

# **Engineering Science**

Analogue & Digital Electronic Control Systems

Class Test

Name:- .....

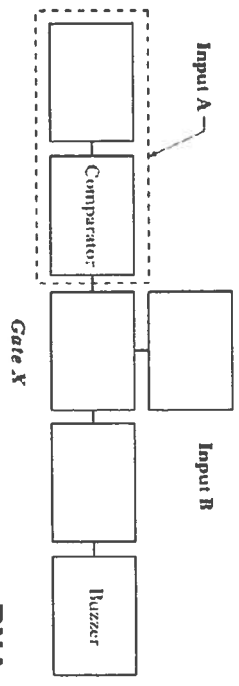
Class Teacher:- .....

Date:- .....

1. An electronic system is used to alert a parent when a child's bedroom becomes too warm. A buzzer will pulse on and off if the bedroom temperature rises above a set level.

(a) Complete the block diagram for the electronic system using the units listed below:

*Inverter Bulb Unit Transducer Driver OR Gate Latch AND Gate  
Light Sensor Delay Unit Pulse Generator Temperature Sensor*



**RNA - 4**

(b) Draw the symbol for *Gate X*

**KU - 2**

(c) Complete the truth table for *Gate X*.

Input A	Input B	Buzzer
0	0	
0	1	
1	0	
1	1	

**KU - 4**

A comparator gives a high **digital** output when the **analogue** input is greater than a set level.

(d) Describe, with the aid of a sketch, the difference between analogue and digital signals.

**KU - 2**

5. (continued)

(c) Using the Data Booklet, state the reference number and full name of the ICs required to construct the logic circuit for the alarm system.

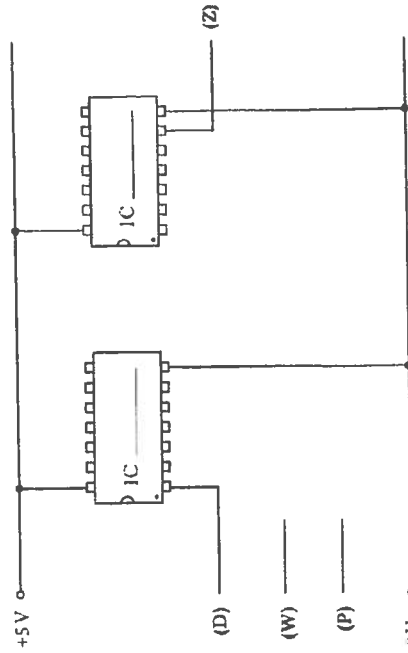
Reference Number \_\_\_\_\_

Full Name \_\_\_\_\_ **KU - 2**

Reference Number \_\_\_\_\_

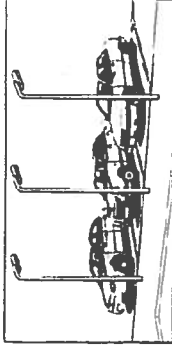
Full Name \_\_\_\_\_ **KU - 2**

(d) Draw the connections to the pin-out diagram below to complete the circuit

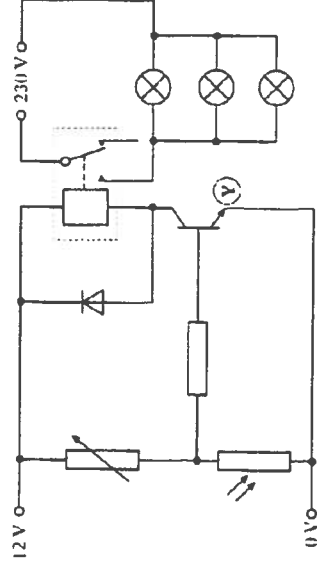


**RNA - 4**

2. The lights in a supermarket carpark are designed to come on automatically when the light level falls below a preset value



The circuit for the lights is shown below.



(a) State why a relay is included in the circuit.

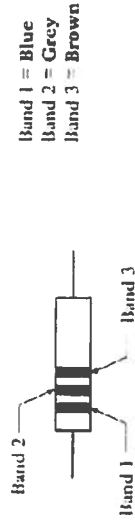
\_\_\_\_\_

**KU - 1**

(b) State the name of component (Y).

**KU - 1**

The colour banding for the resistor used in the lighting circuit is shown below.



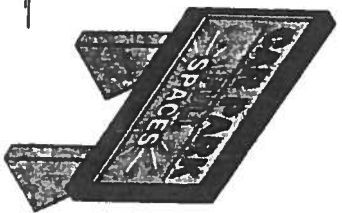
(c) Determine, with reference to your Data Booklet, the value of the resistor.

Resistor value \_\_\_\_\_

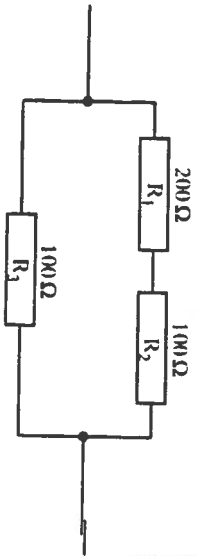
**RNA - 1**

**2. (continued)**

The car park has a sign as shown opposite.



(d) Part of the resistor arrangement for the sign is shown below.



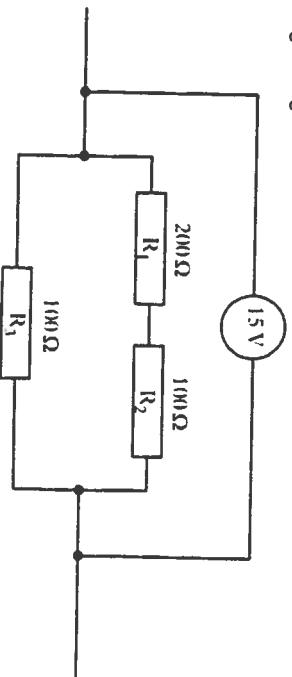
(i) State the total resistance of R1 and R2

**RNA - 1**

(ii) Using the result from (d)(i), calculate the equivalent resistance of the parallel branch above.

**RNA - 2**

(iii) The voltage across the resistance network is 1.5 V. Calculate the current flowing through R3.

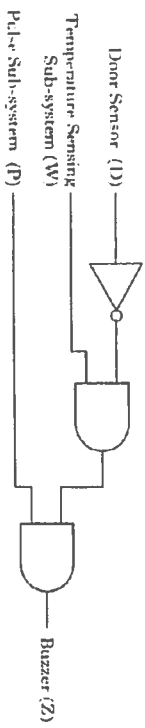


**RNA - 2**

5. A pupil has designed an alarm system for a fridge.

A pulsing alarm (Buzzer Z) will sound if the door is open and the temperature becomes too warm.

A logic circuit diagram for the alarm system is shown below.



(a) Complete the truth table below for the alarm system.

Door sensor (D) (Classed = 1)	Temperature Sensing Sub-system (W) (Warm = 1)	Pulse Sub-system (P)	Buzzer (Z)
0	0	0	
0	0	1	
0	1	0	0
0	1	1	
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	

**RNA - 4**

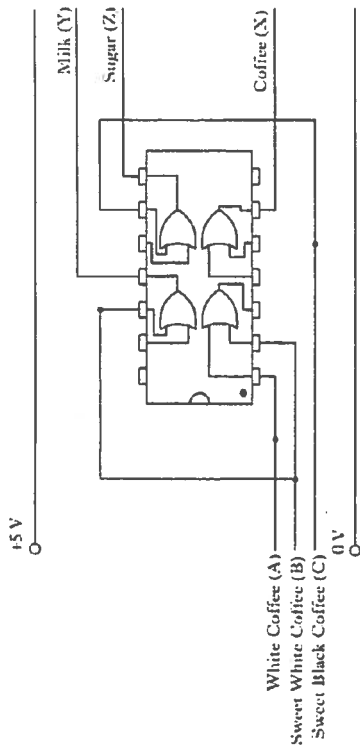
(b) From the truth table, write the Boolean expression which describes when Buzzer (Z) is high.

**KU - 3**

Z =

4. (continued)

(c) Complete the circuit diagram for the vending machine logic system.



**RNA - 5**

(d) State the purpose of the dot on an integrated circuit (IC).

**KU - 1**

(e) When a pupil was modelling this circuit on a prototype board, LEDs were used to show the state of each output.

(i) State what the letters LED stand for

**KU - 1**

When the LEDs were connected directly to the output pins of the IC, they kept "blowing".

(ii) State one alteration which could be made to the circuit to stop this from happening.

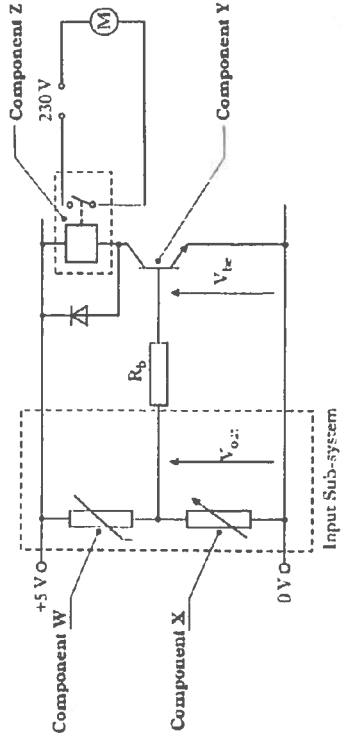
**KU - 1**

(iii) LEDs are "polarity conscious" devices.

State the meaning of the term "polarity conscious".

**KU - 1**

3. An electronic circuit is shown below.



(a) State the name of Component W.

**KU - 1**

(b) (i) State the name of the Input Sub-system.

**KU - 1**

(ii) Explain the operation of the Input Sub-system by completing the following statement.

As the temperature falls, the resistance of Component W \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**RNA - 2**

(c) State the name and function of Component X.

Name \_\_\_\_\_

Function \_\_\_\_\_

**KU - 2**

(d) State the name and function of Component Y.

Name \_\_\_\_\_

Function \_\_\_\_\_

**KU - 2**

Two components protect Component Y in the circuit, one of them being the base resistor,  $R_B$ .

(e) (i) State the name of the other protection component.

\_\_\_\_\_

**KU - 1**

(ii) State what this component is protecting Component Y from.

\_\_\_\_\_

**KU - 1**

Component Y operates when  $V_{be}$  is 0.7 V.

(f) State the name of this operating voltage.

\_\_\_\_\_

**KU - 1**

(g) State the name and function of Component Z.

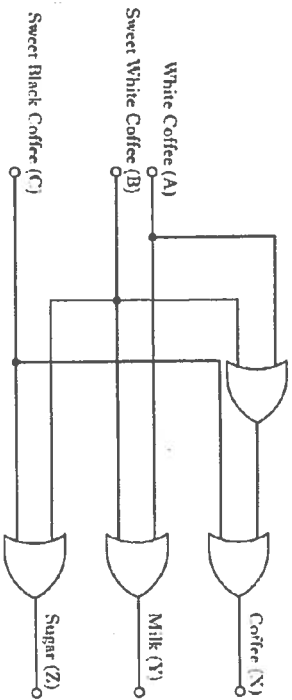
Name \_\_\_\_\_

Function \_\_\_\_\_

**KU - 2**

/ /

4. Part of a logic system used to control the operation of a drinks vending machine is shown below.



(a) Complete the truth table for the above logic system.

White Coffee (A)	Sweet White Coffee (B)	Sweet Black Coffee (C)	Coffee (X)	Milk (Y)	Sugar (Z)
0	0	0			
0	0	1			
0	1	0			
0	1	1			
1	0	0			
1	0	1			
1	1	0			
1	1	1			

**RNA - 3**

(b) With reference to the Data Booklet, state the full name and number of the integrated circuit (IC) required to complete the above logic system.

Full name \_\_\_\_\_

Number \_\_\_\_\_

**KU - 1**

**RNA - 1**