FOR OFFICIAL USE

G

	KU	RNA
Total Marks		

4040/401

NATIONAL QUALIFICATIONS 2011

THURSDAY, 12 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

Scottish candidate number

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.

DO NOT WRITE IN THIS MARGIN

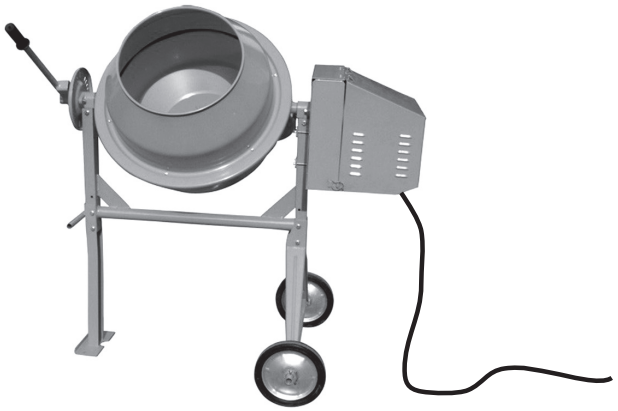
KU	RNA

1. The systems approach is used to analyse problems.

(*a*) Draw the Universal System Diagram.

3 2 1 0

An **electric** cement mixer is shown below.



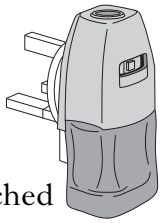
(*b*) Draw a **system diagram** below for the electric cement mixer. Include one main input and one main output **energy**.

2 1 0

DO NOT WRITE IN THIS MARGIN

KU	RNA

2. A student uses electronic boards to simulate an automatic air freshener.

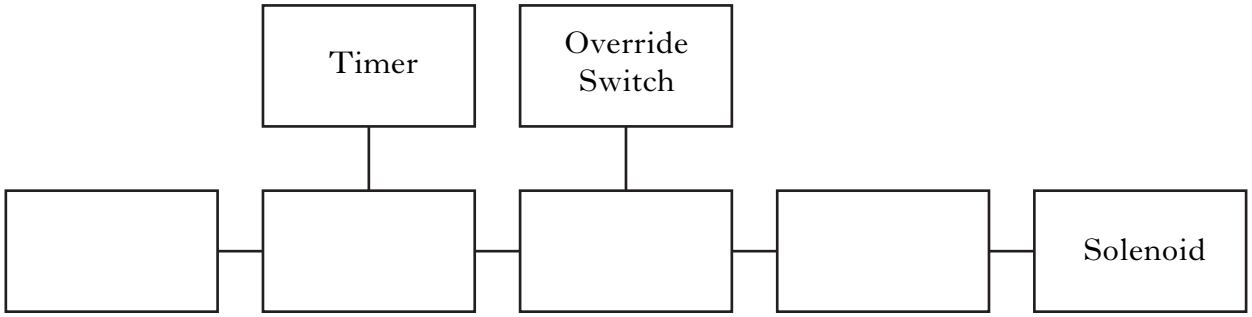


The air freshener will operate,

- automatically, if a switch is activated **and** a set time is reached **or**
- manually, when the override switch is pressed.

(*a*) Complete the block diagram by choosing the correct devices from the list below.

Pulse generator *AND gate* *OR gate* *Slide Switch Unit*
Latch *Temperature sensor* *Transducer driver* *NOT gate*



4 3 2 1 0

(*b*) (i) Complete the truth table for an **OR** gate.

Input A	Input B	Z
0	0	
0	1	
1	0	1
1	1	

3 2 1 0

(ii) Complete the truth table for a **NOT** gate.

Input	Output
0	
1	

2 1 0

(iii) Sketch the logic symbol for an **AND** gate.

2 1 0

(*c*) State the function of a Latch Unit.

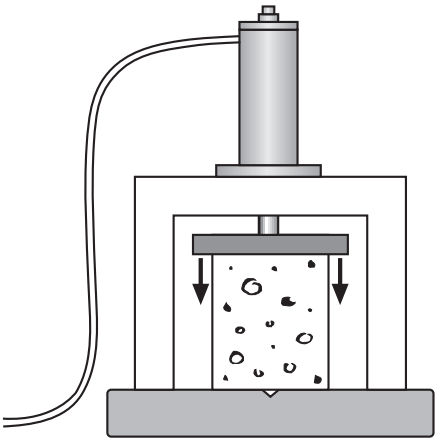
_____

1 0

DO NOT WRITE IN THIS MARGIN

KU	RNA

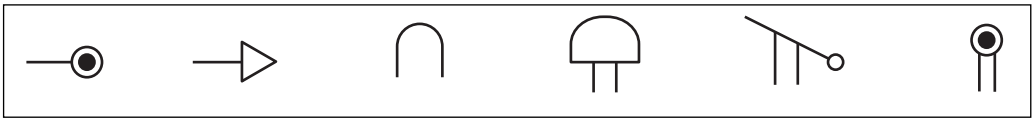
3. A pneumatic cheese press is shown.



An incomplete circuit diagram for the cheese press is shown below.

(*a*) Complete the diagram by:

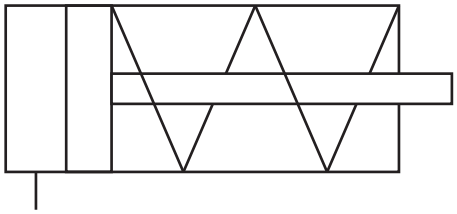
(i) adding the correct pneumatic symbols from the table to form the 3/2, Push Button, Spring Return Valve;

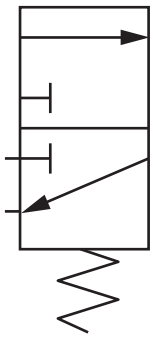


3
2
1
0

(ii) piping the circuit.

Single Acting Cylinder





3/2, Push Button, Spring Return Valve

1
0

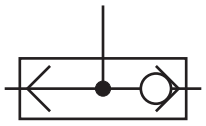
DO NOT WRITE IN THIS MARGIN

KU	RNA

3. (continued)

Pneumatic systems are in common everyday use.

(*b*) State the name of the pneumatic symbols shown below.



3 2 1 0

1 _____ 2 _____ 3 _____

Safety is always important when working with pneumatics.

(*c*) State **two** safety precautions which must be followed when working with pneumatics.

1 _____

2 _____

2 1 0

(*d*) State **two advantages** of using compressed air as an energy source rather than hydraulics (oil) or electricity.

1 _____

2 _____

2 1 0

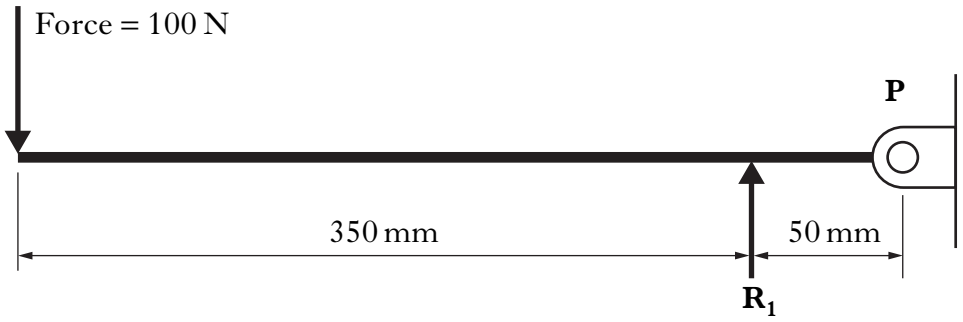
[Turn over

DO NOT WRITE IN THIS MARGIN

KU	RNA

4. A can crusher is shown below.

The diagram below shows the distances and forces acting on the can.



(*a*) (i) State the name given to this diagram.

_____

1 0

(ii) Calculate, by taking moments about **P**, the size of the reaction force $\mathbf{R_1}$.

3 2 1 0

(*b*) State one change to the **can crusher** which could be used to **increase** the force acting on the can.

_____

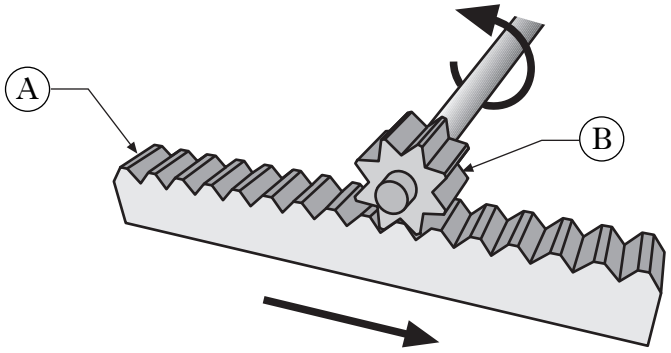
1 0

DO NOT WRITE IN THIS MARGIN

KU	RNA

4. (continued)

(*c*) The mechanism shown below is used in an alternative can crusher.



(i) State the name of parts (A) and (B).

2 1 0

(A) _____ (B) _____

(ii) State the change in type of motion.

2 1 0

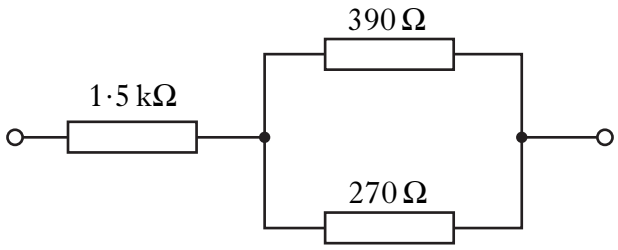
_____ to _____

[Turn over

DO NOT WRITE IN THIS MARGIN

KU	RNA

5. A technician is investigating the circuit below.



(*a*) (i) Calculate the resistance of the **parallel** branch.

2 1 0

(ii) Calculate the **total** circuit resistance.

2 1 0

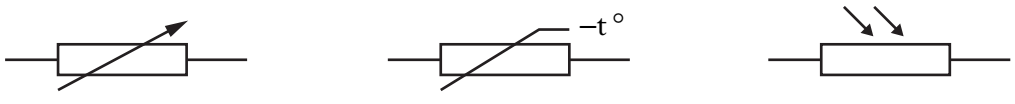
(*b*) Complete, with reference to the Data Booklet, the table below by inserting the missing colour bands for the given resistor values.

Resistor Value	Colour band 1	Colour band 2	Colour band 3
1·5 kΩ			
270 Ω			
390 Ω			

3 2 1 0

There are many different types of resistor.

(*c*) State the name of the electronic symbols shown below.



1 _____ 2 _____ 3 _____

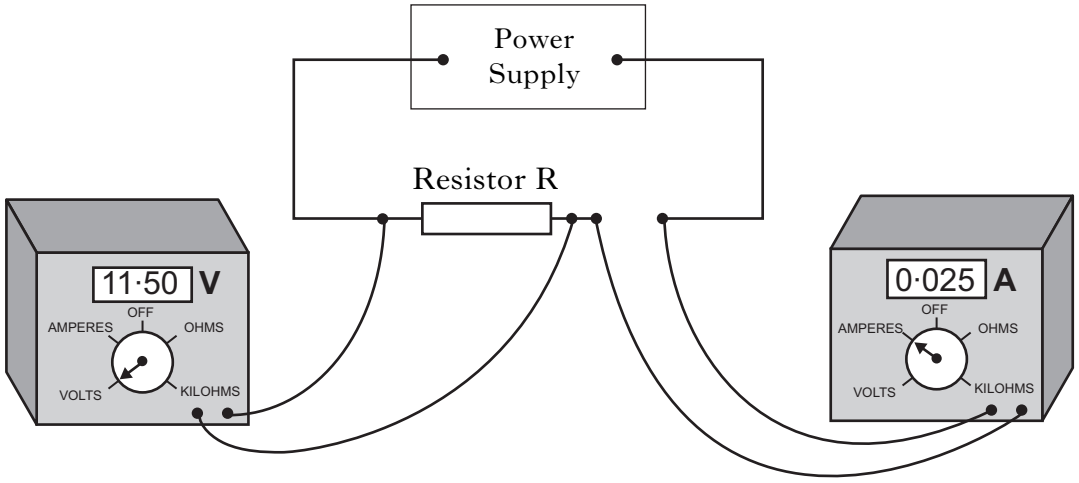
3 2 1 0

DO NOT WRITE IN THIS MARGIN

KU	RNA

5. (continued)

The technician sets up a circuit as shown below.



Using the meter readings above:

(*d*) calculate the value of resistor R.

2
1
0

(*e*) Draw the circuit symbol for:

(i) an ammeter.

1
0

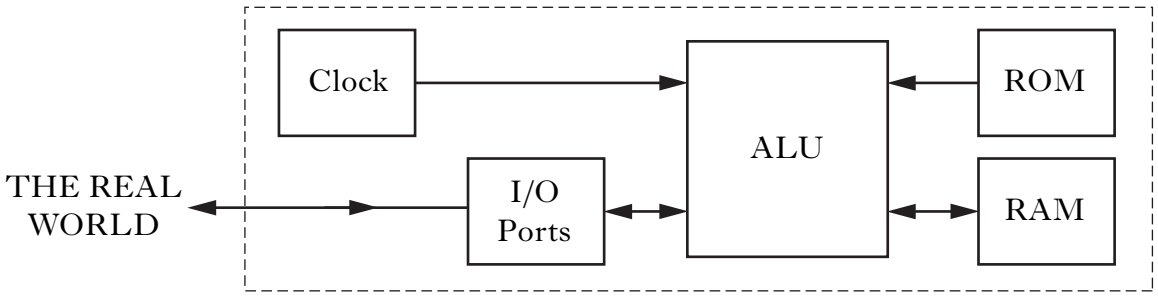
(ii) a voltmeter.

1
0

DO NOT WRITE IN THIS MARGIN

KU	RNA

6. Microcontrollers are used in many everyday devices.



(*a*) State the **full name** of the following microcontroller sub-systems.

(i) ROM _____ **1 0**

(ii) RAM _____ **1 0**

(iii) ALU _____ **1 0**

(*b*) (i) State the **function** of the clock.

_____ **1 0**

(ii) State the **function** of the bus.

_____ **1 0**

(*c*) State **two advantages** of using a microcontroller instead of a hard wired electronic system.

1 _____ **2**

2 _____ **1 0**

A flowchart can be used to develop a PBASIC program.

(*d*) State, with reference to the Data Booklet, the PBASIC command:

(i) for pin 3 and 5 to be **set up** as outputs and the remaining 6 pins as inputs;

_____ **2 1 0**

(ii) to produce a 0·5 second delay;

_____ **1 0**

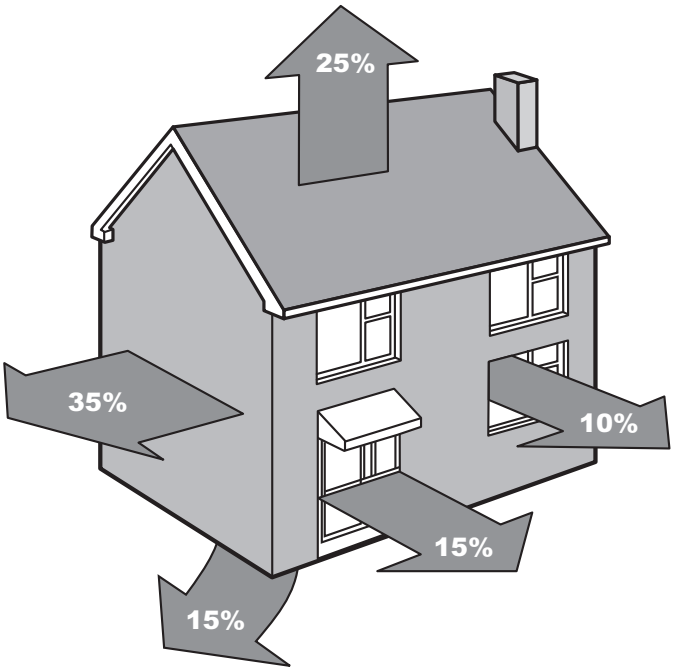
(iii) to switch pin 5 on.

_____ **1 0**

DO NOT WRITE IN THIS MARGIN

KU	RNA

7. The diagram below shows all the ways in which heat is lost from a house.



(*a*) State **two** methods of reducing energy loss within the house.

1 _____ **2 1 0**

2 _____ **2 1 0**

(*b*) Complete the energy conversion statements for each of the given products to show the main input and output energy using the list below.

Potential *Kinetic* *Heat* *Chemical* *Electrical* *Nuclear* *Sound* *Light* *Magnetic*

(i) **Gas cooker** **2 1 0**

_____ energy is converted to _____ energy.

(ii) **A wind-up radio** **2 1 0**

_____ energy is converted to _____ energy.

(iii) **Washing machine** **2 1 0**

_____ energy is converted to _____ energy.

Wind is a **renewable** energy source used to generate electricity.

(*c*) State **two** other sources of **renewable** energy.

1 _____ **2 1 0**

2 _____ **2 1 0**

DO NOT WRITE IN THIS MARGIN

KU	RNA

8. A warning system on a school minibus is operated by a microcontroller.

Part of the control program includes a sub-procedure 'warning' which will activate when the minibus' reverse gear is engaged.

The sequence of operations is as follows:

- a buzzer and lights go on;
- a delay of ½ second;
- the buzzer and lights go off;
- a delay of ½ second;
- only when the reverse gear is disengaged the sequence ends and returns to the main program.

Input Connection	Pin	Output Connection
	7	
	6	
	5	Buzzer
	4	
	3	Lights
	2	
Reverse gear sensor	1	
	0	

DO NOT WRITE IN THIS MARGIN

KU	RNA

8. (continued)

Complete, with reference to the sequence of operations and Data Booklet, the flowchart for the sub-procedure 'warning'.

8 7 6 5 4 3 2 1 0

[*END OF QUESTION PAPER*]

ACKNOWLEDGEMENTS

General Level Question 4—Photograph of a Coca-Cola can. Permission is being sought from Coca-Cola.

General Level Question 8—Photograph of a Maxus minibus is reproduced by kind permission of Eco Concept Ltd.

[BLANK PAGE]

[BLANK PAGE]