

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS
GCSE**

B711/02

**GATEWAY SCIENCE
SCIENCE B**

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

MONDAY 10 JUNE 2013: 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:

Loose sheets for questions 10(d) and 12(b)

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.**
- **The Periodic Table can be found on page 55.**
- **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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$\text{GPE} = mgh$$

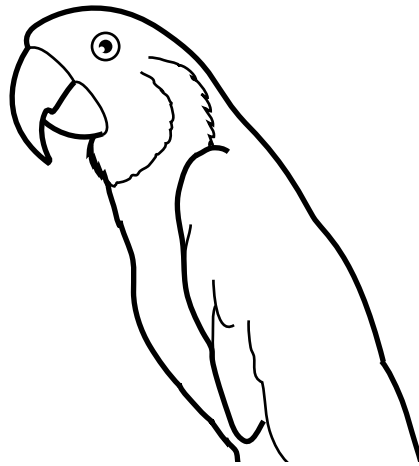
$$mgh = \frac{1}{2}mv^2$$

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

Answer ALL the questions.

SECTION A – MODULE B1

1 Look at the picture of a macaw.



(a) (i) There are 70 chromosomes in each BODY cell of a macaw.

Humans have 23 pairs of chromosomes in each body cell.

How many PAIRS of chromosomes are in a body cell of a macaw?

_____ **[1]**

(ii) The macaw in the picture is male.

Sex is determined by sex chromosomes.

Write down the pair of sex chromosomes that are in each body cell of a HUMAN MALE.

_____ **[1]**

(b) In humans, like many animals, equal numbers of males and females are produced.

Explain how equal numbers of male and female offspring are produced.

Use a genetic diagram.

[2]

(c) The natural environment for a macaw is the top of trees in tropical rainforests.

The position of the eyes on the head of a macaw makes it difficult for it to judge distance.

Explain why.

[2]

[TOTAL: 6]

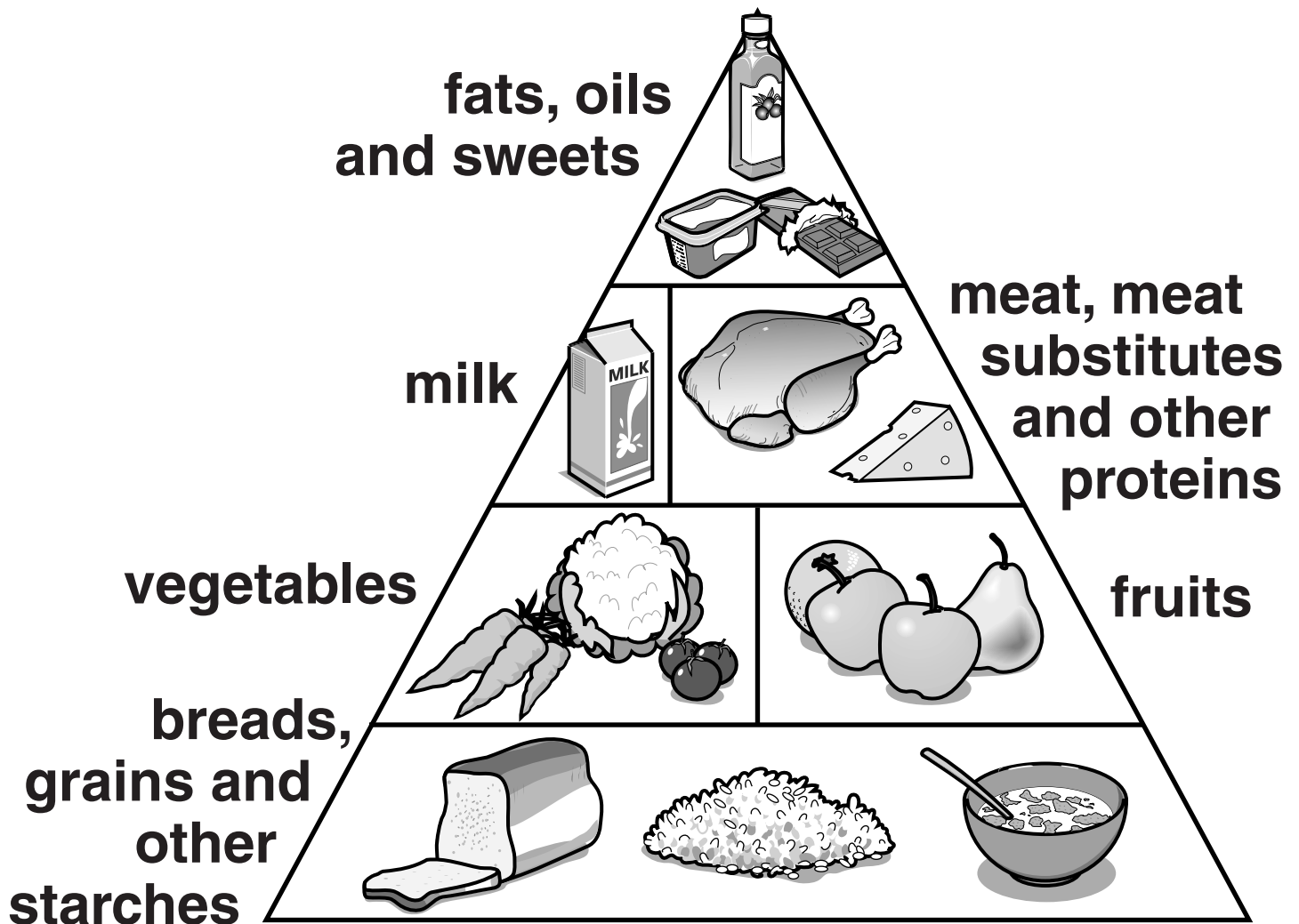
2 This question is about diabetes.

People who have diabetes lack a hormone or the hormone doesn't work properly.

(a) What does this hormone normally control in the body?

_____ **[1]**

(b) Look at the picture of the diabetic food pyramid.
It is a guide to the amounts of different types of food that people with diabetes should eat.



There are two forms of diabetes known as Type 1 and Type 2.

The diabetic food pyramid is used as a guide for people with diabetes.

Explain why using this food guide can help with the control of diabetes and explain the importance of this to people with Type 1 diabetes.



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

[6]

(c) Diabetes can affect the retina.

The retina is part of the eye.

Describe the job of the retina.

[2]

[TOTAL: 9]

3 Look at the table.

It shows the number of cases and the number of deaths for four different types of cancer in the UK, in 2008.

| | Number of cases | | Number of deaths | |
|----------------|-----------------|--------|------------------|--------|
| | Male | Female | Male | Female |
| Type of cancer | | | | |
| colon | 13 359 | 12 192 | 5 226 | 4 938 |
| lung | 22 846 | 17 960 | 19 863 | 15 393 |
| stomach | 4 923 | 2 687 | 3 186 | 1 992 |
| thyroid | 558 | 1 596 | 138 | 216 |

Use data from the table to answer the questions.

- (a) (i) In this study, lung cancer is the most common cancer in both males and females.**

The lifestyle of a person can greatly affect the chance of getting lung cancer.

What changes might someone make to their lifestyle to reduce the risk of lung cancer?

[2]

(ii) Calculate the ratio between cases and deaths for THYROID cancer in both males and females.

**male cases to male deaths
ratio** _____

**female cases to female deaths
ratio** _____

[2]

(iii) Use your answer from PART (ii) to explain whether males or females are more at risk of dying from thyroid cancer.

_____ **[1]**

(b) The treatment of cancer has been improved by the research of Sir Paul Nurse.

Read the article about his research.

Sir Paul Nurse is a scientist who investigated cell division in yeast.

In 1980, his research produced results that were unexpected. He found that the increase in cell numbers was due to delayed cell death rather than more rapid cell division.

For some time, he thought his experiment was flawed. After repeating the experiment, he still got the same results.

Cancer researchers used these results to help them develop entirely new cancer treatments.

In 2001, Sir Paul Nurse received the Nobel Prize for his work.

Suggest reasons why this work has led to him receiving the Nobel Prize.

[2]

[TOTAL: 7]

- 4 Carbon monoxide is a poisonous gas. It causes many deaths in the UK.**

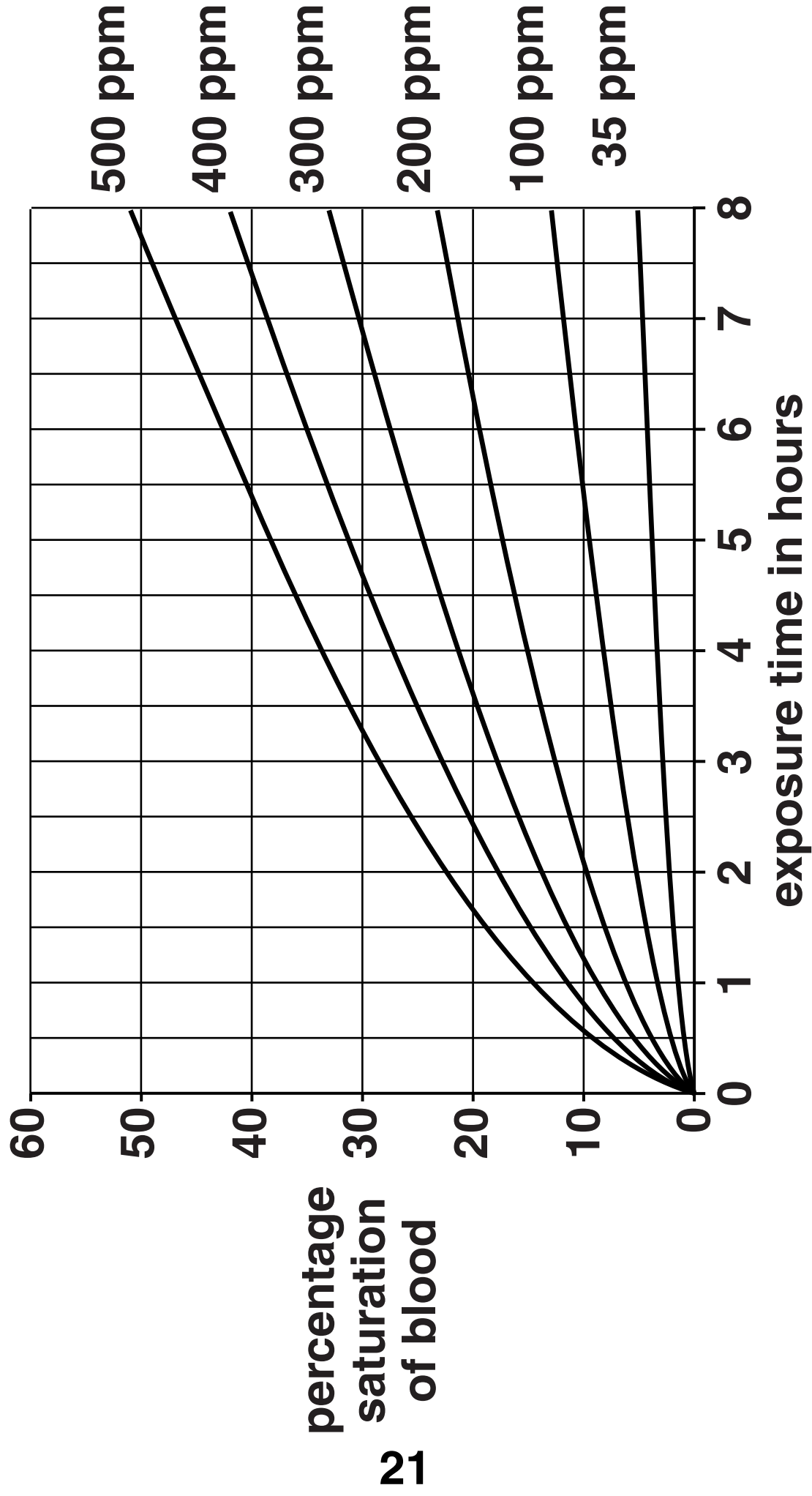
Look at the graph opposite.

It shows the percentage saturation of blood during exposure to different levels of carbon monoxide (parts per million).

- (a) A person becomes unconscious at 40 per cent saturation of blood.**

How much longer will it take to become unconscious at a carbon monoxide concentration of 400 ppm compared to 500 ppm?

_____ **[1]**



(b) An unconscious patient can be treated with oxygen.

The patient needs to breathe 100 per cent oxygen at high pressure.

Suggest how this treatment helps the body recover from carbon monoxide poisoning.

[2]

[TOTAL: 3]

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TURN OVER FOR SECTION B

SECTION B – MODULE C1

5 Crude oil is a mixture of hydrocarbons.

Crude oil is separated into fractions in an oil refinery.

Look at the table opposite. It shows information about some of the fractions.

(a) An alkane has the molecular formula $C_{11}H_{24}$.

Estimate the boiling point of this alkane.

_____ **[1]**

| Fraction | Number of carbon atoms per molecule | Boiling point in °C | Percentage in crude oil (the supply) | Percentage needed by the oil refinery (the demand) |
|--|--|----------------------------|---|---|
| Liquefied Petroleum Gases (LPG) | 1 – 4 | less than 30 | 4 | 11 |
| Petrol | 5 – 9 | 30 – 65 | 11 | 32 |
| Naphtha | 6 – 12 | 65 – 180 | 22 | 4 |
| Paraffin | 10 – 14 | 160 – 250 | 12 | 20 |
| Diesel | 13 – 20 | 250 – 340 | 18 | 15 |
| Bitumen | Over 20 | more than 340 | 23 | 4 |

(b) The petrol fraction has a lower boiling point than the diesel fraction.

Explain why.

[2]

(c) Cracking helps an oil refinery to match the SUPPLY of certain fractions with the DEMAND for them.

Use information from the table to explain how.

[2]

BLANK PAGE

TURN OVER FOR QUESTION 6

6 The air may contain different pollutants.

Look at the table.

It shows the relative concentration of pollutants found in the air in two places in the world.

| Pollutant | Relative concentration in the air | |
|-------------------------------|--|-----------------------|
| | in a city centre | near a volcano |
| carbon monoxide | 0.3 | 0.01 |
| hydrogen sulfide | 0.01 | 210 |
| oxides of nitrogen | 1.5 | 0.1 |
| sulfur dioxide | 200 | 1500 |
| trichlorofluoromethane | 0.01 | 0.005 |

- (a) Some scientists think that volcanic eruptions cause acid rain.**

What evidence is there in the table of data to support this idea?

[2]

- (b) Nitrogen monoxide, NO, reacts with oxygen, O₂.**

Nitrogen dioxide, NO₂, is made.

Write down the BALANCED SYMBOL equation for this reaction.

[2]

[TOTAL: 4]

7 Butane, C_4H_{10} , is a hydrocarbon.

Butane is used as a fuel in a camping stove.

Butane burns in oxygen, O_2 , from the air.

Both COMPLETE combustion and INCOMPLETE combustion can happen when butane burns.

Explain, with the help of BALANCED SYMBOL equations, the advantages of complete combustion over incomplete combustion of butane.



[6]

[TOTAL: 6]

8 Chemists are developing new types of polymers that are:

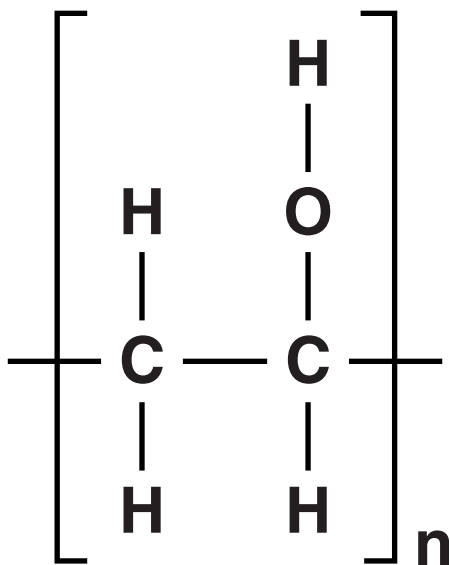
biodegradable

soluble in water.

(a) Explain why chemists are developing these new types of polymers.

[1]

(b) Look at the displayed formula of a polymer that is soluble in water.



This polymer is NOT a hydrocarbon.

Explain why.

[1]

- (c) These chemists publish their results using books, the internet and conferences.**

Why is it important that these chemists publish their results?

[2]

- (d) Look at the table opposite. It shows the properties of some polymers.**

Polymer C is used to make the windscreen of a car.

Explain why.

[2]

[TOTAL: 6]

| Polymer | Colour | Strength (1 = Weak, 10 = Strong) | Hardness (1 = Soft, 10 = Hard) | Biodegradable | Density (1 = Low, 10 = High) |
|----------------|-------------------|---|---|----------------------|---|
| A | white | 10 | 10 | yes | 8 |
| B | black | 3 | 1 | no | 1 |
| C | colourless | 8 | 9 | no | 10 |
| D | colourless | 7 | 1 | no | 3 |
| E | colourless | 8 | 9 | yes | 1 |

9 Potato salad is a mixture of cooked potatoes and mayonnaise.

The mayonnaise contains an emulsifier to help stop oil and water from separating.

(a) Explain, using a labelled diagram, how an emulsifier helps to stop oil and water from separating.

[2]

(b) Potato is easier to digest if it is cooked.

Explain why.

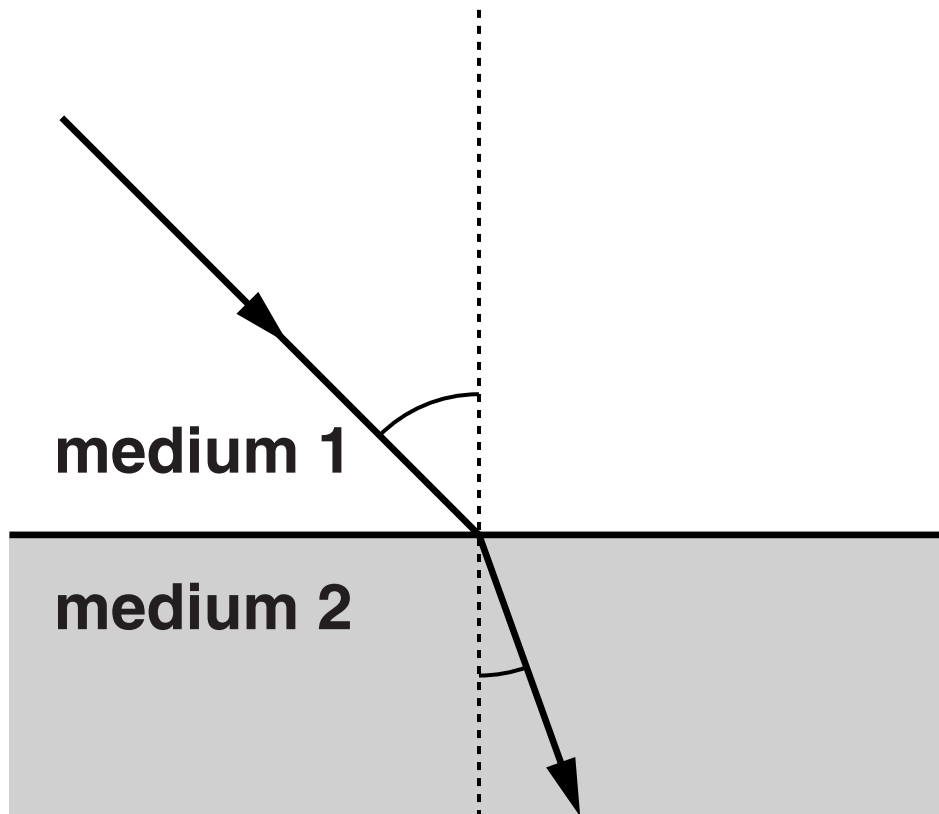
[2]

[TOTAL: 4]

SECTION C – MODULE P1

10 This question is about light.

- (a) (i) The diagram shows light being refracted from medium 1 to medium 2.



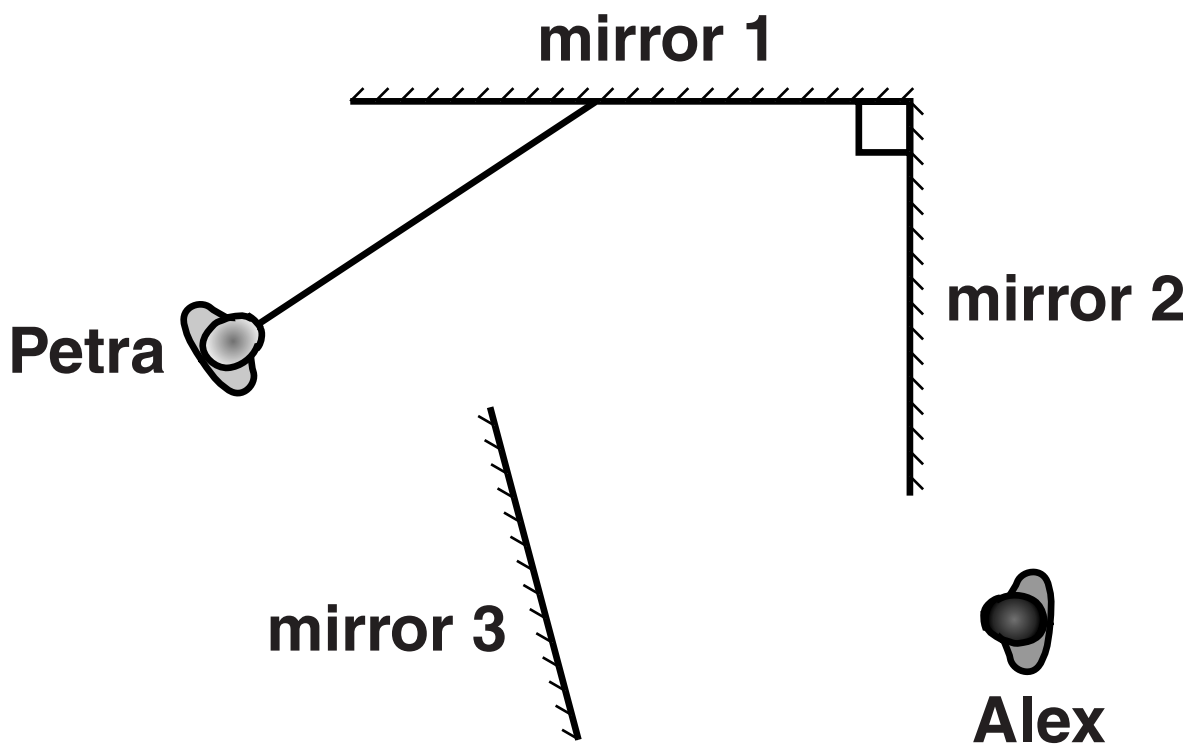
Why does REFRACTION occur?

[1]

(ii) Alex and Petra are at a fairground.

They visit the Hall of Mirrors.

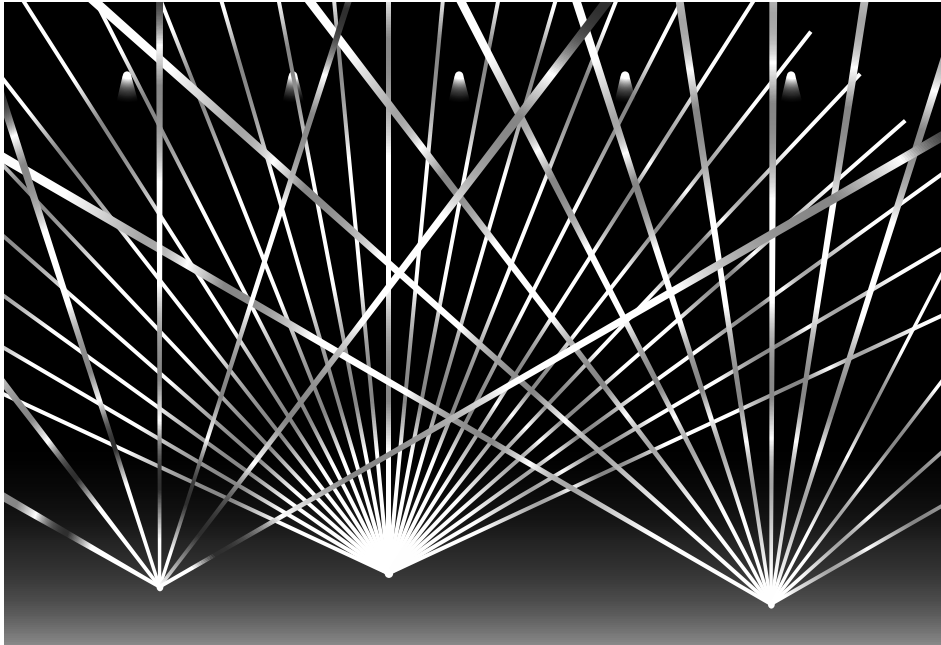
Complete the ray diagram to show how Alex and Petra can see each other.



[1]

(b) Light can be produced by lasers.

Look at the picture of a laser light show.



Laser light shows use lasers with intense coherent beams.

Explain what is meant by an INTENSE COHERENT laser beam.

[2]

(c) Morse code can be used for communication.

Look at the table showing part of the Morse code.

| | |
|----------------------|--------------------------|
| A ·— | 1 ·— — — — |
| B —... | 2 ··— — — |
| C —·—· | 3 ... — — |
| D —·· | 4 ... — |
| E · | 5 |
| F ··—· | 6 —..... |

Morse code can be sent by light.

(i) In the past, coded light signals were used to send messages over LONG distances.

Explain how this was done.

[2]

(ii) Coded signals can also be sent using electrical pulses.

Explain ONE ADVANTAGE of using light signals rather than electrical pulses in modern cable communication systems.

[1]

(d) Look at the diagram on the loose sheet. Light signals can be transmitted using an optical fibre link.

Describe the job of the DE-MULTIPLEXER.

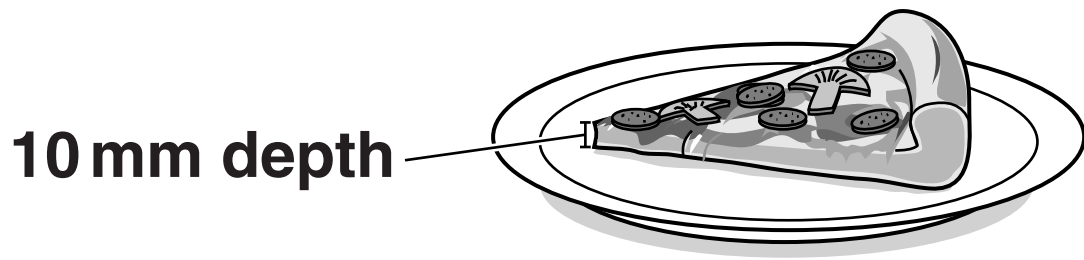
[1]

[TOTAL: 8]

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TURN OVER FOR QUESTION 11

11 Gino wants to heat a thin slice of pizza.

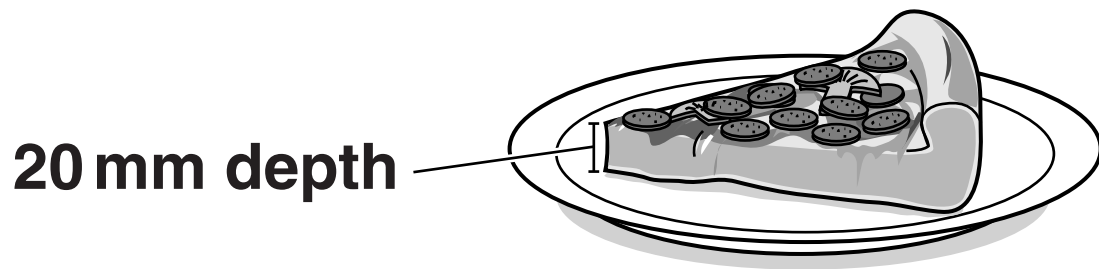


THIN PIZZA SLICE

Look at the information in the table opposite about the two different methods of heating the THIN pizza slice.

| Method of heating | How a pizza slice is heated | Distance waves can penetrate into a pizza slice in mm | Time to heat the thin pizza slice in minutes |
|----------------------------------|---|--|---|
| oven using infrared waves | heats the top surface of the pizza | <1 | 5 |
| oven using microwaves | heats water and fat in the pizza | >7 | 1.5 |

Gino also wants to heat a thicker slice of pizza.



THICK PIZZA SLICE

The THICK pizza contains a greater percentage (%) of WATER AND FAT.

Estimate how long it would take to heat the THICK pizza slice using each of the two different methods of heating.

Use your knowledge and understanding about energy transfer, and the information in the table, to explain your answers.



[6]

[TOTAL: 6]

12 Kathy and Jonathan collect information about different electromagnetic waves.

| Type of electromagnetic wave | Wave speed in m/s | Wavelength in m |
|------------------------------|-------------------|--------------------|
| microwave | 3×10^8 | 2×10^{-2} |
| radio | 3×10^8 | 2 |
| X-ray | 3×10^8 | 2×10^{-9} |
| infrared | 3×10^8 | 2×10^{-5} |

(a) Use the information in the table to calculate the FREQUENCY of the MICROWAVE.

frequency = _____ Hz [3]

(b) The energy of electromagnetic waves is carried by photons.

The chart on the loose sheet shows information about frequency and photon energy.

(i) Use the chart to describe the relationship between frequency and energy.

[1]

(ii) Infrared waves can vary in wavelength.

Infrared radiation from source A has a wavelength of 1×10^{-5} m.

Infrared radiation from source B has a wavelength of 1×10^{-6} m.

Compare the energy AND potential dangers to humans of the radiation emitted by sources A and B.

[2]

[TOTAL: 6]

13 Some waves are potentially harmful to humans.

(a) (i) Noah's skin is naturally DARKER than Aiden's skin.



Noah



Aiden

Noah thinks this may reduce his skin cancer risk from ultraviolet waves.

Is he correct?

Explain why.

[1]

(ii) Sunscreens can reduce the risk of sunburn.

A scientist collects evidence about a new sunscreen.

The scientist carries out four tests.

| Test | Time taken for skin to burn in minutes | |
|-------------|---|-------------------------------|
| | Without sunscreen | With the new sunscreen |
| A | 30 | 70 |
| B | 40 | 90 |
| C | 10 | 15 |
| D | 20 | 50 |

The scientist CANNOT conclude that the sunscreen MORE THAN doubles the time you can safely stay in the sun.

Identify the conflicting evidence and suggest how the confidence of the conclusion could be increased.

[2]

(b) The ozone layer protects the Earth from ultraviolet radiation.

Environmental pollution from CFCs has depleted the ozone layer.

Explain why people are concerned about this.

[2]

[TOTAL: 5]

END OF QUESTION PAPER

The Periodic Table of the Elements

| | | | | | | | | | | | | | | | | | | |
|-------------------------------|-----------------------------|---|-------------------------------------|-------------------------------|----------------------------------|--------------------------------|-------------------------------|----------------------------------|------------------------------------|-----------------------------------|---|-----------------------------|-----------------------------|-----------------------------|-------------------------------|-------------------------------|----------------------------|----------------------------|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 0 | | | | | | | | | | | |
| | | <div>1 H hydrogen 1</div> | | | | | | | | | | | | | | | | |
| | | Key | | | | | | | | | | | | | | | | |
| | | relative atomic mass atomic symbol name atomic (proton) number | | | | | | | | | | | | | | | | |
| 7 Li lithium 3 | 9 Be beryllium 4 | | | | | | | | | | | | | | | | | |
| 23 Na sodium 11 | 24 Mg magnesium 12 | | | | | | | | | | | | | | | | | |
| 39 K potassium 19 | 40 Ca calcium 20 | 45 Sc scandium 21 | 48 Ti titanium 22 | 51 V vanadium 23 | 52 Cr chromium 24 | 55 Mn manganese 25 | 56 Fe iron 26 | 59 Co cobalt 27 | 59 Ni nickel 28 | 63.5 Cu copper 29 | 65 Zn zinc 30 | 70 Ga gallium 31 | 73 Ge germanium 32 | 75 As arsenic 33 | 79 Se selenium 34 | 80 Br bromine 35 | 84 Kr krypton 36 | |
| 85 Rb rubidium 37 | 88 Sr strontium 38 | 89 Y yttrium 39 | 91 Zr zirconium 40 | 93 Nb niobium 41 | 96 Mo molybdenum 42 | [98] Tc technetium 43 | 101 Ru ruthenium 44 | 103 Rh rhodium 45 | 106 Pd palladium 46 | 108 Ag silver 47 | 112 Cd cadmium 48 | 115 In indium 49 | 119 Sn tin 50 | 122 Sb antimony 51 | 128 Te tellurium 52 | 127 I iodine 53 | 131 Xe xenon 54 | 131 Xe xenon 54 |
| 133 Cs caesium 55 | 137 Ba barium 56 | 139 La* lanthanum 57 | 178 Hf hafnium 72 | 181 Ta tantalum 73 | 184 W tungsten 74 | 186 Re rhenium 75 | 190 Os osmium 76 | 192 Ir iridium 77 | 195 Pt platinum 78 | 197 Au gold 79 | 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 | [222] Rn radon 86 |
| [223] Fr francium 87 | [226] Ra radium 88 | [227] Ac* actinium 89 | [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 | 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.

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