

**GENERAL CERTIFICATE OF SECONDARY EDUCATION  
TWENTY FIRST CENTURY SCIENCE  
ADDITIONAL APPLIED SCIENCE A**

**A326/02**

Communications  
(Higher Tier)

**Wednesday 24 June 2009  
Morning**

**Duration: 45 minutes**

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)



Candidate Forename		Candidate Surname	
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Centre Number						Candidate Number				
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**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, however additional paper may be used if necessary.

**INFORMATION FOR CANDIDATES**

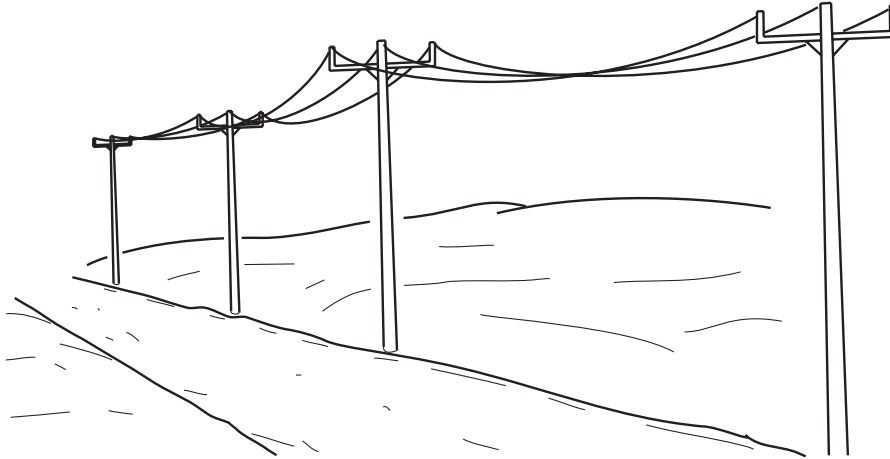
- The number of marks is given in brackets [ ] at the end of each question or part question.
- The total number of marks for this paper is **36**.
- This document consists of **12** pages. Any blank pages are indicated.

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Answer **all** the questions.

- 1 The invention of the Morse telegraph in 1844 increased the **distance** over which people could communicate.



The Morse telegraph uses long and short pulses of electricity to transmit information along copper wires.

For the system to work, the receiver and transmitter have to use the same shared code of long and short pulses.

- (a) Give two **other** examples of shared codes which are used in communications.

1 .....

.....

2 .....

..... [2]

- (b) Morse code is digital. State **two** advantages of sending information in a digital code.

1 .....

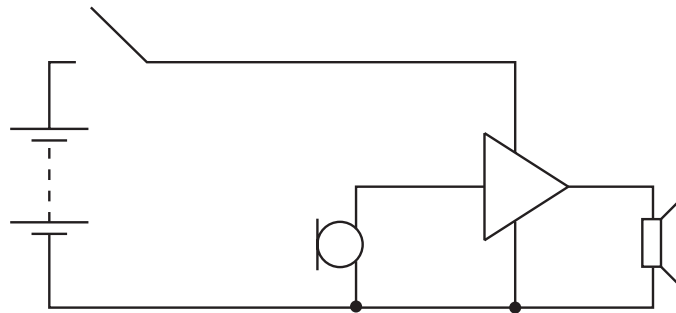
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2 .....

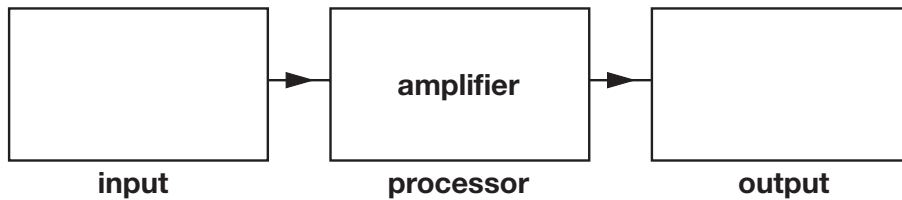
..... [2]

[Total: 4]

2 Here is a circuit diagram of a simple intercom.



(a) Complete the block diagram for the system.



[2]

(b) The intercom contains an amplifier. Complete the sentences for the amplifier. Choose words from the list.

**alternating      digital      direct      amplitude      frequency      modulation**

The amplifier increases the ..... of the input signal.

Amplifiers only work with ..... voltage signals.

[2]

(c) The intercom has this symbol stamped on its casing. What does the symbol mean?



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

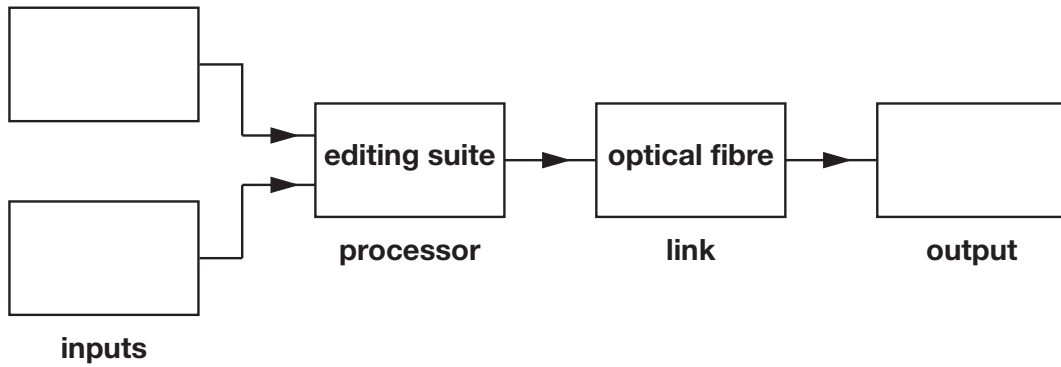
(d) The intercom uses copper wire as the link.  
This is because copper wire is cheap and easy to use over a short distance.

Give an example of a communications system which uses **radio waves** as the link.  
Explain why radio waves are used for the link.

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

[Total: 7]

3 Here is an incomplete block diagram for a cable TV system operating from a studio.



(a) The diagram shows that the system has two different types of input device, but a single output device.

Complete the block diagram. [2]

(b) Explain how the system is managed by people.

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

(c) The link for the cable TV system is optical fibre.

(i) What carries information through optical fibre?

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

(ii) Give another example of a communication system which uses optical fibre as the link. Explain why optical fibre is the **best** type of link to use.

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

- (d) Cable TV uses digital coding.  
Some TV signals are still broadcast from radio masts.  
They use analogue coding of the TV signal instead of digital coding.

State **two** advantages of using analogue coding.

.....

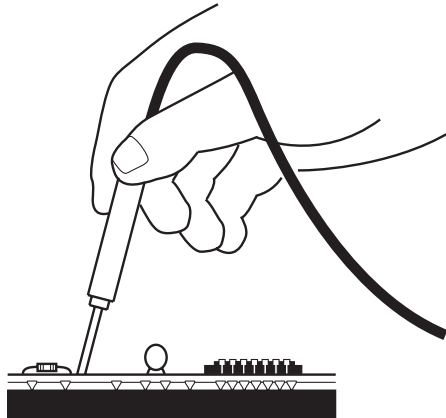
.....

.....

..... [2]

[Total: 9]

- 4 Sally is a communications engineer.  
She tests a piece of faulty equipment with an oscilloscope.



- (a) Sally needs to measure the frequency of a signal across a  $22\ \Omega$  resistor.  
Explain how to measure frequency from the trace on the screen of an oscilloscope.

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

- (b) She measures the amplitude of the signal as  $0.56\text{V}$  and the frequency as  $440\text{Hz}$ .  
Calculate the amplitude of the current in the  $22\ \Omega$  resistor.  
Show your working.

Use the equation  $I = \frac{V}{R}$ .

current = ..... A [2]

- (c) Sally needs to connect the equipment to the mains supply during her tests.  
She checks that the mains supply has an **earth leakage device**.  
Explain how an earth leakage device improves Sally's safety while she tests the equipment.

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

[Total: 6]

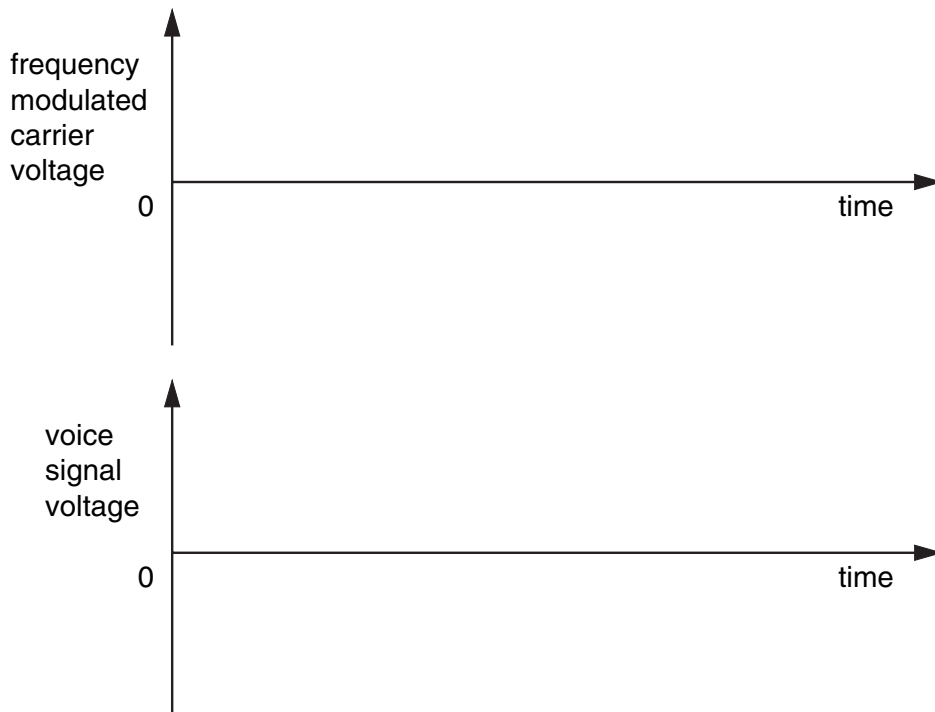


- 5 Sam is a security guard in a shopping precinct.  
He uses a two-way radio to keep in touch with the other security guards.



- (a) The communications system uses frequency modulation of the radio waves to carry voice signals between the handsets.

Draw graphs to show the frequency modulated carrier voltage and voice signal voltage over the same time interval.



[2]

(b) At the start of each shift Sam needs to check that his handset is set to channel 42 in the terrestrial TV band.

(i) State a value for the frequency of a radio wave in the terrestrial TV band.

frequency = ..... unit.....[1]

(ii) Channel 42 has a bandwidth of 6 MHz.  
What does **bandwidth** mean?

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

(c) When Sam uses his handset, radio waves are transmitted and received by the aerial.  
What is the best type of aerial for Sam's handset?

Give a reason for your answer.

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

[Total: 5]

6 Ann uses a website to buy some clothes on the internet.



She uses the keyboard to enter her credit card details.  
The details are stored as a 128 byte code on the hard disc of the computer.

(a) How many bits are there in 128 bytes?

answer ..... [1]

(b) Before placing the details on the internet, the 128 bytes are encrypted with a code received from the website. This makes her details secure from all other users of the internet except the website.

Give **another** example of a communications system where encryption is used.  
Give a reason why the security is necessary.

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

(c) The encrypted code is **compressed** just before it is sent on the internet.  
Why is it compressed?

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

(d) The code arrives at the website server shortly after it leaves Ann's computer.  
A server is an example of a **processor**.  
Explain the function of a processor in a communications system.

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

[Total: 5]

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