

**GENERAL CERTIFICATE OF SECONDARY EDUCATION
 TWENTY FIRST CENTURY SCIENCE
 ADDITIONAL APPLIED SCIENCE A
 Communications (Higher Tier)
 FRIDAY 25 JANUARY 2008**

A326/02

Morning
 Time: 45 minutes

Candidates answer on the question paper.

Additional materials: Calculator
 Pencil
 Ruler (cm/mm)



Candidate Forename

Candidate Surname

Centre Number

Candidate Number

INSTRUCTIONS TO CANDIDATES

- Write your name in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use blue or 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.
- Do **not** write outside the box bordering each page.
- Write your answer to each question in the space provided.

INFORMATION FOR CANDIDATES

- The number of marks for each question is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is **36**.

FOR EXAMINER'S USE		
Qu.	Max.	Mark
1	5	
2	10	
3	8	
4	7	
5	6	
TOTAL	36	

This document consists of **11** printed pages and **1** blank page.

Answer **all** the questions.

- 1 This question is about how a company determines product specifications.



Cambridge Radio Solutions is designing a new two-way radio system for use on farms.

- (a) They start to fill in a specification for the new two-way radio system.

key factor	notes
cost	must be cheaper to use than mobile phones
network coverage	use citizen band frequencies to avoid need for a licence

Write in **three** more key factors, with notes to justify them.

[3]

- (b) The design team at Cambridge Radio Solutions discuss some wider aspects of the product specification.



One aspect they consider is their profit margin.

This is how much money they need to make on each two-way radio system that they sell.

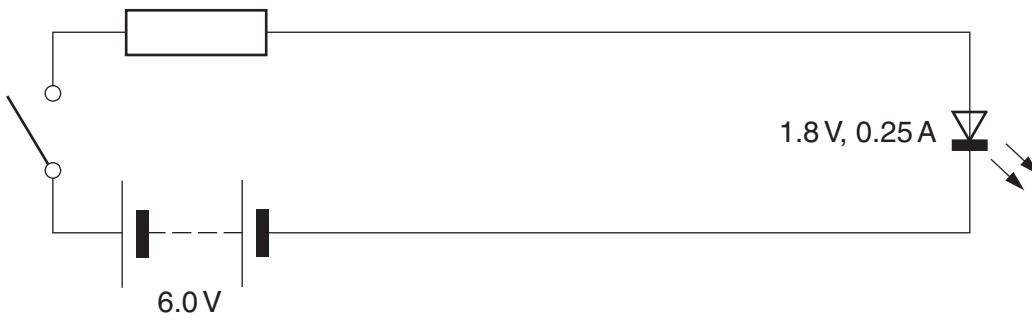
Suggest and justify **two** other wider aspects of the product specification that they should consider.

wider aspect	notes
profit margin	we must make money on each system or we'll go bust

[2]

[Total: 5]

2 Here is the circuit diagram of a simple message system.



(a) When the LED is operating, its voltage and current are 1.8V and 0.25 A.

(i) Draw a voltmeter connected to measure the voltage across the LED. [2]

(ii) Calculate the power of the LED when the switch is closed.

Use $P = VI$.

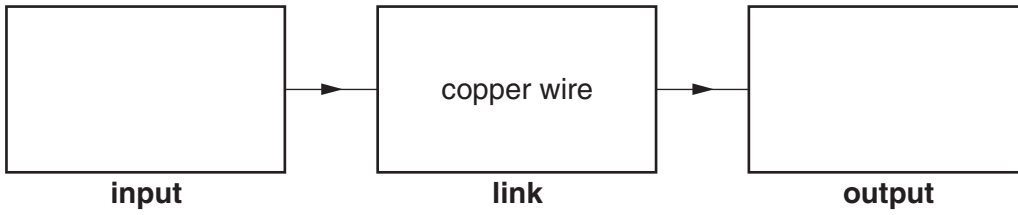
power = W [2]

(iii) Explain how the resistor protects the LED in the circuit.

.....

 [2]

(b) Here is an incomplete block diagram for the simple message system shown on the previous page.



(i) Complete the diagram by putting the names of the components in the **input** and **output** blocks. [2]

(ii) What does the block diagram show?

.....

.....

.....

..... [2]

[Total: 10]

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



(a) Complete the diagram by entering these words into the boxes.

aerial

amplifier

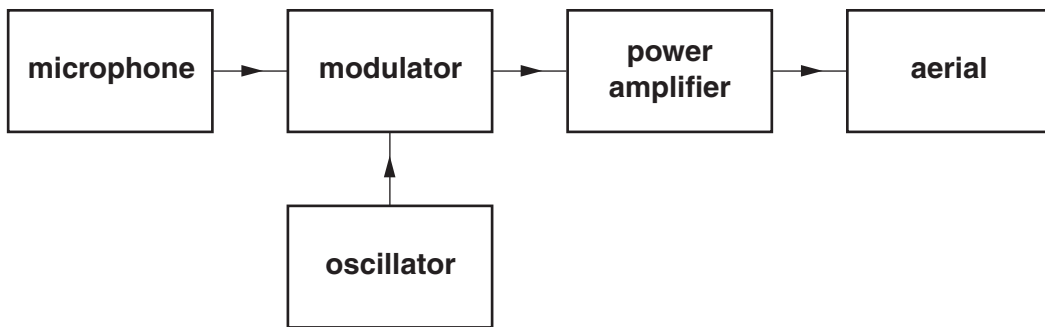
demodulator

loudspeaker

tuner

[3]

(b) Here is the block diagram of the radio **transmitter**.



The transmitter uses frequency modulation.

Describe the process of frequency modulation.

You may draw diagrams of the signals to help your answer.

.....

.....

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

(c) The bandwidth of frequency modulated radio broadcasts in the VHF band is 100 kHz.

(i) What does **bandwidth** mean?

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

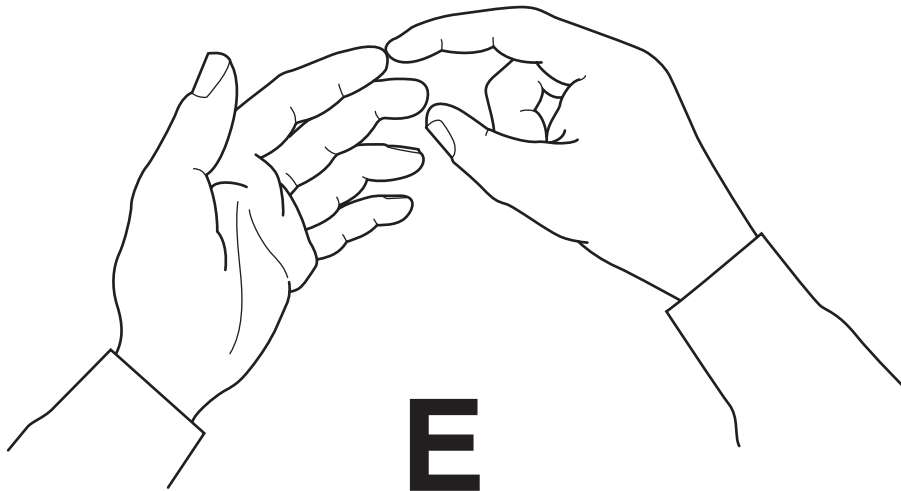
(ii) State a frequency for radio broadcasts in the VHF band.

frequency = MHz [1]

[Total: 8]

4 Sign language uses a visual code to communicate with deaf people.

Here is the code for the letter E.



(a) Name a **code** which uses digital electrical signals to communicate messages.

..... code [1]

(b) Sign language uses an analogue code. A digital code would have a lower **error rate** but also a lower **data transmission rate**. The **range** would remain unchanged.

What is meant by the terms in bold?

error rate

.....

data transmission rate

.....

range

..... [3]

(c) Video uses electrical signals in wires to send pictures.

Draw a block diagram for a simple video system.

Describe the function of each block.

.....

.....

.....

.....

.....

.....

..... [3]

[Total: 7]

5 Digital signals can be used to carry information about pictures.



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(a) The picture is displayed on a computer screen.

Complete the sentences. Choose words from the list.

- circles** **frame** **pixels** **rows** **screen** **window**

The whole picture is called a

It is made of which are arranged in

[3]

(b) A single picture on the screen requires 42 000 **bytes** of information.

(i) Calculate the number of **bits** of information for a single picture.

bits per picture = [1]

(ii) The video signal to the screen has a bit rate of 6 720 000 **bits** per second.

Calculate the refresh rate for the screen.

refresh rate = pictures per second [2]

[Total: 6]

END OF QUESTION PAPER

11
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