

Candidate Name	Centre Number	Candidate Number

WELSH JOINT EDUCATION COMMITTEE
General Certificate of Secondary Education



CYD-BWYLLGOR ADDYSG CYMRU
Tystysgrif Gyffredinol Addysg Uwchradd

293/02

ELECTRONICS

MODULE TEST E1

HIGHER TIER

P.M. THURSDAY, 25 May 2006

(45 minutes)

For Examiner's use only

Total Mark	
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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 $\pm 5\%$
SILVER $\pm 10\%$

2. Preferred Values for Resistors

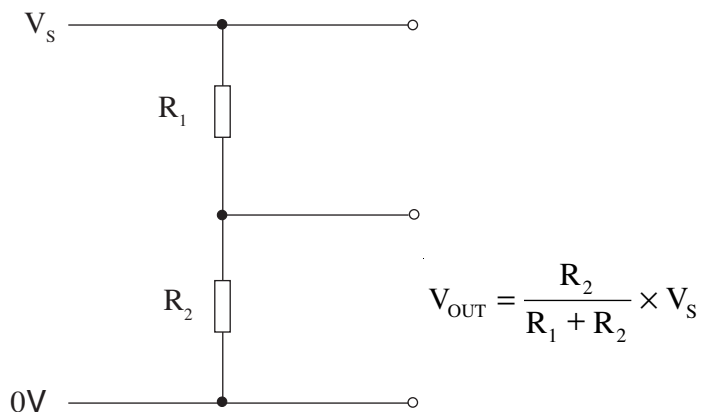
E 12 SERIES OF PREFERRED VALUES
 10; 12; 15; 18; 22; 27; 33; 39; 47; 56; 68; 82 and multiples thereafter

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. **Effective resistance**, R , of two resistors R_1 and R_2 in parallel is given by $R = \frac{R_1 R_2}{R_1 + R_2}$.

6. Voltage Divider



7. **Power** = voltage \times current; $P = VI = I^2 R = \frac{V^2}{R}$.

8. **LED** The forward voltage drop across a LED is 2V.

9. Transistors

(i) **Current gain** = $\frac{\text{Collector current}}{\text{Base current}}$; $h_{FE} = \frac{I_C}{I_B}$.

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

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

1. Here is a list of electronic components:

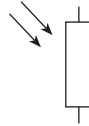
transistor

LED

variable resistor

LDR

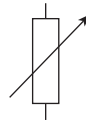
(a) Which component has this symbol?



Answer

[1]

(b) Which component has this symbol?



Answer

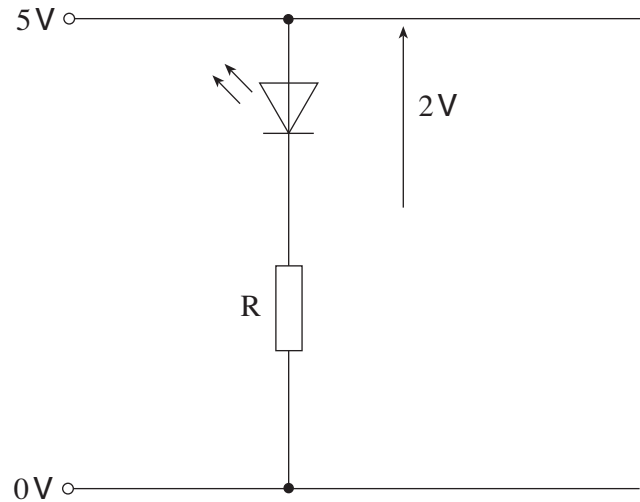
[1]

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

Answer

[1]

2. 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) Calculate how much power is used in the LED. [2]

.....

.....

- (b) The LED is on.

- (i) What is the current through resistor R? [1]

.....

- (ii) What is the voltage across resistor R?

..... [1]

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

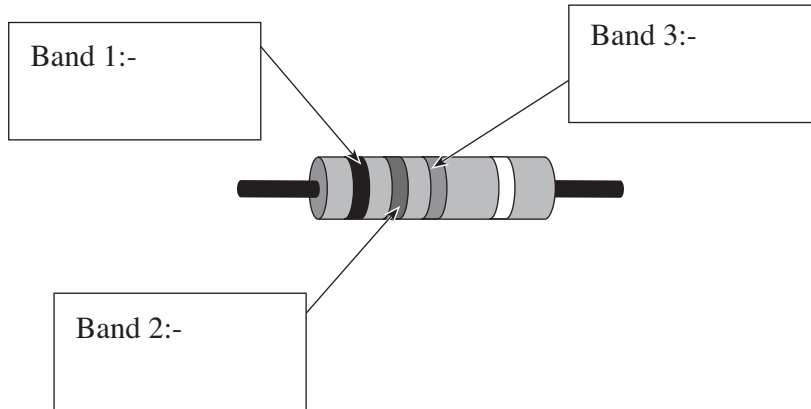
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- (d) Choose a suitable preferred value for resistor R from the E12 series in the information sheet on page 2 so that the LED has **no more** than 10mA flowing through it. [1]

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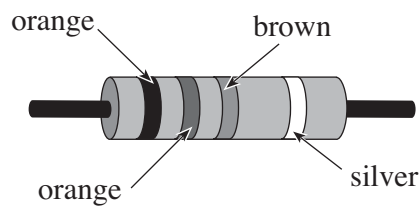
3. The resistor colour code is given in the information sheet on page 2.

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



[3]

- (b) Another resistor has the following colour code.



- (i) Use the colour code to work out the resistance of the resistor.

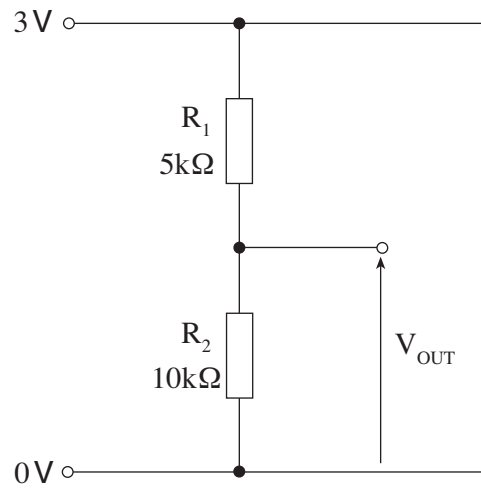
Resistance **in ohms** = [2]

- (ii) Use the tolerance band to calculate the **highest** and **lowest** values the resistor could have.

Highest value **in ohms** =

Lowest value **in ohms** = [2]

- (c) The $10\text{k}\Omega$ resistor is used with a $5\text{k}\Omega$ resistor to make a voltage divider:



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

.....

.....

4. A student wants to build a burglar alarm for a bicycle.

The following sub-systems are available.

Not all of them will be needed.

time delay
AND gate
comparator
transducer driver

OR gate
latch
temperature sensor

inverter
magnetic switch
motor

(a) Choose from this list:

- An analogue input sub-system.
- A processing sub-system which gives a high output **only** when both of its inputs are high.

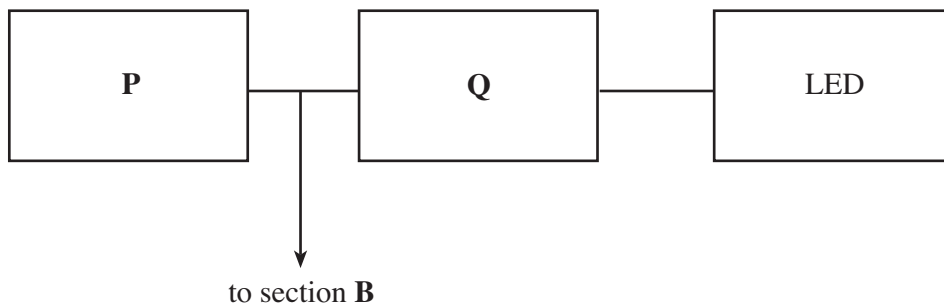
.....

[2]

The burglar alarm contains two sections, **A** and **B**.

(b) Section **A** of the alarm makes a LED light when someone attempts to move the bicycle. The LED should remain on until the bicycle's owner returns.

The block diagram for section **A** is shown below.



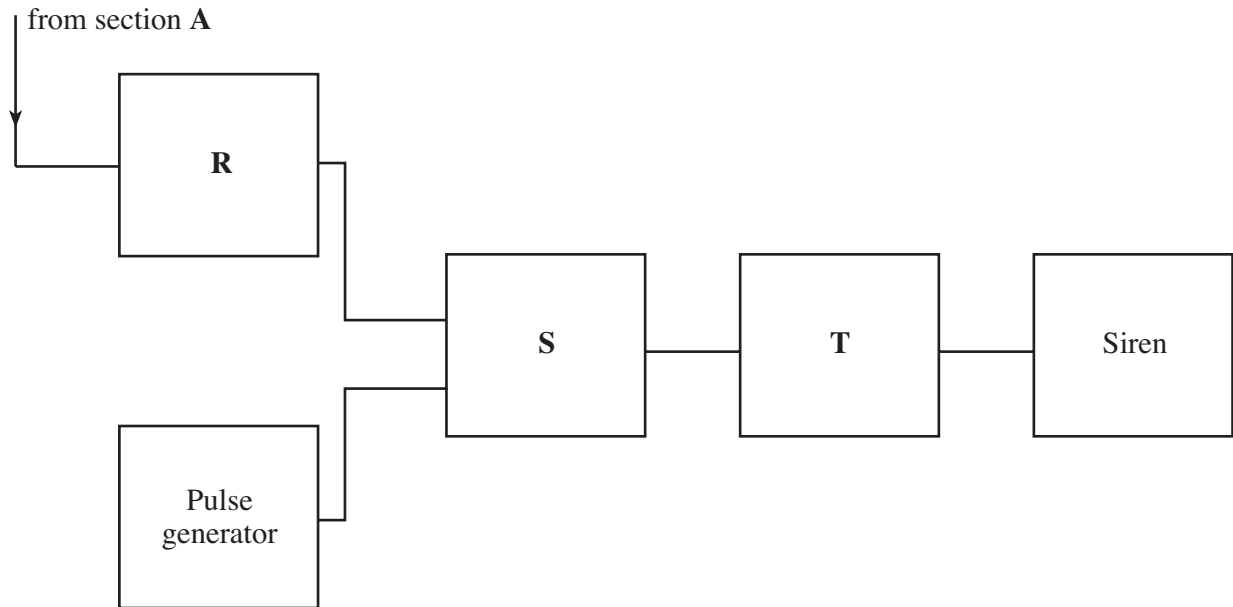
Choose from the list at the top of the page a sub-system to use as :

- Block **P**;
- Block **Q**.

[2]

- (c) Section **B** of the alarm makes a siren keep pulsing on and off for 30 s once it is triggered by section **A**, and then stop.

The block diagram for section **B** is shown below:

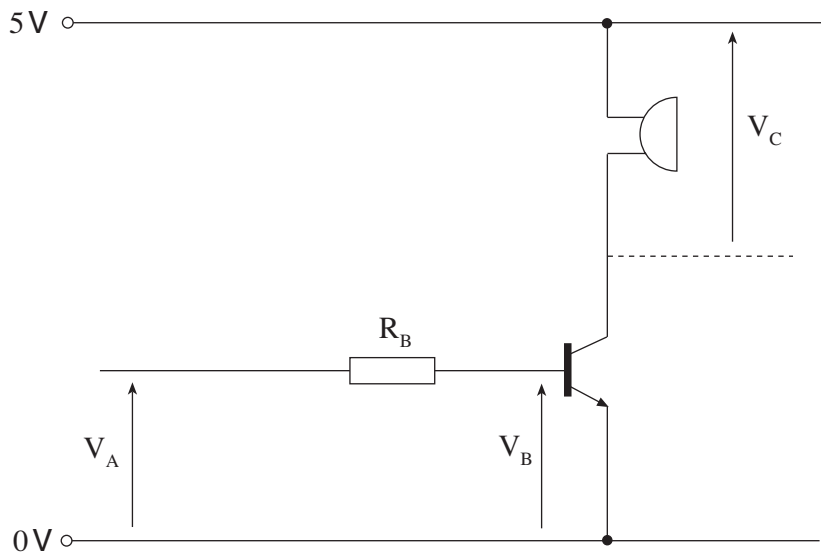


Choose from the list at the top of page 8, a sub-system to use as :

- Block **R**;
- Block **S**;
- Block **T**.

[3]

5. 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 2.7V.

(a) The input voltage V_A is set to

- (i) 0.5V,
- (ii) 3.5V.

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)	0.5V			
(ii)	3.5V			

[5]

(b) The transistor in this circuit has a current gain h_{FE} of 150.
The collector current through the buzzer is 300 mA.

Calculate the base current through R_B .

[1]

.....

(c) $V_A = 2.7\text{ V}$ and the transistor is just saturated.

(i) What is the value of the base emitter voltage V_B ?

.....

(ii) Calculate the voltage drop across R_B when $V_A = 2.7\text{ V}$.

.....

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[2]

(d) Calculate the resistance of R_B .

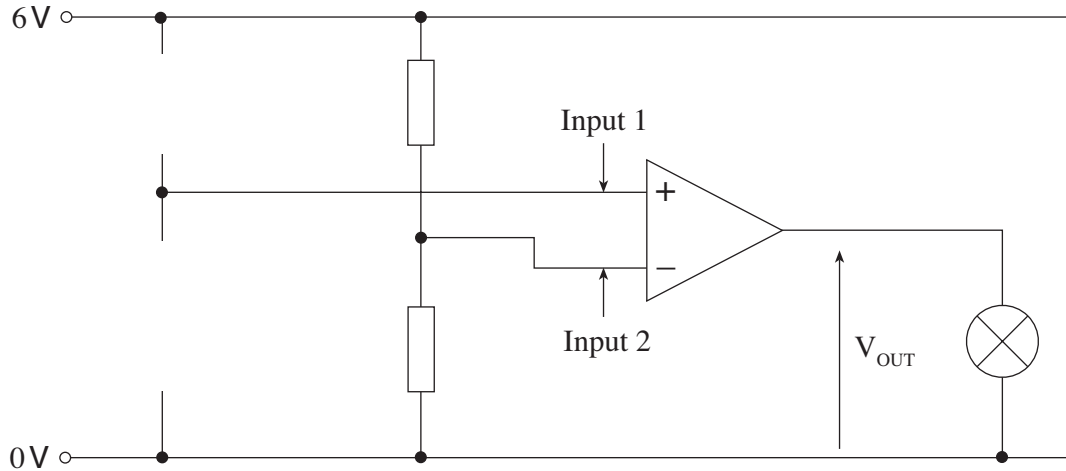
[2]

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6. A warning system is used in a shop to warn the assistant if the temperature in the freezer becomes too warm. An incomplete circuit diagram for this is shown below.



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

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]

- (b) Complete the diagram above to show the sensing circuit used to ensure the voltage into Input 1 of the comparator is high when it is warm.

Remember to use the correct symbols for the components.

[2]