

Candidate forename						Candidate surname					
Centre number						Candidate number					

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS**  
**GCSE**

**B711/02**

**GATEWAY SCIENCE**  
**SCIENCE B**

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

**TUESDAY 12 JUNE 2012: Morning**

**DURATION: 1 hour 15 minutes**  
**plus your additional time allowance**

**MODIFIED ENLARGED**

**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 4–5.
- An enlarged copy of the Periodic Table will be 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**

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

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

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

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

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

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

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

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

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

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

$$\text{force} = \text{mass} \times \text{acceleration}$$

$$\text{weight} = \text{mass} \times \text{gravitational field strength}$$

$$\text{work done} = \text{force} \times \text{distance}$$

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

$$\text{power} = \text{force} \times \text{speed}$$

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

$$\text{momentum} = \text{mass} \times \text{velocity}$$

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

$$\text{GPE} = mgh$$

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

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**Answer ALL the questions.**

**SECTION A – MODULE B1**

**1 Bethany is a scientist.**

**(a) Bethany is female.**

**Her sex is determined by structures inside her body cells.**

**Write down the NAME of these structures and show the COMBINATION that makes her female.**

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

**(b) Bethany is testing some common foods to find their protein content.**

**Proteins are made of lots of small molecules joined together.**

**Write down the name of these molecules.**

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

**(c) Look at the table.**

**It shows the daily protein intake for different age groups in four countries.**

**Protein deficiency (kwashiorkor) is a problem in some countries.**

<b>NAME OF COUNTRY</b>	<b>TYPE OF COUNTRY</b>	<b>AVERAGE PROTEIN INTAKE IN GRAMS PER PERSON PER DAY</b>	
		<b>6 TO 10 YEARS</b>	<b>11 TO 18 YEARS</b>
<b>Ghana</b>	<b>developing</b>	<b>14.9</b>	<b>36.5</b>
<b>Mexico</b>	<b>developing</b>	<b>18.2</b>	<b>40.2</b>
<b>United Kingdom</b>	<b>developed</b>	<b>25.8</b>	<b>45.8</b>
<b>USA</b>	<b>developed</b>	<b>27.3</b>	<b>52.6</b>

**Estimated Average Requirement (EAR) is a measure of daily requirement for protein.**

**It is calculated using the formula**

**EAR in g =  $0.6 \times$  body mass in kg**

**The average body mass of a healthy ten year old boy is 34.0 kg.**

**The EAR for a healthy sixteen year old boy is 40.0 g.**



**Use the table and the information opposite to suggest if boys in developing countries are more at risk of suffering kwashiorkor than boys in developed countries.**



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

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**[6]**

**[Total: 9]**

## 2 Malaria is an infectious disease.

- (a) (i) The pathogen that causes malaria is a protozoa called *Plasmodium*.

Complete the following sentences about how malaria is spread.

Choose words from this list.

BACTERIA

HOST

PARASITE

VACCINE

VECTOR

VIRUS

*Plasmodium* is a \_\_\_\_\_ which causes harm to a human \_\_\_\_\_ .

A mosquito acts as a \_\_\_\_\_ for *Plasmodium* when it feeds on human blood. [3]

- (ii) One symptom of malaria is a high fever.

Core body temperature is normally maintained at 37 °C.

How can a very high temperature lead to death?

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

**(b) Malaria is common in many African countries.**

**SICKLE CELL ANAEMIA is a disorder also found in these countries.**

**Read the information on a new treatment for sickle cell anaemia.**

**Severe sickle cell anaemia can be treated with a medicine called hydroxyurea.**

**Doctors are studying the long-term effects of hydroxyurea on people who have sickle cell anaemia.**

**In a trial to test hydroxyurea, one group of young patients will be given hydroxyurea and another group will be given a substance that is known to have no effect on the body.**

**Doctors will monitor the effects of the treatment on each group but will NOT know which group is treated with hydroxyurea until the end of the trial.**

**What type of trial is this and why do doctors NOT want to know which group is treated with hydroxyurea until the end of the trial?**

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**[2]**

**[Total: 6]**

**3 Cystic fibrosis is a genetic disorder.**

**Akinyi is a child who has cystic fibrosis.**

**It is caused by a RECESSIVE allele.**

**Neither of Akinyi's parents have cystic fibrosis.**

**They want to have another child.**

**(a) What is the probability of their next child having cystic fibrosis?**

**Draw a genetic diagram to explain your answer.**

**(Use F for the dominant allele and f for the recessive allele).**

**probability of next child having cystic fibrosis**

**[2]**

**(b) Akinyi's parents are expecting another child.**

**They are trying to decide whether to have the foetus tested for cystic fibrosis.**

**Suggest what they need to consider and why it may be difficult for them to make such a decision.**

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**[2]**

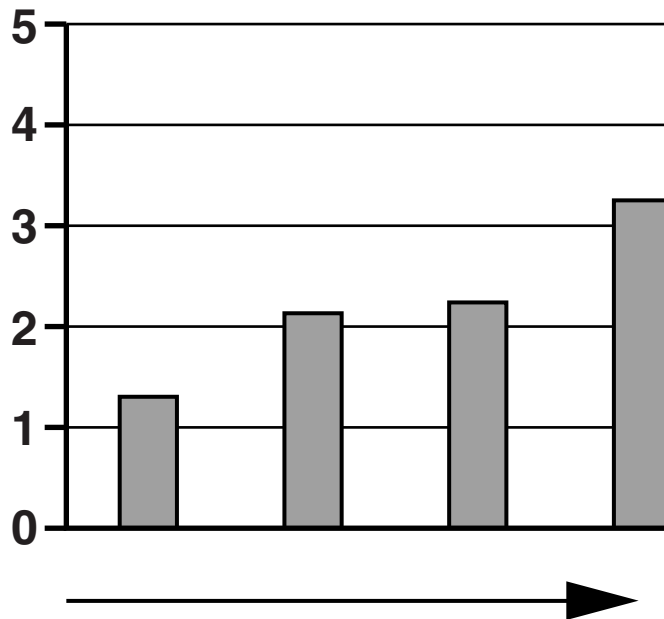
**[Total: 4]**

- 4 Scientists have made links between fatty foods and heart attacks.

Cholesterol is a substance found in fatty foods.

Look at the graph.

% chance of  
heart attacks



cholesterol levels in mg per l of blood

Describe and explain the link between cholesterol levels and heart attacks.

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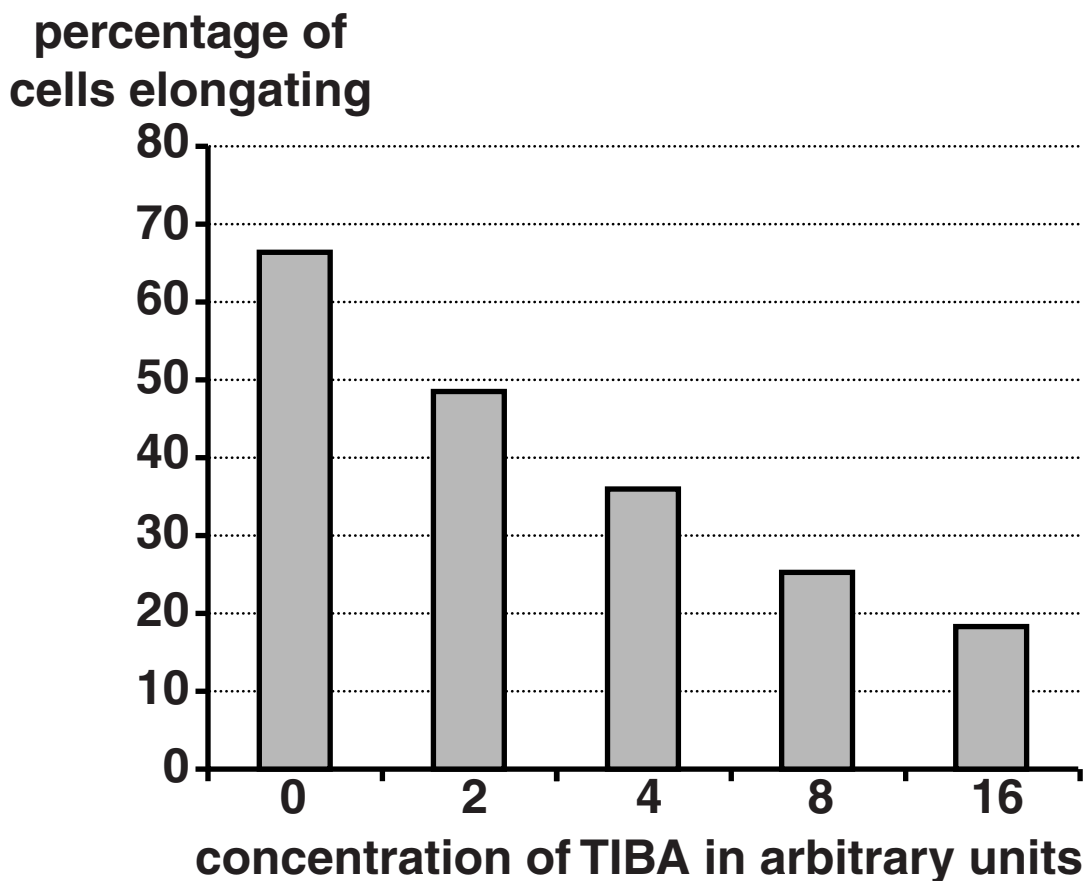
[3]

[Total: 3]

**5 This question is about plant growth.**

**Look at the graph.**

**It shows the results of an experiment measuring the effect of a chemical called TIBA on cells in the shoot TIPS of plants.**



**(a) TIBA inhibits the action of a plant hormone.**

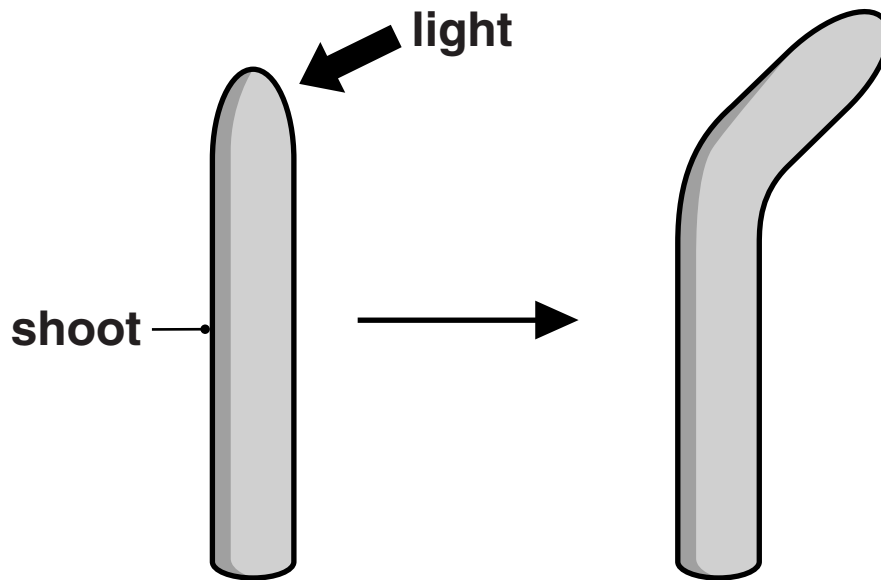
**From the evidence in the graph suggest the name of this hormone.**

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

**(b) Judith is investigating growth of wheat shoots.**

**She grows wheat shoots with light shining from one direction.**

**The growth of the wheat shoots is shown in the diagram.**

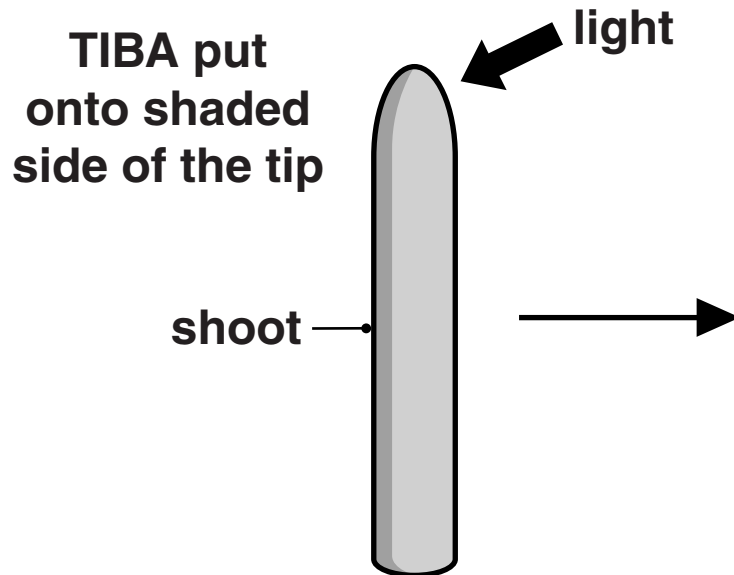




**Judith does a second experiment.**

**She puts TIBA on the shaded side of a growing wheat shoot.**

**She shines light from one direction.**



**Draw what will happen to the growth of the wheat shoot above and explain why this happens.**

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**[2]**

**[Total: 3]**

## SECTION B – MODULE C1

**6 Coal, crude oil and natural gas are NON-RENEWABLE fuels.**

**(a) Crude oil is a non-renewable fuel.**

**What is meant by non-renewable?**

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

**(b) Scientists have tried to estimate how many years it will be before these fuels run out.**

**Look at the table below.**

**It shows one estimate for how many years are left before the fuels will run out.**

<b>FUEL</b>	<b>HOW MANY YEARS BEFORE THE FUEL WILL RUN OUT</b>
<b>coal</b>	<b>143</b>
<b>natural gas</b>	<b>61</b>
<b>crude oil</b>	<b>43</b>

**Other scientists have arrived at different figures than those in the table.**

**It is very difficult to estimate how many years it will take for a non-renewable fuel to run out.**

**Suggest TWO reasons why.**

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**[2]**

**[Total: 3]**

**7 Crude oil contains a mixture of hydrocarbons called alkanes.**

**Look at the table. It gives some information about some of these alkanes.**

<b>ALKANE</b>	<b>MOLECULAR FORMULA</b>	<b>BOILING POINT IN °C</b>
<b>butane</b>	<b>C<sub>4</sub>H<sub>10</sub></b>	<b>0</b>
<b>hexane</b>	<b>C<sub>6</sub>H<sub>14</sub></b>	<b>69</b>
<b>decane</b>	<b>C<sub>10</sub>H<sub>22</sub></b>	<b>174</b>
<b>hexadecane</b>	<b>C<sub>16</sub>H<sub>34</sub></b>	<b>287</b>

**(a) Crude oil is separated by fractional distillation.**

**Explain, in terms of intermolecular forces, why crude oil can be separated by fractional distillation.**

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**[2]**

**(b) LPG contains propane and butane.**

- (i) There is a link between the number of carbon atoms and the number of hydrogen atoms in an alkane molecule.**

**A molecule of propane has 3 carbon atoms.**

**The molecular formula for propane is  $C_3H_x$ .**

**Work out the value for x.**

\_\_\_\_\_

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

- (ii) Propane reacts with oxygen,  $O_2$ .**

**Carbon dioxide and water are made.**

**Construct the BALANCED SYMBOL equation for this reaction.**

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

- (c) Debbie is thinking of buying a new petrol-engined car.

She finds this information about a new car.

fuel consumption in km per litre	16
carbon dioxide emissions in g/km	90

This information was obtained for a car moving at a steady speed of 80 km/h.

- (i) Show, by calculation, that the mass of carbon dioxide made when she uses 5.0 litres of petrol is 7200 g.

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[2]

- (ii) Debbie uses 5.0 litres of petrol when DRIVING AROUND A LARGE TOWN.

Will Debbie make 7200 g of carbon dioxide EVERY TIME she uses 5.0 litres of petrol?

Explain your answer.

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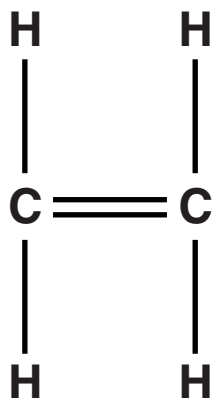
[1]

[Total: 8]

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**8 Ethene is an unsaturated hydrocarbon.**

**Look at the displayed formula for ethene.**



- (a) Explain why ethene is both unsaturated and a hydrocarbon.**

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**[2]**

- (b) Ethene is an alkene.**

**Bromine water can be used to test for an alkene.**

**What is the colour change when ethene is bubbled through bromine water?**

**colour at start** \_\_\_\_\_

**colour at end** \_\_\_\_\_

**[2]**



**(c) Ethene is used to make poly(ethene).**

**Poly(ethene) is an addition polymer.**

**Draw the displayed formula for poly(ethene) below.**

**[1]**

**[Total: 5]**

## **9 Paints contain pigments.**

**Some pigments are THERMOCHROMIC and others are PHOSPHORESCENT.**

**They are used to colour a number of objects.**

- (a) Write down one use of a thermochromic pigment and explain why it is suitable for this use.**

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**[2]**

- (b) Modern ‘glow in the dark’ watches are made using phosphorescent pigments.**

**Seventy years ago ‘glow in the dark’ watches were not as safe as they are today.**

**Explain why.**

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**[1]**

**[Total: 3]**

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## **10 Plastics contain polymer molecules.**

**Many shopping bags are made from polymers (plastics).**

**Poly(ethene) is often used to make plastic shopping bags.**

**These shopping bags need to be disposed of after use.**

**One of the properties of poly(ethene) is that it is non-biodegradable.**

**Suggest, with reasons, OTHER properties needed by poly(ethene) so that it can be used to make a plastic shopping bag and explain the environmental and economic problems related to disposing of these bags.**



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

[illegible]

**[Total: 6]**

## **SECTION C – MODULE P1**

- 11 (a) Nihal takes a black and white THERMOGRAM picture of his house.**

**Thermograms can be used to measure temperature.**

- (i) What is TEMPERATURE?**

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

- (ii) Explain how temperature could be measured using Nihal's thermogram.**

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

- (b) Nihal decides to add curtains to all the windows in his house.

TYPE OF CURTAIN	COST TO FIT IN £	SAVING ON FUEL BILLS PER YEAR IN £	PAYBACK TIME IN YEARS
lightweight curtains	130	10	
heavyweight curtains	2000	100	

- (i) Calculate the PAYBACK TIME for BOTH types of curtain.

Write your answers in the table above. [1]

- (ii) Nihal expects to keep the curtains for 25 years.

Use this information to EXPLAIN which type of curtain would be the BEST to fit.

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[2]

[Total: 6]

## **12 Mobile phones use microwave radiation.**

- (a) Scientific studies look at the EFFECTS of mobile phone microwave radiation.**

**Results from these studies are published.**

**Explain why scientists publish their results.**

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[2]

- (b) MICROWAVES can be used to transmit information over long distances.**

**Television broadcasters use PORTABLE microwave transmitters mounted on vans.**

**They transmit programmes from an outside broadcast back to a studio.**

**Television broadcasters need to reduce signal loss as much as possible.**



**Explain the problems they may have in reducing signal loss and the possible objections from members of the public.**



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

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**[6]**

**[Total: 8]**

**13 Earthquakes produce seismic waves.**

**(a) Look at the recording of seismic waves opposite.**

**Use the recording to describe the amplitude and timing of the LARGEST seismic wave.**

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[1]

**(b) The TWO types of seismic waves are P WAVES and S WAVES.**

**Which type of wave will be seen first on the recording and why?**

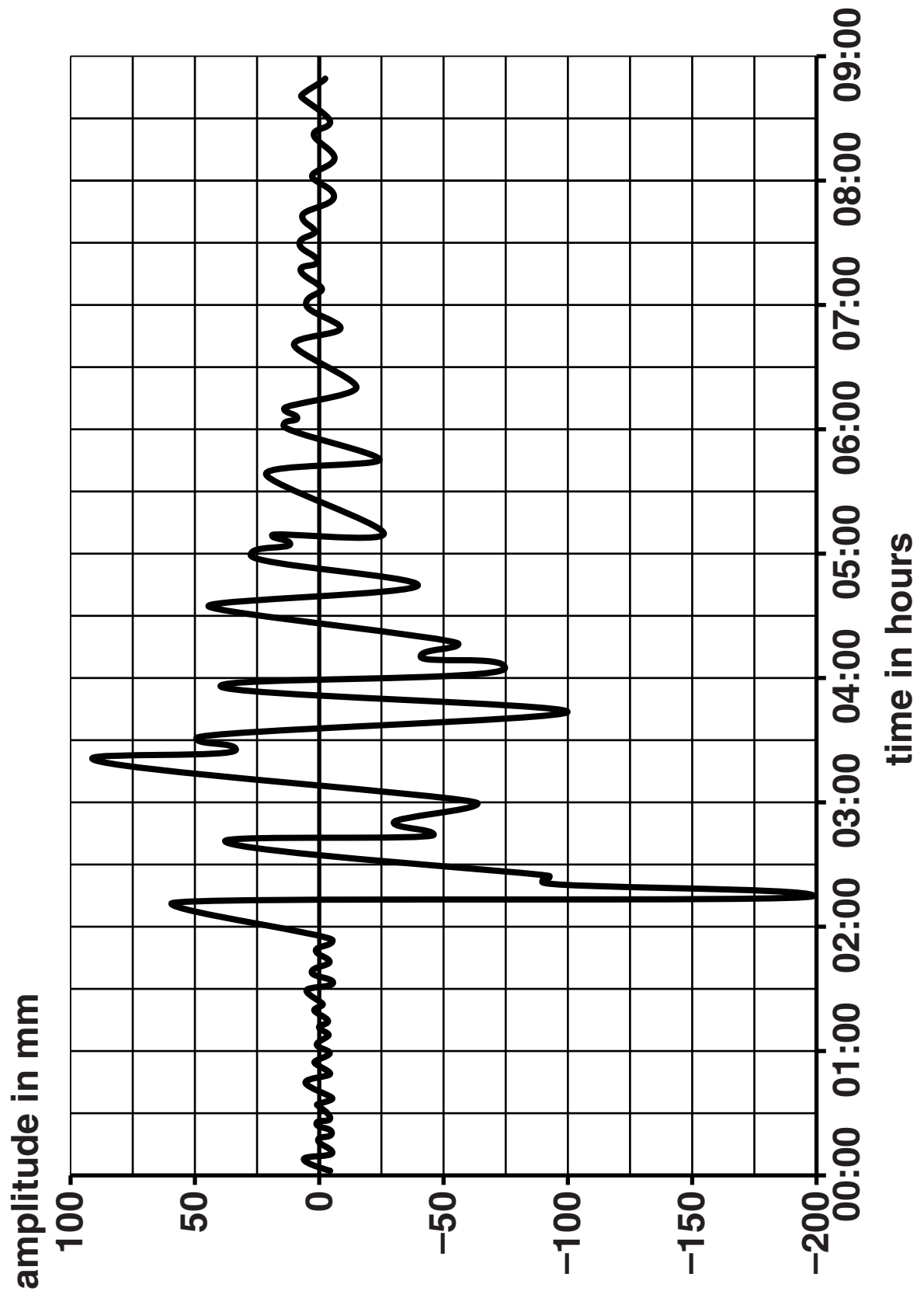
**TYPE of wave** \_\_\_\_\_

**REASON** \_\_\_\_\_

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[1]

**[Total: 2]**



- 14 This question is about the **ELECTROMAGNETIC SPECTRUM**. Examples of five different types of electromagnetic wave being used are listed below.

**X-RAY OF A HAND**

**RADIO BROADCAST**

**MICROWAVE OVEN**

**CANDLES GIVING OFF VISIBLE LIGHT**

**ULTRAVIOLET LIGHT SHOWING A HAND PRINT**

- (a) Put the five types of electromagnetic wave in the table below in order of **INCREASING** wavelength.

Two other types of electromagnetic wave are already in the table.

<b>AVERAGE WAVELENGTH IN m</b>	<b>TYPE OF ELECTROMAGNETIC WAVE</b>
$10^{-12}$	gamma ray
$10^{-10}$	
$10^{-8}$	
$0.5 \times 10^{-6}$	
$10^{-5}$	infrared wave
$10^{-2}$	
$10^3$	

[2]

**(b) The speed of electromagnetic waves in a vacuum is  $300 \times 10^6$  m/s.**

**Use the data in the table in part (a) to calculate the average FREQUENCY of INFRARED waves.**

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**answer \_\_\_\_\_ Hz**

**[2]**

- (c) The range of INFRARED frequencies can be divided into three bands.

Look at the table.

BAND	WAVELENGTH RANGE IN m	FREQUENCY RANGE IN Hz	ENERGY RANGE IN J
IR-A	$7 \times 10^{-7}$ to $1.4 \times 10^{-6}$	$4.3 \times 10^{14}$ to $2.1 \times 10^{14}$	$3 \times 10^{-19}$
IR-B	$1.4 \times 10^{-6}$ to $3 \times 10^{-6}$	$2.1 \times 10^{14}$ to $1 \times 10^{14}$	↓
IR-C	$3 \times 10^{-6}$ to $1 \times 10^{-3}$	$1 \times 10^{14}$ to $3 \times 10^{11}$	$2 \times 10^{-22}$

Use the data in this table to answer the questions.

- (i) Which BAND does the frequency you calculated in part (b) fit into?

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

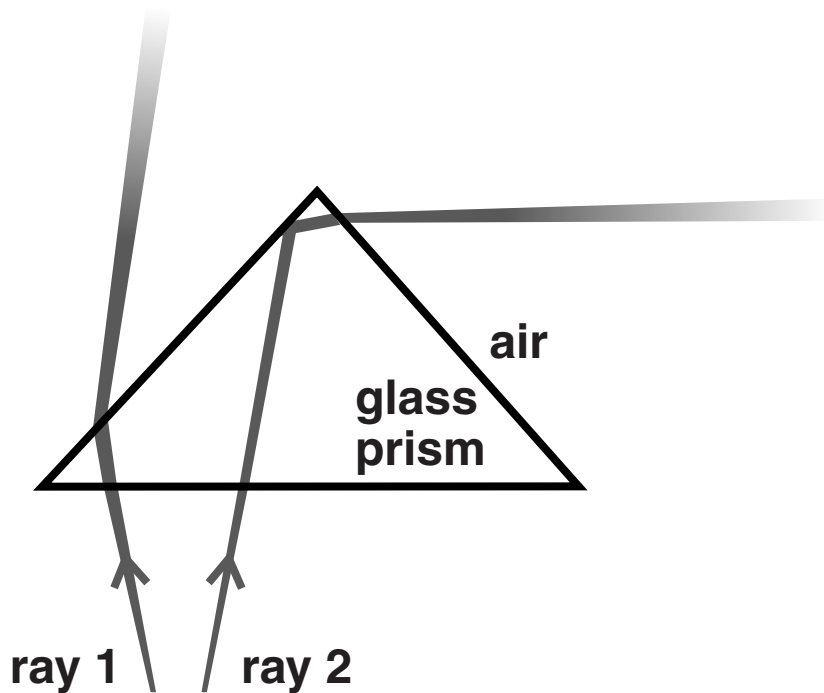
- (ii) Predict the ENERGY of band IR-B.

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

- (iii) Describe the relationship between wavelength and energy.

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

(d) Look at the picture of a prism.



Describe, using properties of light, the **DIFFERENCES** between the path taken by ray 1 and the path taken by ray 2.

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[2]

[Total: 9]

**END OF QUESTION PAPER**

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