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General Certificate of Secondary Education

TWENTY FIRST CENTURY SCIENCE
ADDITIONAL APPLIED SCIENCE A
Unit 5: Communications (Foundation Tier)

A326/01

Tuesday 22 June 2010
Morning

Duration: 45 minutes

Candidate Forename		Candidate Surname	

| Centre Number					Candidate Number				

INSTRUCTIONS TO CANDIDATES

*   Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
*   Use black ink. Pencil may be used for graphs and diagrams only.
*   Read each question carefully and make sure that you know what you have to do before starting your answer.
*   Answer **all** the questions.
*   Do **not** write in the bar codes.
*   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

*   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 **36**.
*   This document consists of **12** pages. Any blank pages are indicated.

Turn over

Answer **all** the questions.

1 Here is an incomplete block diagram for a radio **receiver.**

	→		→	
		amplifier	→	
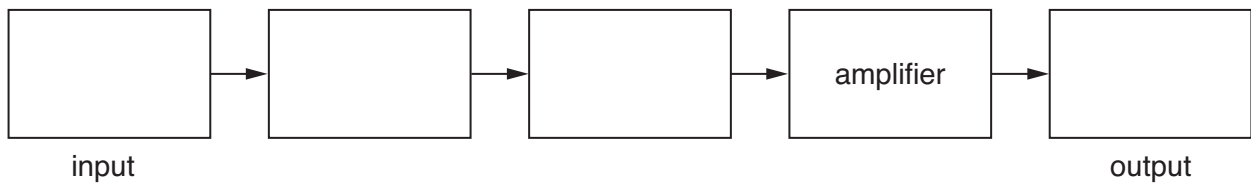
input   output

(a) Complete the block diagram.

Choose words from this list.

aerial   demodulator   loudspeaker   tuner   **[3]**

(b) The diagram has an **input** block on the left. There is an **output** block on the right.

What type of block are the other three?

Put a (ring) around the correct answer.

modulator   processor   sampler   **[1]**

(c) Draw straight lines to link each **radio band** with the correct **typical frequency**.

radio band   **typical frequency**

| 250 kHz |

| VHF |

| 1.0 MHz |

| 100 MHz |

| medium wave |

| 600 MHz | **[2]**

(d) Here are the broadcast frequencies for three different radio channels.

radio channel	broadcast frequency
1	27.60 MHz
11	27.70 MHz
21	27.80 MHz

   (i) Why must each channel have a different frequency?

   ....

   .... **[1]**

   (ii) Complete the sentences by putting a ⟨ring⟩ around the best word.

   The frequency for each channel is decided by the
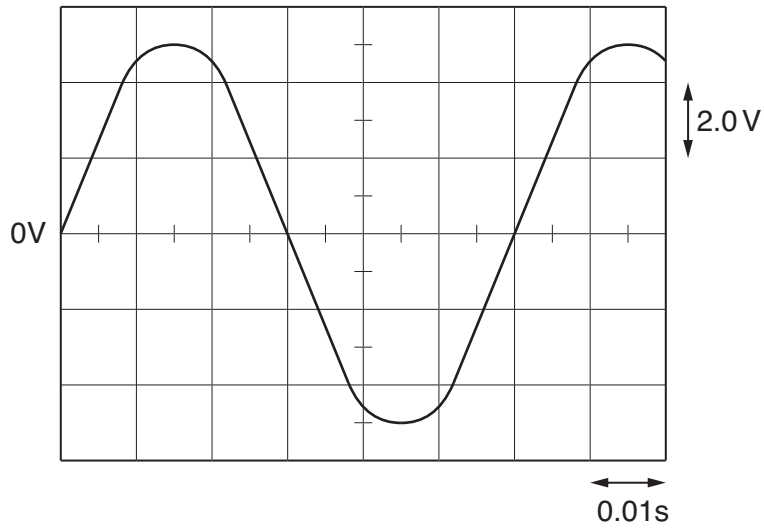
   government   manufacturer   owner

   To switch from one channel to another, the owner adjusts the

   aerial   loudspeaker   tuner

   [2]

   [Total: 9]

2 Here is the trace of a signal as seen on an oscilloscope screen.

0V

2.0 V

0.01s

(a) Use the trace to show that the **amplitude** of the signal is 5.0V.

....

....

.... **[2]**

(b) How long does it take for one cycle of the signal? Put a (ring) around the correct answer.

0.01 s   0.03 s   0.06 s   0.08 s   **[1]**

(c) Which of these statements best describes how to find the **frequency** of the signal?
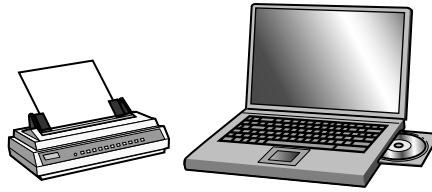
Put a tick (✓) in the box next to the correct answer.

Divide 1.0 by the time for one cycle.   ☐

Multiply the time for one cycle by 1000.   ☐

Divide the time for one cycle by the amplitude.   ☐

Multiply the time for one cycle by the amplitude.   ☐   **[1]**

[Total: 4]

3 Jo is thinking of buying a printer for her laptop computer.

She finds this data sheet comparing the specification for three different printers.

	printer model		
	MWB58	**JCB42**	**OCR12**
mass of printer	2.5 kg	2.0 kg	1.5 kg
time to print a test page	2.5 s	10 s	5.0 s
range of power sources	230 V mains only	230 V mains or 6 V battery	230 V mains only
possible computer connections	USB cable optical fibre	USB cable radio wave	optical fibre radio wave

(a) Jo wants a wireless connection between computer and printer.

Which printer should she **not** choose?

Give a reason for your answer.

....

.... **[2]**

(b) Which printer could Jo use anywhere?

Give a reason for your answer.

....

.... **[2]**

Turn over

(c) Data can be transmitted in analogue form or digital form.

The computer transmits data to the printer in digital form.

What are the advantages of sending data in digital form?

Put ticks (✓) in the boxes next to the **two** correct statements.

The data needs less processing.

The electronic circuits are much simpler.

The electronic circuits are programmable.

The data is transferred with no loss of quality.

The data can be encrypted to increase security. **[2]**

[Total: 6]

4   Voice messages can be sent from one place to another along three different links.

   (a)   Draw straight lines to match each **link** with the type of **signal** passing through it.

link	**signal**
air	radio waves
optical fibre	electric current
copper wire	light and infrared

[2]

   (b) **(i)**   Give one example of a communication system which uses optical fibre to send messages from one place to another.

.... [1]

   (ii)   Give a reason why your example uses optical fibre.

....

.... [1]

   (c)   Complete the sentences.

   Choose the best words from the list.

analogue   compressed   decoded   digital   electrical   encoded

   The sound of a voice contains information in .... form.

   Before the voice message can be sent along a link it must be ....   **[2]**

[Total: 6]

5 Sam sells two-way radio communication systems.

He wants to sell his radios for parents to keep in touch with their children.

Each child would carry a radio all of the time.

The parents could then talk to them from anywhere in the house or garden.

Sam starts to write down the **key factors** of the product specification.

He gives a reason for each key factor.

key factor	reason
weight	must be light enough for children to carry
power output	less than 4 W to comply with OfCom regulations

(a) Complete the table with **three** more key factors. Give a reason for each one. **[3]**

(b) Sam considers effects which could limit the range of the two-way radio system.

Draw straight lines to link each **effect** with its correct **explanation**.

effect	explanation
reflection	radio waves can cancel each other out
absorption	radio waves can't pass through walls easily
interference	the direction of radio waves can be easily changed

[2]

(c) Sam decides to use a digital format for the voice signals.

Here are the processing stages required.

They are in the wrong order.

A Demodulate the radio waves.

B Amplify the signal from the microphone.

C Convert each sample into a binary code.

D Convert each binary code into a voltage.

E Sample the signal many times in each second.

F Use the binary codes to modulate the radio waves.
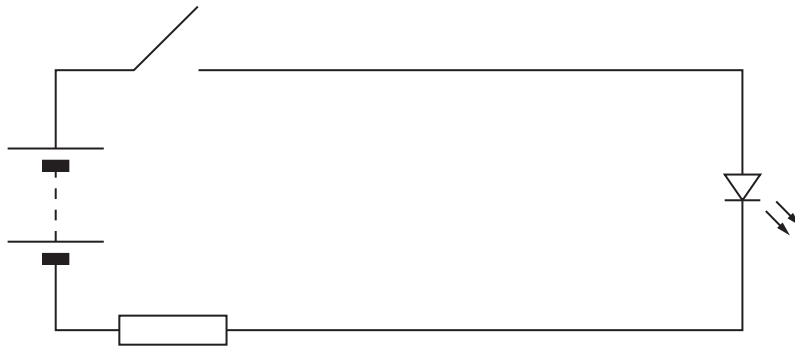
G Use an amplifier to feed the voltage out of a loudspeaker.

Complete the table to show the correct order.

B						G

[2]

[Total: 7]

6 Here is the circuit diagram for a simple signalling system.

(a) Use the circuit diagram to complete the block diagram for the system.

input		copper wire		output
	→		→	
input		link		output
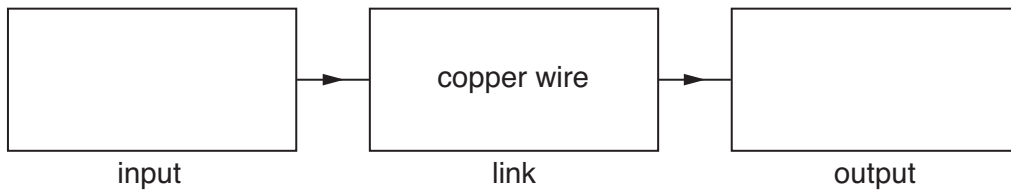
[2]

(b) The system uses **binary code** to send messages from one place to another.

   (i) State another code which can be used to send messages along wires.

   ....

   .... **[1]**

   (ii) Sound can also be used to carry messages by using a code.

   Describe an example of the use of sound to carry a coded message.

   ....

   .... **[1]**

   [Total: 4]

END OF QUESTION PAPER

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