

Candidate forename		Candidate surname	
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Centre number						Candidate number				
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**OXFORD CAMBRIDGE AND RSA EXAMINATIONS  
GCSE**

**B711/02**

**GATEWAY SCIENCE**

**SCIENCE B**

**Science modules B1, C1, P1 (Higher Tier)**

**THURSDAY 12 JANUARY 2012: Morning**

**DURATION: 1 hour 15 minutes**

**SUITABLE FOR VISUALLY IMPAIRED CANDIDATES**

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

**OCR SUPPLIED MATERIALS:**

**None**

**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. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).

## **INFORMATION FOR CANDIDATES**

- Your quality of written communication is assessed in questions marked with a pencil () .
- A list of equations can be found on pages 4 and 5.
- The Periodic Table is provided.
- 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.

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## EQUATIONS

$$\text{energy} = \text{mass} \times \frac{\text{specific heat capacity}}{\text{}} \times \text{temperature change}$$

$$\text{energy} = \text{mass} \times \text{specific latent heat}$$

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

$$\text{wave speed} = \text{frequency} \times \text{wavelength}$$

$$\text{power} = \text{voltage} \times \text{current}$$

$$\text{energy supplied} = \text{power} \times \text{time}$$

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

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

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

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

**force = mass × acceleration**

**weight = mass × gravitational field strength**

**work done = force × distance**

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

**power = force × speed**

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

**momentum = mass × velocity**

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

**GPE = mgh**

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

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

**Answer ALL the questions.**

**SECTION A – MODULE B1**

- 1 The table shows information about the alcohol in different brands of beer.**

<b>BRAND</b>	<b>VOLUME OF BEER IN CAN OR BOTTLE IN ml</b>	<b>UNITS OF ALCOHOL IN CAN OR BOTTLE</b>
<b>A</b>	<b>440</b>	<b>1.8</b>
<b>B</b>	<b>330</b>	<b>1.6</b>
<b>C</b>	<b>440</b>	<b>1.5</b>
<b>D</b>	<b>275</b>	<b>1.0</b>
<b>E</b>	<b>330</b>	<b>1.7</b>

**1 unit = 10 ml of pure alcohol**

**1 unit is also the amount of alcohol that the average adult can drink and remove from their blood in one hour.**

- (a) How many ml of alcohol are in one can of BRAND A?**

**answer \_\_\_\_\_ ml**

**[1]**

- (b) (i) If an average adult drinks one can of BRAND C, how many MINUTES will it take to remove all the alcohol from the blood?**

**answer \_\_\_\_\_ min [1]**

- (ii) Billy drinks a can of BRAND C.**

**It takes 120 minutes for all the alcohol to be removed from his blood.**

**This is different from the time it takes an average adult.**

**Explain why it is different.**

\_\_\_\_\_  
\_\_\_\_\_ [1]

- (c) Billy drinks 100 ml of each brand on different days, one brand per day.**

**Which brand will take longest to be removed from his blood?**

**You MUST show your working.**

**answer \_\_\_\_\_ [2]**

**(d) Billy is more likely to have an accident while driving if there is alcohol in his blood.**

**This is because alcohol is a depressant.**

**Depressants slow down the transmission of nerve impulses.**

**Explain how depressants slow down the transmission of nerve impulses.**

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**[2]**

**[Total: 7]**



**2 John and Steve are trying to stay fit and healthy.**

**They eat balanced diets and enjoy playing football.**

**(a) Regular exercise and eating a balanced diet help reduce high blood pressure.**

**(i) Write down ONE OTHER way to reduce high blood pressure.**

\_\_\_\_\_ [1]

**(ii) Although John and Steve both eat balanced diets, they do NOT eat exactly the same foods.**

**Write down and explain ONE medical reason why balanced diets may vary.**

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [2]

**(b) When they play football, John and Steve sweat.**

**Explain how sweating works and why it is necessary.**

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [2]

**(c) John has a bath after his game.**

**He puts his foot in the bath but quickly pulls it out because the water is too hot.**

**This is an example of a spinal reflex action.**

**(i) In this reflex action, what is the receptor?**

\_\_\_\_\_ [1]

**(ii) In this reflex action, what is the effector?**

\_\_\_\_\_ [1]

**[Total: 7]**

**3 Sam's baby is due to have an MMR (measles, mumps and rubella) vaccine.**

**(a) Explain how vaccination (immunisation) works.**

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[3]

**(b) Sam is worried because she has heard that there may be some risks associated with vaccination.**

**Despite these risks, why do doctors usually recommend that babies are vaccinated?**

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[1]

**(c) Measles, mumps and rubella can NOT be treated with antibiotics.**

**Suggest why.**

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[1]

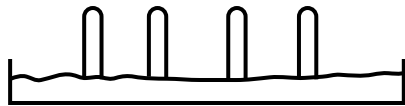
**[Total: 5]**

**4 Jane investigates phototropism in wheat seedlings.**

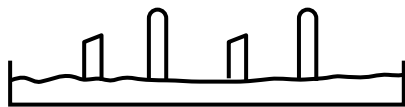
**She cuts the tips off some of her seedlings.**

**She leaves the seedlings by the window.**

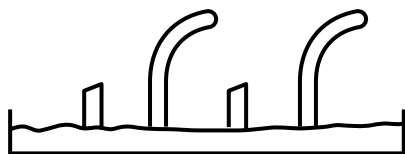
**She looks at them again two days later.**



**seedlings at start**



**seedlings with some of their tips cut off**



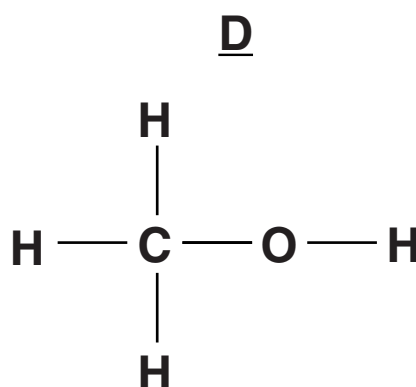
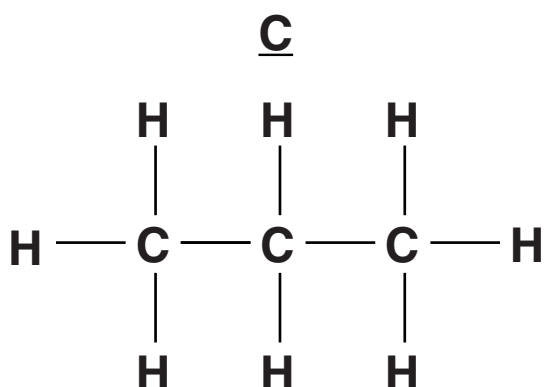
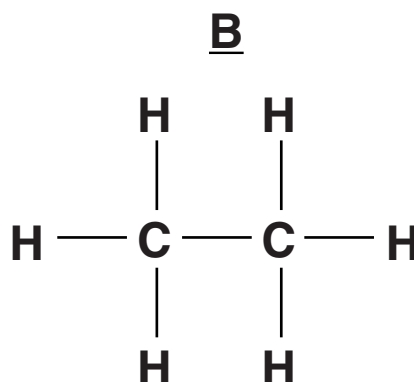
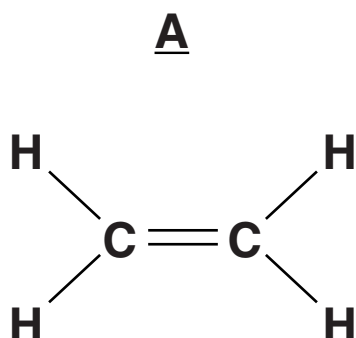
**seedlings after two days**

**Describe and explain the results that occurred after two days.**



## SECTION B – MODULE C1

5 Look at the displayed formulas of some carbon compounds.



(a) Which compound will decolourise bromine water?

Choose from A, B, C or D.

answer \_\_\_\_\_ [1]

(b) What is the molecular formula of compound C?

\_\_\_\_\_ [1]

**(c) Compound A is ethene.**

**Draw the displayed formula of the polymer poly(ethene).**

**[1]**

**(d) Compound C is a SATURATED hydrocarbon.**

**What is meant by saturated?**

\_\_\_\_\_ **[1]**

**[Total: 4]**

- 6 (a) Look at the table, opposite. It shows some information about polymers.
- (i) None of these polymers would be suitable for making the pipe on a petrol pump at a petrol station.

Explain why.

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[2]

- (ii) Which property, not in the table, would be necessary for the polymer used to make this pipe?

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[1]

- (b) GORE-TEX® fabric is used to make outdoor clothing.

GORE-TEX® fabric is made with nylon laminated with a PTFE membrane.

The PTFE has small holes in it.

GORE-TEX® fabric is waterproof but ALSO breathable.

Explain why.

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[2]

[Total: 5]



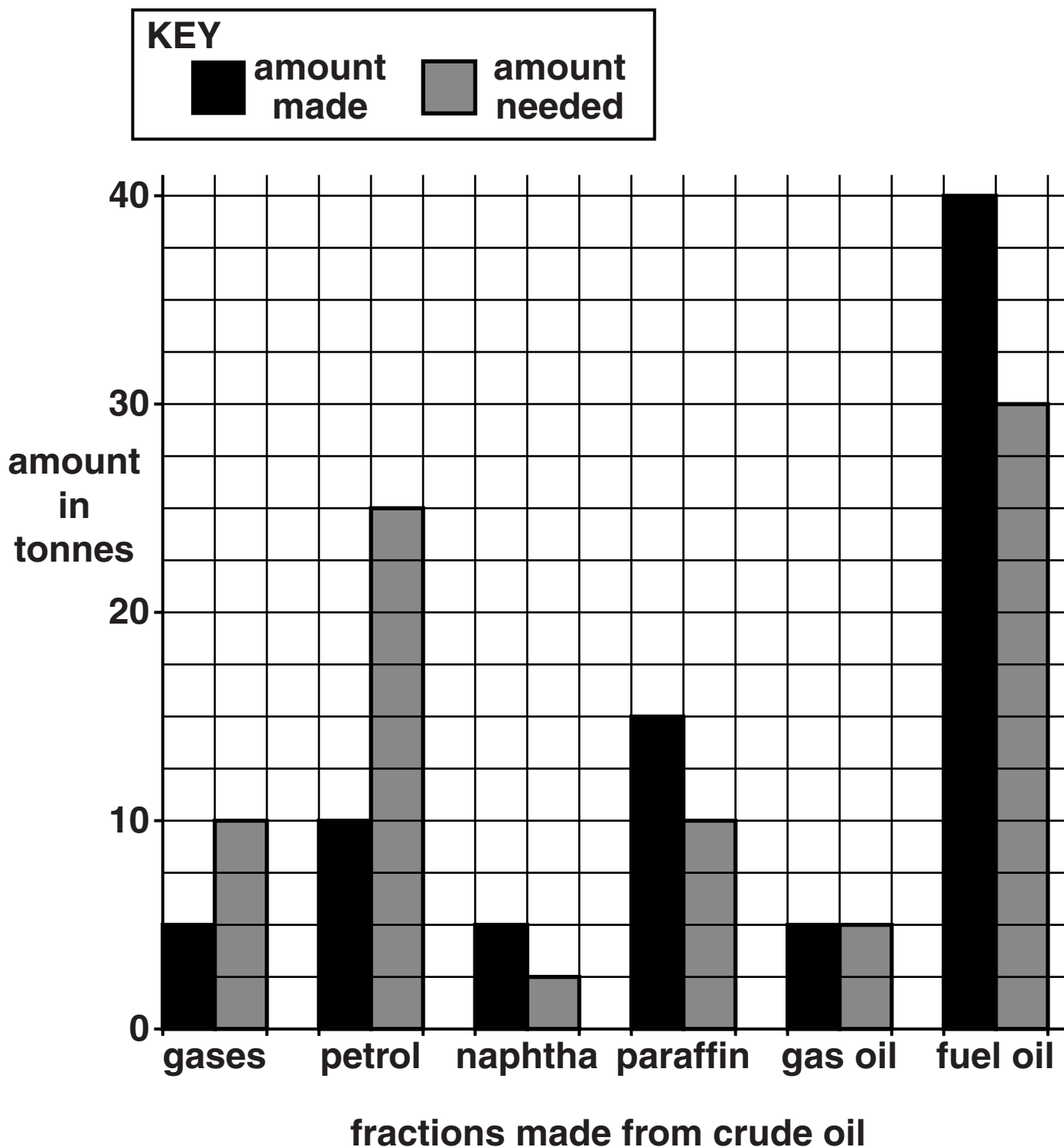
<b>POLYMER</b>	<b>MELTING POINT IN °C</b>	<b>SOLUBILITY IN WATER</b>	<b>SOLUBILITY IN PETROL</b>	<b>IS IT BIODEGRADABLE?</b>
<b>A</b>	<b>80</b>	<b>slightly soluble</b>	<b>insoluble</b>	<b>yes</b>
<b>B</b>	<b>90</b>	<b>slightly soluble</b>	<b>soluble</b>	<b>no</b>
<b>C</b>	<b>120</b>	<b>insoluble</b>	<b>insoluble</b>	<b>yes</b>
<b>D</b>	<b>95</b>	<b>insoluble</b>	<b>soluble</b>	<b>no</b>

## 7 Oil refineries separate crude oil into useful fractions.

They do this by fractional distillation.

The bar chart shows the amount of some fractions **MADE** from 100 tonnes of crude oil.

It also shows the amount of these fractions **NEEDED** for everyday uses.



- (a) Look at the amount made and the amount needed for each fraction in the bar chart.

What problems does this give the manager of an oil refinery?

Explain how cracking overcomes these problems. Include an equation for cracking.



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

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[6]

**(b) The UK economy needs large amounts of crude oil from overseas.**

**There are political issues resulting from the need to import crude oil.**

**Write about these POLITICAL issues.**

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**[2]**

**[Total: 8]**

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**8 Look at the table, opposite. It shows information about some fuels.**

**(a) A new power station plans to use fuel C.**

**Explain the advantages and disadvantages of this choice.**

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**[3]**

**(b) Methane, CH<sub>4</sub>, is a fuel.**

**Methane burns in oxygen, O<sub>2</sub>.**

**Carbon dioxide and water are made.**

**Write a BALANCED SYMBOL equation for this reaction.**

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**[2]**

**[Total: 5]**

<b>FUEL</b>	<b>ENERGY VALUE IN KILOJOULES PER kg</b>	<b>AVAILABILITY</b>	<b>COST IN £ PER kg</b>	<b>STATE AT ROOM TEMPERATURE</b>	<b>ESTIMATED YEARS OF SUPPLY LEFT</b>	<b>POLLUTION</b>
<b>A</b>	<b>4800</b>	<b>good</b>	<b>1.30</b>	<b>liquid</b>	<b>20</b>	<b>makes carbon dioxide and some sulfur dioxide</b>
<b>B</b>	<b>4960</b>	<b>limited</b>	<b>0.80</b>	<b>liquid</b>	<b>12</b>	<b>makes carbon dioxide</b>
<b>C</b>	<b>8950</b>	<b>good</b>	<b>0.33</b>	<b>solid</b>	<b>50</b>	<b>makes carbon dioxide and large amounts of sulfur dioxide</b>
<b>D</b>	<b>3700</b>	<b>good</b>	<b>1.30</b>	<b>gas</b>	<b>8</b>	<b>makes carbon dioxide</b>

**9 Chemical changes happen when potatoes and meat are cooked.**

**(a) The protein molecules change shape when meat is cooked.**

**What is the name of this process?**

\_\_\_\_\_ [1]

**(b) Potato is easier to digest when it is cooked.**

**Explain why.**

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [2]

**[Total: 3]**



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## **SECTION C – MODULE P1**

**10 The Sun is giving out all types of electromagnetic radiation.**

**The ozone layer absorbs some of this radiation.**

**(a) Which type of radiation is absorbed by the ozone layer?**

\_\_\_\_\_ [1]

**(b) Scientists have discovered a hole in the ozone layer over Antarctica.**

**What has caused this hole in the ozone layer?**

\_\_\_\_\_  
\_\_\_\_\_ [1]

**(c) Look at the following information.**

- **Exposure to sunlight can cause skin cancer.**
- **To reduce this effect children are often covered in high SPF sunscreen.**
- **Rickets is a disease caused by a lack of vitamin D.**
- **Sunlight is used to make vitamin D.**

**Reduction in the number of skin cancer cases is an advantage of using high SPF sunscreen.**

**Use the information to suggest one possible DISADVANTAGE of using high SPF sunscreen.**

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[1]

**[Total: 3]**

- 11 (a) Lasers produce an INTENSE beam of light which is coherent.

Explain what is meant by intense AND coherent.

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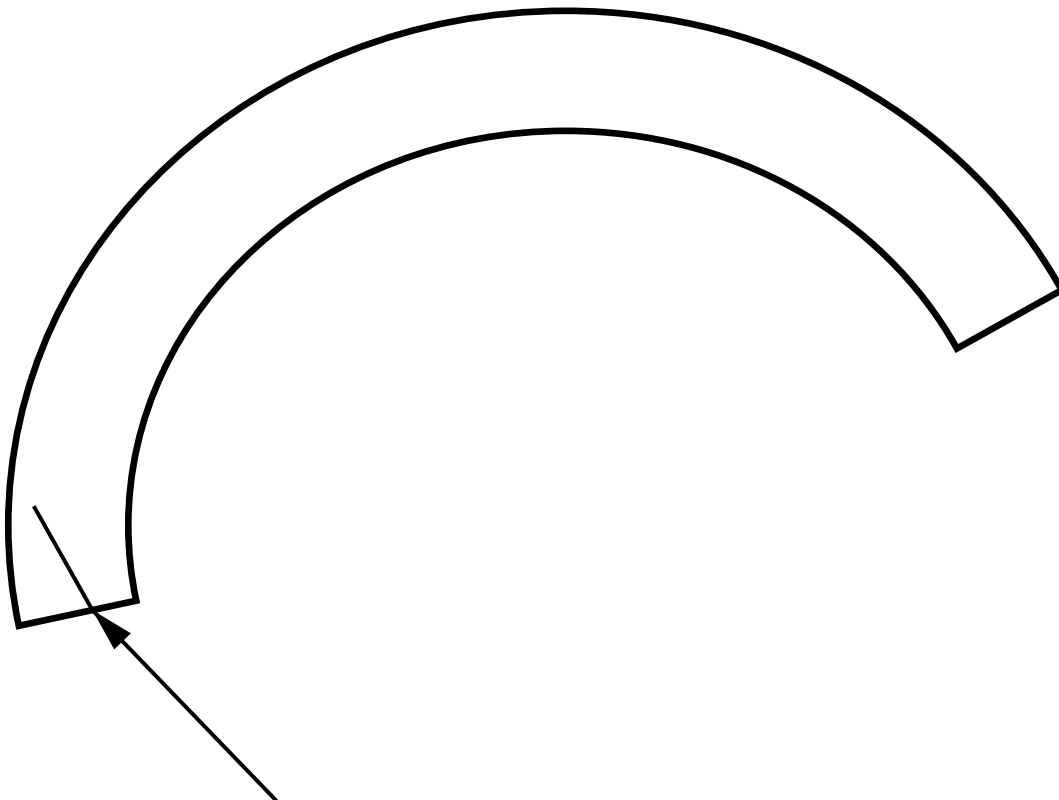
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[2]

- (b) Many telephone companies use optical fibres to carry signals over large distances.

Look at the enlarged diagram of an optical fibre.



Continue the ray to show its path along the fibre from one end to the other.

[2]

**(c) Some people think the use of mobile phones is safe.**

**Others think mobile phones may be harmful to health.**

**Write about one of the possible health risks from using mobile phones and suggest how this risk can be reduced.**

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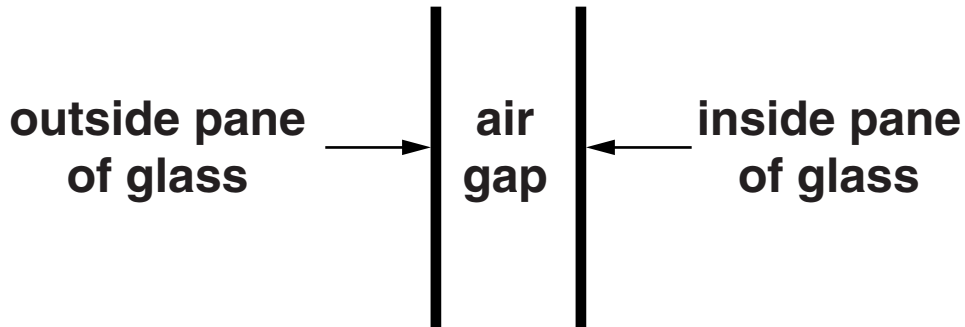
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**[2]**

**[Total: 6]**

**12 Vicky finds that the energy bills for her house are high.**

**She knows that double glazing will reduce the energy transfer through her windows.**



**Look at the information in the table.**

<b>TYPE OF WINDOW</b>	<b>SIZE OF AIR GAP IN mm</b>	<b>AVERAGE COST TO FIT PER WINDOW IN £</b>	<b>TOTAL SAVING FOR A 3 BED-ROOMED HOUSE IN £ EACH YEAR</b>
<b>P</b>	<b>4</b>	<b>600</b>	<b>170</b>
<b>Q</b>	<b>8</b>	<b>600</b>	<b>196</b>
<b>R</b>	<b>16</b>	<b>600</b>	<b>209</b>
<b>S</b>	<b>20</b>	<b>600</b>	<b>210</b>
<b>T</b>	<b>32</b>	<b>600</b>	<b>210</b>

**Describe how the design of double glazed windows reduces energy transfer and use the data to evaluate the effectiveness of increasing the air gap on reducing energy transfer.**



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

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**[6]**

**[Total: 6]**

- 13 (a) Neil notices that when ice melts, the temperature does not change.

Explain why.

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[1]

- (b) Neil is holding a party. He wants to make sure he has enough ice to cool all the drinks.

He investigates how much ice is needed to cool a glass of orange juice.

He adds ice to cool the orange juice from 20°C to 5°C.

temperature of the ice	0°C
original temperature of the orange juice	20°C
mass of orange juice	0.4 kg
specific heat capacity of orange juice	4100 J/kg °C
specific latent heat of water	330 000 J/kg



- (i) Calculate the amount of energy transferred from the drink.

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answer \_\_\_\_\_ J [2]

- (ii) What mass of ice would need to melt to transfer this amount of energy?

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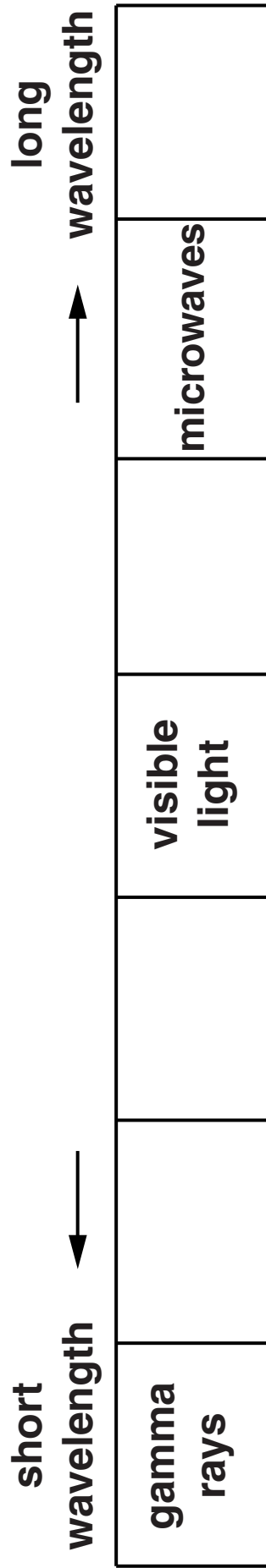
answer \_\_\_\_\_ kg [2]

[Total: 5]

**14 This question is about waves.**

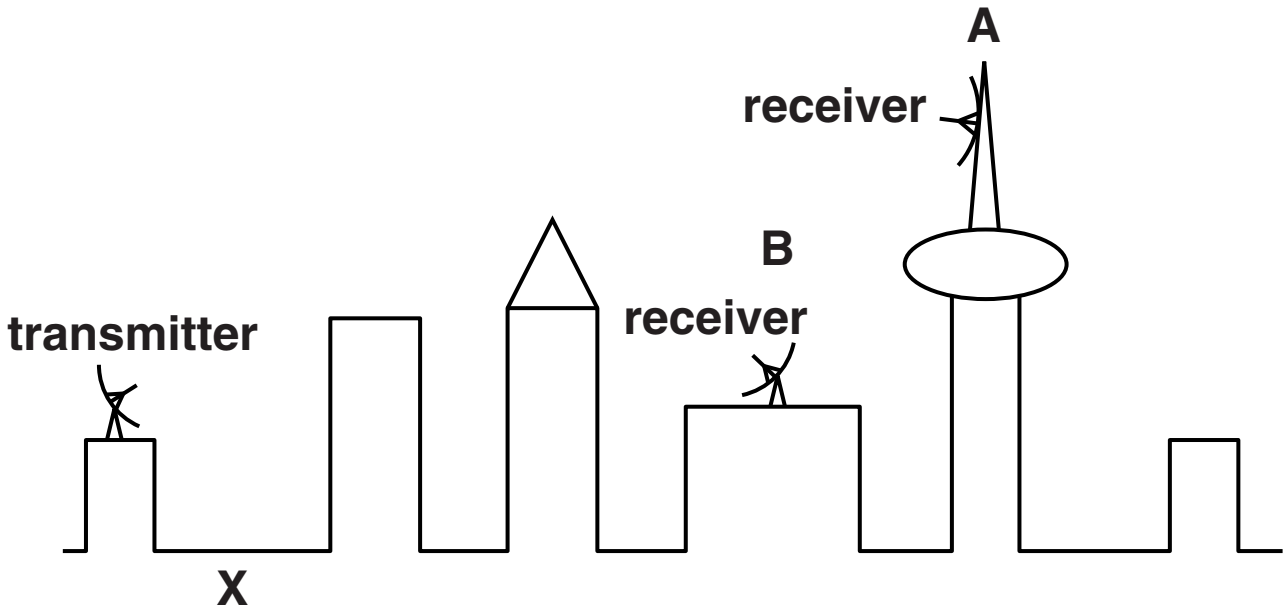
**(a) The table, opposite shows part of the electromagnetic spectrum.**

**Complete the table by filling in the OTHER types of electromagnetic wave. [2]**



**(b) The diagram shows part of the skyline of a city.**

**The transmitter transmits both microwaves and radio waves to the city.**



**(i) Microwave signals can be received at the top of building A, but not at the top of building B.**

**However, radio waves can be received at the top of both buildings A and B.**

**Explain why.**

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**[2]**

- (ii) City planners are considering putting another building, as tall as building A, at position X.**

**This could have an effect on radio communications throughout the city.**

**Describe the effect and suggest a possible solution.**

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**[1]**

**[Total: 5]**

**END OF QUESTION PAPER**

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# The Periodic Table of the Elements

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7	Li lithium 3	9	Be beryllium 4	23	Na sodium 11	24	Mg magnesium 12	39	K potassium 19	40	Ca calcium 20	88	Sr strontium 38	133	Ba barium 56	[223]	Fr francium 87	[226]	Ra radium 88	[227]	Ac* actinium 89	178	Hf hafnium 72	[261]	Rf rutherfordium 104	[262]	Db dubnium 105	[266]	Sg seaborgium 106	[264]	Bh bohrium 107	[277]	Hs hassium 108	[268]	Mt meitnerium 109	[271]	Ds darmstadtium 110	[272]	Rg roentgenium 111	63.5	Cu copper 29	59	Ni nickel 28	59	Co cobalt 27	56	Fe iron 26	55	Mn manganese 25	52	Cr chromium 24	96	Mo molybdenum 42	93	Nb niobium 41	181	Ta tantalum 73	184	W tungsten 74	190	Os osmium 76	192	Ir iridium 77	195	Pt platinum 78	106	Pd palladium 46	103	Rh rhodium 45	101	Ru ruthenium 44	108	Ag silver 47	112	Cd cadmium 48	115	In indium 49	70	Ga gallium 31	73	Ge germanium 32	75	As arsenic 33	79	Se selenium 34	80	Br bromine 35	84	Kr krypton 36	119	Sn tin 50	122	Sb antimony 51	127	I iodine 53	128	Te tellurium 52	131	Xe xenon 54	137	Cs caesium 55	[223]	Fr francium 87	[226]	Ra radium 88	[227]	Ac* actinium 89	139	La* lanthanum 57	139	Y yttrium 39	89	Y yttrium 39	45	Sc scandium 21	48	Ti titanium 22	45	Sc scandium 21	48	Ti titanium 22	91	Zr zirconium 40	91	Zr zirconium 40	178	Hf hafnium 72	[261]	Rf rutherfordium 104	[262]	Db dubnium 105	[266]	Sg seaborgium 106	[264]	Bh bohrium 107	[277]	Hs hassium 108	[268]	Mt meitnerium 109	[271]	Ds darmstadtium 110	[272]	Rg roentgenium 111	201	Hg mercury 80	201	Hg mercury 80	204	Tl thallium 81	207	Pb lead 82	209	Bi bismuth 83	[209]	Po polonium 84	[210]	At astatine 85	[222]	Rn radon 86	11	B boron 5	12	C carbon 6	14	N nitrogen 7	16	O oxygen 8	19	F fluorine 9	20	Ne neon 10	27	Al aluminium 13	28	Si silicon 14	31	P phosphorus 15	32	S sulfur 16	35.5	Cl chlorine 17	40	Ar argon 18	40	He helium 2

Elements with atomic numbers 112-116 have been reported but not fully authenticated

\* The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.