FOR OFFICIAL USE

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	KU	RNA
Total Marks		

4040/401

NATIONAL QUALIFICATIONS 2010

TUESDAY, 4 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.

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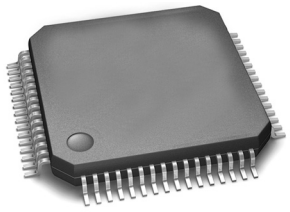
1. Microcontrollers consist of several sub-systems.



(*a*) Complete the table by matching the correct sub-system from the list below with its function given in the table.

ALU *Clock* *RAM* *Bus* *ROM*

Microcontroller sub-systems	**Function**
	Synchronises the system and controls the speed of operation.
	The "brain" of the microcontroller that carries out mathematical functions.
	Used to move information between microcontroller sub-systems.
	Temporary memory used during the running of the program/task.
	Permanent memory where a program can be stored.

5
4
3
2
1
0

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

(i) **ROM**

Full name _____

1
0

(ii) **RAM**

Full name _____

1
0

(iii) **ALU**

Full name _____

1
0

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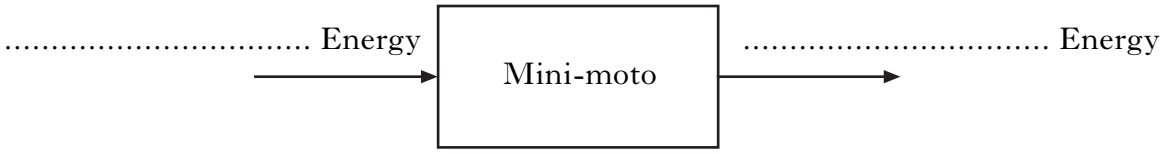
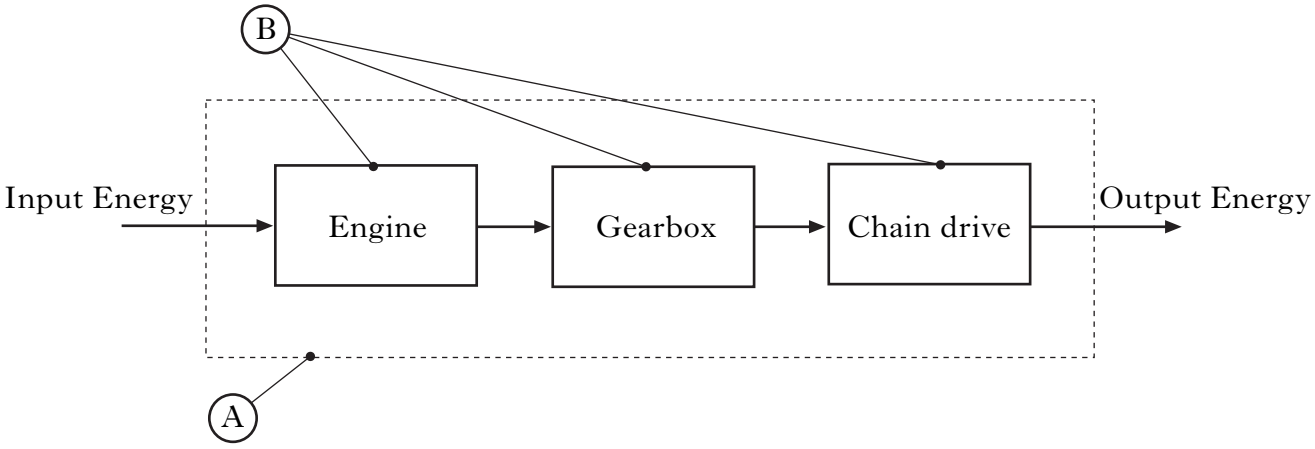
2. A petrol driven mini-moto is shown below.

(*a*) Complete the system diagram below for the mini-moto by adding the main input **energy** and the main output **energy**.



2
1
0

(*b*) The main parts of a mini-moto drive system are shown in the diagram below.



(i) (A) separates the system from the outside world.

State the name of this part of the diagram.

_____

1
0

(ii) The whole system can be broken down into several parts labelled above as (B).

State the name given to these parts.

_____

1
0

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3. An automatic sliding roof for a sports stadium is operated by a microcontroller.

Part of the control program includes a sub-procedure 'close' which will run when frost is detected.

The sequence is as follows:

- the floodlights switch on;
- after a 5 second delay the roof motor switches on;
- when the stadium roof is fully closed a limit switch is activated which stops the motor;
- the sequence ends and returns to the main program.

INPUT/OUTPUT CONNECTIONS

Input Connection	Pin	Output Connection
	7	
	6	Roof motor
	5	
	4	Floodlights
	3	
	2	
Limit Switch	1	
	0	

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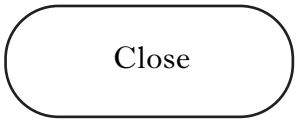
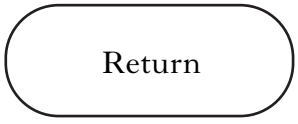
3. (continued)

(*a*) Complete, with reference to the sequence of operations and Data Booklet, the flowchart for sub-procedure 'close'.





7 6 5 4 3 2 1 0

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3. (continued)

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The flowchart is used to develop a PBASIC program.

(*b*) With reference to the Data Booklet state the PBASIC command:

(i) for pin 4, and 6 to be **set up** as an output and the remaining 6 pins set up as inputs; **2 1 0**

_____

(ii) to produce a 5 second delay. **1 0**

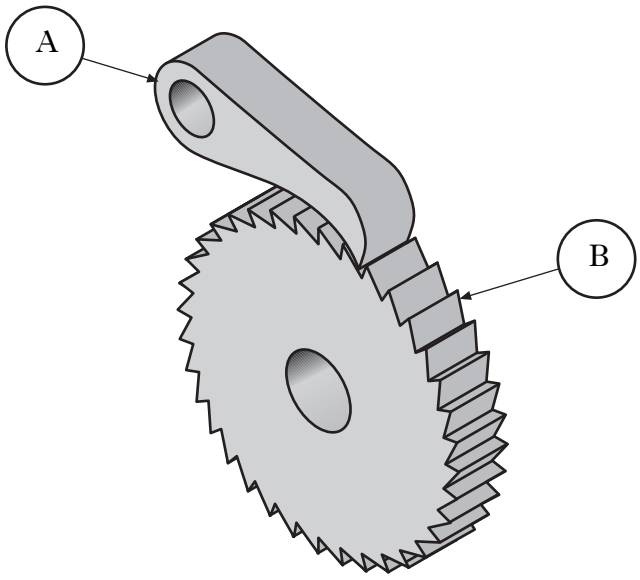
_____

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

1 _____ **2 1 0**

2 _____

The device shown in the sketch below is part of the stadium roof mechanism.



(*d*) State the name of parts (A) and (B). **2 1 0**

(A) _____ (B) _____

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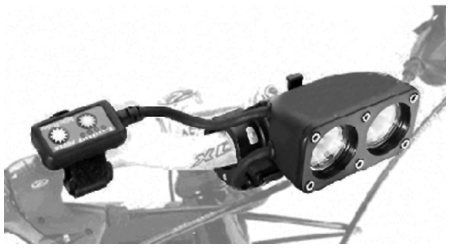
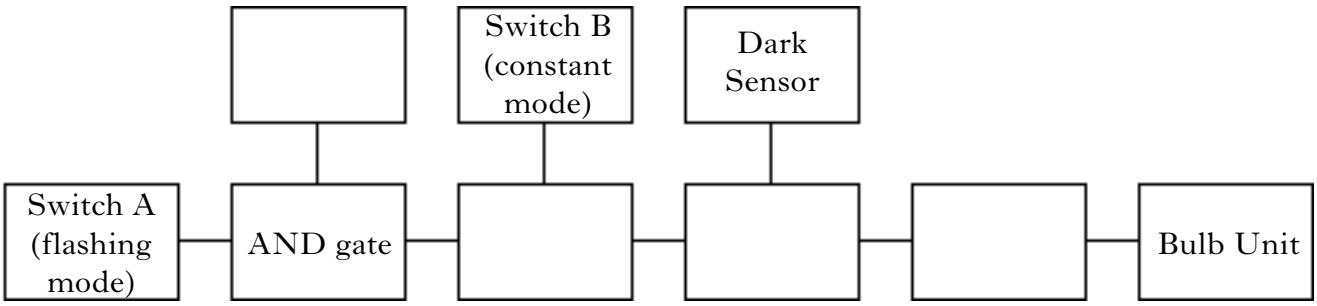
4. A bicycle light is modelled using electronic boards.



The light can be activated manually by either switch A (flashing mode) **or** by switch B (constant mode). It will also switch on automatically when darkness is sensed.

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

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



4 3 2 1 0

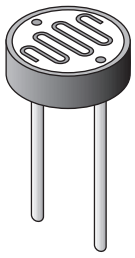
(*b*) (i) Sketch the logic symbol for an AND gate.

2 1 0

(ii) Complete the truth table for an AND gate.

Input A	Input B	Z
0	1	0

3 2 1 0



(*c*) State the name of the electronic component shown opposite.

_____

1 0

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

_____

1 0

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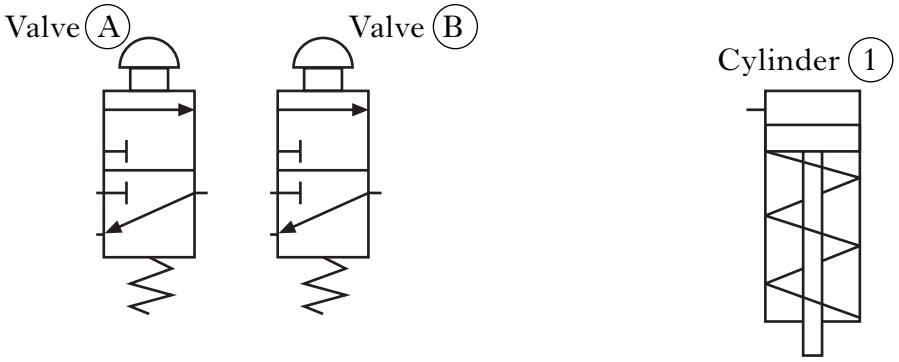
5. Pneumatic circuits can be used to perform logical operations.

(*a*) Draw the symbols for exhaust and mains air on Valve (A) below. **2 1 0** **2 1 0**

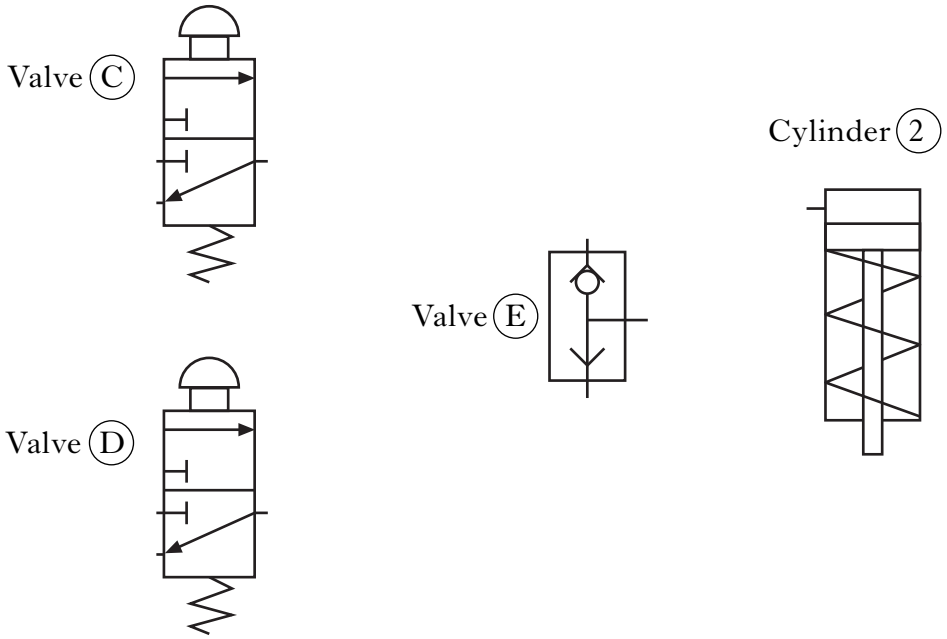
(*b*) Complete the piping of the pneumatic circuits below to give:

(i) **AND** control;



2 1 0

(ii) **OR** control.



3 2 1 0

(*c*) State the **full name** of the following pneumatic components. **3 2 1 0**

(i) Valve (D) _____ **1 0**

(ii) Valve (E) _____ **1 0**

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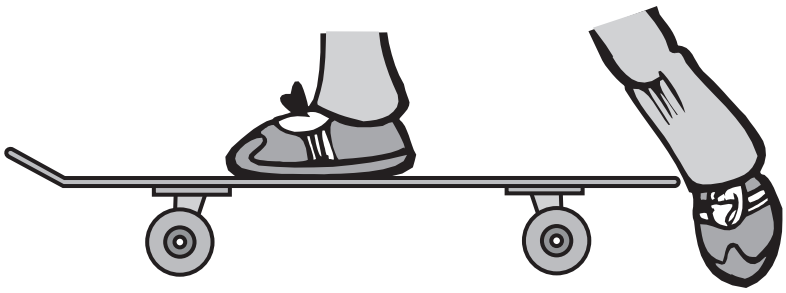
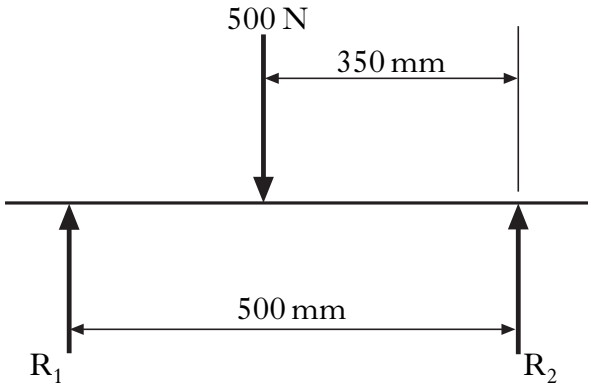
6. A skateboarder is shown below.



The diagram below shows the forces and distances on the skateboard.



(*a*) State the name given to the type of diagram shown above.

1 0

(*b*) (i) Calculate, by taking moments about R_2, the size of the reaction force R_1.

3 2 1 0

(ii) Calculate the reaction force R_2.

2 1 0

Bearings are used in the wheels of a skateboard to reduce friction.

(*c*) State **one** other method which can be used to reduce friction.

1 0

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7. A hire shop in a popular Spanish resort rents out electric scooters.

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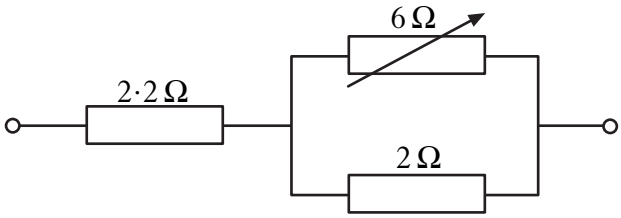
The scooters use rechargeable batteries.

(*a*) Part of a resistor arrangement for the battery charger is shown.



(i) Calculate the resistance of the **parallel** branch shown above.

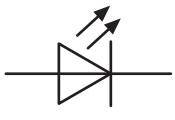
2 1 0

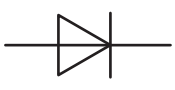
(ii) Calculate the **total** circuit resistance for the arrangement shown above.

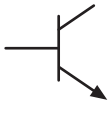
2 1 0

Other electronic components are used in the battery charger.

(*b*) State the name of the electronic components shown below.







3 2 1 0

1 _____ 2 _____ 3 _____

7. (continued)

The current flowing through the 2·2 Ω resistor is 0·6 amps.

(*c*) (i) Calculate the voltage across the 2·2 Ω resistor.

KU	RNA
	2
	1
	0

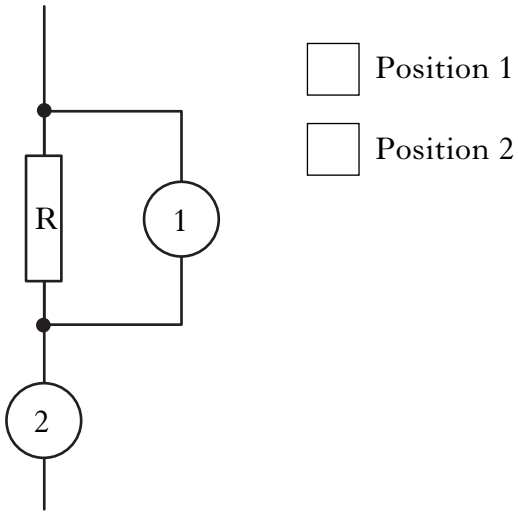
(ii) Calculate the power used by the 2·2 Ω resistor.

KU	RNA
	2
	1
	0

(iii) Draw the symbol for an ammeter.

KU	RNA
1	
0	

(*d*) (i) Select (✓) the correct position of a voltmeter to measure the voltage across the resistor R.



(ii) Draw the symbol for a voltmeter.

KU	RNA
1	
0	
1	
0	

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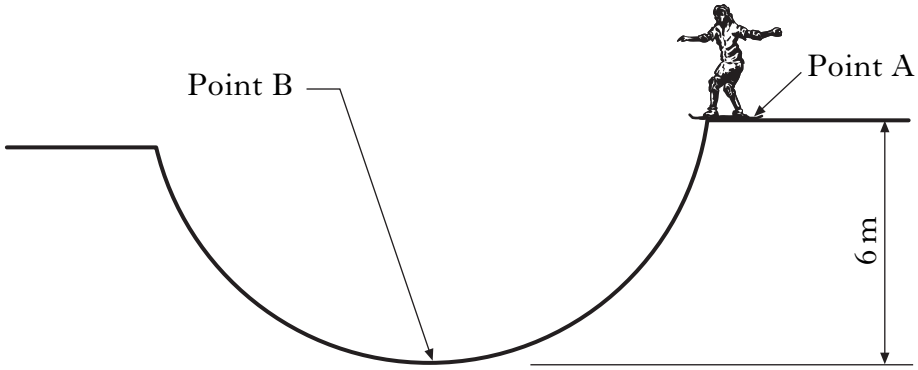
8. A snowboarder of mass 65kg is standing at point A on a half pipe.



(*a*) Calculate the potential energy of the snowboarder at point A.

2 1 0

The snowboarder is travelling at 10 m/s when he reaches point B.

(*b*) Calculate the kinetic energy of the snowboarder at point B.

2 1 0

(*c*) Complete the table below to indicate (✓) whether each listed energy source is renewable or non-renewable.

Energy source	Energy type	
	Renewable	*Non-renewable*
Wind		
Coal		
Gas		
Bio-mass		
Wave		

5 4 3 2 1 0

[*END OF QUESTION PAPER*]