Candidate Name	Centre Number	Candidate Number

WELSH JOINT EDUCATION COMMITTEE

General Certificate of Secondary Education

CYD-BWYLLGOR ADDYSG CYMRU

Tystysgrif Gyffredinol Addysg Uwchradd

293/01

ELECTRONICS

MODULE TEST E1

FOUNDATION TIER

P.M. THURSDAY, 25 May 2006

(45 minutes)

For Examiner's use only

Total Mark	

ADDITIONAL MATERIALS

In addition to this examination 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** the questions 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 ± 5%

SILVER ± 10%

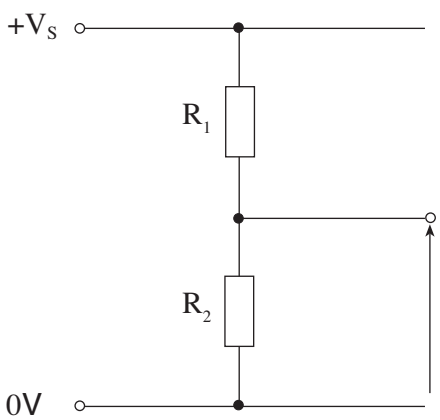
2. Preferred Values for Resistors

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



$$V_{OUT} = \frac{R_2}{R_1 + R_2} \times V_S$$

6. Power = voltage × current; P = VI

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

8. Transistors

The forward voltage drop across the base emitter junction is 0·7 V.

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

1. Some electronic sub-systems are listed below:

OR gate *light sensor* *latch* *bulb*

(a) Which **one** of these is an output sub-system? ..... [1]

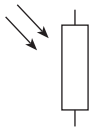
(b) Which **one** of these is an input sub-system? ..... [1]

(c) Which **one** of these keeps the output on until reset? ..... [1]

2. Here is a list of electronic components:

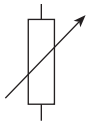
transistor *LED* *variable resistor* *LDR*

(a) Which component has this symbol?



Answer ..... [1]

(b) Which component has this symbol?



Answer ..... [1]

(c) Which component from the list would you use to sense changes in light level?

Answer ..... [1]

3. Four types of mechanical switches are listed below.

tilt *micro* *toggle* *magnetic*

Choose the most appropriate switch from the list for the following jobs.

(a) To be used with a magnet as part of a bicycle speedometer.

Answer .....

(b) To warn drivers of off-road vehicles that the vehicle may be in danger of toppling over.

Answer .....

[2]

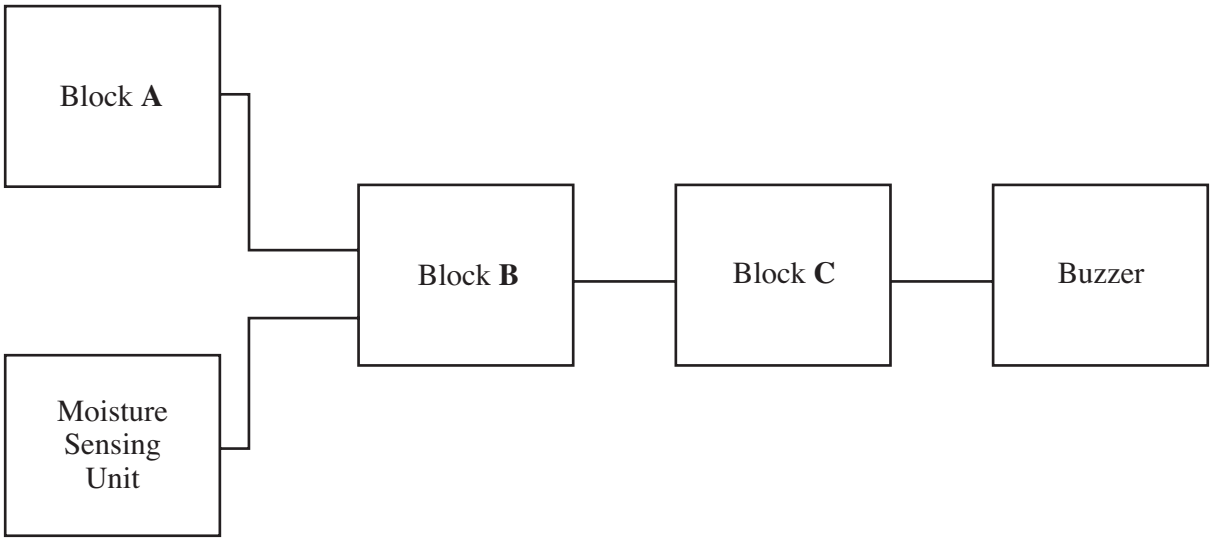
4. Put the three currents in order of size, starting with the **smallest**, and ending with the **biggest**.

1 milliamp (mA)
1 amp (A)
1 microamp (μA)

..... → ..... → .....

[2]

5. Here is a system to switch on a lamp if it is too dark or too wet.



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

Temperature sensing unit	Time delay
OR gate	Transistor switch / transducer driver
Pulse unit	Light sensing unit

Which sub-system is:

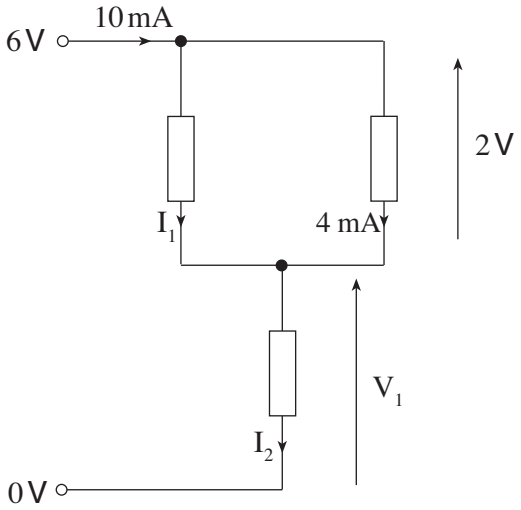
(a) a suitable unit for block **A**? .....

(b) a suitable unit for block **B**? .....

(c) a suitable unit for block **C**? .....

[3]

6. Look at the following diagram.



Write down the values of the following:

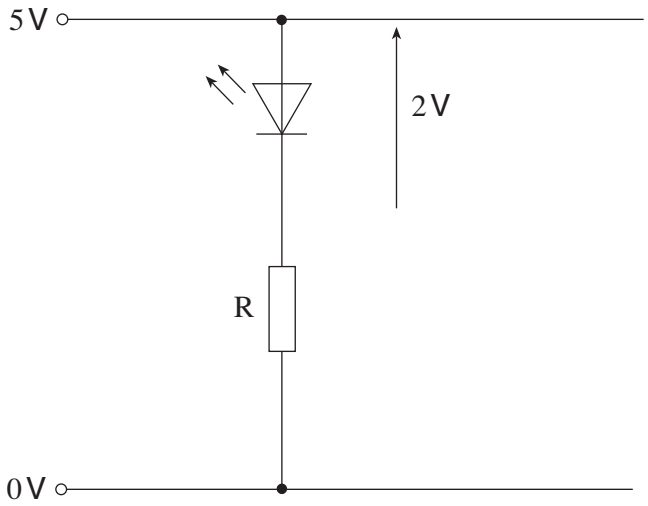
(a) I_1 ..... mA

(b) I_2 ..... mA

(c) V_1 V

[3]

7. The LED in the following circuit needs a current of **10 mA** and forward voltage drop of **2 V** across it to make it light correctly.



(a) How much power is used in the LED?

Choose the correct answer from the following list:

50 mW 20 mW 50 W 20 W

..... [1]

(b) The LED is on.

(i) What is the current through resistor R ?

.....

(ii) What is the voltage across resistor R ?

.....

[2]

(c) Use the formula in the information sheet on page 2 to calculate a suitable resistance for resistor R. [2]

.....

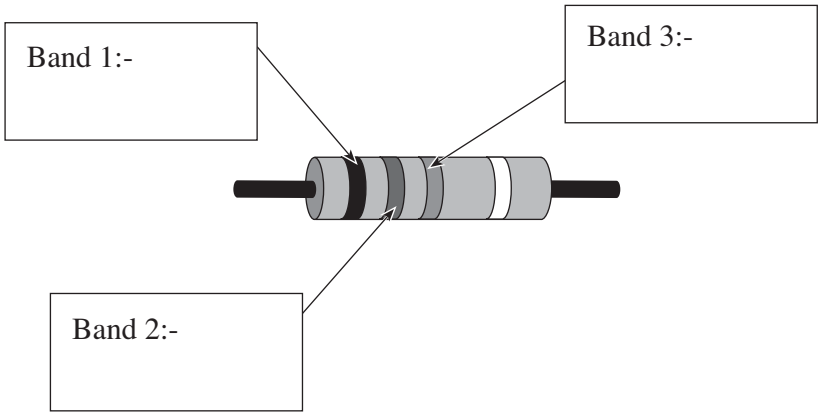
.....

(d) Choose a suitable preferred value for resistor R from the E12 series in the information sheet on page 2. [1]

.....

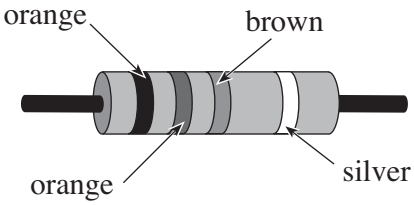
8. The resistor colour code is given in the information sheet on page 2.

(a) Use the information to work out the colour code for a **10 kΩ** resistor.
Write the colours in the correct spaces on the diagram below.



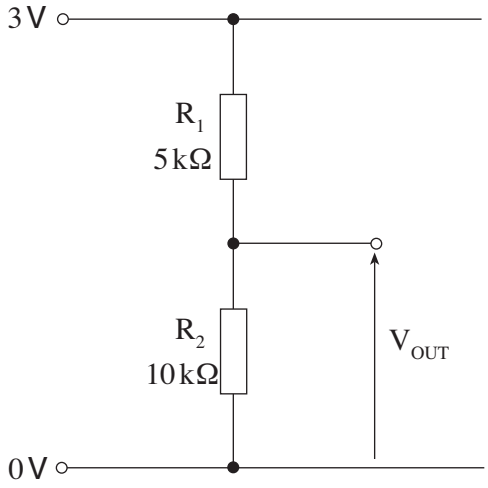
[3]

(b) Use the colour code to work out the resistance of the following resistor .



Resistance **in ohms** = ... [2]

(c) The **10 kΩ** resistor is used with a **5 kΩ** resistor to make a voltage divider:



(i) What is the combined resistance of R_1 and R_2? [1]

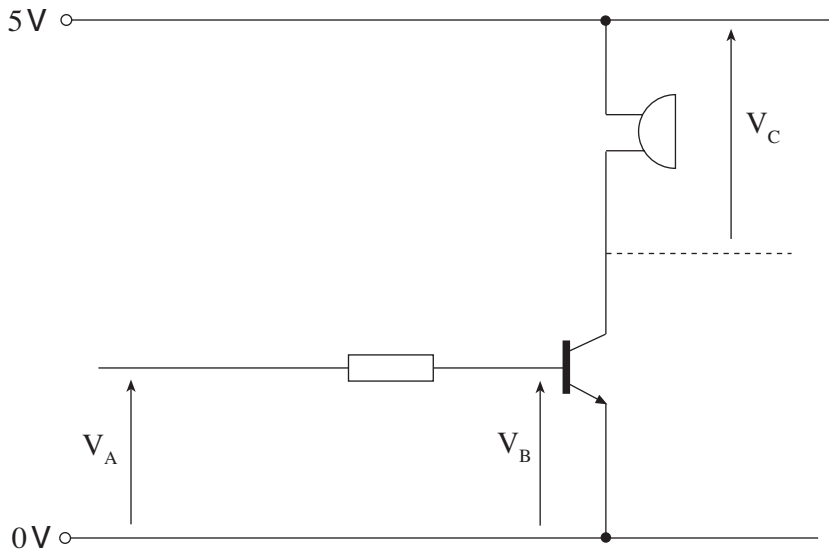
.....

(ii) Use the equation given in the information sheet on page 2 to calculate the value of voltage V_{OUT}. [2]

.....

.....

9. The following circuit diagram shows part of a system used to switch on a buzzer.



The transistor is **just** saturated when the input voltage V_A is 2·5 V.

The input voltage V_A is set to

(i) 0·5 V,

(ii) 3·5 V.

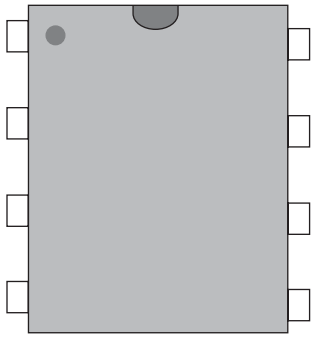
Complete the following table to show:

- the voltages V_B and V_C;
- whether the buzzer will be **On** or **Off**.

	V_A	V_B	V_C	Buzzer On/Off?
(i)	0·5 V			
(ii)	3·5 V			

[5]

10. *(a)* The diagram shows a comparator IC seen from above.

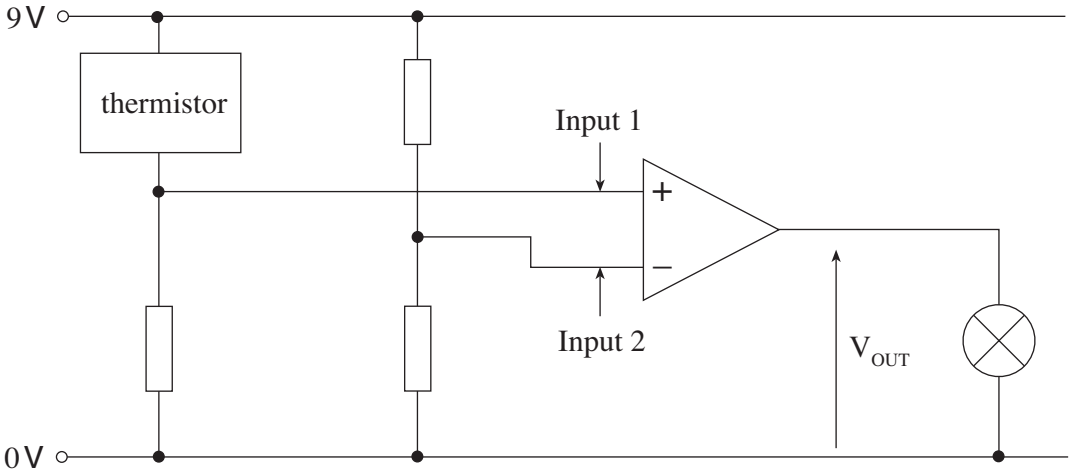


(i) **Label** pin 1 with the number 1.

(ii) **Label** pin 7 with the number 7.

[2]

(b) A warning system is used in a shop to warn the assistant if the temperature in the freezer becomes too warm. The circuit diagram for this is shown below.



(i) The circuit makes use of a thermistor. Draw the circuit symbol for a thermistor in the space below. [1]

(ii) The output V_{OUT} of the comparator saturates at + 6 V and 0 V.

Complete the table for the given values of the input voltages.

Input 1 (V)	Input 2 (V)	Output V_{OUT} (V)
3·2	4·0	
4·5	2·1	

[2]