OCR
Oxford Cambridge and RSA

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Wednesday 17 June 2015 – Morning

GCSE GATEWAY SCIENCE
PHYSICS B

B752/01 Physics modules P4, P5, P6 (Foundation Tier)

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)

Duration: 1 hour 30 minutes

* B 7 5 2 0 1 *

* 3 7 9 1 4 5 2 7 6 7 *

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. 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).
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

- The quality of written communication is assessed in questions marked with a pencil (✎).
- A list of equations can be found on page 2.
- 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 **85**.
- This document consists of **28** pages. 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

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

power = force × speed

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

momentum = mass × velocity

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

GPE = mgh

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

$$v = u + at$$

$$v^2 = u^2 + 2as$$

$$s = ut + \frac{1}{2}at^2$$

$$m_1u_1 + m_2u_2 = (m_1 + m_2)v$$

$$\text{refractive index} = \frac{\text{speed of light in vacuum}}{\text{speed of light in medium}}$$

$$\text{magnification} = \frac{\text{image size}}{\text{object size}}$$

$$I_e = I_b + I_c$$

$$\frac{\text{voltage across primary coil}}{\text{voltage across secondary coil}} = \frac{\text{number of primary turns}}{\text{number of secondary turns}}$$

power loss = (current)^2 × resistance

$$V_pI_p = V_sI_s$$

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Question 1 begins on page 4

PLEASE DO NOT WRITE ON THIS PAGE

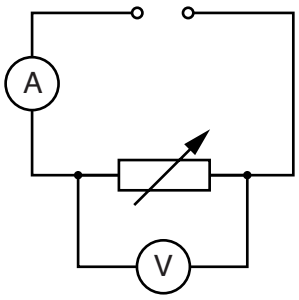
Answer **all** the questions.

SECTION A – Module P4

1 Ksenia and Eva investigate five different variable resistors.

They set each variable resistor to the maximum resistance.

They keep the voltage the same and use this circuit to measure the current.



Look at their results.

Variable resistor	Current reading on ammeter in amps
A	0.12
B	0.15
C	0.16
D	0.06
E	0.11

(a) All the wires inside the variable resistors are
- made of the same material
- the same thickness.

(i) Which of the five variable resistors in the table has the **longest** wire?

Choose from

A **B** **C** **D** **E**

answer ..... **[1]**

(ii) Which variable resistor will have the **highest** resistance?

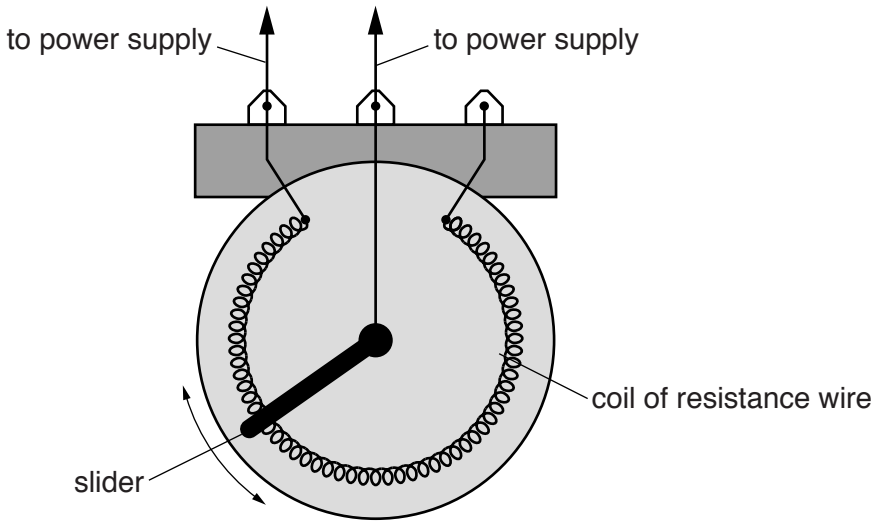
Choose from

A **B** **C** **D** **E**

answer ..... **[1]**

(b) Ksenia looks inside variable resistor **A**.

Look at the diagram.



The slider moves around touching the coil of resistance wire.

Draw on the diagram where the slider should be to get the **highest** current reading. **[1]**

(c) Eva writes down a voltmeter reading for variable resistor **B**.

ammeter reading = 0.15 A
voltmeter reading = 0.70 V

Calculate the resistance of variable resistor **B** to 2 significant figures.

.....

.....

Resistance of variable resistor **B** ..... unit of resistance ..... **[3]**

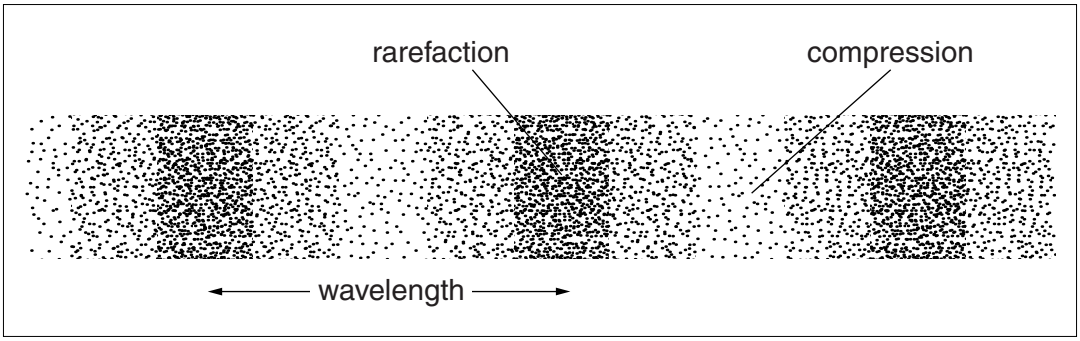
2 Arnav collects two sets of information about sound and ultrasound.

One is a table and the other is a diagram.

Table

Wave	Type of wave	Uses
sound	longitudinal	• talking to each other • measuring blood flow • listening to music
ultrasound	transverse	• breaking down kidney stones • measuring blood flow • X-ray of bones • cooking food

Diagram



Describe and explain what is wrong in the table and the diagram.

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

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..... **[6]**

3 Scientists use several methods to find out when old plants lived.

(a) Here is information about two methods.

	Relative Dating	Absolute Dating
Method	Find out where plant fossils are in layers of rocks. Newer rocks are on top of older rocks. The method can be used in very old rocks.	This uses carbon dating. The amount of radioactive Carbon-14 can be measured in dead plants. This can be compared with the amount of Carbon-14 in living plants to find the age.
Problems	Cannot find the exact age of the plant fossils.	Cannot be used for very old dead plants as the amount of Carbon-14 is too low.

Describe why scientists might use both methods to find out when old plants lived.

.....

.....

..... **[2]**

(b) Another method uses radioactive dating of rocks by calculating the ratio of two metals in the rocks.

One of the metals is uranium.

What is the name of the other metal?

Choose from

lead

potassium

rubidium

strontium

thorium

answer ..... **[1]**

4 Radioactivity is measured by the number of decays per second.

Here are measurements from three radioactive sources **A**, **B** and **C**.

	Number of decays per second		
Time in minutes	**Source A**	**Source B**	**Source C**
0	2020	998	1034
100	998	251	862
200	496	63	674
300	252	16	566
400	174	4	472

(a) Describe what happens to the measurements for **all** the sources.

.....

..... **[2]**

(b) Source **B** has the shortest half-life.

Explain how the measurements in the table show this.

..... **[1]**

(c) Where does this radiation come from?

Choose the **best** answer from

all atoms

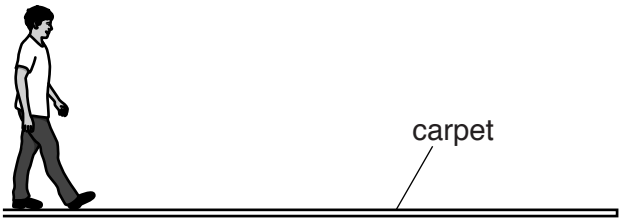
all elements

electrons orbiting the nucleus

nucleus

answer ..... **[1]**

5 Patrick walks on a nylon carpet.



Patrick becomes charged.

Then he receives an electrostatic shock.

(a) Describe how Patrick can become charged and suggest how he receives an electrostatic shock.

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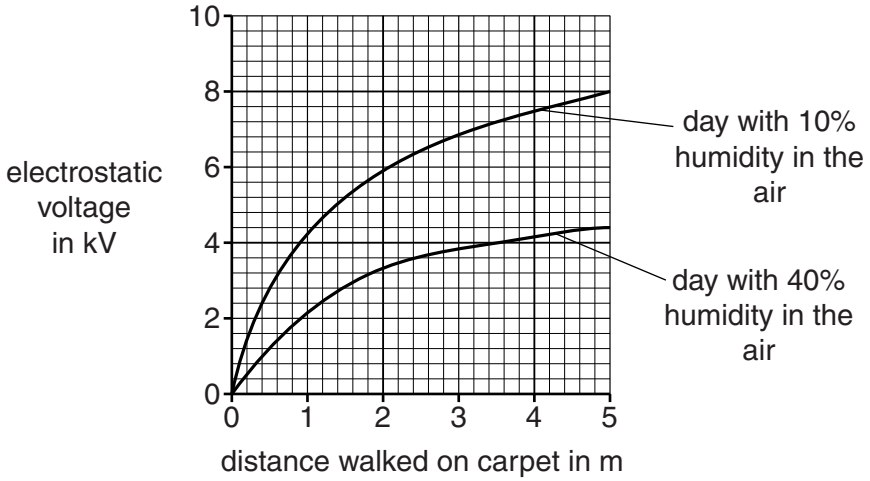
..... **[2]**

Question 5(b) begins on page 10

(b) Patrick's electrostatic voltage is measured when he walks on the carpet on different days.



(i) Use the graph to describe what happens as Patrick walks along the carpet.

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..... **[2]**

(ii) Use the graph to compare the data for the two days.

.....

..... **[1]**

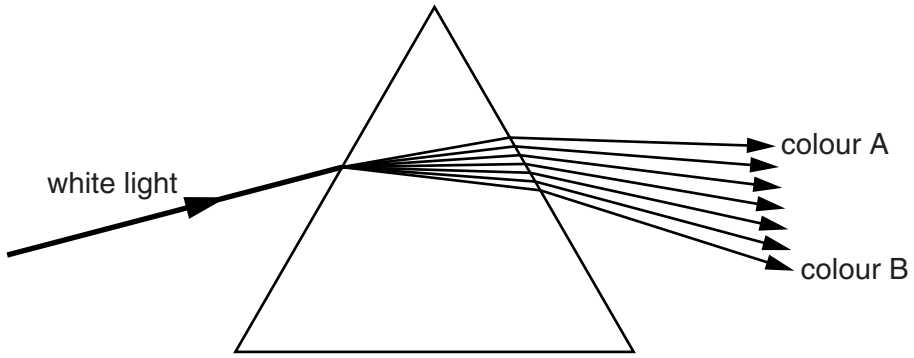
(iii) Draw a line on the graph to show what will happen to the electrostatic voltage when there is 20% humidity in the air. **[1]**

SECTION B – Module P5

6 Chantal does some experiments with light in class. She investigates how light behaves.

(a) Chantal shines a beam of white light through a prism.

Look at the diagram.



Complete the sentences about the light.

Choose from

diffracts

frequency

green

amplitude

red

reflects

refracts

violet

wavelength

When the white light enters the prism it ..... and disperses into its seven colours.

Colour **A** is ..... .

Colour **B** has the smallest ..... . **[3]**

(b) She sends a laser beam through an optical fibre.

The laser beam is totally internally reflected as it moves along the fibre.

Describe one other use of total internal reflection.

.....

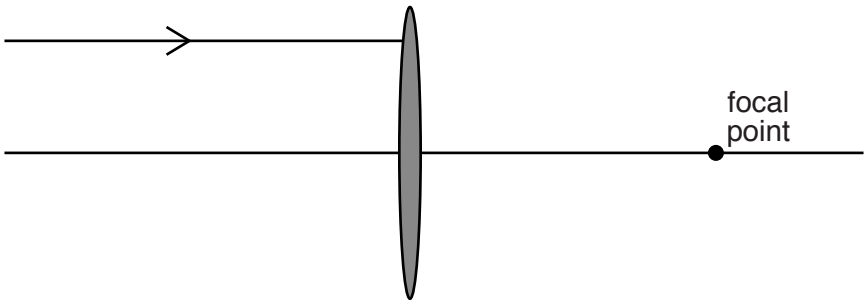
..... **[1]**

(c) Chantal experiments with converging lenses.

(i) Write down another name for a converging lens.

..... **[1]**

(ii) Complete the path of the light ray after it goes through the converging lens.



[1]

(d) Converging lenses are used in cameras to produce images.

Describe the **type** of image and **where** it is produced in a camera.

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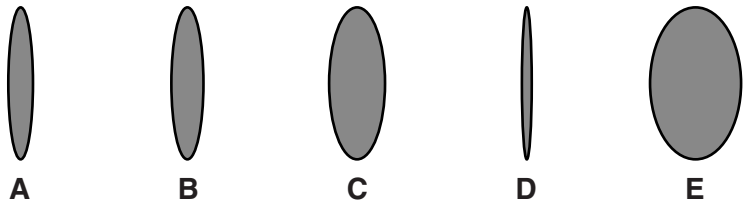
..... **[2]**

(e) Chantal has some converging lenses with different thicknesses.



She wants to arrange the lenses in the order of their focal lengths.

Put the lenses in the correct order. Complete the table. One has been done for you.

Focal length in cm	Lens
5	
10	
15	B
20	
25	

[2]

7 Electromagnetic waves are used for communication.

Look at the information about different waves.

Wave	Wavelength	Frequency
A	3.3 m	90 MHz
B	15 m	20 MHz
C	0.006 m	50 GHz

(a) Which wave is reflected by the ionosphere?

answer .....

Explain why you chose this wave.

.....

..... **[2]**

(b) Which wave can pass through the Earth's atmosphere but is reduced in strength because of absorption and scattering?

answer .....

Explain why you chose this wave.

.....

..... **[2]**

8 Artificial satellites are put into space for scientific research.

The satellites are carried into space by rockets.

(a) A rocket accelerates steadily from rest and reaches 6000 m/s after 5 minutes.

Calculate the average speed and the distance travelled in this time.

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average speed .....m/s

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.....

distance .....m **[3]**

(b) The scientists on the International Space Station (ISS) carry out scientific research.

They send their research findings for **peer review**.

Who is involved in this peer review and what do they do?

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..... **[2]**

9 Chris is trying to demonstrate interference of sound waves to his class.

He has a keyboard connected to loudspeakers.

Describe how he uses this equipment so that his students can hear the effects of interference and explain how interference occurs.

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

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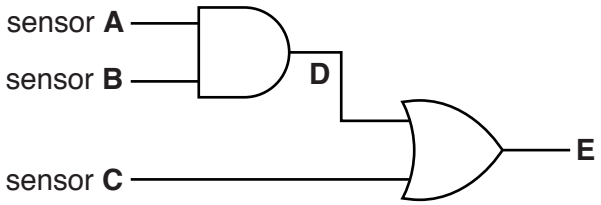
..... **[6]**

SECTION C – Module P6

10 Enzo connects three input sensors to logic gates to make a logic system.



Input **A** is 1 when it is hot and 0 when it is cold.

Input **B** is 1 when it is wet and 0 when it is dry.

Input **C** is 1 when it is light and 0 when it is dark.

He completes part of the truth table to show the output at **E**.

Inputs				**Output**
A	**B**	**C**	**D**	**E**
0	0	0	0	0
0	0	1	0	1
0	1	0		
0	1	1		
1	0	0		
1	1	0		

From part of the completed truth table Enzo has found one of the conditions when the output at **E** is 1.

This is when it is **cold**, **dry** and **light**.

Name the two logic gates and complete the truth table to find out the other conditions when the output at **E** is 1.

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

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..... **[6]**

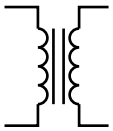
Question 11 begins on page 18

11 Transformers are used in many different appliances.

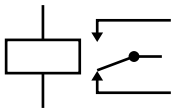
(a) Which symbol is used for a transformer?

Choose from

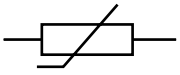
A



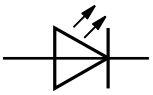
B



C



D



answer ..... **[1]**

(b) Complete the sentences about transformers.

Use a **different** word for each sentence.

Choose words from

AC **DC** **isolating** **step-down** **step-up**

Transformers are devices that work with ..... .

Phone chargers use ..... transformers.

Bathroom shaver sockets producing 230V output use .....

transformers. **[2]**

(c) The voltage of electricity used in the home is 230 V.

The voltage of electricity used for some power lines is more than 110 000 V.

Transformers are used as part of the National Grid.

Explain why transformers improve the transfer of electricity to the home.

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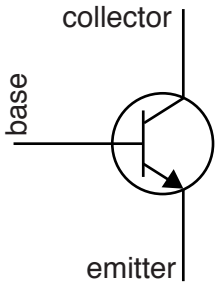
..... **[2]**

Question 12 begins on page 20

12 The NPN transistor is the basic building block of electronic components.



The currents flowing through the transistor terminals are $\mathbf{I_c}$ $\mathbf{I_b}$ and $\mathbf{I_e}$.

Here are the currents of different transistors.

$\mathbf{I_b}$ in mA	$\mathbf{I_c}$ in mA	$\mathbf{I_e}$ in mA
2	80	.....
4	100	.....
8	120	.....

(a) Calculate the **three** missing values for $\mathbf{I_e}$ and put your answers in the table.

[1]

(b) Look at the sizes of the currents I_b and I_c in the table.

(i) Describe, in general, how I_b is different to I_c.

.....

..... **[1]**

(ii) Explain this difference.

.....

.....

.....

..... **[2]**

(c) Transistors are being made that are smaller than ever before.

This is called miniaturisation.

This has allowed companies to make miniature mobile phones.

Describe an advantage and a disadvantage of using a miniature mobile phone.

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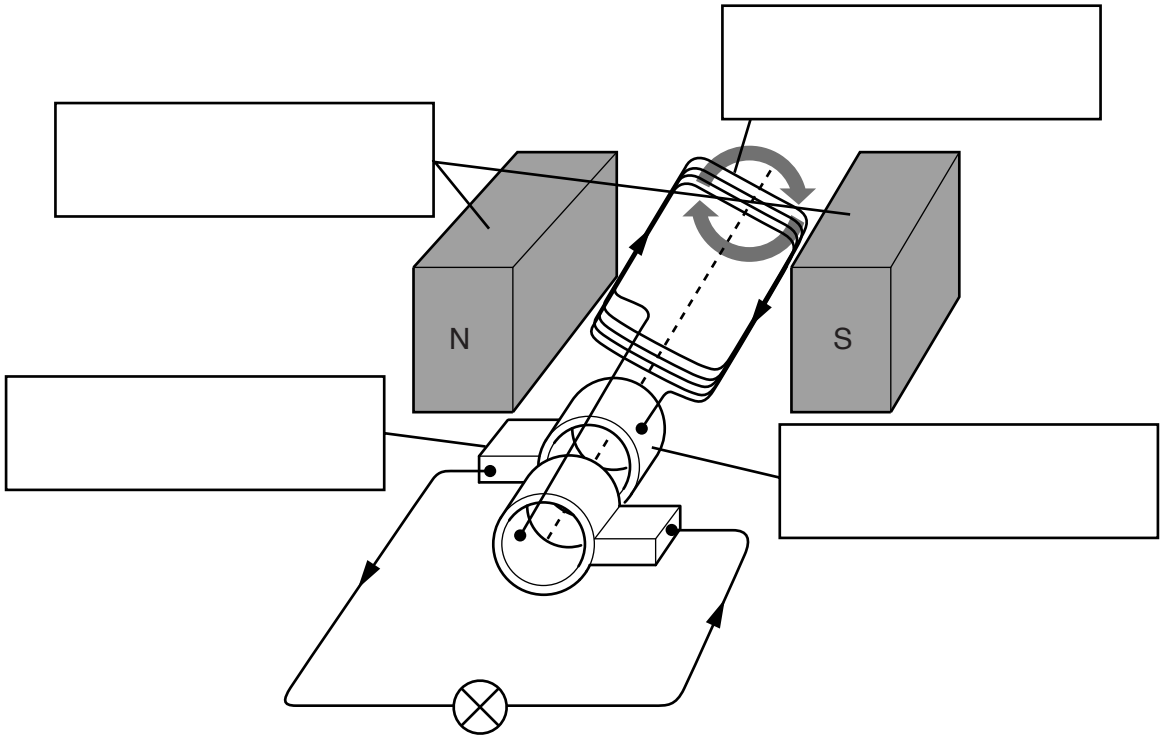
..... **[2]**

13 AC generators are used to generate electricity.

Here is a diagram of a small AC generator.



(a) Label the four parts of the generator on the diagram.

Use the words

brush **coil** **magnet** **slip ring**

[1]

(b) This AC generator generates electricity by rotating the coils of wire.

Describe another way electricity can be generated using an AC generator.

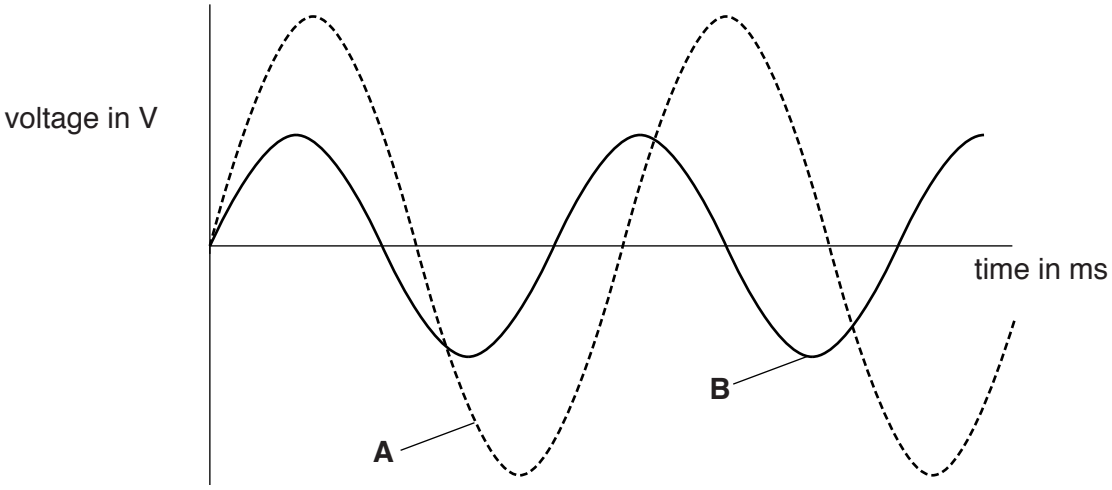
.....

..... **[1]**

(c) The mains electricity in the UK is supplied at a frequency of 50 Hz.

Look at the diagram.

It shows two different AC voltages.



A has a frequency of 50 Hz and a supply voltage of 230 V.

Compare these values with the frequency **and** supply voltage of **B**.

How does the frequency **and** supply voltage of **B** compare with **A**?

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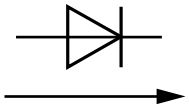
..... **[2]**

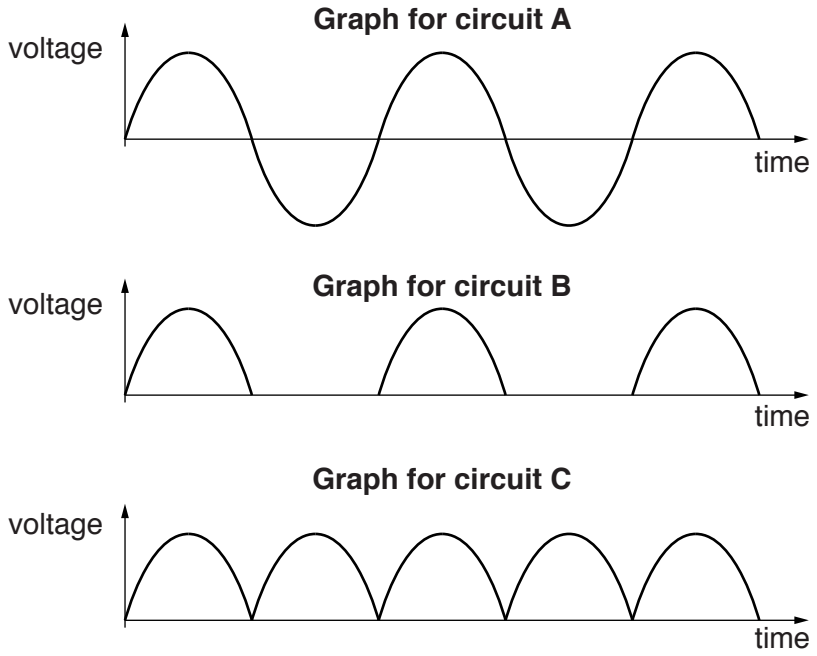
14 Diodes and capacitors are used to produce a constant DC output.

(a) A diode only allows current to flow in one direction.



current only flows in this direction through this diode

Felix looks at the voltage–time graphs from three different circuits, **A**, **B** and **C**.



Describe the type of rectification, if any, shown by each graph.

State which circuits are the result of using diodes.

.....

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.....

..... **[3]**

(b) A capacitor is added to circuit **C**.

Predict what will happen to the voltage on graph **C**.

Draw the line on the axes below.

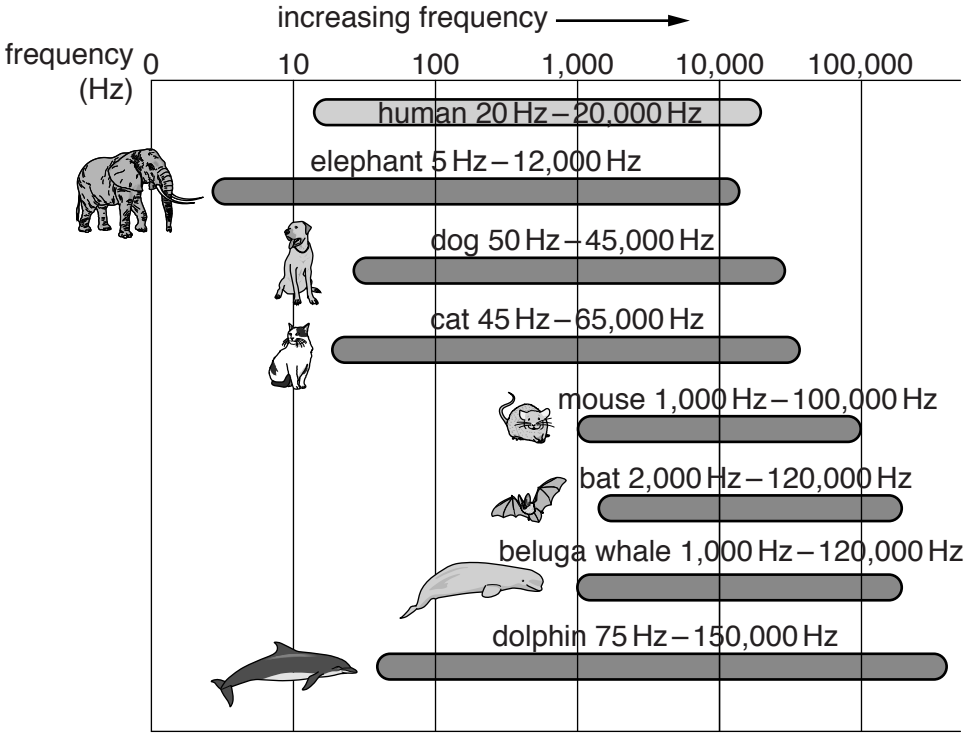
[1]

SECTION D begins on page 26

SECTION D

15 Rene researches the range of sounds that different animals can hear.
She finds the lowest and highest frequency sounds the animals can hear.

(a) Look at some of her research data.



(i) Which animal can hear the **lowest** frequency?

..... **[1]**

(ii) Which animal can hear the **highest** frequency?

..... **[1]**

(iii) Which animal has the largest frequency **range** of hearing?

..... **[1]**

(b) 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	Lower frequency limit of hearing in Hz	Upper frequency limit of hearing in Hz	Frequency range of hearing in Hz
Jane	22	19 000	18 978
Alec	19	20 000	19 981
Dionne	24	20 100	
Niamh	16	19 800	19 784
Evangelos	15	20 000	19 985
average	19.2		19 760.8

Rene has not completed her table.

(i) Which person has the largest frequency **range** of hearing?

.....

Explain your answer using a calculation.

.....

..... **[2]**

(ii) Calculate the average upper frequency limit of hearing for this group of people.

.....

.....

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

(iii) Rene's original research shows 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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..... **[3]**

END OF QUESTION PAPER