

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, 24 May 2007

(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 $\pm 5\%$
SILVER $\pm 10\%$

2. Preferred Values for Resistors

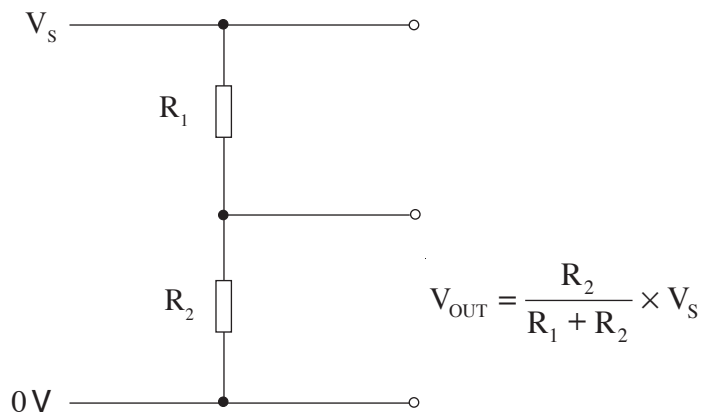
E 12 SERIES OF PREFERRED VALUES
 10; 12; 15; 18; 22; 27; 33; 39; 47; 56; 68; 82 and multiples thereafter

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:

thermistor

LED

variable resistor

LDR

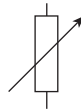
(a) Which component has this symbol?



Answer

[1]

(b) Which component has this symbol?



Answer

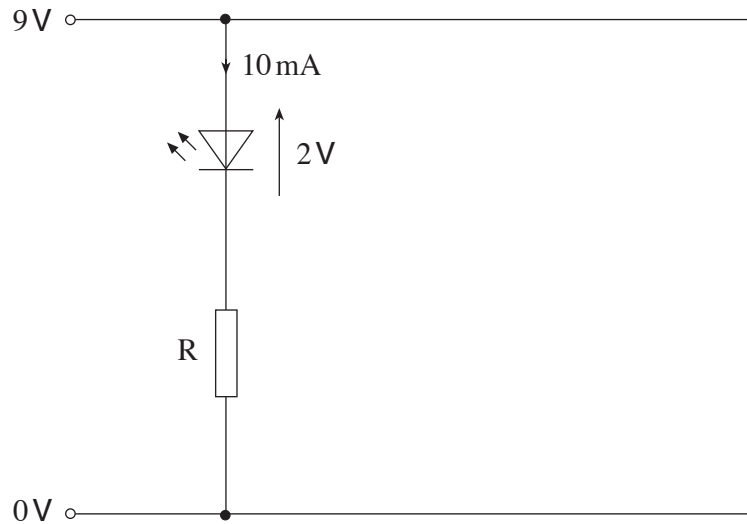
[1]

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

Answer

[1]

2. The LED in the following circuit has a current of **10 mA** and forward voltage drop of **2 V** across it.



- (a) Calculate how much power is used in the LED.

.....
 [2]

- (b) (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.

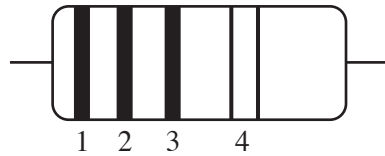
.....
 [2]

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

..... [1]

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

Here is a diagram of a **560 Ω** resistor.

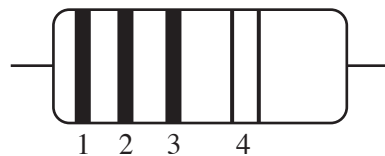


(a) Complete the following table.

[2]

Resistor value	Colour of Band 1	Colour of Band 2	Colour of Band 3
560 Ω			

(b) Here is a diagram of another resistor **R**.



Colour of Band 1	Colour of Band 2	Colour of Band 3	Colour of Band 4
red	violet	red	silver

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

Resistance **in ohms** =

[2]

(ii) What is the **percentage** tolerance of resistor **R**?

.....

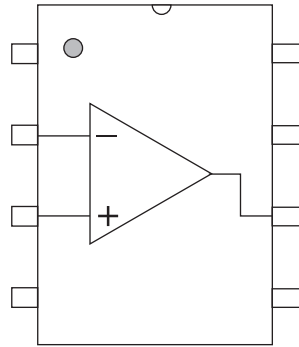
[1]

(iii) What is the tolerance in **ohms** of resistor **R**?

.....

[1]

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



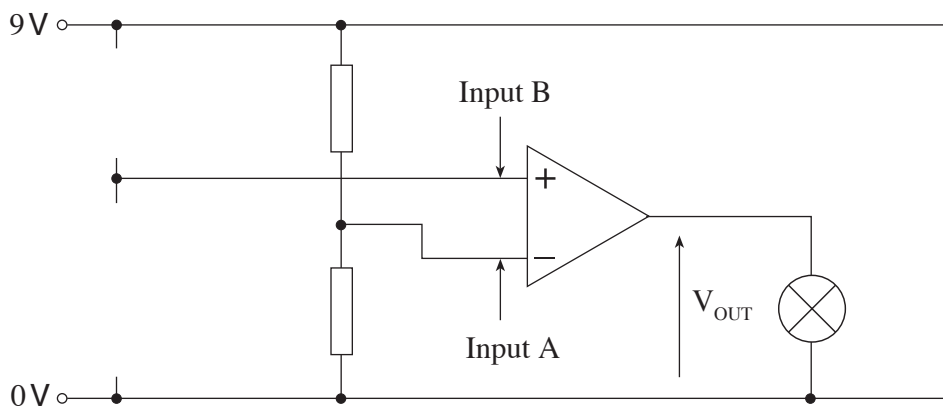
- (i) What is the pin number of the non-inverting input of the comparator?

.....
[1]

- (ii) What is the pin number of the output of the comparator?

.....
[1]

- (b) The following diagram shows part of a circuit which indicates when the temperature in a greenhouse is too high.



The output V_{OUT} of the comparator saturates at 9V and 0V.

(i) Complete the table for the given values of the input voltages.

[2]

Input A (V)	Input B (V)	Output V_{OUT} (V)
4.5	2.3	
4.5	4.8	

(ii) Complete the circuit diagram opposite to make:

- the voltage at input **B** high when it is warm,
- the voltage at input **A** adjustable.

[3]

5. An intruder alarm is required for a bedroom.

The following subsystems are available.
Not all of them will be needed.

AND gate
transducer driver
buzzer

OR gate
comparator
inverter

micro switch
light sensor

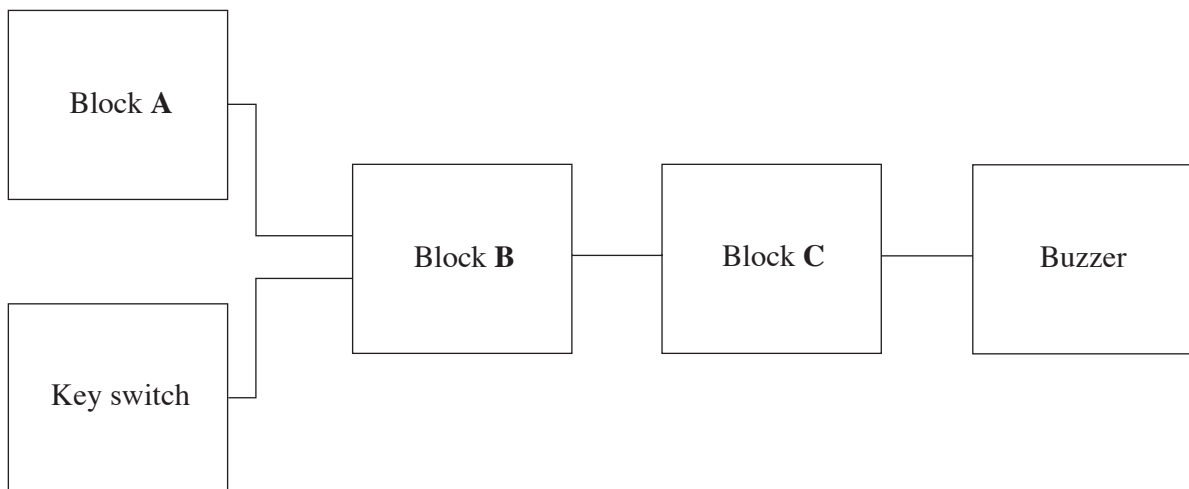
(a) Choose from this list:

- a processing subsystem which gives a high output **only if both** of its inputs are high
.....
- an analogue input subsystem.

[2]

(b) The block diagram shows a possible design.

The alarm is set by turning a key-operated switch.
If someone then opens the door, a micro switch operates and the buzzer sounds.



Choose from the list at the top of the page a subsystem to use as :

- Block A
- Block B
- Block C

[3]

(c) This system has a major design fault.

(i) Identify this fault.

.....
[1]

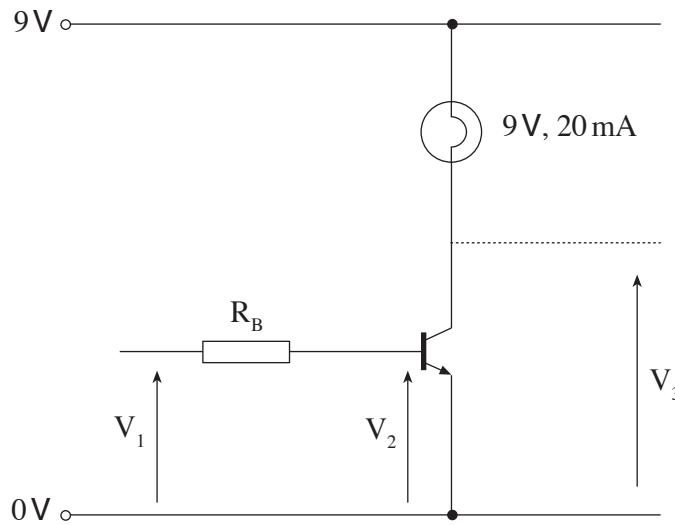
(ii) Name an additional subsystem which is needed to correct this fault.

.....
[1]

(iii) Put an "X" on the diagram opposite to show where you would place this subsystem.

[1]

6. The following circuit diagram shows part of a system used to switch on a lamp.



The transistor is **just** saturated when the input voltage V_1 is 2.7V.

(a) Complete the following table to show:

- the voltage V_2 and V_3 for the input voltages V_1 given,
- whether the bulb will be **On** or **Off**.

[5]

V_1	V_2	V_3	Bulb On/Off?
0.4V			
3.0V			

(b) $V_1 = 2.7V$ and the transistor is just saturated.

The transistor in this circuit has a current gain h_{FE} of 100.
The collector current through the lamp is 20 mA.

(i) Calculate the base current through R_B .

..... [1]

(ii) Calculate the voltage drop across R_B .

..... [1]

(iii) Calculate the resistance of R_B .

.....
.....
.....

[2]