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| Surname | Centre Number | Candidate Number |
| Other Names | | 0 |

**GCSE**

4121/01



S17-4121-01

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

TUESDAY, 23 MAY 2017 – MORNING

2 hours

| For Examiner's use only | | |
|-------------------------|--------------|--------------|
| Question | Maximum Mark | Mark Awarded |
| Section A | 1. | 15 |
| | 2. | 10 |
| | 3. | 10 |
| | 4. | 25 |
| Section B | 5. | 10 |
| | 6. | 15 |
| | 7. | 20 |
| | 8. | 15 |
| Total | 120 | |

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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 booklet, 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.

The computer keyboard vacuum cleaner below has been designed and made as a novelty gift.

**Product Features**

- Powered by 12 volt USB connection.
- USB cable length 1 metre.
- Weight: 50g.
- Comes with nozzle and brush attachments.
- Retail price: £15.49.
- Available in four different colours.

- (a) Before designing the computer keyboard vacuum cleaner, a design specification was written.

Study the **three** specification points below and explain how these have been met by the product.

- (i) The computer keyboard vacuum cleaner must remove dust. [2]

Explanation:

- (ii) The computer keyboard vacuum cleaner must be portable and easy to store when not in use. [2]

Explanation:

- (iii) The computer keyboard vacuum cleaner must be suitable for use with all laptops and computers. [2]

Explanation:

- (b) Describe the target market that the computer keyboard vacuum cleaner has been designed for. [2]

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- (c) The manufacturer has made 150 computer keyboard vacuum cleaners in **each** of the four colours available in the range.

- (i) State the correct scale of production that the manufacturer has used. [1]

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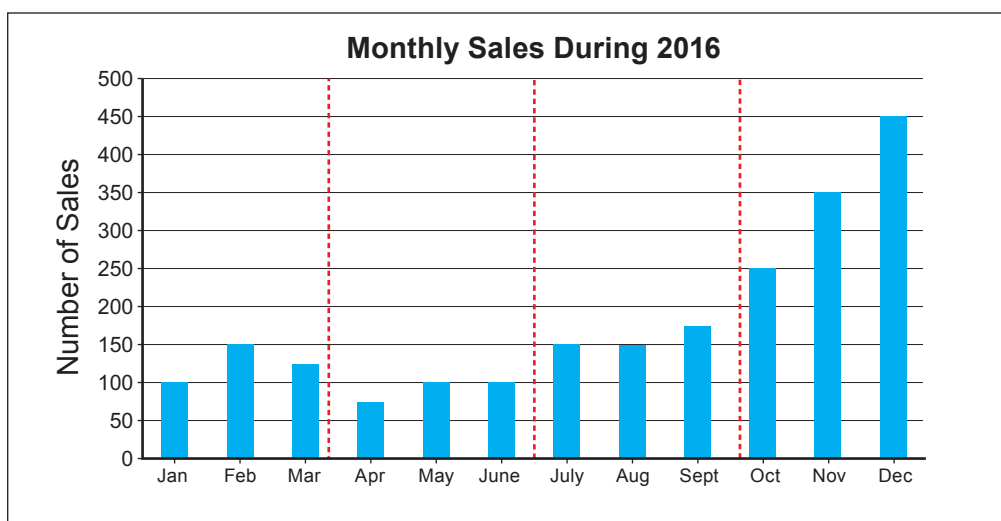
- (ii) During production 6% of the computer keyboard vacuum cleaners were found to have defects. Calculate the exact number of computer keyboard vacuum cleaners that were faulty. [2]

(Show all your workings.)

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- (d) The bar chart below shows the monthly sales totals for 2016.



- (i) State the quarter with the lowest sales. [1]

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- (ii) Give **one** reason why sales begin to increase at the end of the year. [1]

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- (iii) Calculate the average monthly sales for the 2016 period. [2]
- (Show all your workings.)




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

(a) Using the word bank below, name **each** of the logos shown. 3 x [1]

Aluminium Recycling British Standards Institution Glass Bottle Bank Green Dot

| | | |
|---|---|---|
|  |  |  |
| Name: | Name: | Name: |

(b) Many products on sale are now required to display (energy) labels like the one shown.



(i) State the reason for these labels. [1]

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(ii) Describe the importance of these labels to the consumer when making purchasing decisions. [2]

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(c) Explain how designers can use an aspect of the 6Rs to improve existing products or develop radically new products. [2]

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(d) Using **one** example, explain how government incentives can encourage society to be more environmentally friendly. [2]

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3. This question is about the Designers that you have studied. It is worth a total of 10 marks.
During your course you have studied the work of Shigeru Miyamoto and James Dyson.

(a) Write the name of the correct designer associated with the images below. 2 x [1]



Designer:

Designer:

(b) Write a short essay in the space below describing the work of James Dyson, identifying the features that make all Dyson products easily recognisable from competitors' products. [8]

Marks will be awarded for the content of the answer and the quality of written communication.

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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) Describe how CAD (Computer Aided Design) can be used during the design process. [2]

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.....

(b) Describe an important feature that should be included in an effective design specification. [2]

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.....

(c) Explain how a design specification should be used when designing and developing ideas. [3]

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- (d) A car manufacturer requires you to design a roadside assistance warning device to be used by car owners in the unlikely event of a breakdown.

Specification

The device must:

- be battery powered and flash 3 red LEDs to warn road users that a car requires assistance;
- automatically illuminate a warning symbol in dark conditions;
- be made from weather resistant and highly visible materials;
- be stable, freestanding and can be folded flat when not in use.



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Marks will be awarded for:

- | | |
|---|-----|
| (i) details of the electronic circuit used in the device; | [5] |
| (ii) a block diagram of the electronic system used; | [3] |
| (iii) fully labelled details of the overall look of the device; | [4] |
| (iv) details of how the device stores flat and stands with stability; | [2] |
| (v) sizes, materials and quality of communication. | [4] |

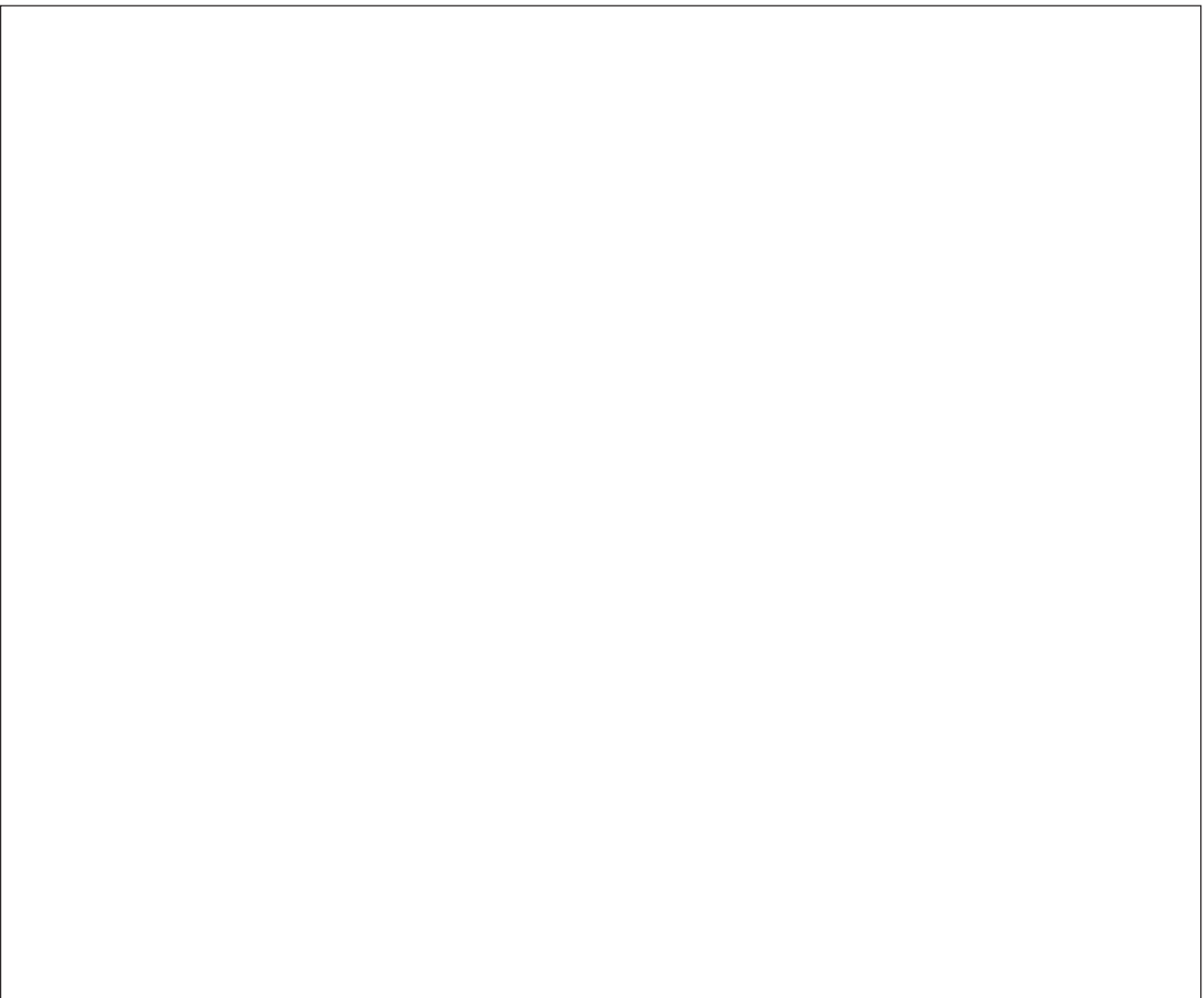
Draw details of the electronic circuit used in the box below.

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



Draw fully labelled details of the overall look of the device in the box below including how it stands and stores flat.



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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) Draw a line to link **each** scale of production to the correct description below. [2]

Continuous Flow Production

A single product is made.

Large numbers of products are made.

Mass Production

Products are made 24 hours
a day, 7 days a week.

(b) When products are manufactured for European markets, they are required to bear the symbol below.



Explain why a product is awarded this symbol.

[2]

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- (c) (i) Complete the table below by naming the missing stages when a printed circuit board (pcb) is manufactured using wave soldering.



2 x [1]

| Stage 1 | Stage 2 | Stage 3 | Stage 4 |
|----------------|----------------|----------------|----------------|
| Fluxing | | Solder wave | |

- (ii) Describe what happens during the Fluxing stage of wave soldering. [2]

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- (d) Explain why commercial manufacturers automate production lines when manufacturing products in volume. [2]

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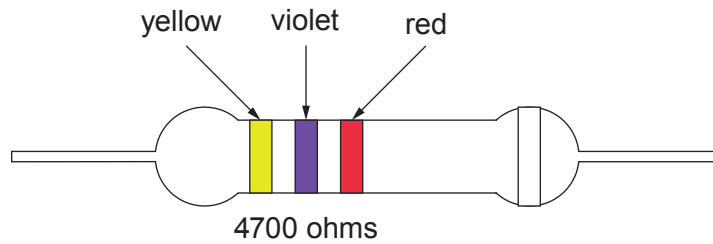
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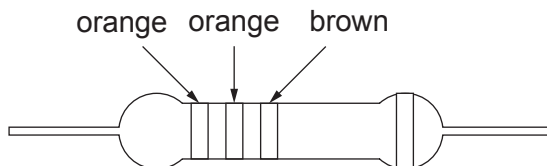
6. This question is about Materials and Components. It is worth a total of 15 marks.

(a) Study the example below showing details of how the table of resistor colour codes has been used to work out the value of a resistor.

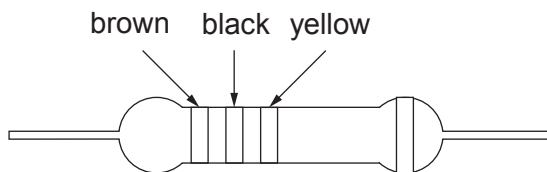


| | | | | | | | | | |
|-------|-------|-----|--------|--------|-------|------|--------|------|-------|
| Black | Brown | Red | Orange | Yellow | Green | Blue | Violet | Grey | White |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |

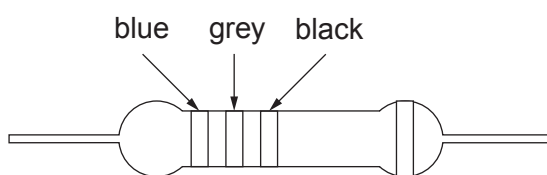
Calculate the value of the resistors below.



Value: [1]



Value: [1]

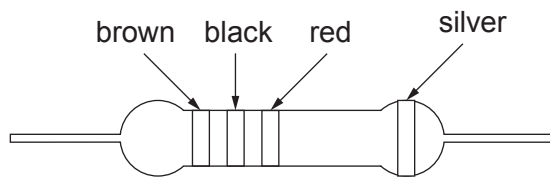


Value: [1]

- (b) Resistors also have a tolerance band and the colour code for this is shown below.

| | |
|-----------|---------|
| Gold | +/- 5% |
| Silver | +/- 10% |
| No Colour | +/- 20% |

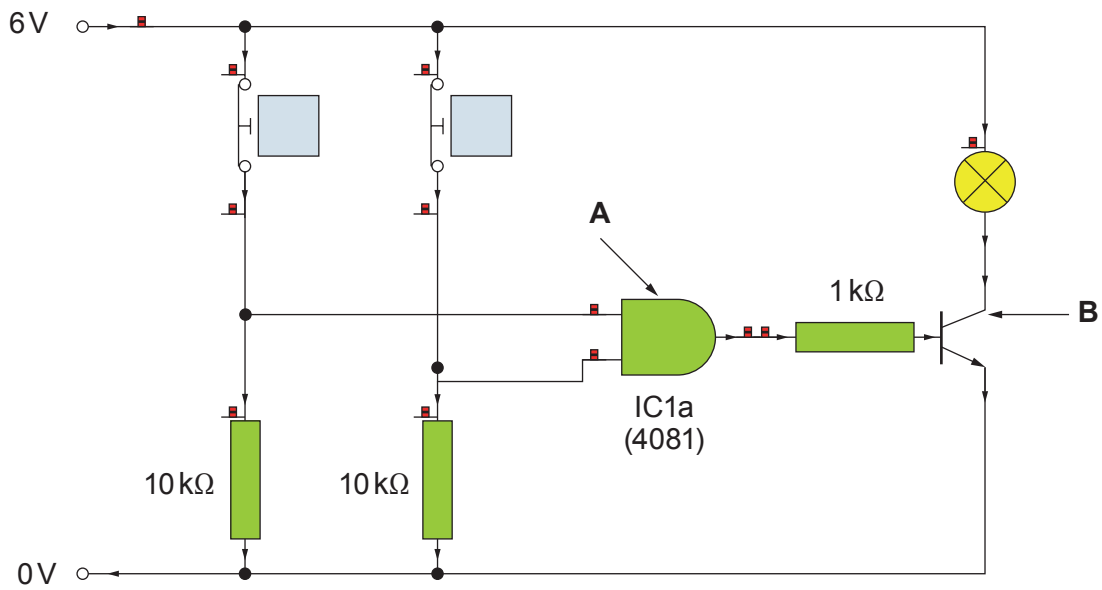
State the maximum value for the resistor shown below.



Maximum Value: [1]

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(c) Study the circuit below.



(i) State the name of an input component in the circuit. [1]

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(ii) Explain the role of the component labelled **A**. [2]

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(iii) Describe in detail why the component labelled **B** is required. [3]

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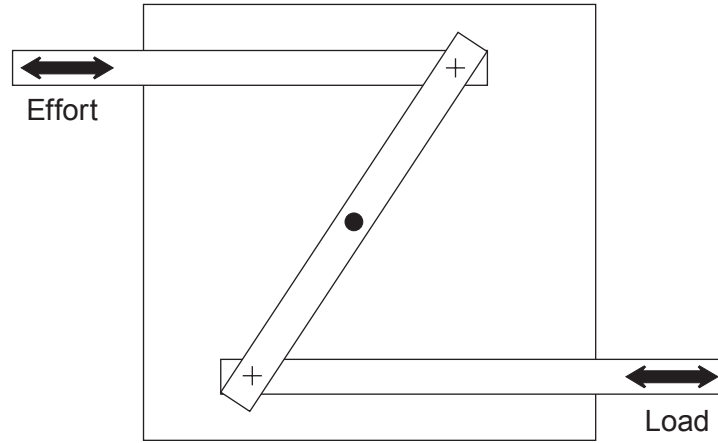
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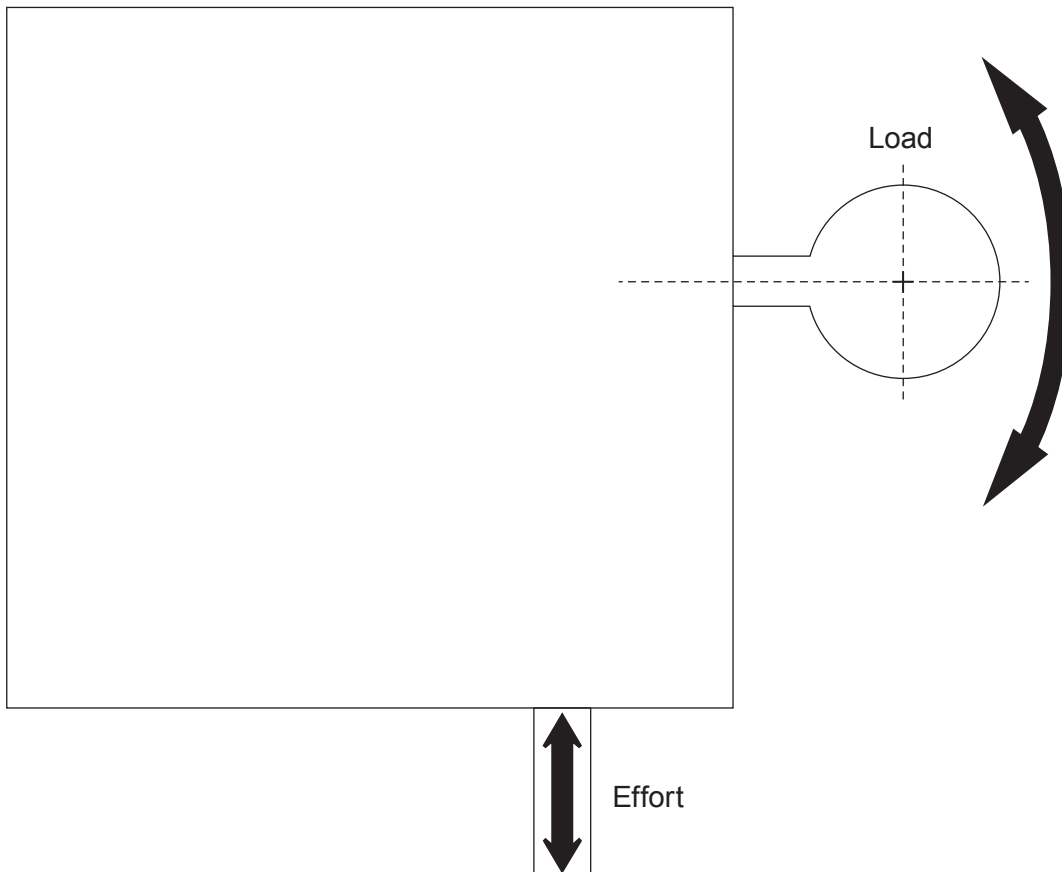
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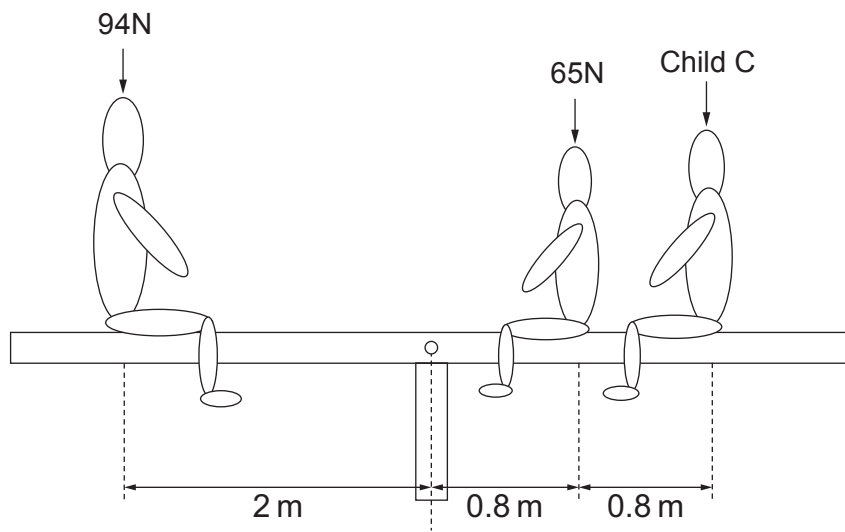
- (d) Study the example of a linkage diagram shown below which is to be used in moving birthday cards.
 (Note: + is a moving pivot, • is a fixed pivot.)



Complete the linkage system below using • for fixed pivots and + for moving pivots to achieve the desired movements with a velocity ratio (VR) of 1:2. [3]



- (e) Three children sit on a seesaw that remains in equilibrium.



Using the principle of moments, calculate the force of **Child C**.
(Show all your workings.)

[2]

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

(a) (i) Study the images of equipment below, and describe how **each** is used when making control systems.



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 [1] [1] [1]

(ii) State the name of the standard electronic component shown and explain why this is used in a circuit.

Name: [1]

Explanation:

.....
 [2]

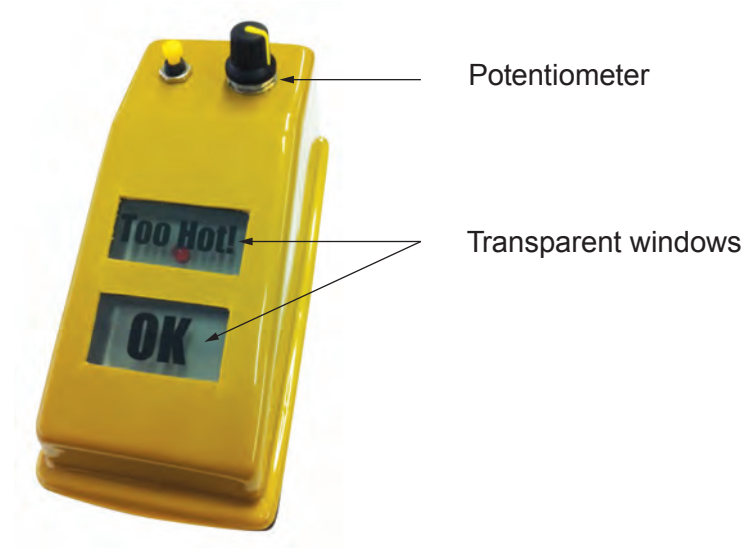


(b) Write the meaning of **each** of the workshop symbols shown below. 2 x [1]



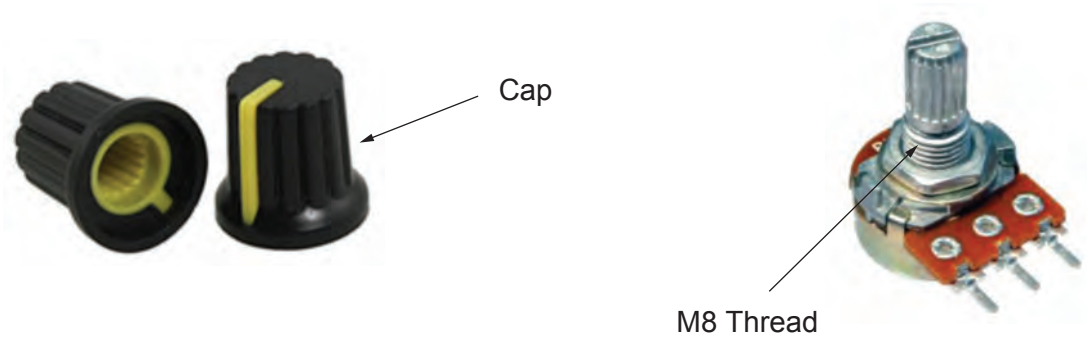
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- (c) A student has made the temperature sensing device shown below.



- (i) Name the process used to make the casing of the temperature sensing device. [1]
-
- (ii) Name a suitable plastic material to make the transparent windows. [1]
-
- (iii) Using notes and sketches, describe how you would create the rectangular openings in the casing before securing the transparent windows in place. [3]

- (iv) The potentiometer needs to be fitted to the case so that the user can adjust the sensitivity of the device.



In the space below, show how you would mark out and fit the potentiometer to the casing, including details of all tools, equipment and machinery required. [4]

Blank space for drawing the marking and fitting process.

- (v) The 'Too Hot!' and 'OK' text used to finish the sensing device are produced using the equipment shown. Complete the table describing the three stages of producing and applying the text.



| | |
|-----------------------|--|
| <p>Stage 1</p> | <p>.....</p> <p>.....</p> <p>..... [1]</p> |
| <p>Stage 2</p> | <p>.....</p> <p>.....</p> <p>..... [1]</p> |
| <p>Stage 3</p> | <p>.....</p> <p>.....</p> <p>..... [1]</p> |

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

- (a) A sports centre uses the automatic entry system shown below to allow members to use a card to gain access to facilities. The display panel illuminates a red light for 2 seconds if a card is not approved and a buzzer sounds for 1 second. A green light illuminates if the card is approved.



- (i) Complete the table placing a **tick** (✓) to show whether the statement is true or false. 2 x [1]

| | True | False |
|--|------|-------|
| The display panel is an input device. | | |
| The buzzer is an output of the system. | | |

- (ii) Explain the role of the Barcode Reader.

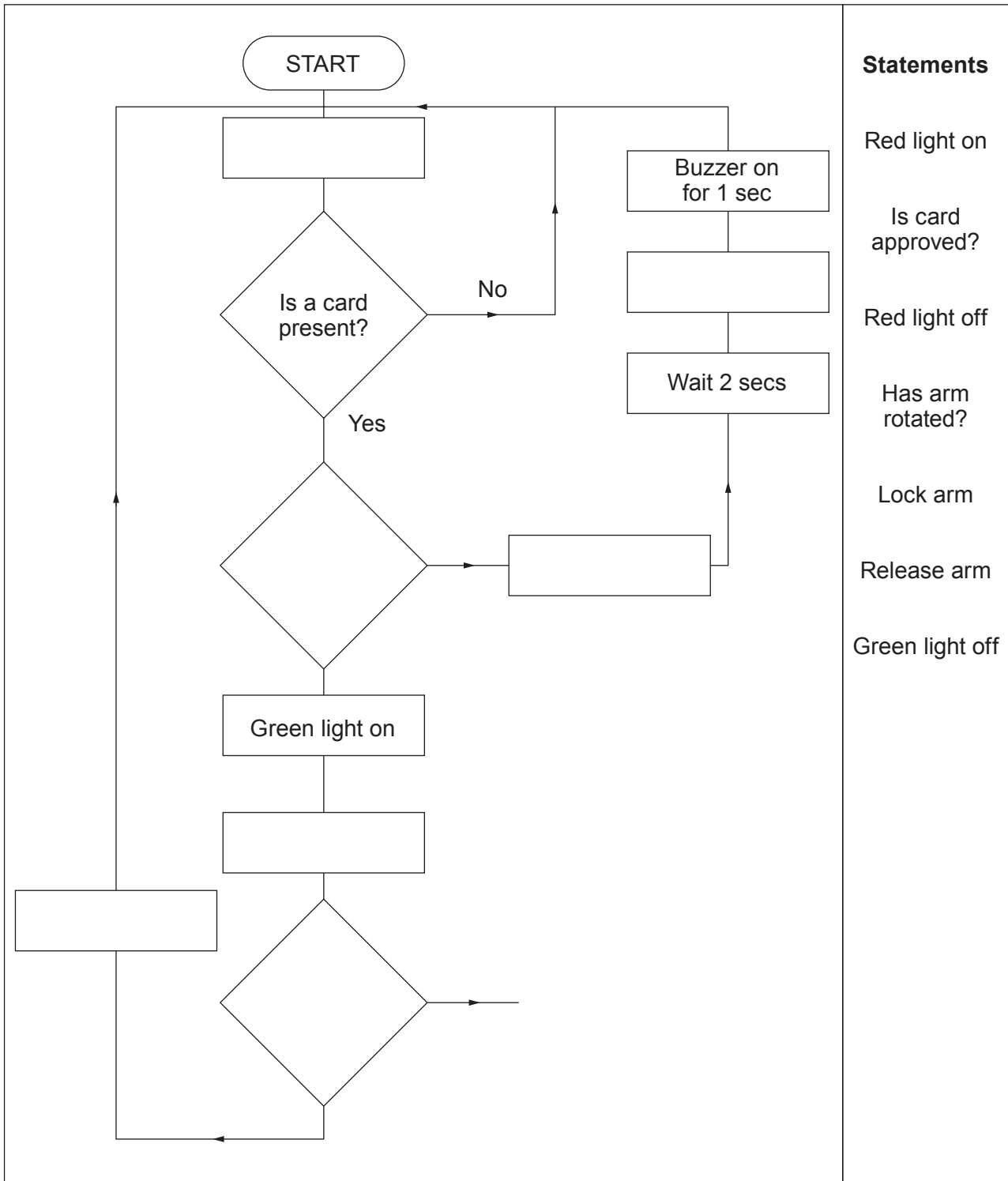
[2]

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(b) The flowchart below shows how the automatic entry system is controlled.

(i) Complete the flowchart by placing the statements in the correct positions and adding any missing feedback loops. [8]



Statements

- Red light on
- Is card approved?
- Red light off
- Has arm rotated?
- Lock arm
- Release arm
- Green light off

- (ii) In the space below, explain how the flowchart could be improved to limit the number of members using the sports centre facilities to 50 at any given time. [3]

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