

Engineering Science

Analogue & Digital Electronic Control Systems

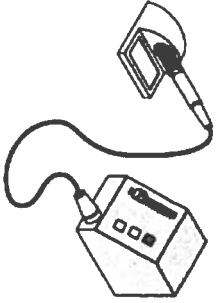
Revision

Name:-

Class Teacher:-

Date:-

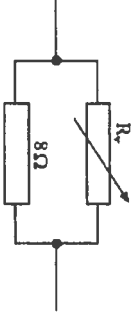
1 A technician uses a temperature controlled soldering iron.



The heating element uses 25 V, 90 W.

- (a) Calculate the current flowing through the heating element.
(Show all working and units.)

- (b) Part of the resistor arrangement for the soldering iron is shown.



- (i) Calculate the equivalent resistance given by the parallel arrangement shown above when the variable resistor (R_v) = 8Ω

$$R_{\text{equiv}} = \frac{R_1 \times R_2}{R_1 + R_2}$$

DO NOT
WRITE IN
THIS
MARGIN

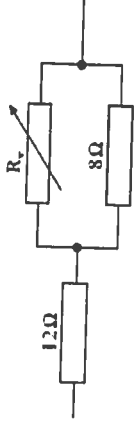
KU	RNA
----	-----

2
1
0

2
1
0

KU	RNA
1	0
1	0
2	1 0

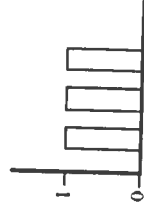
(continued)



(ii) Using your answer from part (b)(i), state the total resistance for the arrangement shown above.

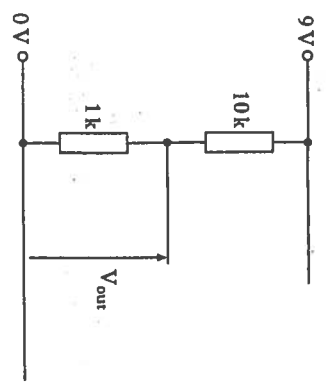
(c) A thermistor is used to sense the temperature of the heating element. Sketch the symbol for a thermistor.

(d) State the type of electronic signal shown below.





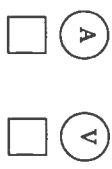
(a) Calculate the voltage V_{out} in the circuit shown below.



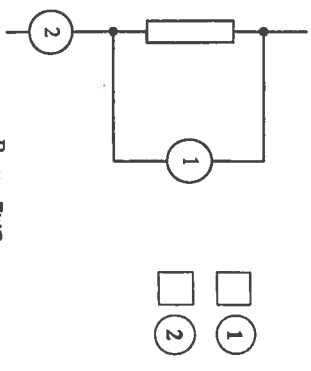
$V_{out} =$ _____

(b) The resistor configuration shown above is known as a _____

(c) (i) Indicate the symbol for the meter used to measure current.
Tick (✓) the correct box.



(ii) Indicate the position for the meter to measure current through the resistor.
Tick (✓) the correct box.



DO NOT WRITE IN THIS MARGIN

KU RN

1 0

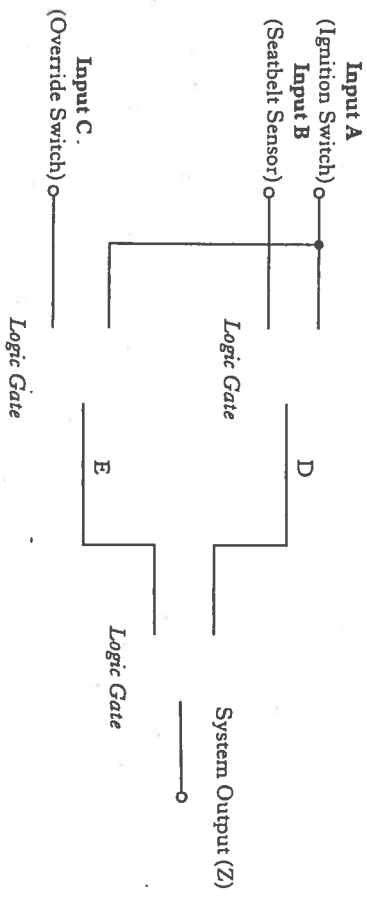
1 0

1 0

2 1 0

10 A safety system is being developed for a car to ensure the engine will not operate unless the ignition is switched on and the driver's seatbelt is fastened. For maintenance purposes, the seatbelt sensor can be bypassed using an override switch. For this to operate, the ignition should also be on.

(a) Complete the combinational logic diagram below for the control system.



(b) Complete the truth table for the logic diagram.

Input A	Input B	Input C	D	E	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			

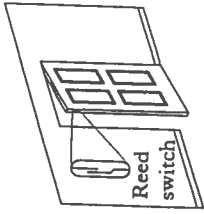
DO NOT WRITE IN THIS MARGIN

KU RNA

3 2 1 0

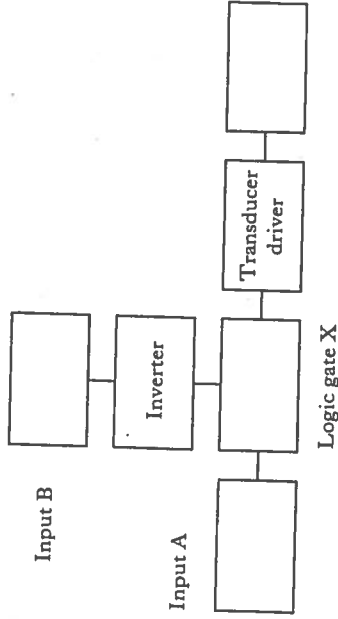
3 2 1 0

9 A pupil has designed an alarm which sounds a warning when the system is switched on and the door is opened.



- (a) Name the device that operates a reed switch.
- (b) Part of the electronic control system for the alarm is shown as a block diagram. Choose the most suitable boards from the list below, then complete the block diagram.

- NOT gate
- Buzzer
- Switch unit
- Bulb unit
- OR gate
- AND gate
- Magnetic switch
- Pulse generator



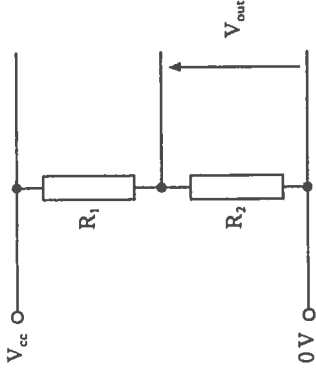
(c) Complete the truth table for the alarm system.

Input A	Input B	Inverter	Output
0	0		
0	1		
1	0		
1	1		

(d) Draw the symbol for an Inverter.

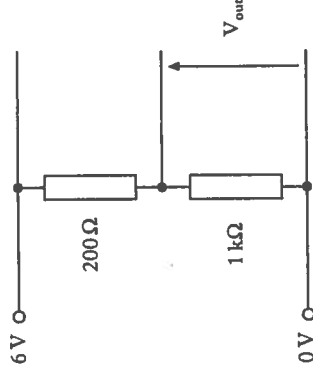
(e) Name an electronic board that could be used to keep the alarm on until the system is reset.

3 Many electronic circuits have two resistors in series as shown below.



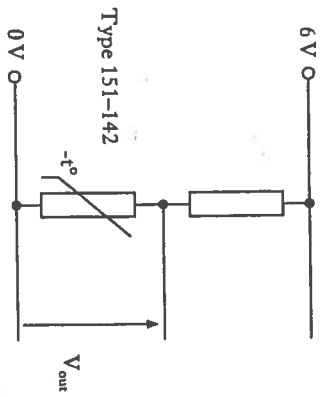
(a) State the name of the above resistor arrangement.

(b) Calculate the output voltage, V_{out} , in the circuit below. (Show all working and units.)



3 (continued)

The circuit below uses a thermistor to form a sensing circuit.



- (c) With reference to the Data Booklet, determine the resistance of the thermistor type 151-142, at a temperature of 0°C.
Resistance _____ kΩ
- (d) State what would happen to the output voltage, V_{out} , if the temperature increases.

Turn over

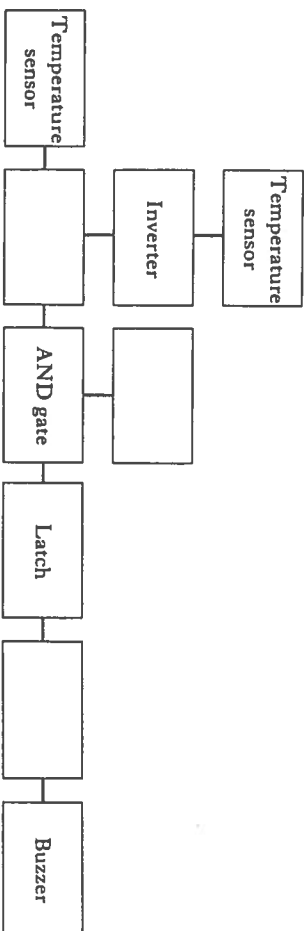
DO NOT WRITE IN THIS MARGIN
KU RNA

1
0

8 In a baby care unit the temperature of an incubator is monitored.



- (a) A buzzer sounds when the temperature goes above or below the preset levels and the on/off switch is high.
Choose the correct devices from the following list to complete the block diagram.
Pulse Generator OR gate Latch NOT gate AND gate
Transducer Driver OR gate On/Off Switch Temperature sensor



- (b) Sketch the logic symbol for the AND gate.
- (c) State the function of the Latch.

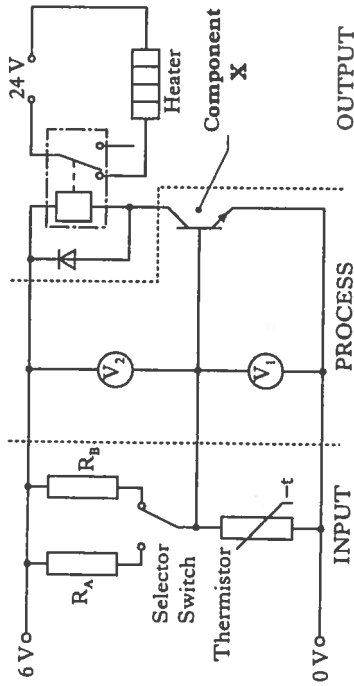
DO NOT WRITE IN THIS MARGIN
KU RNA

3
2
1
0

2
1
1
0

1
0

6 The temperature control in a model tumble drier is provided by an electronic system as shown below. The user selects one of two temperature settings using a selector switch.



(a) (i) State the name of Component X.

(ii) Explain the function of Component X.

(b) Explain why the following components are required in the above circuit.

(i) Relay

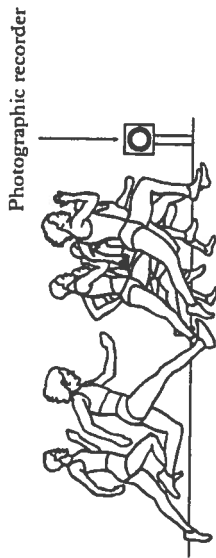
(ii) Diode

(c) (i) State the name of the input part of the circuit.

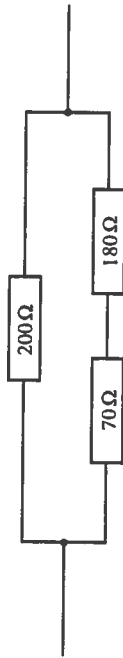
(ii) Explain, using appropriate terminology, the operation of the input part of the circuit.

DO NOT
WRITE IN
THIS
MARGIN

4 A photographic recorder is used at the finish line in a 100 metre sprint.



Part of the electronic circuit is shown below.



(a) (i) Calculate the resistance of the series branch.

(ii) Calculate the total circuit resistance.

(b) Calculate the current flowing through the 200 ohm resistor when the voltage across it is 5 volts.

DO NOT
WRITE IN
THIS
MARGIN

DO NOT
WRITE IN
THIS
MARGIN

DO NOT
WRITE IN
THIS
MARGIN

KU RNA

2 1 0

2 1 0

2 1 0

2 1 0

2 1 0

2 1 0

2 1 0

2 1 0

2 1 0

2 1 0

2 1 0

2 1 0

2 1 0

2 1 0

2 1 0

2 1 0

2 1 0

2 1 0

2 1 0

2 1 0

2 1 0

2 1 0

2 1 0

2 1 0

2 1 0

2 1 0

2 1 0

2 1 0

2 1 0

2 1 0

2 1 0

2 1 0

2 1 0

4 (continued)

- (c) Complete, with reference to the Data Booklet, the table below by inserting the missing colour bands for the given resistor values.

Resistor Value	Colour band 1	Colour band 2	Colour band 3
70 Ω			
180 Ω			
3.4 kΩ			

The following components are also used in the circuit.

- (d) State the name of the electronic symbols shown below.



1 _____ 2 _____

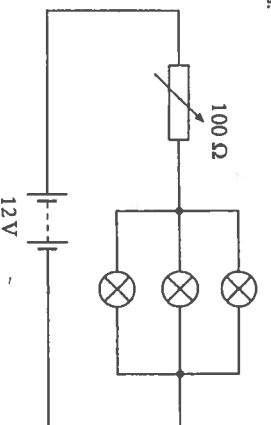
[Turn over

DO NOT
WRITE IN
THIS
MARGIN

KU RNA

3
2
1
0

5. The variable resistor in the circuit shown below is used to control the brightness of 3 identical lamps.



When the variable resistor is adjusted to 100 Ω, the current through each lamp is 30 mA.

- (a) Calculate, showing all working and units:

- (i) the total current flowing through the circuit;
- (ii) the voltage drop across the variable resistor;
- (iii) the resistance of one lamp.

- (b) Describe how the variable resistor controls the brightness of the lamps.

DO NOT
WRITE IN
THIS
MARGIN

KU RNA

2
1
1
0

3
2
2
1
0

3
2
2
1
0