relative risk of having an accident if you drink alcohol and drive.

Connie writes down some conclusions about the graph on the loose sheet.

Put a tick (✓) next to TWO conclusions that best match the graph.

20–29 year olds reduce the relative risk of an accident by 30 if they have blood alcohol level of 50 mg/100 ml instead of 80 mg/100 ml.

Only those aged 18–19 will have an accident with a blood alcohol level of 10 mg/100 ml. ☐

People over 30 are 20 times better drivers than people in other age groups. ☐

People with a blood alcohol level of 150 mg/100 ml are at least 200 times more likely to have an accident than people with no alcohol in their blood. ☐

The lower the blood alcohol level the more likely you are to have an accident. ☐
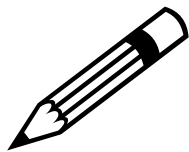
[2]

[TOTAL: 7]

**3**   **Polio is an illness caused by a virus.
In 1988 a campaign started to rid the
world of polio.
The campaign wanted to vaccinate
children all over the world.**

**Look at the graph on the loose sheet. It
shows the number of polio cases in the
world from 1984 to 2004.**

**Explain how vaccinations work and use
the data to conclude if the campaign
was successful or not.**

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

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____ **[6]**

**[TOTAL: 6]**

4   Benny is cooking his tea.

    He lifts a hot plate of food.

    The plate is too hot to hold.

    Benny drops the plate.

    (a) Benny's response to the hot plate is
        a reflex action.

**Finish the flow chart below to show the path taken by the impulse that causes the reflex.**

```
┌─────────────────┐
│    receptor     │
│                 │
└─────────────────┘
         │
         ▼
┌─────────────────┐
│    sensory      │
│    neurone      │
└─────────────────┘
         │
         ▼
┌─────────────────┐
│ _____ │
│    neurone      │
└─────────────────┘
         │
         ▼
┌─────────────────┐
│     motor       │
│    neurone      │
└─────────────────┘
         │
         ▼
┌─────────────────┐
│                 │
│ _____ │
│                 │
└─────────────────┘
```
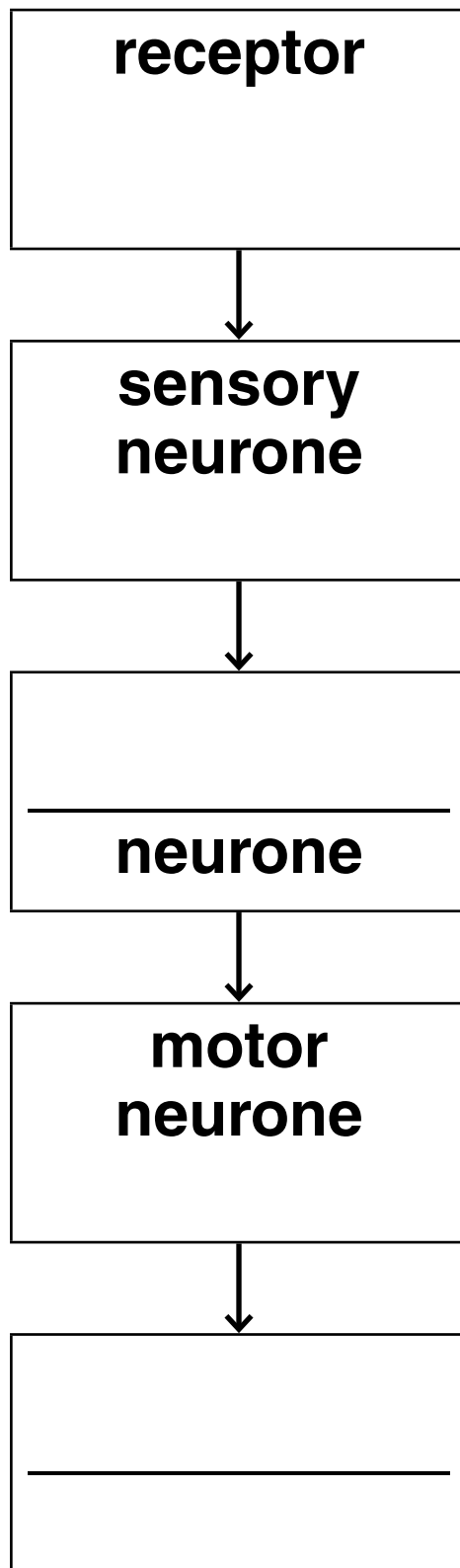
[2]

**(b)** Motor neurones are part of Benny's nervous system.

Look at the diagram below of a motor neurone.
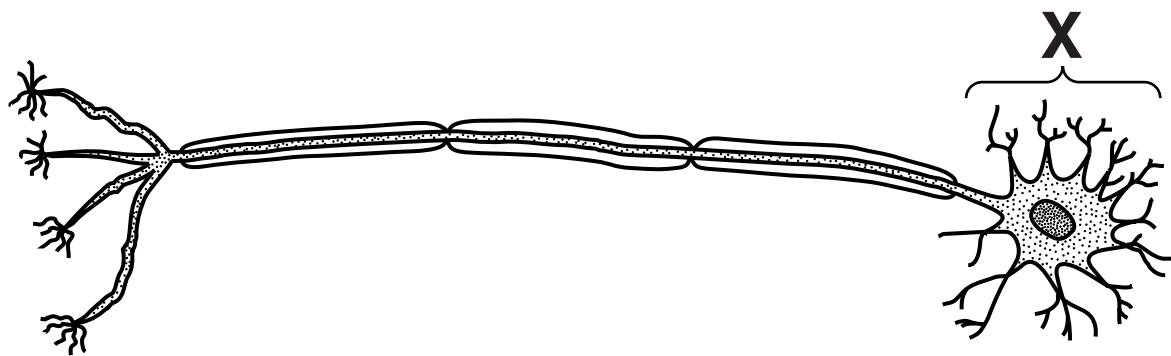


Write down the name of part X.

_____ [1]

**(c)** Sometimes neurones can be damaged.

Look at the pictures of an undamaged and a damaged neurone.

## undamaged neurone
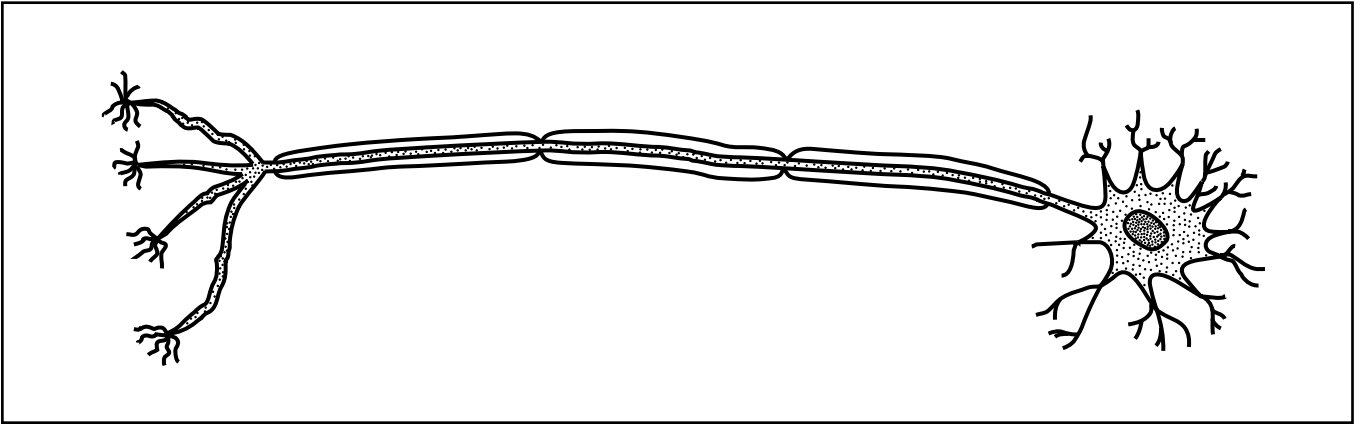


## damaged neurone
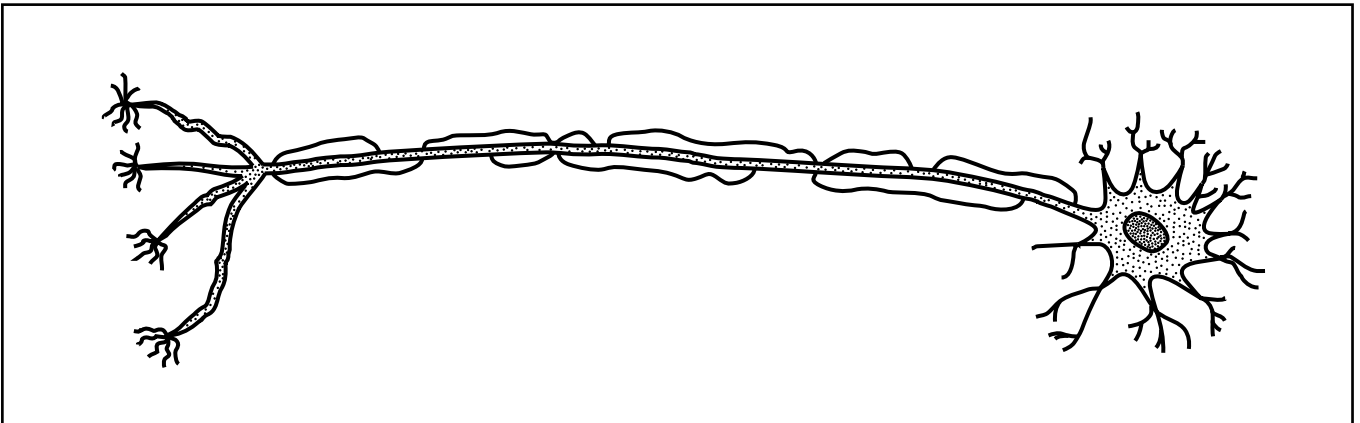


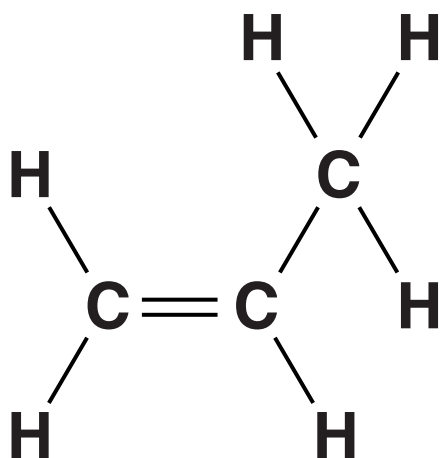**How would the damage affect the transmission of impulses?**

**Explain your answer.**

_____

_____

_____ **[2]**

**[TOTAL: 5]**

## SECTION B – Module C1

5   This question is about carbon compounds.

Look at the displayed formulas.

### Compound A



### Compound B
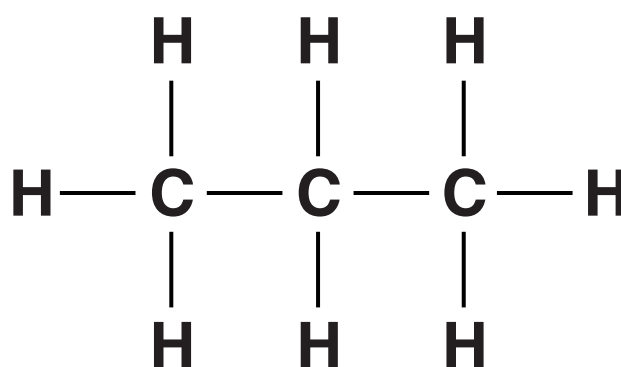


### Compound C
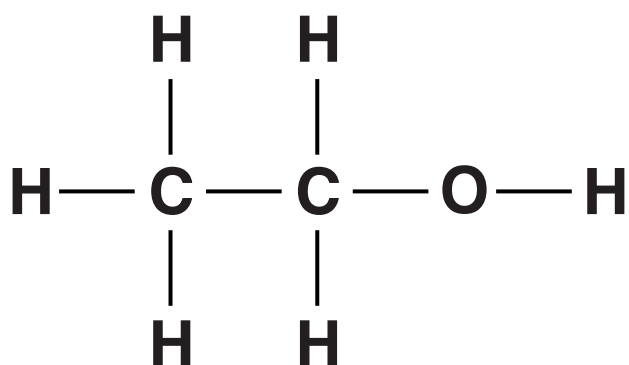


### Compound D
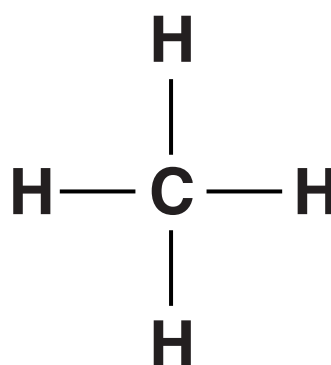
**(a)** Which compound is NOT a hydrocarbon?

Explain your answer.

_____

_____ [2]

**(b)** What is the MOLECULAR FORMULA of compound C?

_____ [1]

**(c)** Compound A is an UNSATURATED compound.

Explain why.

_____

_____ [1]

**(d)** **Molecules of compound A can join together to make a polymer.**

**Draw the DISPLAYED FORMULA of the polymer made.**

**[1]**

**[TOTAL: 5]**

# BLANK PAGE

**6** This question is about crude oil.

Crude oil is a fossil fuel.

(a) Fossil fuels are FINITE resources and are NON-RENEWABLE.

Explain what is meant by finite AND non-renewable.

_____

_____

_____

_____ **[2]**

**(b) Crude oil is often transported in large ships called oil tankers.**



**This could cause ENVIRONMENTAL PROBLEMS.**

**Explain TWO of these environmental problems.**

_____

_____

_____ **[2]**

(c) Crude oil is separated into useful fractions by fractional distillation.

Look at the table below. It shows information about some of the fractions separated from crude oil.

| FRACTION | PERCENTAGE SUPPLY IN CRUDE OIL | PERCENTAGE DEMAND FROM CUSTOMERS |
|---|---|---|
| LPG | 2 | 4 |
| petrol | 15 | 27 |
| diesel | 14 | 21 |
| paraffin | 14 | 9 |
| heating oil | 14 | 14 |
| fuel oil and bitumen | 36 | 25 |

**There is not enough petrol to meet the demand for it.**

 (i) Write down the names of TWO other fractions where the supply does not meet the demand from customers.

_____ **and**

_____

**[1]**

(ii) Explain how an oil refinery matches the supply of PETROL with the demand for it.

Use information from the table on page 26 to help you.

_____

_____

_____

_____ **[2]**

**[TOTAL: 7]**

# BLANK PAGE

7 This question is about fuels.

(a) Butane, $C_4H_{10}$, burns in oxygen, $O_2$.

Carbon dioxide and water are made.

Write a BALANCED SYMBOL equation for this combustion reaction.

_____ [2]

(b) Some carbon monoxide is made when petrol burns in a car engine.

A catalytic converter changes carbon monoxide into another gas.

What is the name of this gas?

_____ [1]

(c) **Look at the information about some fuels.**

| FUEL | STATE AT ROOM TEMPERATURE | AVAILABILITY |
|---|---|---|
| COAL | solid | good |
| METHANE | gas | good |

| FUEL | ENERGY RELEASED IN kJ/g | CARBON DIOXIDE RELEASED (0=LOW, 5=HIGH) | COST OF 1 kg IN £ |
|---|---|---|---|
| COAL | 33 | 3.7 | 0.3 |
| METHANE | 56 | 2.8 | 1.3 |

**Richard wants to use methane to heat a new factory.**

**Edward suggests using coal instead of methane.**

**Evaluate the advantages and disadvantages of these two fuels and suggest which would be the more sensible choice to heat the factory.**

**Use the information from the table on page 30 to help you.**
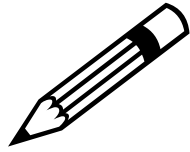
✏️ **The quality of written communication will be assessed in your answer to this question.**

_____

_____

_____

_____

_____

_____

_____

_____ **[6]**

**[TOTAL: 9]**

**8** **Helen has bought a new bottle of perfume.**

**(a) Draw a straight line to join each PROPERTY OF HELEN'S PERFUME to the most important REASON.**

**Draw only THREE lines.**

32

| PROPERTY OF HELEN'S PERFUME | REASON |
|---|---|
| | so the perfume cannot be washed off easily |
| insoluble in water | |
| | so Helen is not poisoned |
| does not react with water | |
| | so Helen can put the perfume directly onto her skin |
| non-irritant | |
| | so that the perfume does not react with perspiration |

[2]

33

**(b)** Helen's friends are able to smell her perfume because it is VOLATILE (evaporates easily).

Explain, using ideas about particles, why Helen's perfume evaporates easily.

_____

_____

_____

_____ **[2]**

**[TOTAL: 4]**

# BLANK PAGE

**SECTION C – Module P1**

9 This question is about waves.

(a) Look at the list.

It shows waves from the electromagnetic spectrum.

infrared

radio

ultraviolet

visible

X-rays

Complete the sentences using words from the list.

(i) The wave that is reflected by shiny surfaces and can heat the surface of food is

_____. [1]

(ii) **The wave with the greatest wavelength is**

_____. [1]

(b) **Look at the diagram below of two transverse waves.**

**height in cm**
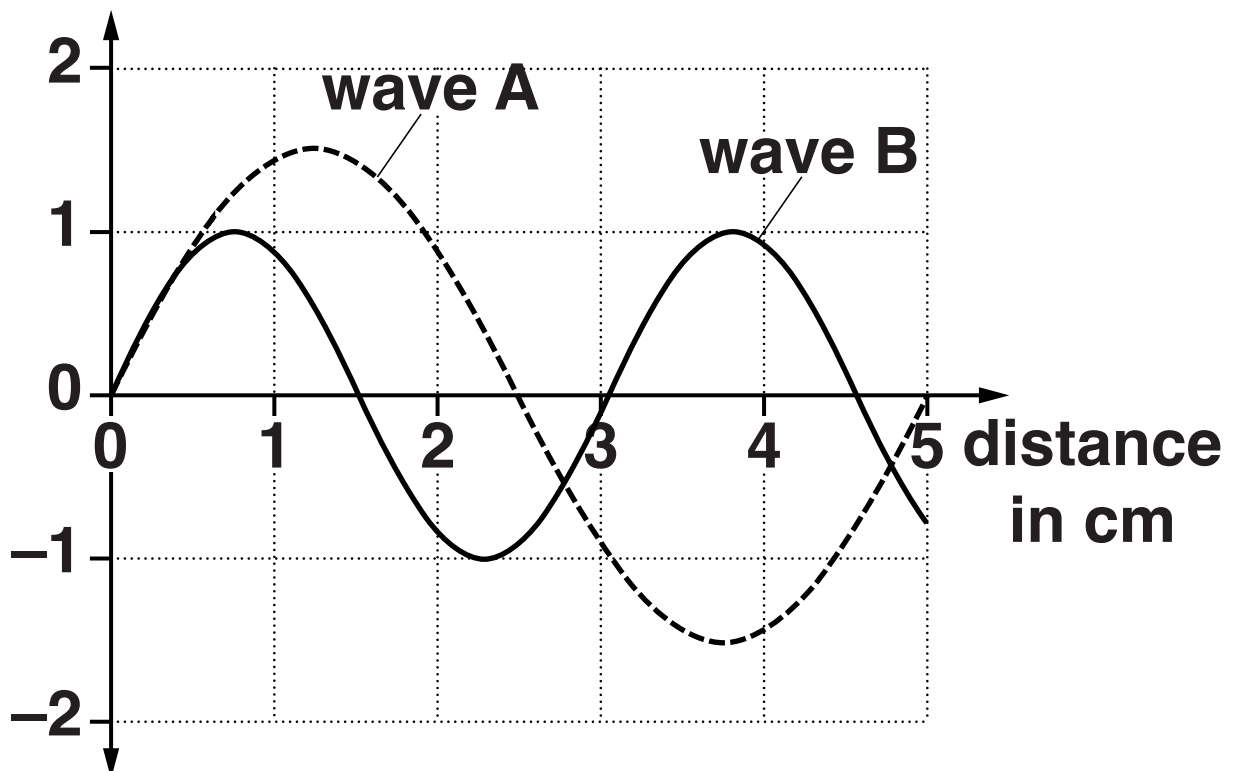


**What is the DIFFERENCE in wavelength between wave A and wave B?**

_____

**Difference in wavelength**

_____ cm                    [1]

(c) Mobile phones use microwave signals.

There is not much diffraction of microwave signals around large buildings.

This causes signal loss.

One way a mobile phone company can reduce the problem is to boost the signal.

Suggest TWO other ways a mobile phone company can reduce the problem of signal loss.
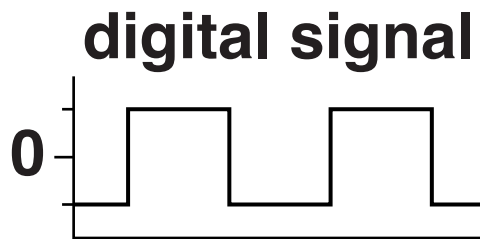
_____

_____

_____ [2]

[TOTAL: 5]

# BLANK PAGE

**10** This question is about digital and analogue signals.

Look at the information showing what happens to the signals when noise is added to them.

**digital signal**

0 ⊣

**analogue signal**

0 ⊣

**noise**

0 ⊣

**noise**

0 ⊣

**digital signal + noise**

0 ⊣

**analogue signal + noise**

0 ⊣
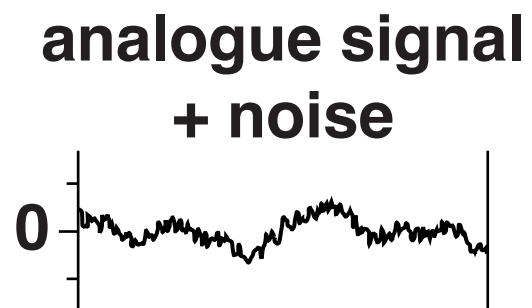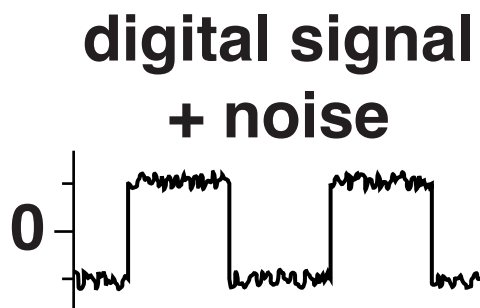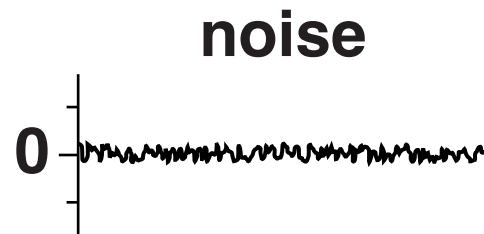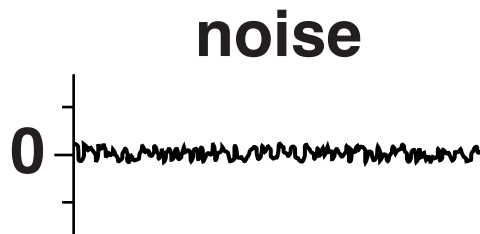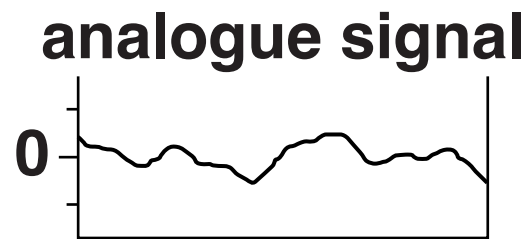
Use the diagrams to explain why it is easier to remove noise from digital signals and how the properties of digital signals played a part in the switching from analogue to digital TV broadcasts. **[6]**

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

_____

_____

_____

_____

_____

_____

_____

_____

_____

**[TOTAL: 6]**

**11** **The condition of the ozone layer near the South Pole concerns scientists.**

**Scientists have been measuring the mean amount of ozone in the upper atmosphere.**
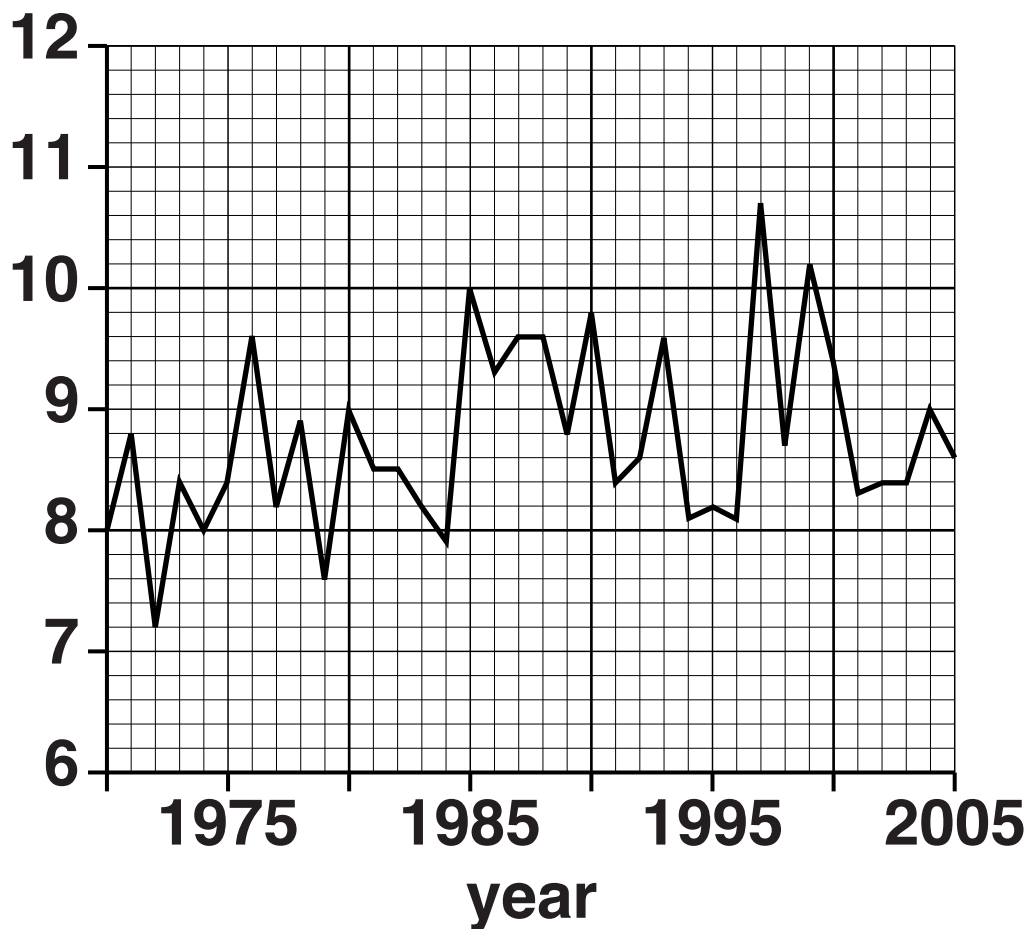
**Look at their results from 1970 to 2005.**

**GRAPH 1**

**mean amount of ozone in Dobson units**



year
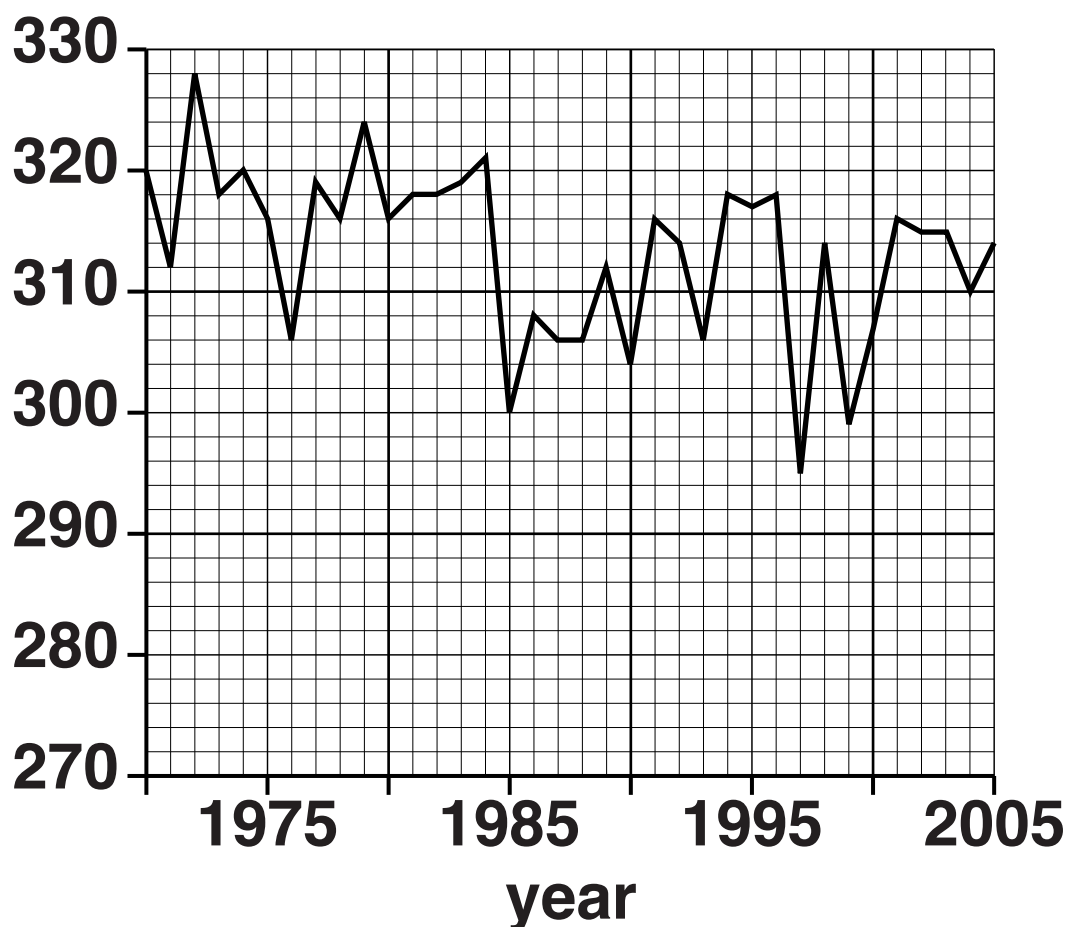
**Scientists have also been measuring the mean ultraviolet (UV) index from 1970 to 2005.**

**GRAPH 2**

mean
UV index



year

**(a)** Look at GRAPH 1 on page 42.

Scientists predicted that the amount of ozone in 1997 was the lowest they were likely to record.

Is this prediction correct?

_____

Explain your answer.

_____

_____ **[1]**

**(b) (i)** Compare Graphs 1 and 2 on pages 42 and 43.

Describe the relationship between the mean amount of ozone and mean UV index.

_____

_____ **[1]**

(ii) **Describe why it is important to maintain a high level of ozone in the Earth's upper atmosphere.**

_____

_____ **[1]**

(c) **Describe why the reduction in the level of pollution from CFCs needed international agreement to benefit society.**

_____

_____

_____

_____ **[2]**

**[TOTAL: 5]**

**12  Lyndsay and Kevin buy a new house.**

insulation
in loft

large
windows
on south side
of house

small
double
glazed
windows
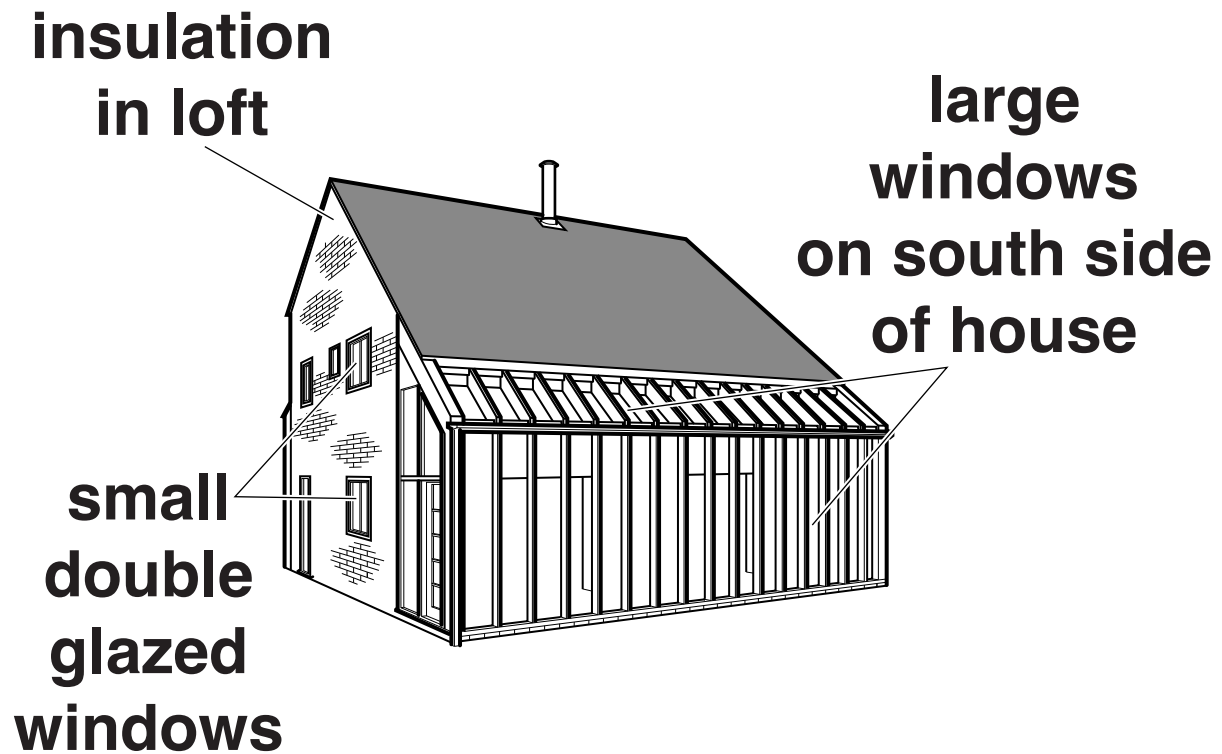


(a)  Their house does NOT have cavity wall insulation but is more energy efficient than most houses.

Look at the picture.

**Explain how TWO energy saving features of their house improve its energy efficiency.**
**Use ideas about energy transfer in your answer.**

_____

_____

_____

_____

_____ **[2]**

**(b)** Here are three different ways to increase the energy efficiency of Lyndsay and Kevin's house.

| HOW TO INCREASE ENERGY EFFICIENCY | COST TO INSTALL IN £ | SAVING ON ENERGY BILLS EACH YEAR IN £ |
|---|---|---|
| Cavity wall insulation | 1400 | 400 |
| Low energy light bulbs for whole house | 20 | 10 |
| Thermostat for heating | 35 | 100 |

**(i)** One of the ways to increase efficiency is to add cavity wall insulation to the house.

Lyndsay thinks this is a good idea because they will be living in the house for at least 5 years.

Use the information in the table above to show that Lyndsay is correct.

_____

_____

_____

_____ **[2]**

**(ii)** Kevin thinks the cost of cavity wall insulation is expensive.

He wants to spend £55 on low energy light bulbs and a thermostat.

Which will save more money after 5 years:

cavity wall insulation

low energy light bulbs and a thermostat?

answer

_____

Explain your answer.

_____

_____

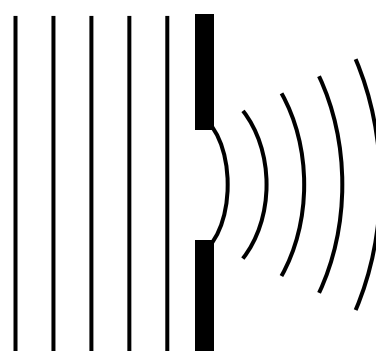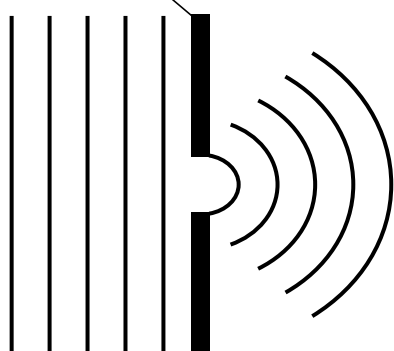_____ **[2]**

**[TOTAL: 6]**

# BLANK PAGE

**13** **Diffraction patterns in water are made using a ripple tank.**

**Look at the two different diffraction patterns.**

**Diffraction pattern A**     **Diffraction pattern B**

**barrier**



**Describe and explain the similarities and differences between these two diffraction patterns.**

**You may draw on the diffraction patterns and draw diagrams to help explain your answer.**

_____

_____

_____

_____ **[3]**

**[TOTAL: 3]**

**END OF QUESTION PAPER**

# ADDITIONAL ANSWER SPACE

**If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).**

55

56

57

|  | 59 |
|  |  |
|  |  |
|  |  |
|  |  |

**OCR**
Oxford Cambridge and RSA