

FOR OFFICIAL USE

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	KU	RNA
Total Marks		

# 4040/401

NATIONAL  
QUALIFICATIONS  
2009

TUESDAY, 5 MAY  
1.00 PM – 2.15 PM

TECHNOLOGICAL  
STUDIES  
STANDARD GRADE  
General Level

Fill in these boxes and read what is printed below.

Full name of centre

Town

Forename(s)

Surname

Date of birth

Day Month Year

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Scottish candidate number

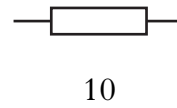
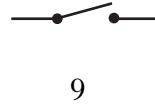
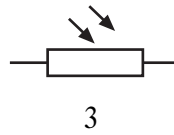
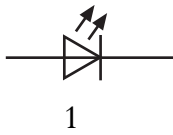
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Number of seat

- 1 Answer all the questions.
- 2 Read every question carefully before you answer.
- 3 Write your answers in the spaces provided.
- 4 Do **not** write in the margins.
- 5 Do **not** sketch in ink.
- 6 All dimensions are given in millimetres.
- 7 **Show all working and units where appropriate.**
- 8 Reference should be made to the Standard Grade and Intermediate 2 Data Booklet (2008 edition) which is provided.
- 9 Before leaving the examination room you must give this book to the invigilator. If you do not, you may lose all the marks for this paper.



1. (a) The following electronic symbols have been numbered 1 to 10.



Complete the table below by inserting the symbol number for each item.

The first one has been completed for you.

Item	Symbol Number
Resistor	10
Lamp	
LED	
Motor	
Transistor	
Switch	
LDR	

6  
5  
4  
3  
2  
1  
0

System diagrams can be used to solve electronic problems.

(b) Draw the **Universal System Diagram**.

3  
2  
1  
0









5. (continued)

(b) State the **full name** of the following pneumatic components.

(i) Valve (B) \_\_\_\_\_

(ii) Valve (D) \_\_\_\_\_

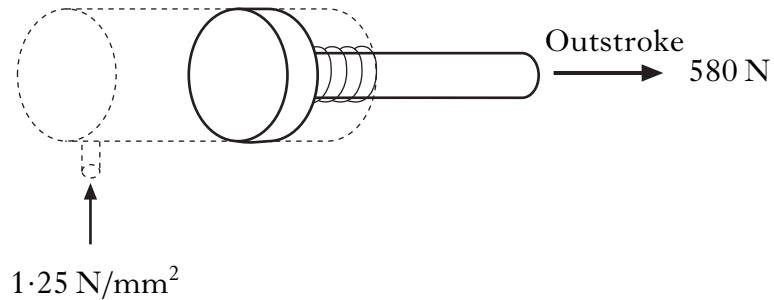
(iii) Cylinder (1) \_\_\_\_\_

(c) State **one** advantage of using compressed air as an energy source.

\_\_\_\_\_

(d) Calculate the piston area if air is supplied at  $1.25 \text{ N/mm}^2$  and the outstroking force of the piston rod is  $580 \text{ N}$ .

**(Ignore the force of the spring.)**



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3

2

1

0

1

0

1

0

1

0

2

1

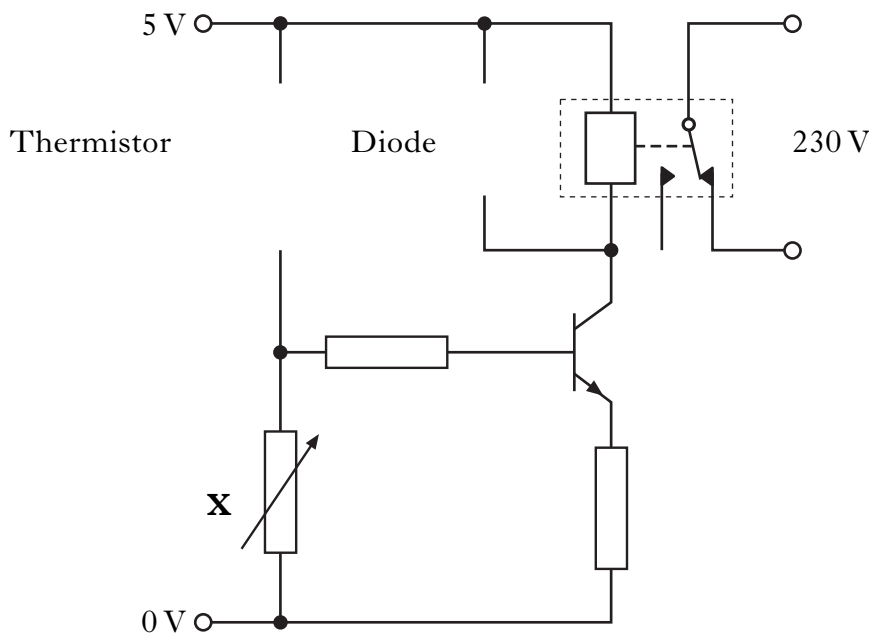
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[Turn over

6. A microwave oven is fitted with a safety circuit that will automatically switch off if the outside surface gets too warm.



The incomplete safety circuit is shown below.



- (a) Draw the symbols for the two components named above to complete the safety circuit.
- (b) State the name of component **X**.
- (c) Determine, with reference to the Data Booklet, the temperature **range** of a **type 1** thermistor.
- (d) State the saturation voltage of a transistor.

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1 0	2 1 0
1 0	2 1 0
1 0	

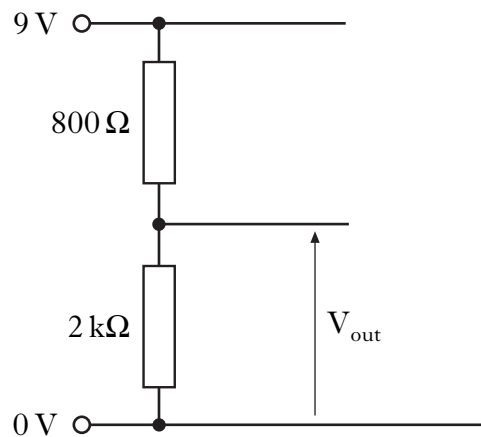
6. (continued)

- (e) (i) Calculate the current flowing through the relay if the coil has a resistance of  $400\ \Omega$  and a voltage drop of  $4\ \text{V}$ .

- (ii) Calculate the power used by the relay coil.

Resistors are used in many electronic circuits.

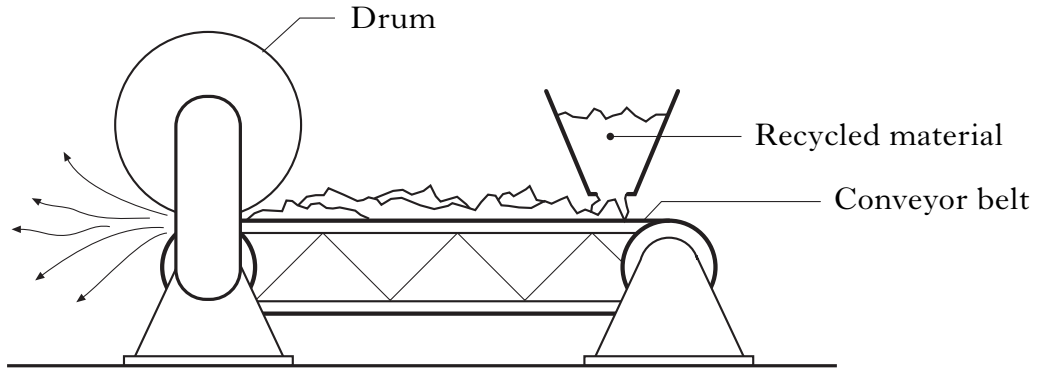
- (f) (i) Calculate the voltage  $V_{\text{out}}$  in the circuit shown below.



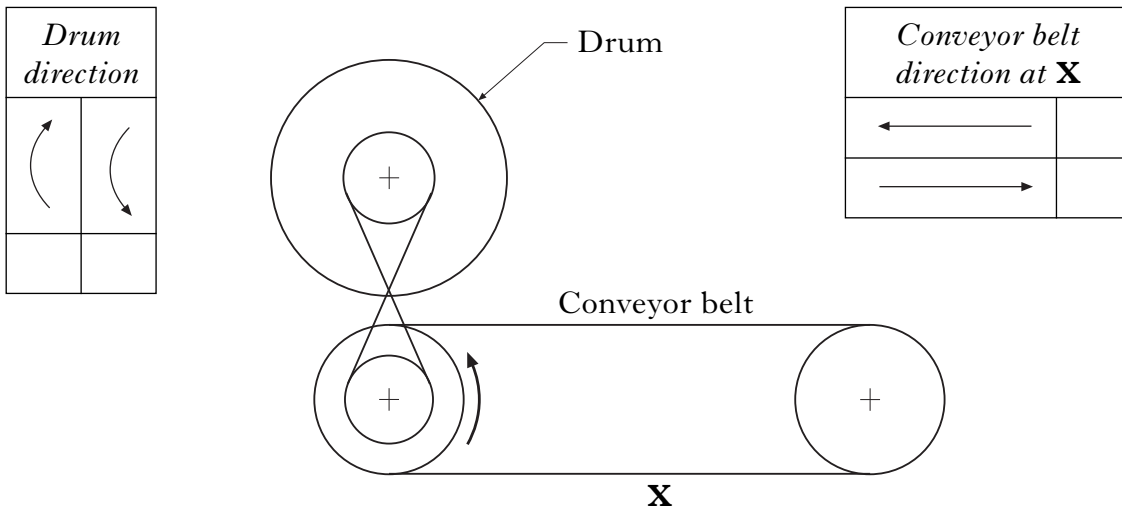
- (ii) State the name of the series resistor arrangement shown above.

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	2 1 0
	2 1 0
	2 1 0
	1 0

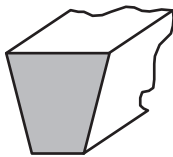
7. A conveyor belt system is used in a recycling process.



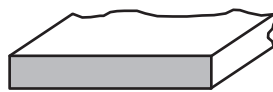
(a) Indicate (✓) on the tables below the direction of movement of the conveyor belt and the drum.



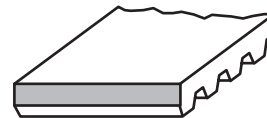
Three different types of belt are shown below.



(1) V belt



(2) Flat belt



(3) Toothed belt

(b) State which belt (1, 2 or 3) is used for:

(i) crossed belt drives;

\_\_\_\_\_

(ii) positive (non-slip) drives.

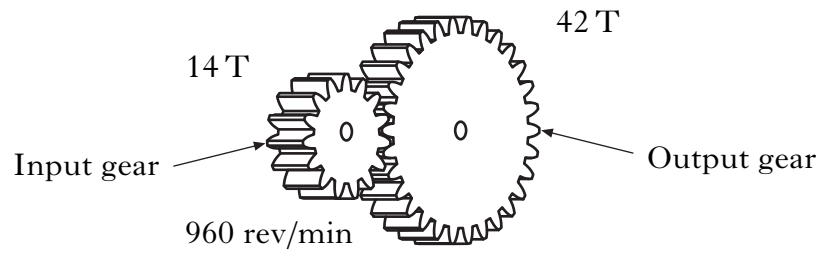
\_\_\_\_\_

1  
0  
  
1  
0

2  
1  
0

7. (continued)

An electric motor drives the conveyor belt system through a simple gear train.



(c) Calculate the speed of the output gear when the input gear rotates at 960 rev/min.

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	<p>2 1 0</p>

[Turn over

8. An automatic bicycle rack for a car is operated by a microcontroller.



The sequence of operations for **lowering** a bicycle is listed below.

- The sequence begins with the lift arm motor off and locking solenoid on.
- When the 'down' switch is pressed the locking solenoid switches off then 10 seconds later the lift arm motor rotates forward.
- When the lift arm is in the fully lowered position a limit switch is activated which stops the motor.
- The sequence ends.

Input Connection	Pin	Output Connection
	7	
	6	
	5	
	4	
	3	Lift Arm Motor FORWARD
	2	Locking Solenoid
Limit Switch	1	
Down Switch	0	

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**8. (continued)**

(e) State the function of the clock in a microcontroller.

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<b>1</b>	
<b>0</b>	

*[END OF QUESTION PAPER]*

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