

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, 12 June 2007

(1 hour 15 minutes)

For Examiner's use only	
Total Mark	

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 $\pm 10\%$

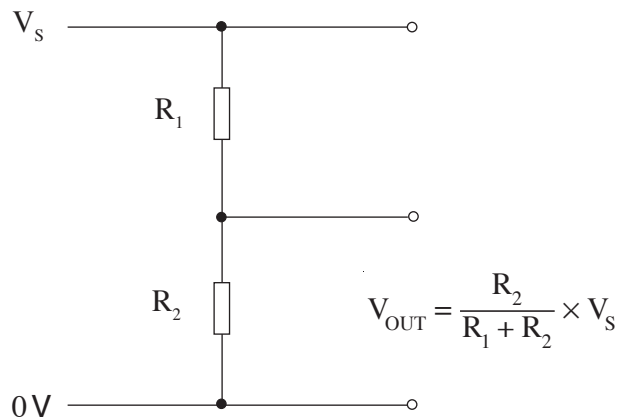
2. Preferred Values for Resistors

E 12 SERIES OF PREFERRED VALUES
10; 12; 15; 18; 22; 27; 33; 39; 47; 56; 68; 82 and multiples thereafter

3. Resistance = $\frac{\text{voltage}}{\text{current}}$; $R = \frac{V}{I}$.

4. Effective resistance, R, of two resistors R_1 and R_2 in series is given by $R = R_1 + R_2$.

5. Voltage Divider



6. Power = voltage \times current; $P = VI$.

7. LED The forward voltage drop across a LED is 2V.

8. Transistors

The forward voltage drop across the base emitter junction is 0.7V.

9. Amplifiers

Voltage gain $A = \frac{V_{\text{OUT}}}{V_{\text{IN}}}$.

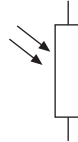
Non-inverting amplifier: $A = 1 + \frac{R_F}{R_1}$.

Answer all questions in the spaces provided.

1. Here is a list of electronic components:

LDR thermistor variable resistor LED

(a) Which component has this symbol?



Answer

[1]

(b) Which component from the list would you use to sense changes in temperature?

Answer

[1]

2. Here is a list of electronic subsystems:

comparator buzzer latch light sensor

Which subsystem:

(a) is an output?

[1]

(b) is an input?

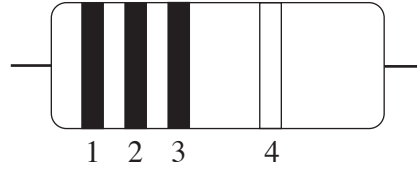
[1]

(c) stays on until it is reset?

[1]

3. The resistor colour code is given in the information sheet on page 2.

Here is a diagram of an $820\ \Omega$ resistor with a 5% tolerance.



Complete the following table.

[4]

Resistor value	Colour of Band 1	Colour of Band 2	Colour of Band 3	Colour of Band 4
$820\ \Omega \pm 5\%$				

4. Four bulbs **A**, **B**, **C** and **D** are working at the following currents and voltages.

Bulb	Current (A)	Voltage (V)
A	0.1	12
B	0.2	12
C	0.2	9
D	0.3	6

(a) Which bulb uses the **most** power? [1]

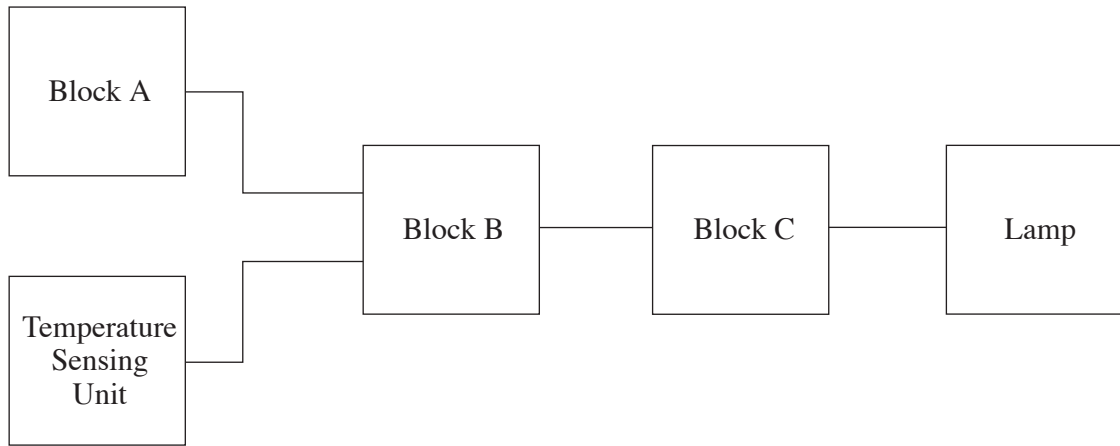
(b) Use the formula in the information sheet on page 2 to calculate the power used by bulb **C**.

.....

.....

[2]

5. Here is a system to warn a gardener if the soil is too cold or too wet.



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

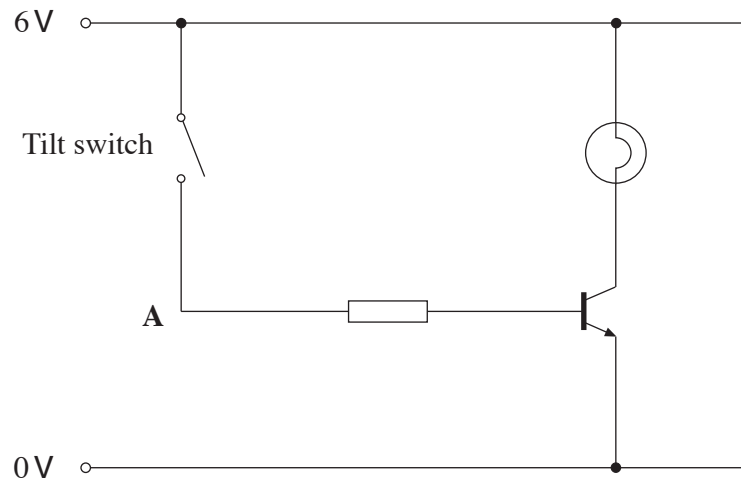
- moisture sensing unit OR gate light sensing unit latch*
comparator transistor switch / transducer driver

Which subsystem is:

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

[3]

6. The following circuit diagram shows a transistor switching circuit. The tilt switch is shown in the open position.



- (a) Complete the table:

Tilt switch	Bulb On/Off?
closed	
open	

[1]

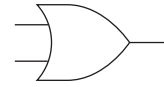
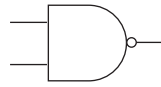
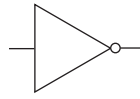
- (b) What is the voltage at A when the switch is closed?

[1]

- (c) Suggest a suitable application for the circuit.

[1]

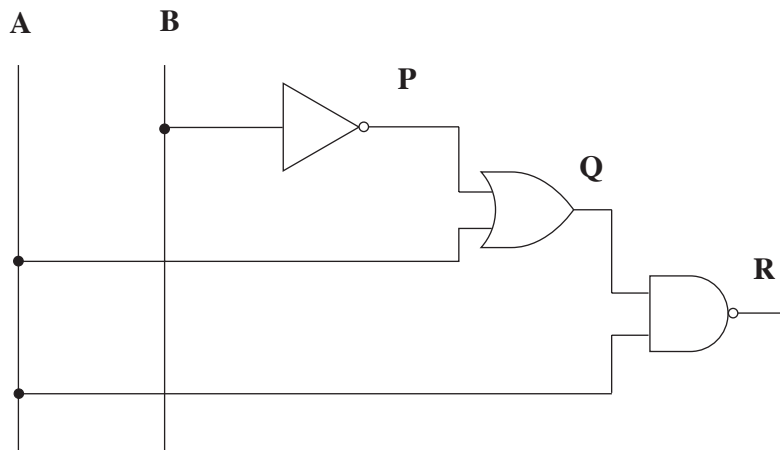
7. (a) Write the name of each logic gate in the space provided.



(i) (ii) (iii)

[3]

(b) The three logic gates are connected as follows.

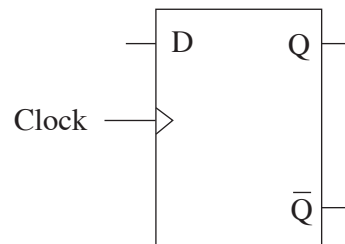


Complete the truth table.

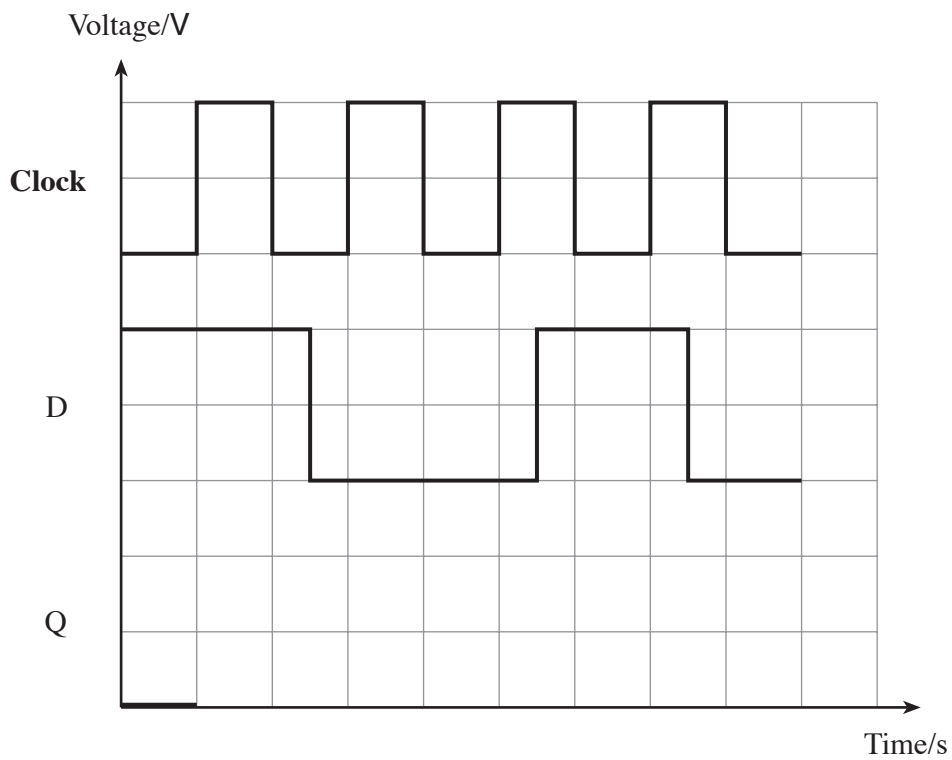
Inputs		Outputs		
A	B	P	Q	R
0	0			
0	1			
1	0			
1	1			

[3]

8. Here is a diagram of a D-type flip-flop.

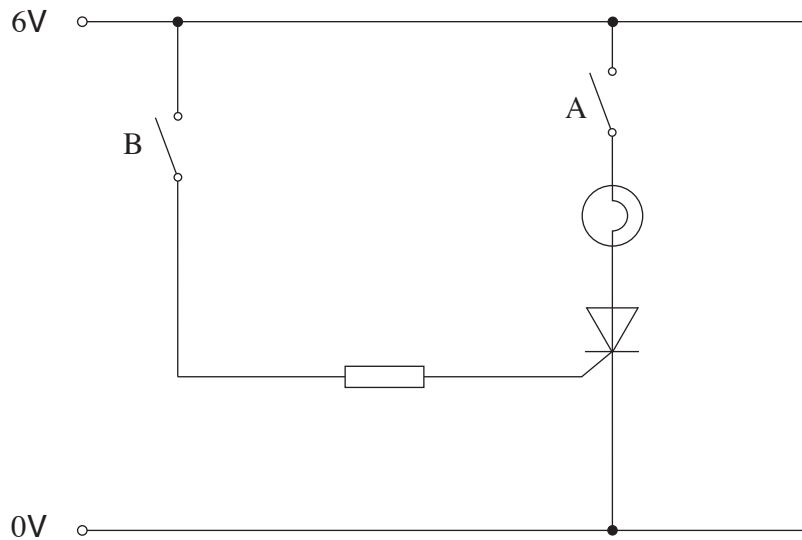


Complete the timing diagram below to show the output Q when the following signals are applied to the clock and D inputs.



[4]

9. The diagram shows a thyristor switching circuit.



To start with:

- the bulb is **OFF**
- both switches are **OPEN** as shown.

State what happens to the bulb when:

(a) switch **A** is closed,

..... [1]

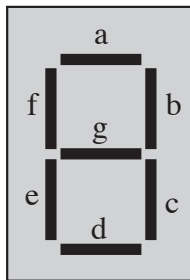
(b) switch **B** is then closed,

..... [1]

(c) switch **B** is then opened.

..... [1]

10. Here is a diagram of a seven segment display. It can be used to display numbers or letters.

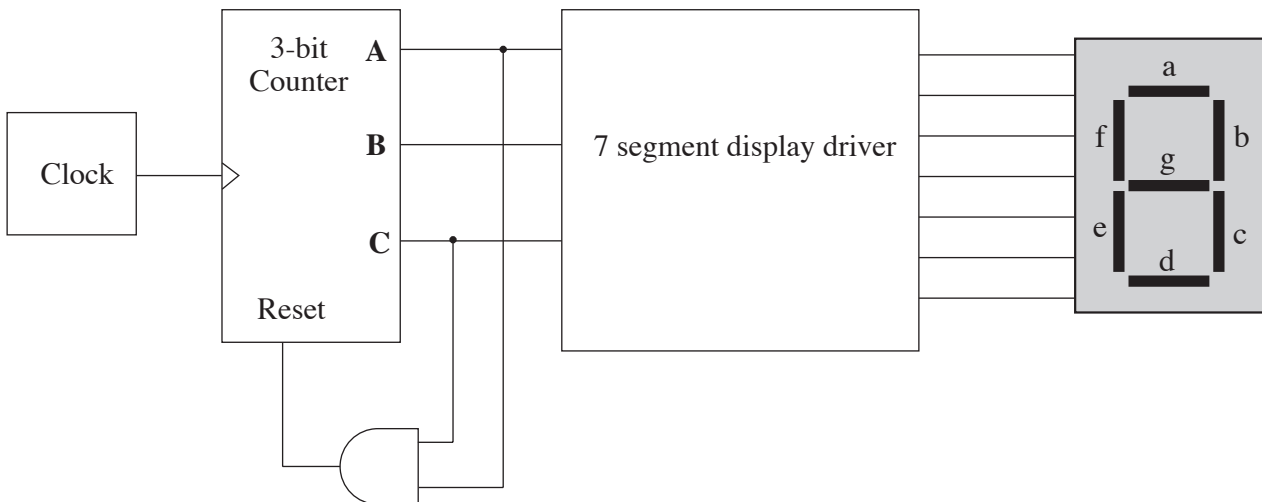


(a) Complete the following table to show which segments are lit when the following number and letter are displayed.

Number or letter	Segment						
	a	b	c	d	e	f	g
2	1	1	0				
b							

[2]

(b) A clock and three bit counter are connected to the display as follows. A is the least significant bit (LSB).



The counter is reset when it receives a logic 1 at the reset pin.

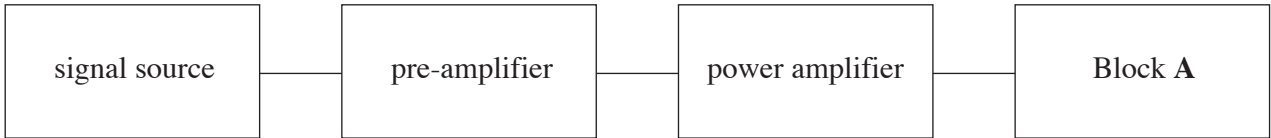
(i) At what count does it reset?

.....

(ii) What is the highest number displayed?

.....

11. The block diagram for a disco sound system is shown below.



(a) (i) Name one possible signal source.

..... [1]

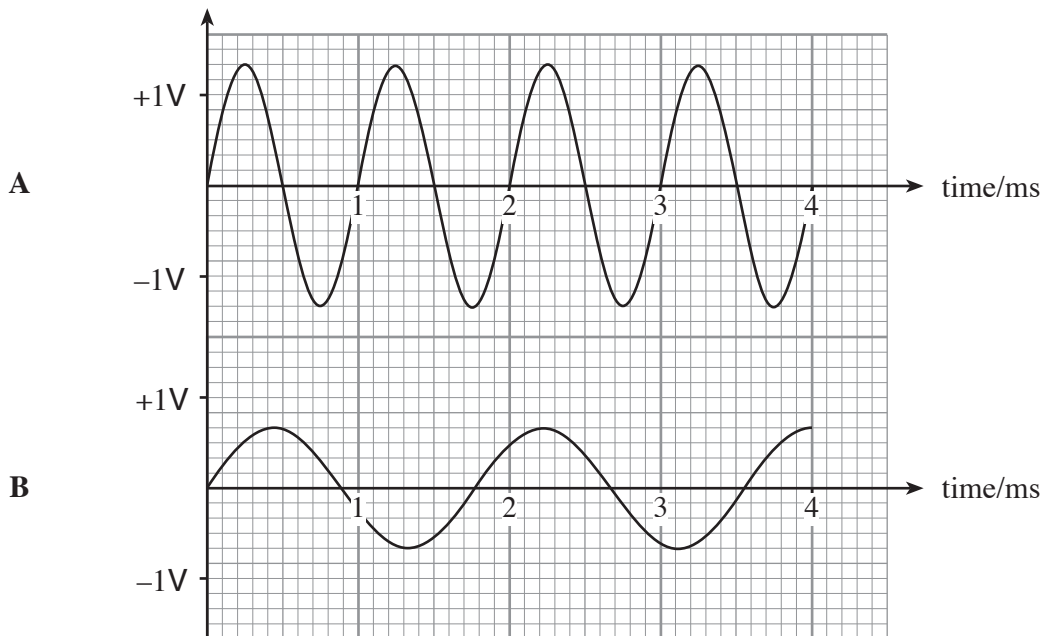
(ii) Why is a pre-amplifier needed?

.....
 [1]

(iii) What is Block A?

..... [1]

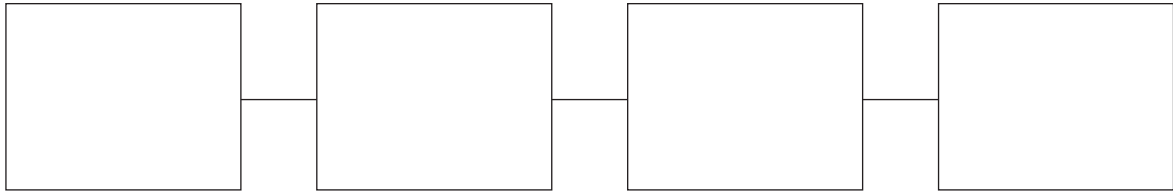
(b) The following waveforms were produced by two signal sources.



(i) Which signal, A or B, produces the **lower** pitch? [1]

(ii) Which signal, A or B, produces the **louder** sound? [1]

12. 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 tuned circuit headphones microphone aerial

(b) Choose any subsystem from the above list which:

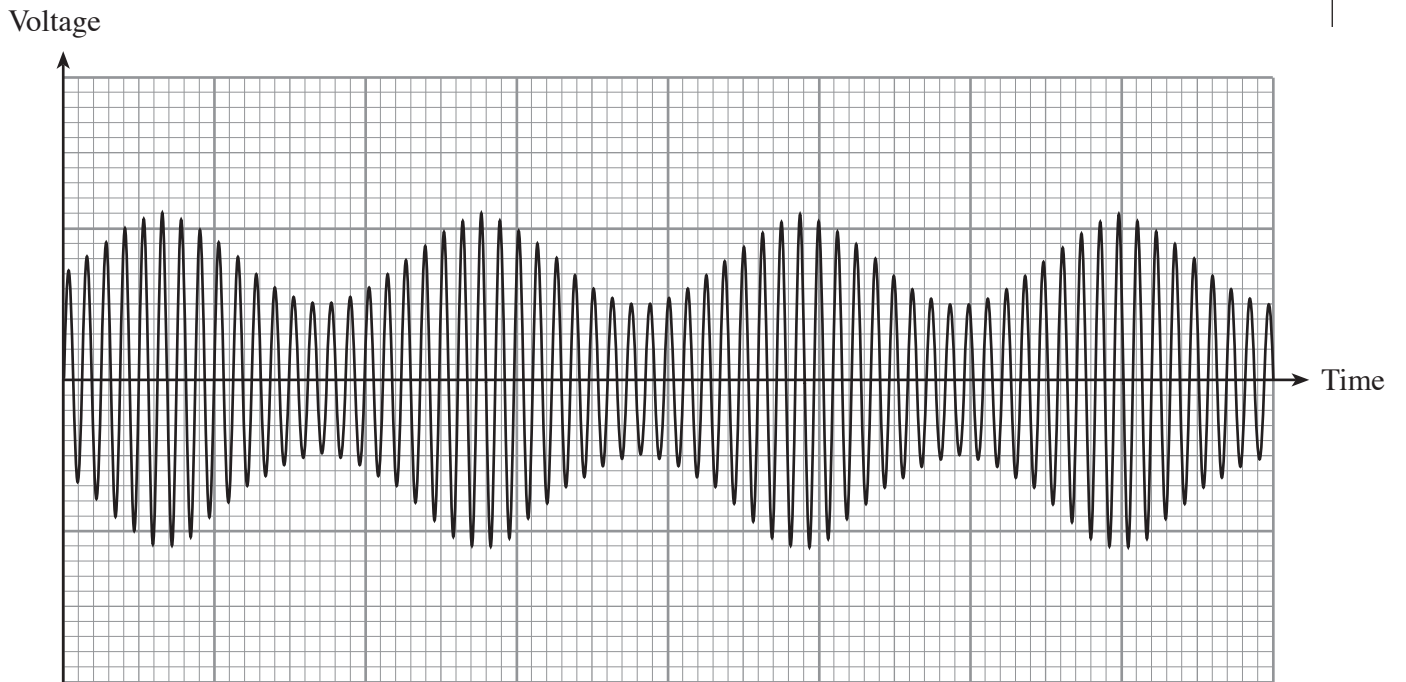
(i) is the input device to the radio.

(ii) enables the audio signal to be heard.

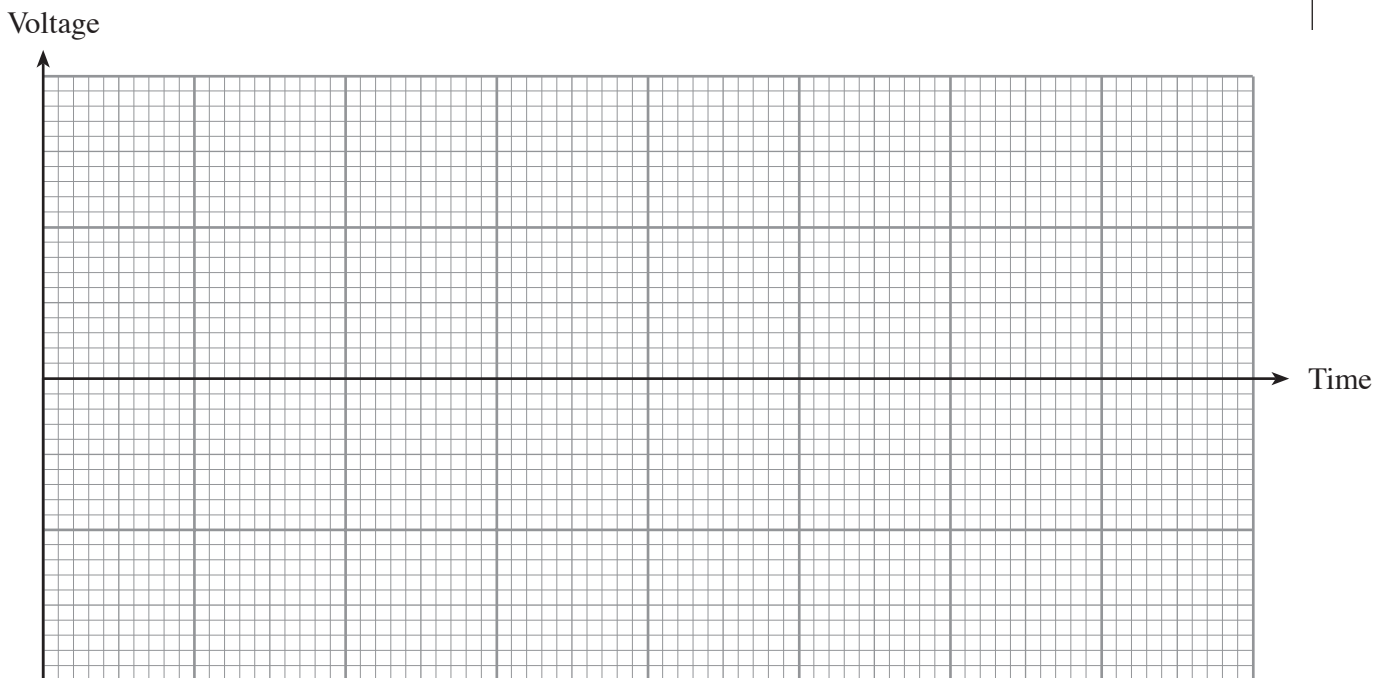
(iii) selects the radio station you want to listen to.

[3]

(c) The graph shows a modulated carrier wave.

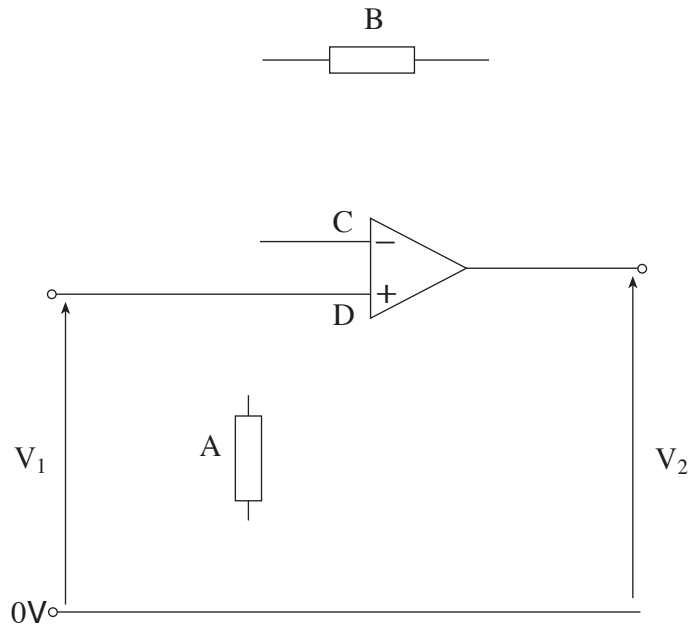


Use this information to sketch the audio signal which is being carried.



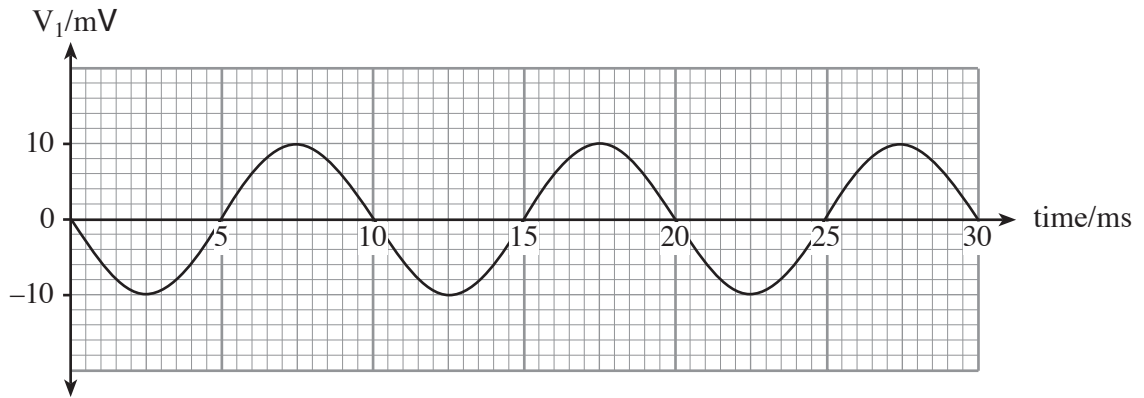
[2]

13. The diagram shows an incomplete **non-inverting** amplifier circuit.



- (a) (i) Which input, C or D, on the diagram is the **inverting input**? [1]
- (ii) Complete the diagram for the **non-inverting** amplifier. [2]
- (iii) Which resistor, A or B, is the **feedback resistor**? [1]

- (b) The resistors A and B are chosen to give a gain of 40.
The following signal is the input voltage V_1 .



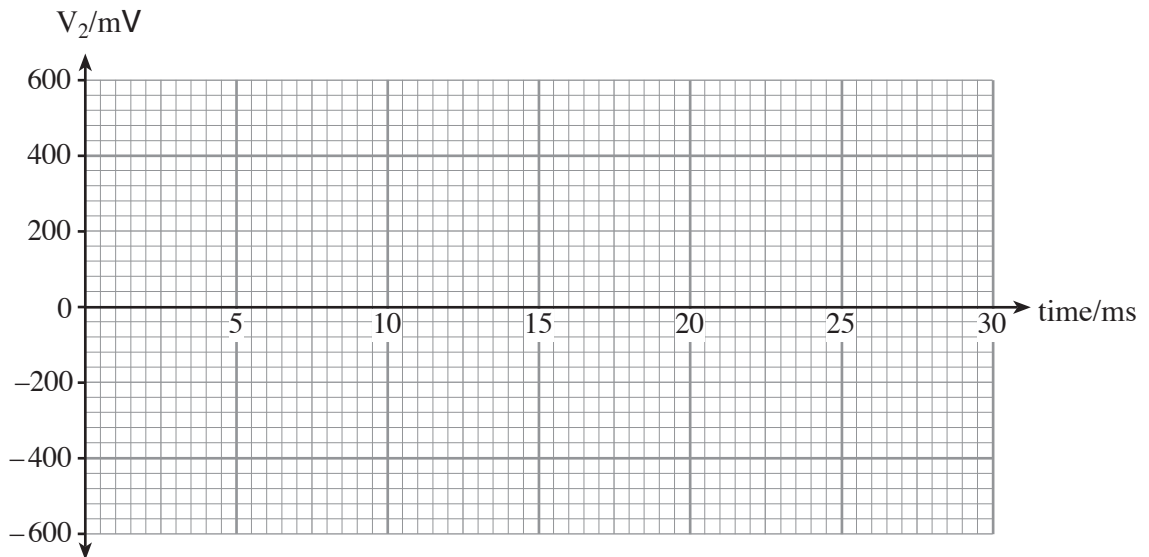
- (i) Calculate the highest value of the **output voltage** V_2 in mV.

.....

.....

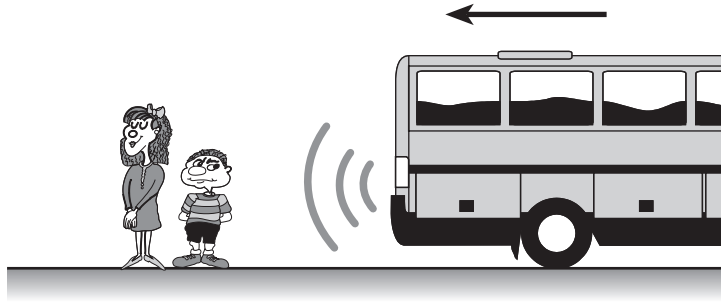
[2]

- (ii) Draw a graph of this output voltage V_2 .



[3]

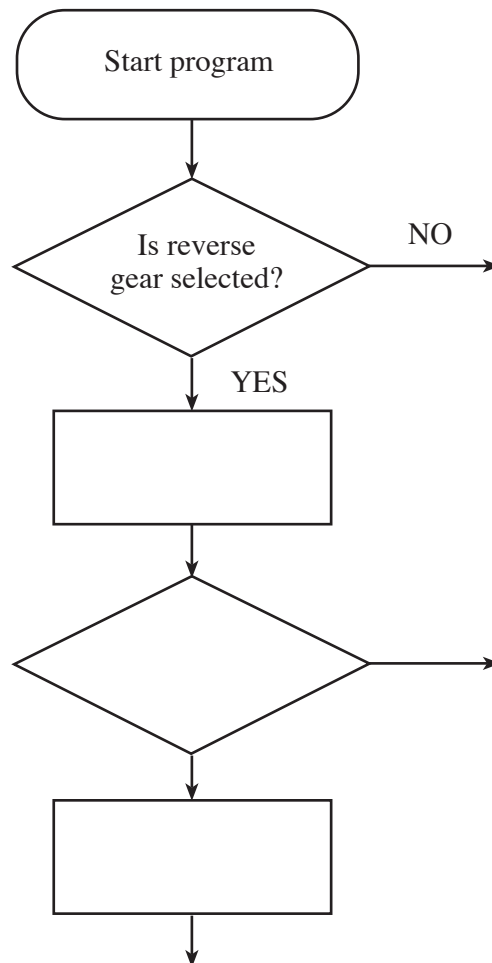
14.



Some school buses have a reversing system controlled by a microcontroller.

- The system pulses a bleeper when reverse gear is selected.
- The system also switches on a warning lamp inside the bus if it senses something near the back of the bus.

The flowchart shows **part** of the operation of this reversing system. Some parts of the flowchart have been left out.



(a) Name a suitable device to sense when reverse gear is selected.

[1]

(b) **Complete the flow chart** for the program required by:

- writing the correct instruction from this list in the empty boxes,

Is something near?
Switch on reverse bleeper
Switch on warning lamp

- adding correct branches to the decision boxes,
- writing yes/no on the second decision box.

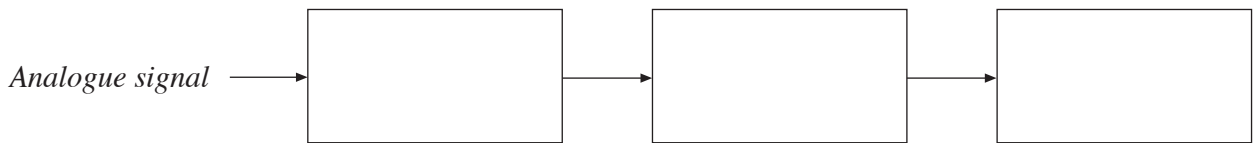
[6]

15. An analogue signal can be converted to a digital signal and transmitted as a series of binary numbers.

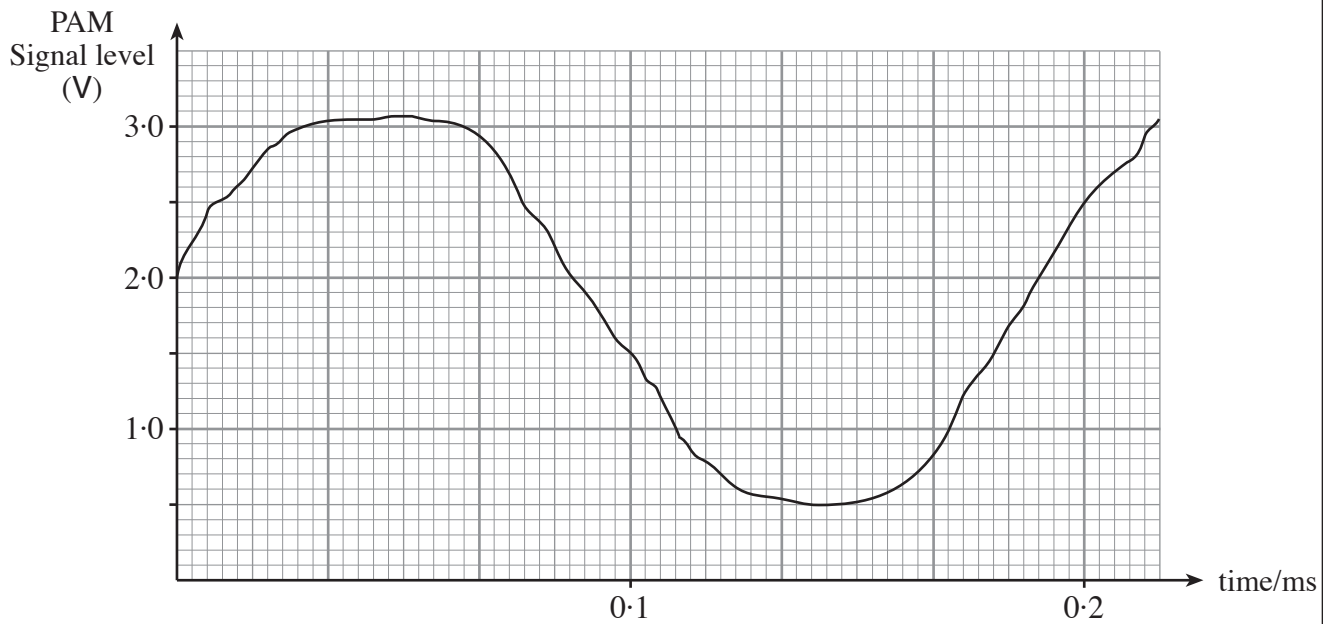
(a) The following lists the steps involved:

ADC (Analogue to digital conversion) sampling PAM signal

Write these steps in their correct order in the following boxes. [2]



(b) The following graph shows an analogue signal being sampled at the times shown.



Complete the table to show the PAM voltages.

time of sampling pulse (ms)	PAM voltage (V)
0	
0.1	
0.2	

[3]