

**GENERAL CERTIFICATE OF SECONDARY EDUCATION**

**TWENTY FIRST CENTURY SCIENCE**

**A326/02**

**ADDITIONAL APPLIED SCIENCE A**

Unit 5: Communications (Higher 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)

**Tuesday 22 June 2010  
Morning**

**Duration: 45 minutes**



Candidate Forename		Candidate Surname	
--------------------	--	-------------------	--

Centre Number						Candidate Number				
---------------	--	--	--	--	--	------------------	--	--	--	--

**MODIFIED LANGUAGE**

**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.

Answer **all** the questions.

1 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.

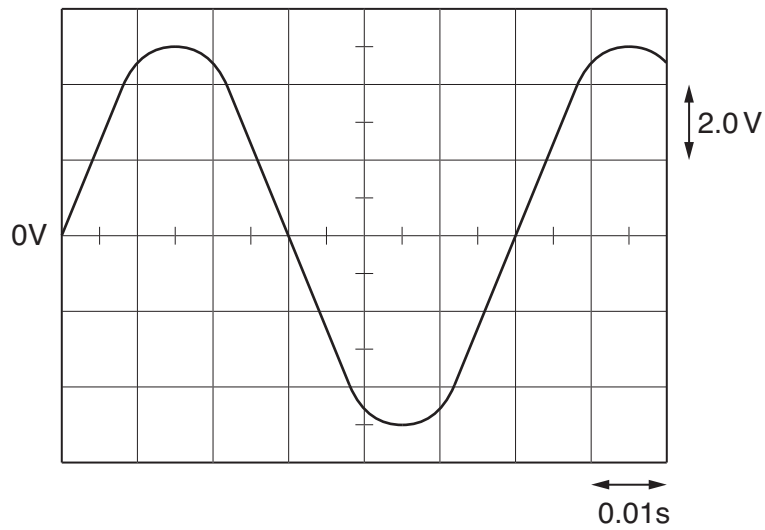
Complete the table to show the correct order.

<b>B</b>						<b>G</b>
----------	--	--	--	--	--	----------

[2]

[Total: 7]

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



(a) Calculate the amplitude of the signal.

amplitude = ..... V [2]

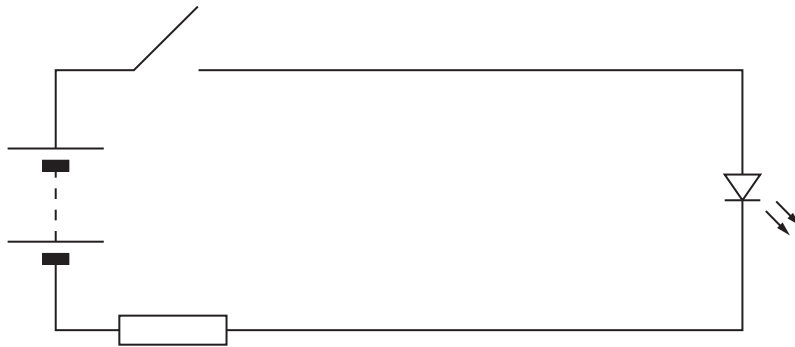
(b) Calculate the frequency of the signal.

Show that it is about 17 Hz.

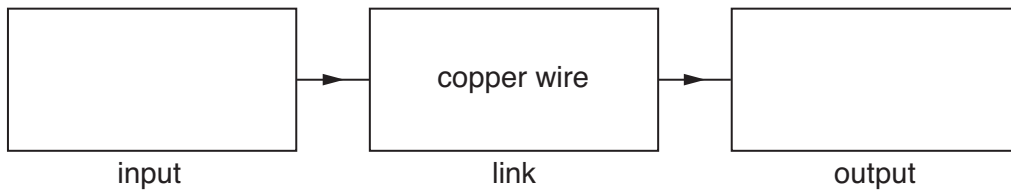
answer = ..... [1]

[Total: 3]

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



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



[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]

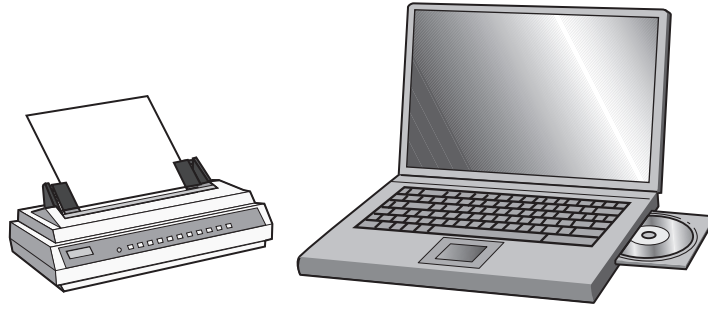
(ii) Sound can also be used to carry messages by using a code.

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

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

[Total: 4]

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



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

	printer name		
	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	230V mains or 6V battery	6V battery only	230V mains only
possible computer connections	USB cable optical fibre	USB cable radio wave	optical fibre radio wave

- (a) Jo wants a printer which can be placed away from the laptop, anywhere in the house or garden.

Which printer should she use?

Justify your choice.

.....

.....

.....

..... [3]

(b) The computer transmits data to the printer in digital format.

(i) Explain the difference between a digital format and an analogue one.

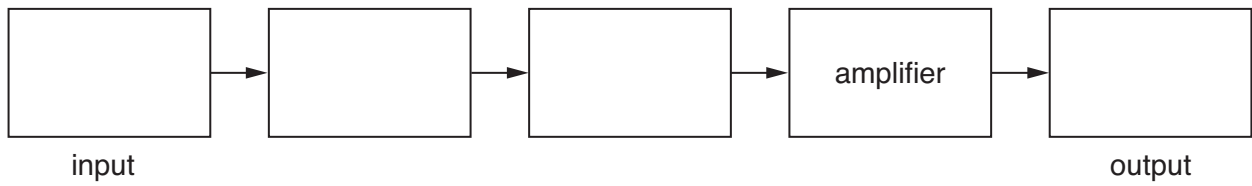
.....  
.....  
..... [2]

(ii) What are the advantages of sending the data in digital format?

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

[Total: 7]

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



(a) Complete the block diagram for the radio receiver.

[3]

(b) All of the blocks change the signals which pass through them.

There is an **input** block on the left.

There is an **output** block on the right.

(i) What type of block are the other three?

..... blocks [1]

(ii) In what way are these blocks different from input and output blocks?

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

(c) The radio receiver picks up a broadcast with a frequency of 1.5 MHz.

(i) In which radio band is this frequency?

..... [1]

(ii) Use the equation  $c = f\lambda$  to calculate the wavelength of the radio waves.

Show your working.

$c = 300\,000\,000\text{ m/s}$   
 $1\text{ MHz} = 1\,000\,000\text{ Hz}$

wavelength = ..... m [2]



(d) The radio broadcast uses amplitude modulation with a bandwidth of 10kHz for each channel.

(i) What is meant by the term **amplitude modulation**?

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

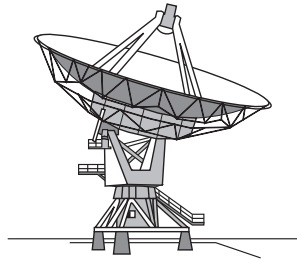
(ii) What is meant by the term **bandwidth**?

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

[Total: 10]

6 Messages can be sent from one place to another in different ways.

One way is to pass a radio wave through the atmosphere.



(a) Give an example of a communication system that sends **another** type of signal along a link.

Your answer should include

- a description of the link
- the name of the signal which passes through it
- why your example uses that type of link.

.....

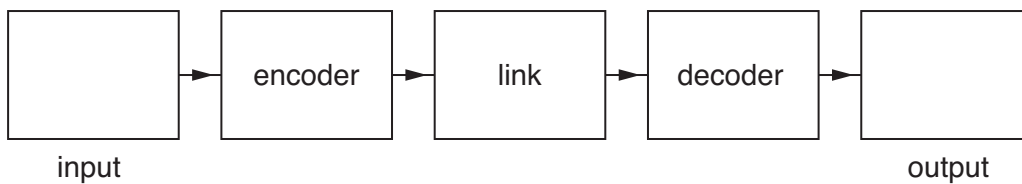
.....

.....

.....

..... [3]

(b) Complete the block diagram below for your communication system.



[2]

[Total: 5]

**END OF QUESTION PAPER**

11  
BLANK PAGE

PLEASE DO NOT WRITE ON THIS PAGE

**PLEASE DO NOT WRITE ON THIS PAGE**



**Copyright Information**

OCR is committed to seeking permission to reproduce all third-party content that it uses in its assessment materials. OCR has attempted to identify and contact all copyright holders whose work is used in this paper. To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced in the OCR Copyright Acknowledgements Booklet. This is produced for each series of examinations, is given to all schools that receive assessment material and is freely available to download from our public website ([www.ocr.org.uk](http://www.ocr.org.uk)) after the live examination series.

If OCR has unwittingly failed to correctly acknowledge or clear any third-party content in this assessment material, OCR will be happy to correct its mistake at the earliest possible opportunity.

For queries or further information please contact the Copyright Team, First Floor, 9 Hills Road, Cambridge CB2 1GE.

OCR is part of the Cambridge Assessment Group; Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.