

Candidate Name	Centre Number	Candidate Number

WELSH JOINT EDUCATION COMMITTEE
General Certificate of Secondary Education



CYD-BWYLLGOR ADDYSG CYMRU
Tystysgrif Gyffredinol Addysg Uwchradd

298/01

ELECTRONICS

TERMINAL EXAMINATION

FOUNDATION TIER

P.M. TUESDAY, 13 June 2006

(1 hour 15 minutes)

For Examiner's use only	
Total	

ADDITIONAL MATERIALS

In addition to this question paper you may need a calculator.

INSTRUCTIONS TO CANDIDATES

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write **all** the answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

No certificate will be awarded to a candidate detected in any unfair practice during the examination.

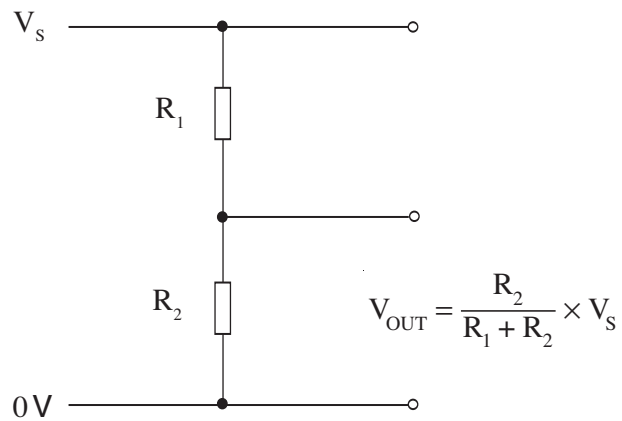
INFORMATION SHEET

This information may be of use in answering the questions.

1. Resistor Colour Codes

BLACK	0	GREEN	5
BROWN	1	BLUE	6
RED	2	VIOLET	7
ORANGE	3	GREY	8
YELLOW	4	WHITE	9

The fourth band colour gives the tolerance as follows:
GOLD $\pm 5\%$
SILVER $\pm 10\%$



$$A = \frac{V_{OUT}}{V_{IN}}$$

$$A = 1 + \frac{R_F}{R_1}$$

Answer **all** questions in the spaces provided.

1. Here is a list of electronic sub-systems:

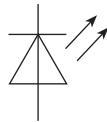
Time Delay Light sensor Latch Solenoid

- (a) Which **one** of these is an output sub-system? [1]
- (b) Which **one** of these is an input sub-system? [1]
- (c) Which **one** of these keeps the output on for a fixed length of time? [1]

2. Here is a list of electronic components:

transistor LED variable resistor LDR

- (a) Which component has this symbol? [1]

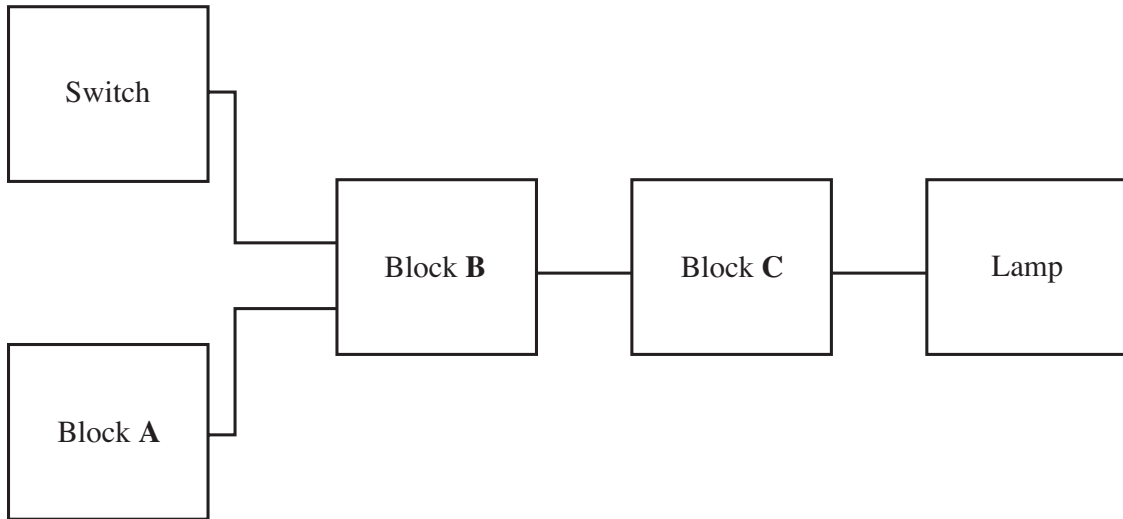


Answer

- (b) Which component from the list would you use to sense light? [1]

Answer

3. Here is a system that controls a garden lamp. The lamp comes on when the switch is operated and it is dark.



You can choose any of the following sub-systems to use for blocks **A**, **B** and **C**:

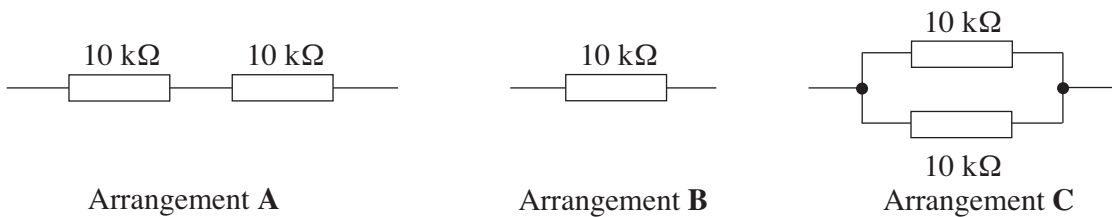
- Temperature sensing unit
- OR gate
- Pulse unit
- Transistor switch / transducer driver
- AND gate
- Light sensing unit

Which sub-system is:

- (a) a suitable unit for block **A**?
- (b) a suitable unit for block **B**?
- (c) a suitable unit for block **C**?

[3]

4. (a) Some 10 kΩ resistors are arranged as follows.



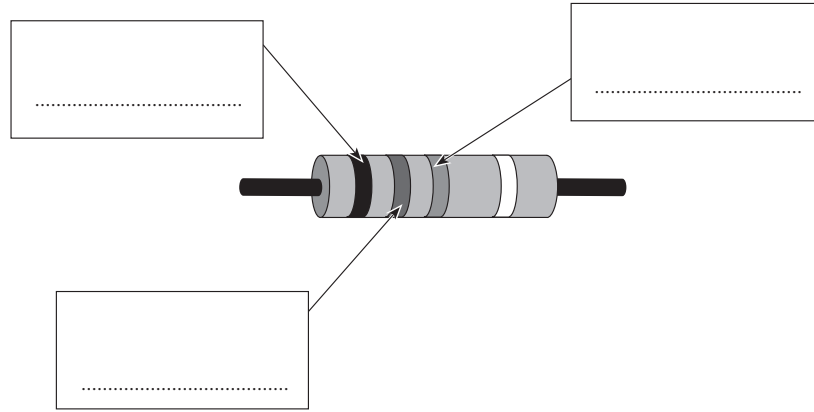
- (i) Which arrangement **A**, **B** or **C** has the *lowest* resistance?
- (ii) Which arrangement **A**, **B** or **C** has the *highest* resistance?

[2]

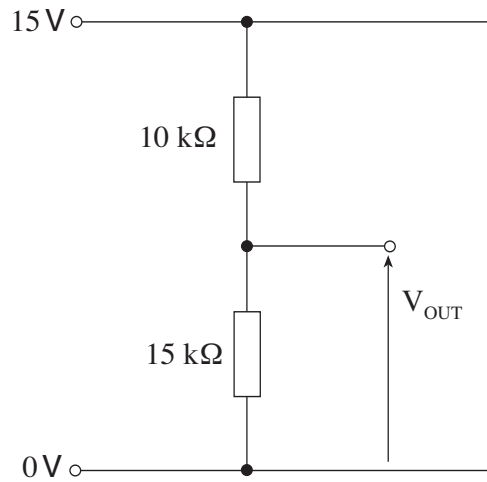
(b) Use the information sheet on page 2 to answer parts (i) and (ii).

- (i) Work out the colour code for a **10 kΩ** resistor.
Write the colours in the correct spaces on the diagram below.

[3]



- (ii) The 10 kΩ resistor is used in a voltage divider circuit as follows.



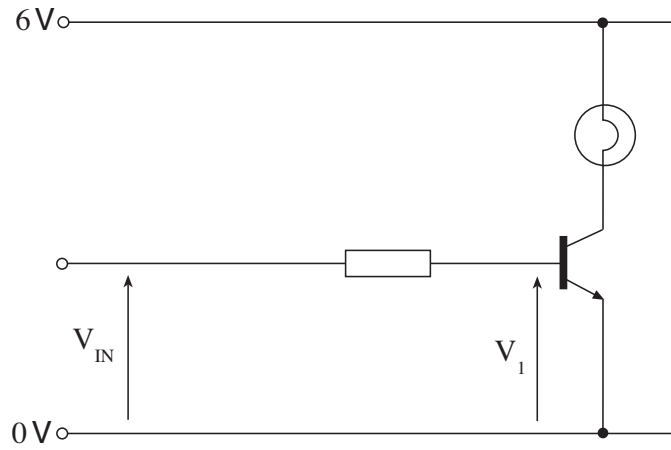
Calculate the output voltage V_{OUT} .

[2]

.....

.....

5. Here is a transistor circuit used to switch a bulb on and off.



The transistor is **just** saturated when the input voltage V_{IN} is 2.5 V.

Complete the following table to show the voltage V_1 and whether the bulb will be on or off.

V_{IN} (V)	V_1 (V)	Bulb On/Off?
0.4		
2.5		

[4]

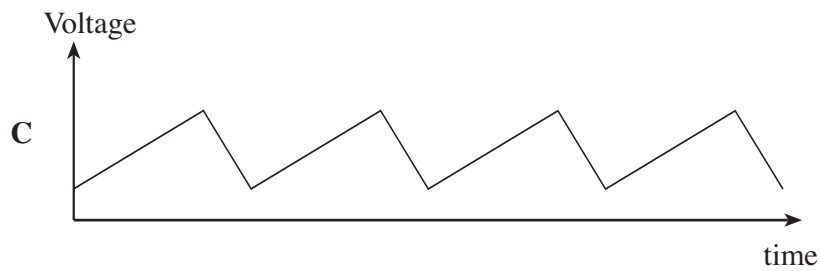
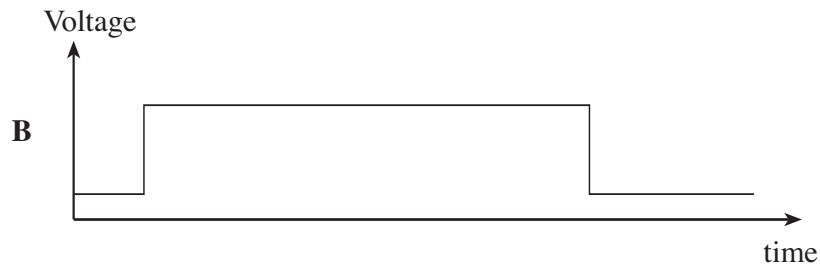
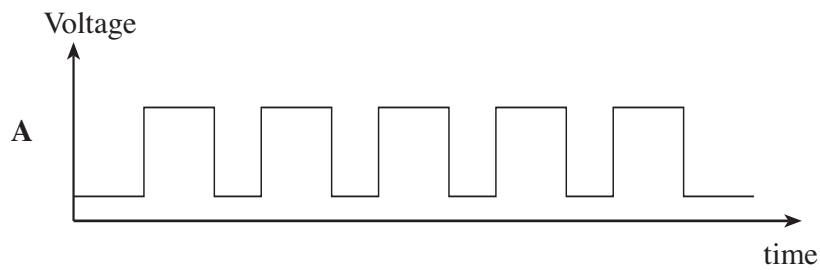
6. (a) Which of the following is another name for a monostable circuit?

- A Inverter
- B Time delay
- C Pulse generator
- D Latch

Answer

[1]

(b) Which of the following is the output signal produced by a monostable circuit?



Answer

[1]

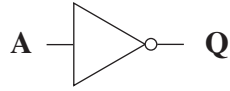
(c) Give one use of a monostable circuit.

[1]

.....

7. (a) Write the name of each logic gate in the space provided and complete the truth tables.

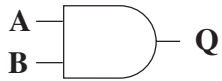
(i) **Gate 1**



Input	Output
A	Q
0	
1	

Name of gate:

(ii) **Gate 2**



Inputs		Output
A	B	Q
0	0	
0	1	
1	0	
1	1	

Name of gate:

[4]

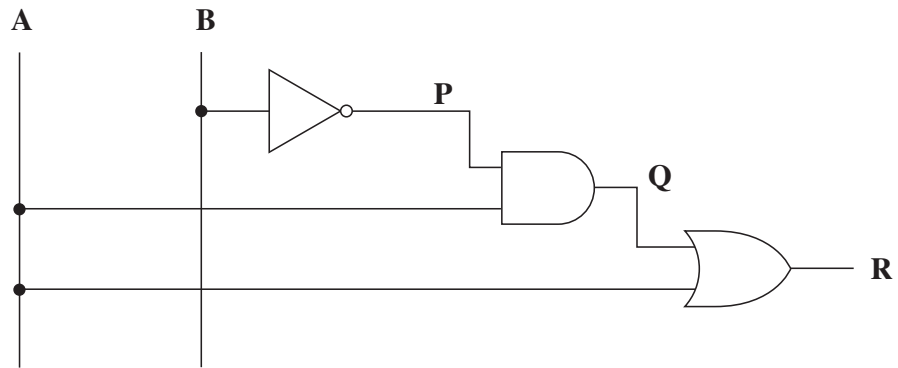
(b) (i) Give the name of a logic gate which produces an output that is the inverse (*opposite*) of **Gate 2** above.

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(ii) Draw the symbol of this gate in the space below.

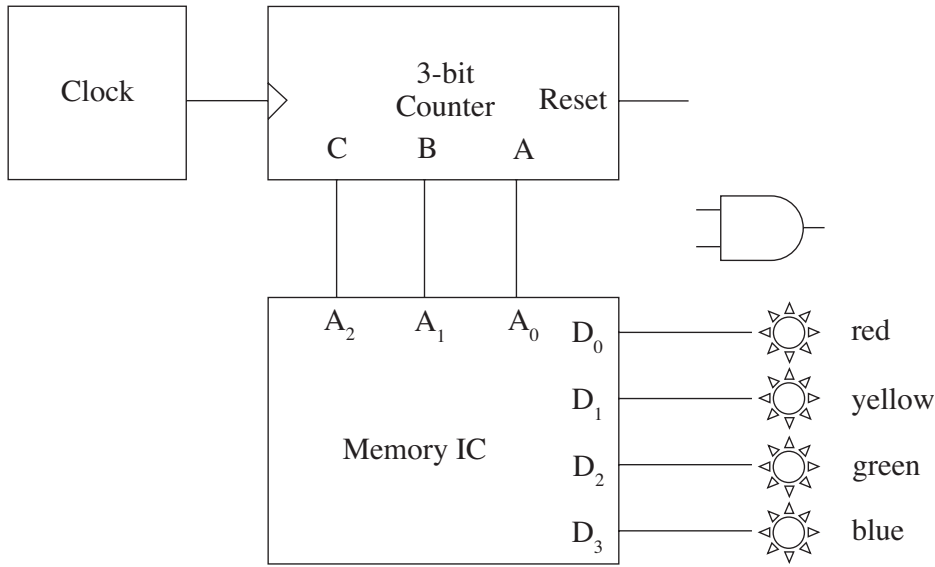
[2]

- (c) The two gates named in part (a) are arranged with an OR gate in the following logic system. Complete the truth table. [3]



Inputs		Outputs		
A	B	P	Q	R
0	0			
0	1			
1	0			
1	1			

8. An incomplete circuit diagram for a disco light system is shown below.



- The lamps display a 5 step sequence.
- The steps for the pattern are stored in a memory IC.
- Each memory location is accessed in turn under the control of a clock and 3-bit counter.
- Each lamp is on when its data output is 1.

Memory address			Data (to lamps)			
A ₂	A ₁	A ₀	D ₃	D ₂	D ₁	D ₀
0	0	0	0	0	0	0
0	0	1	1	0	0	0
0	1	0	1	1	0	0
0	1	1	1	1	1	0
1	0	0	1	1	1	1
1	0	1	Reset to start			

(a) The 3-bit counter is reset after the correct number of steps to allow the sequence to be repeated.

(i) Write down the memory address, in binary, of the first unused memory location. [1]

.....

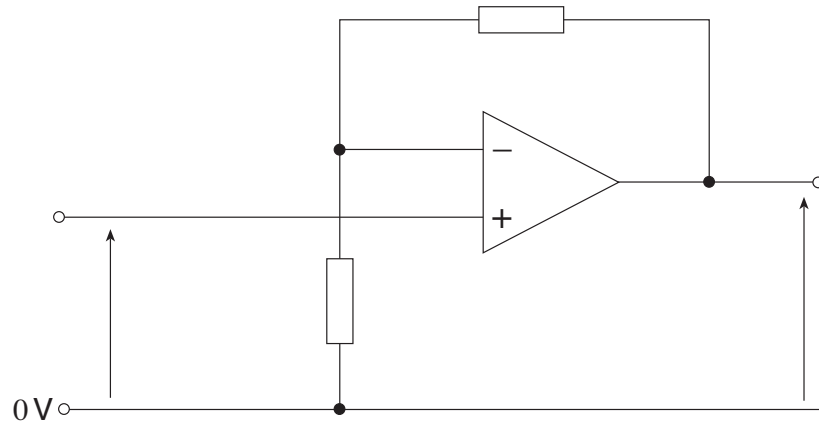
(ii) Complete the diagram above to show how the counter can be reset.

- C is the most significant bit of the counter.
- The counter is reset when the reset pin is taken to logic 1. [3]

(b) The clock gives 1 pulse every second. For how long is the green lamp on for in each sequence? [1]

.....

9. The following diagram shows a **non-inverting** amplifier.



(a) Label **each** of the following on the diagram above.

- Feedback resistor (label it R_F)
- Input voltage (label it V_{IN})
- Output voltage (label it V_O)
- Inverting input (label it G)

[4]

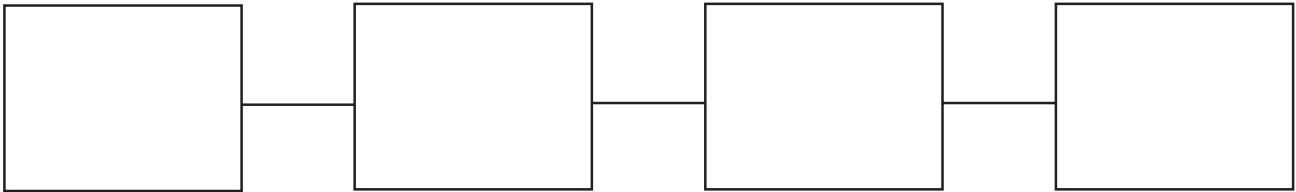
(b) The amplifier has a voltage gain of **30**.
If the input voltage is 10 mV, calculate the output voltage.

[2]

.....

.....

10. The following is a block diagram for a simple radio receiver.



(a) Label the boxes on the diagram above, choosing from the following list. [4]

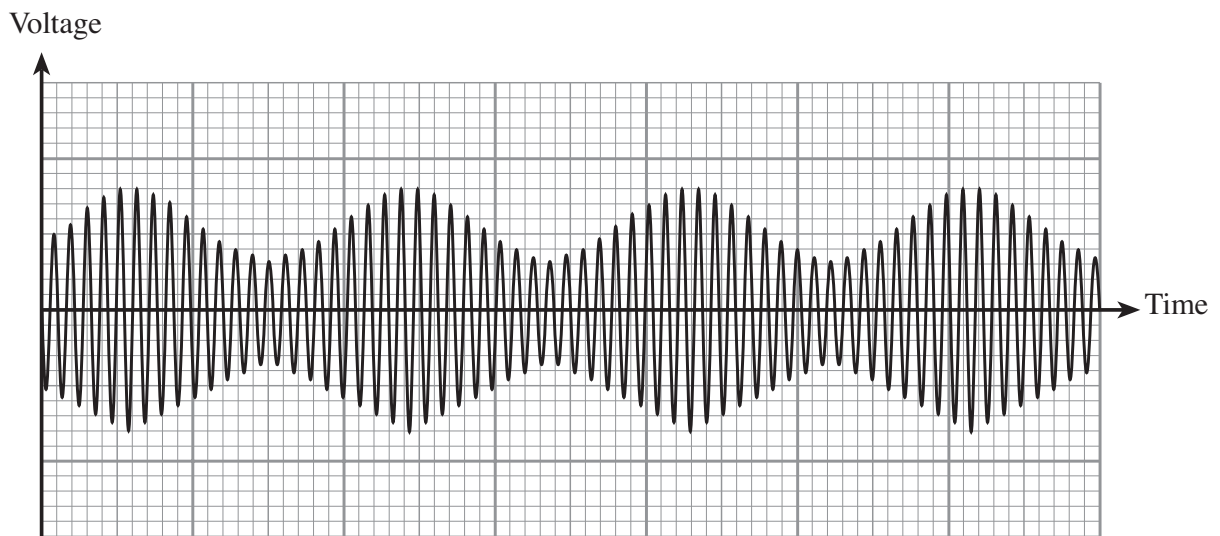
Demodulator Headphones Tuned circuit Aerial Microphone

(b) Choose any sub-system from the above list which:

- (i) is the input device to the radio.
- (ii) separates the audio signal from the radio signal.
- (iii) enables the audio signal to be heard.
- (iv) selects the radio station you want to listen to.

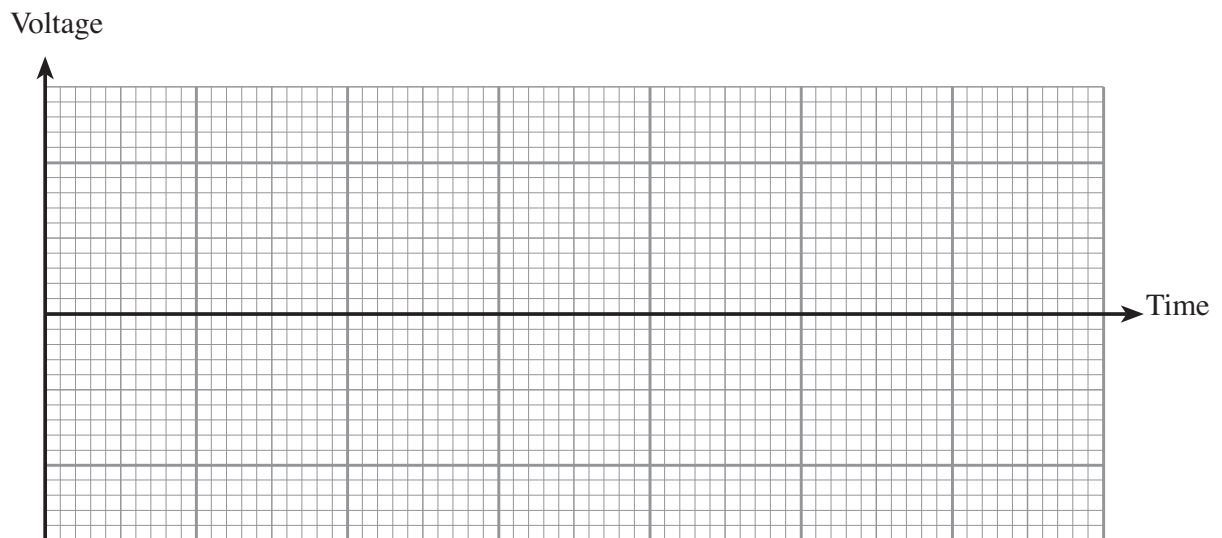
[4]

(c) The graph shows a modulated carrier wave.

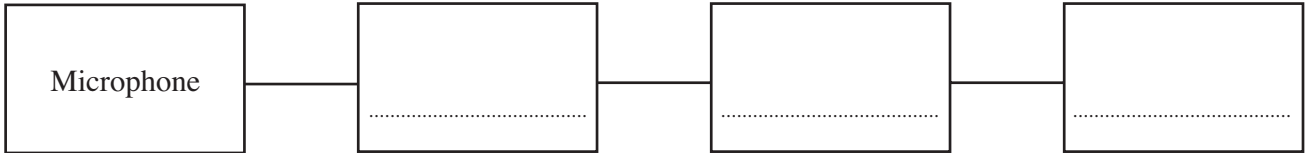


Use this information to sketch the audio signal which is being carried.

[2]



11. The block diagram for a public address system used in a school hall is shown below.

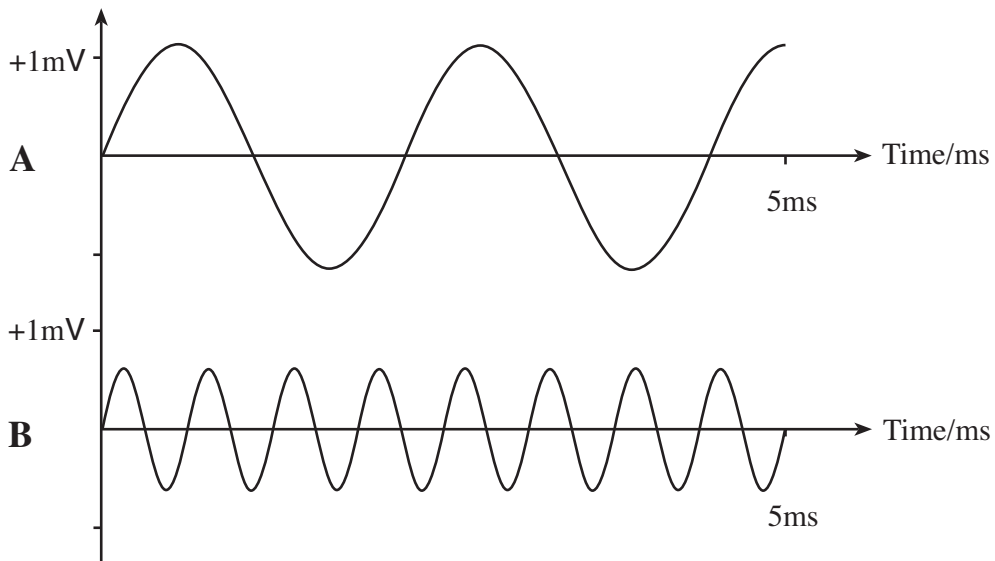


(a) Write the names of the other three blocks in the boxes on the above diagram. Choose from the following list.

Power amplifier Loudspeaker Comparator Pre-amplifier

[3]

(b) The following waveforms were produced by two microphones A and B.



(i) Which signal **A** or **B** is the **louder**?

[1]

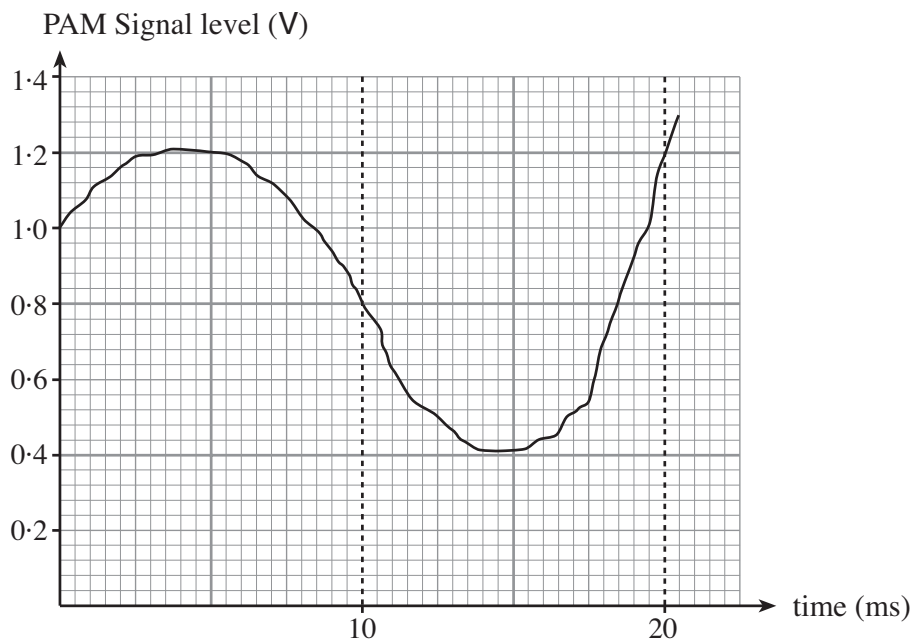
(ii) Which signal **A** or **B** has the **lower** pitch?

[1]

12. Two steps are needed to digitise an analogue signal.

- The signal must first be sampled to produce a PAM (pulse amplitude modulated) signal.
- The PAM signal is then converted to a binary signal by an ADC (analogue to digital converter).

The following graph shows the analogue signal being sampled at the times shown to produce the PAM voltage signal.



(a) Complete the table to show the PAM voltages.

Time of sampling pulse(ms)	PAM voltage(V)
0	1.0
10	
20	

[2]

(b) The following table shows some of the binary outputs from the ADC for various values of PAM voltage. Complete the table.

PAM voltage(V)	ADC binary output
0.2	0 0 0 1
0.4	0 0 1 0
0.6	0 0 1 1
0.8	
1.2	

[2]

13. The heating system in a new school is controlled by a computer program.

If the temperature is **below 17°C**, the heating is switched **ON**.

If the temperature is **above 21°C**, the heating is switched **OFF**.

(a) Name a suitable component to be used to sense the temperature. [1]

.....

(b) Older systems use a timer to switch the heating on for the same time every day. The new system uses feedback. Give **one** advantage of using feedback apart from cost. [1]

.....

(c) Why is it better to have two switching levels rather than switch the system ON and OFF at one temperature? [1]

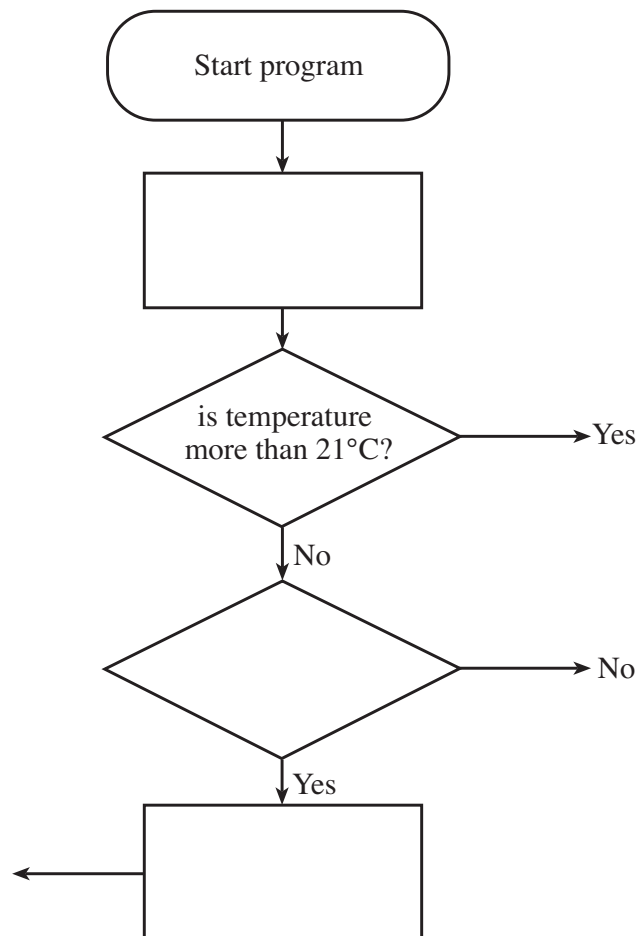
.....

(d) Complete the following flow chart for the program required by :

(i) writing the correct instruction from this list in the empty boxes.

heating ON *is temperature less than 17°C?* *heating OFF*

(ii) adding correct branches to the decision boxes.



[6]