

Surname	Centre Number	Candidate Number
Other Names		0

**GCSE**

4121/01

**DESIGN & TECHNOLOGY****UNIT 1****FOCUS AREA: Systems and Control Technology**

A.M. WEDNESDAY, 15 May 2013

2 hours

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Question 1	
Question 2	
Question 3	
Question 4	
Question 5	
Question 6	
Question 7	
Question 8	
<b>TOTAL MARK</b>	

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010001**ADDITIONAL MATERIALS**

You will need basic drawing equipment, coloured pencils and a calculator for this examination.

**INSTRUCTIONS TO CANDIDATES**

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet. Where the space is not sufficient for your answer, continue at the back of the book, taking care to number the continuation correctly.

You are reminded of the necessity for good English and orderly presentation in your answers.


**INFORMATION FOR CANDIDATES**

The number of marks is given in brackets at the end of each question or part-question.

**Section A***Marked out of 60      60 minutes*

1. This question is about Product Analysis. It is worth a total of 15 marks.

An electric paper stapler has been launched to compete with existing products.

	<p>Features:</p> <ul style="list-style-type: none"> <li>• Powered by 4 × AA batteries or mains transformer (not supplied).</li> <li>• Transparent casing.</li> <li>• Staples between 2 and 12 sheets.</li> <li>• Visible mechanical components.</li> </ul>
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- (a) A design specification was produced before designing the stapler.

Write a detailed specification point for each of the following headings.

- (i) Environmental impact: ..... [2]

.....

- (ii) Function: ..... [2]

.....

- (iii) Styling: ..... [2]

.....

- (b) The electric stapler has to appeal to potential consumers.

- (i) State the potential target market for the electric stapler. [1]

.....

- (ii) Describe how the electric stapler would appeal to the target market. [2]

.....

.....

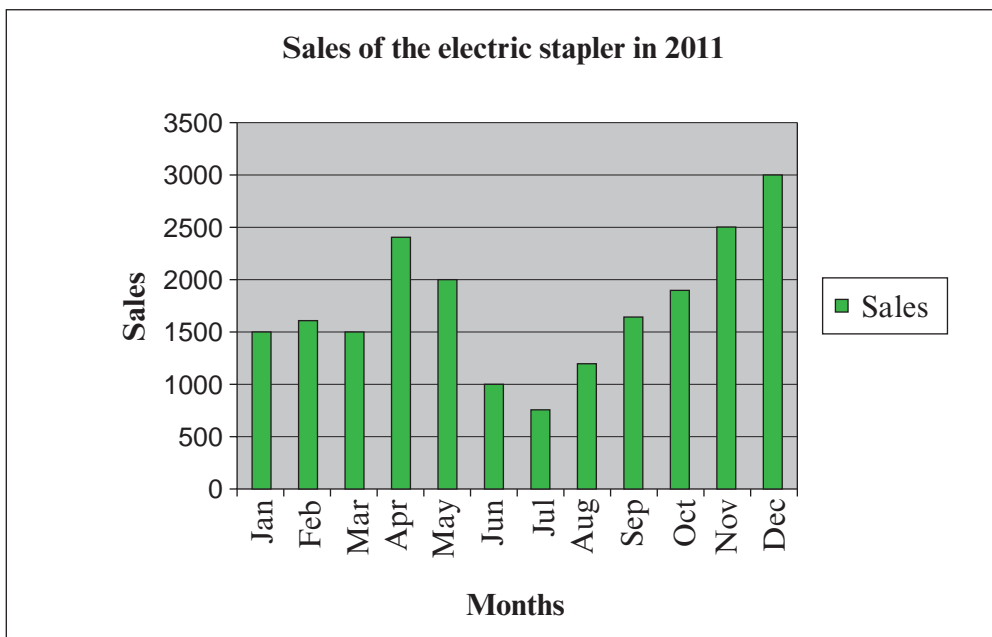
- (c) Describe the health and safety considerations facing the designer when designing the electric stapler for use by the consumer. [3]

.....

.....

.....



- (d) The bar chart below shows the monthly sales during 2011.



- (i) State the month with the lowest sales. [1]
- .....
- (ii) The manufacturer makes 18% profit when the electric stapler is sold for £10.00. Calculate how much profit (in £s) was made during December. [2]
- .....
- .....

2. This question is about the general issues of Design and Technology. It is worth a total of 10 marks.

(a) Study the two logos and **tick (✓)** the correct meaning for each logo. [2]

<i>Logo</i>	<i>Meaning</i>	<i>Tick (✓)</i>
	<ul style="list-style-type: none"> <li>Paper and card recycling.</li> </ul>	
	<ul style="list-style-type: none"> <li>Can be placed in a steel recycling facility.</li> </ul>	
	<ul style="list-style-type: none"> <li>Glass bottle bank.</li> </ul>	
	<ul style="list-style-type: none"> <li>Contributes towards packaging recycling.</li> </ul>	
	<ul style="list-style-type: none"> <li>Can be placed in an aluminium recycling facility.</li> </ul>	
	<ul style="list-style-type: none"> <li>Do not litter.</li> </ul>	

(b) Complete the table below by naming the correct 'R' for each of the descriptions.

**One example has been done for you.**

[5]

<i>R</i>	<i>Description</i>
REPAIR	When a product breaks, try to fix it.
.....	Take the material from a waste product and make another product.
.....	Consider other alternatives to sustain our current way of life.
.....	Limit the energy used.
.....	Reject a product because you do not need it.
.....	A product is made using reprocessed materials from other products.

(c) Describe how society can be encouraged to become more sustainable.

[3]

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4. This question is about the Design Process and how it is used. It is worth a total of 25 marks.

(a) Complete the design process by adding the stages from the list below in the correct order. [4]

Development    Initial Ideas    Brief and Specification    Final Idea    Template

<i>Problem</i>
Research and Analysis
.....
.....
.....
.....
Planning the Making
Manufacture
Evaluation

(b) (i) Name **one** CAD programme you have used when designing. [1]

.....

(ii) Explain how a CAD programme is useful during the designing process. [2]

.....

.....

.....

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- (c) A recycling centre requires you to design and make an automatically illuminating recycling sign to be situated at the entrance.

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### Specification

The device must:

- be battery powered and use 3 ultra-bright LEDs;
- include the recycling logo and automatically illuminate at night;
- be made from materials suitable for outdoor use;
- be fixed to a 60 mm diameter post.

Marks will be awarded for:

- |  |     |
|--|-----|
| (i) designing an illuminated sign;                             | [1] |
| (ii) fully labelled details of the overall look of the device; | [3] |
| (iii) a block diagram of the electronic system used;           | [3] |
| (iv) details of the electronic circuit used in the device;     | [5] |
| (v) details of how the device fits to the 60 mm diameter post; | [2] |
| (vi) sizes, materials and quality of communication.            | [4] |

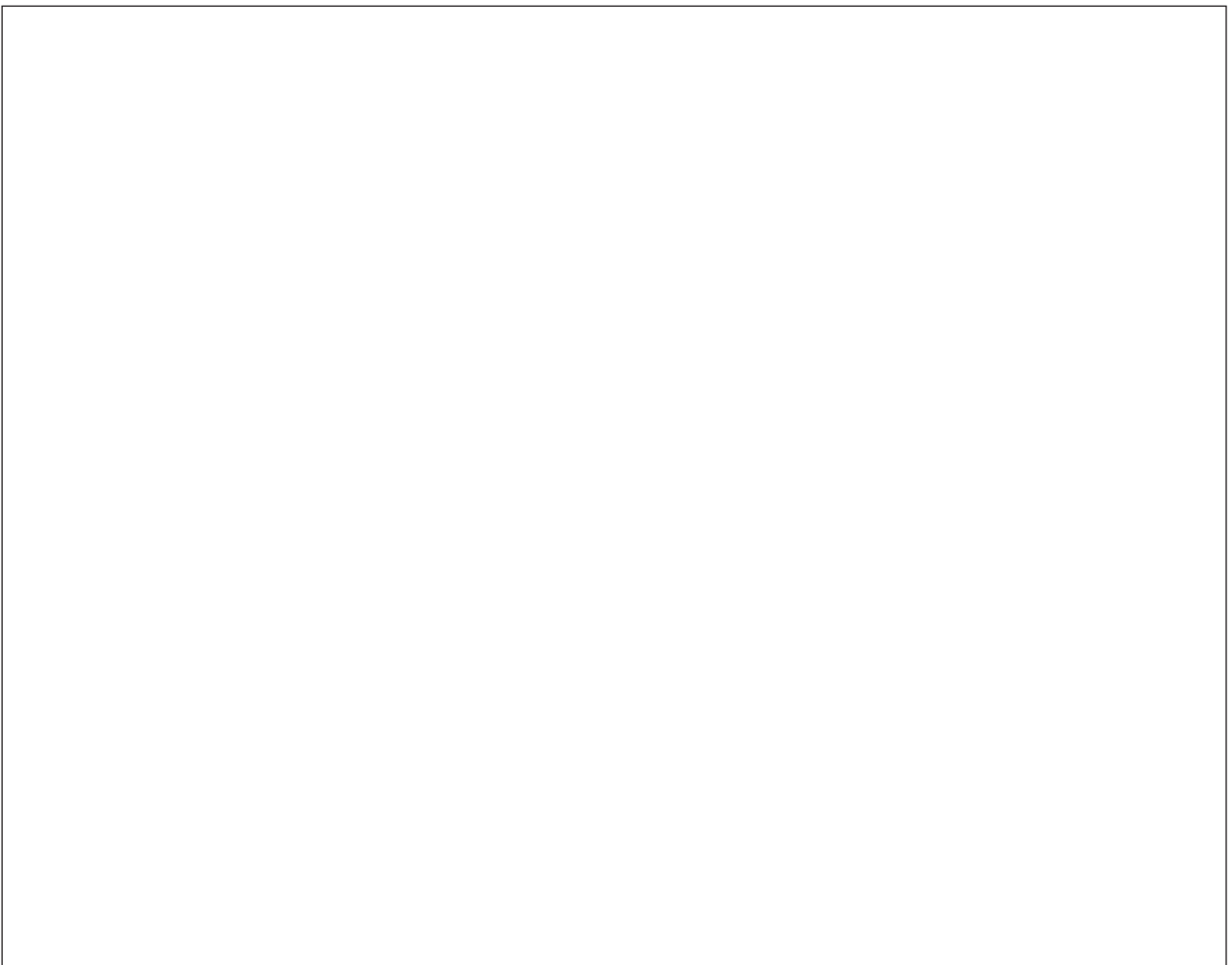
Draw fully labelled details of the overall look of the device in the box below, including how the device fits to a 60 mm diameter post.



Draw a block diagram of the electronic system in the box below.



Draw details of the electronic circuit used in the box below.



**Section B**

*Marked out of 60 60 minutes*

5. This question is about Commercial Manufacturing Processes. It is worth a total of 10 marks.

(a) Using the word bank, complete the table by placing the correct production scale next to each description. [4]

**Mass Production      One-Off Production      Batch Production**  
**Rapid Prototyping      Continuous Flow Production**

<i>Description</i>	<i>Production Scale</i>
A single item is made specifically to order.	.....
Many thousands of identical items produced 24 hours a day 7 days a week.	.....
500 identical special edition items are produced.	.....
A large number of identical items are produced using automation.	.....

(b) In industry, a production line can be fully automated. Describe **two** benefits for the manufacturer of this type of production line. [4]

Benefit 1: .....

.....

Benefit 2: .....

.....

(c) Describe how Moore’s Law has contributed towards the trend of miniaturisation. [2]

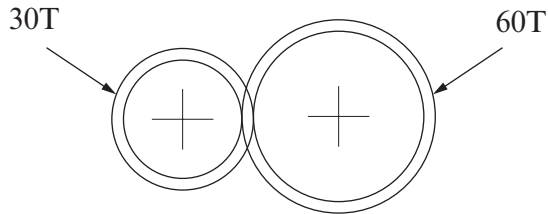
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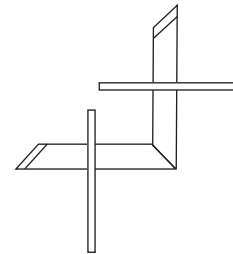
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6. This question is about Materials and Components. It is worth a total of 15 marks.

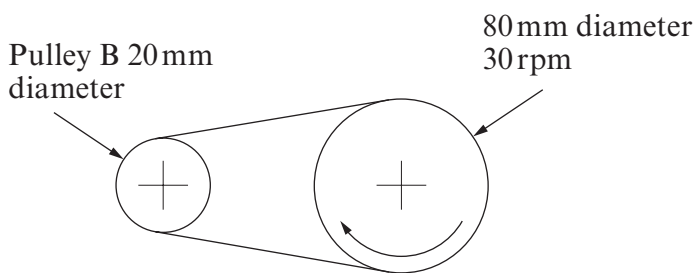
(a) Study the mechanisms shown below.



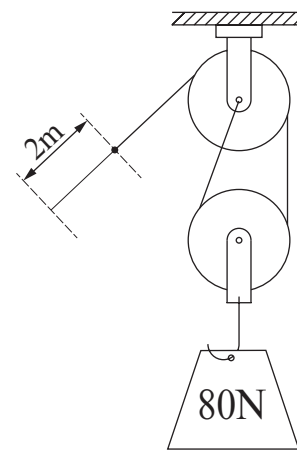
Spur gears



Bevel gears



Simple pulley



Lifting pulley

(i) State the name of the mechanism that transfers rotary motion through 90 degrees. [1]

(ii) State the velocity ratio (VR) of the spur gear system. [1]

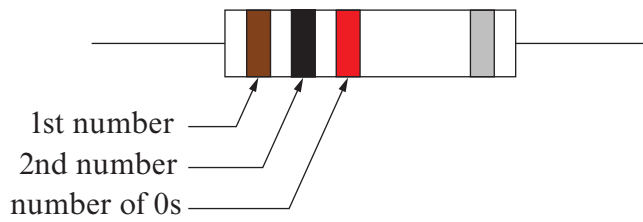
(iii) In the lifting pulley system a 40 N effort is used to move an 80 N load. Calculate the distance moved by the 80 N load if the effort moves 2 m. [2]

Show all workings.

(iv) Calculate the rotational velocity (RV) of pulley B in the simple pulley system. [2]

Show all workings.

(b) Study the resistor colour code below.



e.g. 1 0 00

Resistor is 1000 ohms or 1 k ohm.

BLACK		0
BROWN		1
RED		2
ORANGE		3
YELLOW		4
GREEN		5
BLUE		6
VIOLET		7
GREY		8
WHITE		9

Calculate the values of the following resistors using the colour code.

[3]

Red Red Orange

Yellow Violet Orange

Orange Orange Black



Value: .....

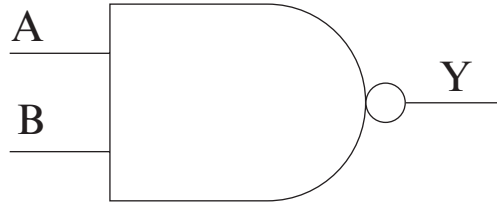
Value: .....

Value: .....

(c) Complete the table by sketching the correct symbol for each electronic component. [3]


(d) Complete the truth table for the logic gate shown.

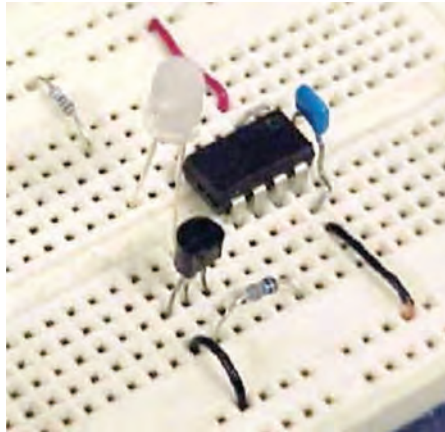
[3] Examiner  
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A	B	Y
0	0	0
1	0	
0	1	
1	1	

7. This question is about Tools, Equipment and Making. It is worth a total of 20 marks.

A student makes the electronic circuit shown below.



- (a) (i) State the name of the board this circuit is constructed on. [1]

.....

- (ii) The circuit is designed to flash the LED. When powered the LED does not function. Describe **one** test to check if the LED works. [2]

.....

.....

- (b) Complete the table by selecting the correct stages for making a printed circuit board (PCB) in a school workshop. [4]

Place in etching tank.    Place in UV light box.    Develop PCB image.

Drill holes in the pcb.    Rinse with water.

<i>Stage No.</i>	<i>Description</i>
Stage 1	Produce transparency and cut photo etch board to size.
Stage 2	.....
Stage 3	.....
Stage 4	.....
Stage 5	.....
Stage 6	Rinse with water and dry PCB.

(c) Describe **two** safety precautions to be considered when using a soldering iron.

Precaution 1: ..... [2]

.....

Precaution 2: ..... [2]

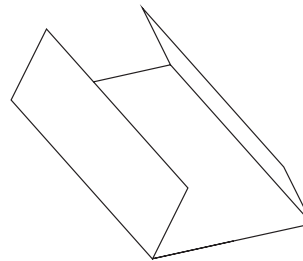
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(d) Use annotated sketches to explain in detail, how you could make the battery holder shown below from a piece of 1.5 mm thick High Impact Polystyrene (HIPS). [5]

*Name any tools, machines or equipment used.*



Battery holder



(e) CAM can be used to make identical products in large quantities. Give **two** advantages of using CAM in this way.

Advantage 1: ..... [2]

.....

Advantage 2: ..... [2]

.....

8. This question is about ICT, CAD, CAM, Systems and Processes. It is worth a total of 15 marks.

(a) A multi-function torch for use outdoors has three different modes. The user presses the desired mode button to activate the chosen mode.



- White light beam for torch function if torch mode button is continually pressed.

- A siren will bleep for 2 minutes to give location of user if siren mode button is selected.

- Mode buttons.

- Two flashing red lights on for 5 minutes if help button is pressed.

(i) Name **one** input to the torch system.

[1]

.....

(ii) Name **one** output to the torch system.

[1]

.....



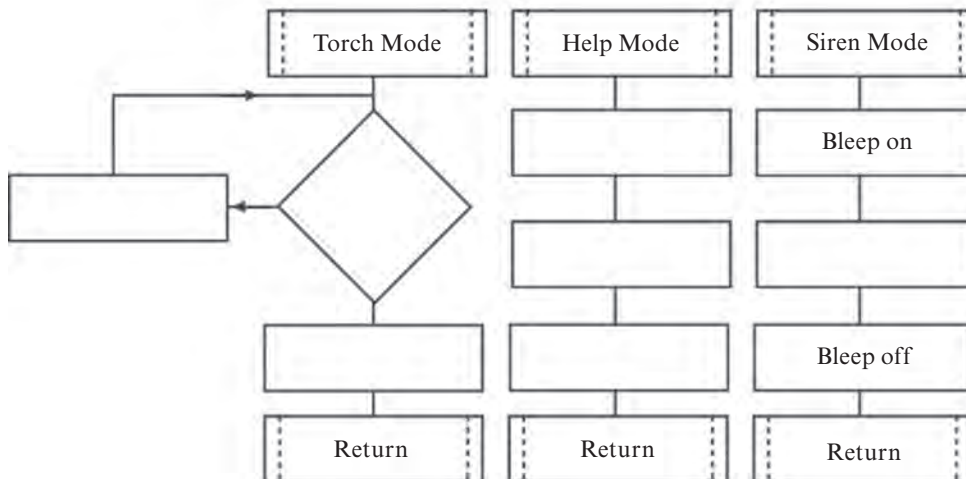
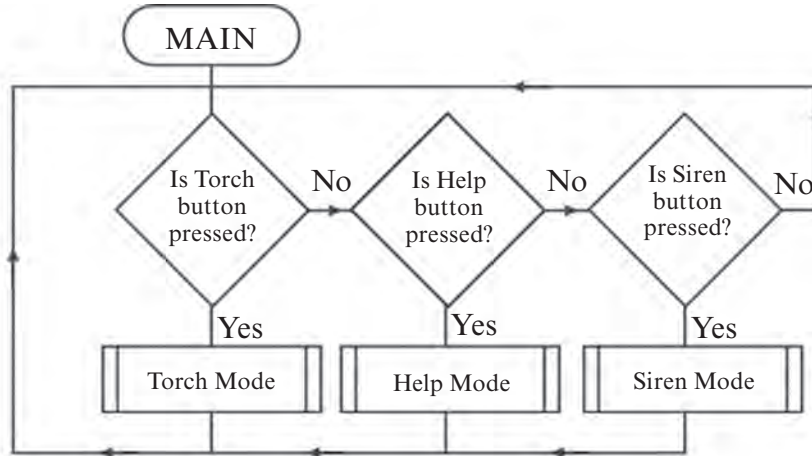
(b) The flowchart below is used to control the torch system.

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(i) Complete the flowchart by placing the statements in the correct positions. [7]

**Statements**

- Wait 5 minutes  
2 red lights off
- Wait 2 minutes  
White beam off
- Flash 2 red lights  
Is torch button pressed?
- White beam on



(ii) Explain why a *Macro* or *sub routine* approach has been used in this flowchart. [2]

.....

.....

(c) Give **two** reasons why a PIC (Programmable Interface Controller) could be a suitable component to control the torch.

Reason 1: .....

..... [2]

Reason 2: .....

..... [2]

**END OF PAPER**

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**For continuation only**

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