



**General Certificate of Secondary Education  
June 2011**

**Engineering (Double Award) 48503**

**(Specification 4850)**

**Unit 3: Written Paper**

**Final**

***Mark Scheme***

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- 1 (a) (i) **Complete the missing view in the space provided above showing all the detail.**

2 marks for correct view and orientation  
2 marks for centrelines  
2 marks for hidden detail

(6 marks)

- 1 (a) (ii) **What type of pictorial drawing is Figure 1?**

Isometric

(1 mark)

- 1 (a) (iii) **What type of orthographic drawing is Figure 2?**

Third Angle Projection

(1 mark)

- 1 (b) (i) **From the information in Figure 3, calculate the total length required.**

3 marks for correct response  
2 marks for a close answer  
1 mark for a good attempt

Answer:  $175 + 200 + 175 + 200 + 350 = 1100 \text{ mm}$

(3 marks)

- 1 (b) (ii) **How many pieces can be cut from the sheet to minimise waste material?**

4 marks for correct answer and calculation  
3 marks for correct procedure and close answer  
2 marks for a close answer and sensible method  
1 mark for a good attempt

Answer: single sheet –  $1100 \text{ mm} \times 460 \text{ mm}$

(close answer) try  $460 \text{ into } 1250 = 2$

$1100 \text{ into } 2500 = 2$

Therefore 4 pieces may be cut from a standard sheet

(best fit) try  $1100 \text{ into } 1250 = 1$

$460 \text{ into } 2500 = 5$

Thus 5 pieces may be cut from the sheet

(4 marks)

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**1 (b) (iii) What type of machines would be used to cut the sheet and produce the holes in Part A?**

1 mark for each of the following:

Cutting the sheet – guillotine, laser cutter, flame cutter etcetera  
Producing the holes – drilling m/c, press tool, piercing m/c etcetera

*(2 marks)*

**2 (a) (i) Process**

Zinc galvanising, polymer powder coating

*(1 mark)*

**2 (a) (ii) Description of process**

1 mark for each stage of the process –

Description of process to include:

- Chemical cleaning
- Priming or other preparatory surface treatment
- Application of surface protection
- Molten or fluidised material

*(3 marks)*

**2 (a) (iii) State one reason why painting had not been considered.**

1 mark for one of the following:

Paint would scratch more easily than zinc and offer no protection  
Polymer powder coating is more wear-resistant than paint

*(1 mark)*

**2 (b) (i) Hazard 1**

1 mark for hazard and 1 mark for the control:

Hazards and controls could include:

- Fumes – wear mask and use fume extraction
- Skin contact – wear and use appropriate PPE
- Excessive heat – wear and use appropriate PPE
- Airborne particles – wear eye protection

*(2 marks)*

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**2 (b) (ii) Hazard 2**

1 mark for hazard and 1 mark for the control:

Hazards and controls could include:

- Fumes – wear mask and use fume extraction
- Skin contact – wear and use appropriate PPE
- Excessive heat – wear and use appropriate PPE

Airborne particles – wear eye protection

*(2 marks)*

**2 (c) Give two reasons why mild (low carbon) steel has been chosen for the caravan steps.**

1 mark for any two of the following:

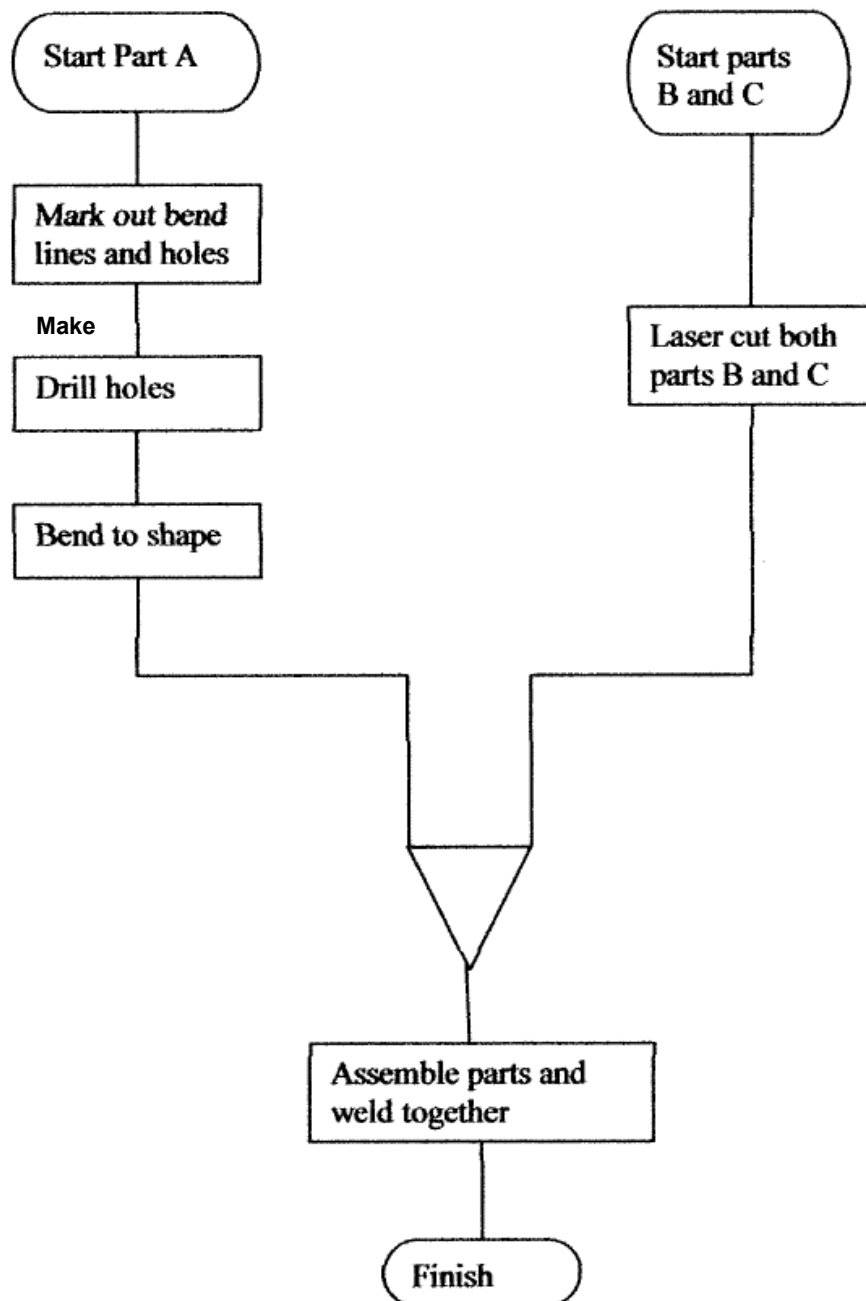
- Cheap to produce
- Easy to bend into required shape
- Easily welded and fabricated
- Any other valid reason

*(2 marks)*

- 3 Complete the production flow chart, for the component shown in Figure 3 on page 4 using the symbols given at the bottom of the page.

NB the 'Make Holes' and 'Bend to Shape' boxes can be entered in the opposite order and still be accepted

*1 mark for each correct symbol or statement*



(7 marks)

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**4 (a) Name the following components and symbols.**

D2 – Light Emitting Diode (LED)  
C1 – Capacitor  
R3 – Resistor  
B1 – Battery (power supply) / cell

(4 marks)

**4 (b) Describe what the component labelled IC1 NE555 does in the circuit in Figure 4.**

2 marks for a correct response, 1 mark for a limited response

Integrated circuit, used as a timer or similar

(2 marks)

**5 (a) Complete the table on the page opposite to work out the coordinates to which the cutter needs to go to start cutting, and the coordinates to which it needs to go to finish the cut.**

Operation	X coordinate	Y coordinate	Z coordinate
Move to start	+100	+100	+15
Plunge to depth	+100	+100	-3
Raise cutter	+100	+100	+15
Move to	+650	+350	+15
Plunge to depth	+650	+350	-3
Raise cutter	+650	+350	+15
Move to	0	0	0 or any positive value

1 mark for each missing value

(6 marks)

**5 (b) (i) Explain how CAD/CAM could be used to produce the drilled holes in Figure 5.**

2 marks for a complete explanation

1 mark for a limited explanation

CAD software is used to draw the exact shape and dimensions of the component to be machined; this information is then converted to a Part Program that can be downloaded on to a CNC machine for the manufacture of the component.

(2 marks)

- 
- 5 (b) (ii) What precautions should be taken before running a new CNC Part Program to manufacture a batch of a 1000 components? You should give two examples in your answer.**

2 marks for an explanation covering at least two of the following  
1 mark for a limited explanation giving only one point

- To confirm that the program produces a product that meets the specification
- To check for possible collisions with ancillary equipment (clamps etc)
- To confirm cutting parameters are correct (speeds, feeds, depth of cut etc)

*(2 marks)*

- 5 (c) Explain one method of protecting the operator when using a CNC milling machine.**

2 marks for an explanation covering at least one of the following  
1 mark for a limited explanation

- Interlock guarding around the machining envelope
- Locked off switching when changing cutters, cleaning, etc
- Any other valid response

*(2 marks)*

- 6 (a) Give two examples of the industrial use of robots in manufacturing.**

2 marks each for two of the following

- Pick and Place for automated assembly from circuit boards to cars
- Materials handling – from stores or between machines
- Processes – welding, painting, etc
- Workholding – hot wire forming, laser cutting, etc
- Any other valid example

*(4 marks)*



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**6 (b) Explain the difference between Computer Integrated Manufacturing (CIM) and CAD/CAM.**

2 marks for a well written explanation citing CIM and CAD/CAM  
1 mark for a limited explanation citing CAD/CAM and CIM

CIM is the integration of **all** the functions in a manufacturing enterprise from product concept to sale and dispatch. CAD/CAM is part of a CIM system, concerned only with the design and production element of a manufacturing enterprise.

*(2 marks)*

**7 (a) Give two examples of how ICS could operate in a modern factory.**

4 marks for a well written explanation giving two examples  
3 marks for a limited explanation giving one good example  
2 marks for a well written explanation covering only one example or two limited examples  
1 mark for a limited explanation giving only one example

- Monitoring and adjusting environmental temperature in the workplace
- Operation of a flexible manufacturing cell
- Planned maintenance procedures
- Production data handling, i.e. tool life expectancy, Statistical Process Control, etc
- Any valid example

*(4 marks)*

**7 (b) Give two examples of the application of smart materials in engineering.**

2 marks each for two examples

- Shape memory – simple bi-metal strip such as in Kettle or Iron
- Chromic materials – colour change in response to pressure or temperature
- Any application of the above or other smart materials

*(4 marks)*

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**8 (a) Discuss the advantages and disadvantages associated with burning fossil fuels in power stations.**

Advantages: cost, generally much cheaper than renewable sources  
availability, especially coal (vast reserves exist in UK)

Disadvantages: pollution, global warming, loss of political freedom  
(especially from Gazprom for the supply of gas), unreliable, finite  
resource / not sustainable

*1 mark for a limited explanation covering at least 2 points above*

*2 marks for a limited explanation covering at least 3 points above*

At this level, candidates express straightforward ideas clearly, if not always fluently. Arguments stray from the point on occasion or may be presented weakly. There may be many or a number of errors of grammar, punctuation and spelling.

*3 marks for a good explanation covering at least 2 points above*

*4 marks for good explanation covering at least 3 points above*

At this level, candidates express complex ideas fluently and clearly. Sentences and paragraphs follow on from one another smoothly and logically. There may be occasional or few/no errors of grammar, punctuation and spelling. For full marks, a candidate's response must meet these criteria.

*(4 marks)*

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**8 (b) Explain, giving two examples, how a company can contribute to a responsible system of recycling and waste management.**

Candidates should note:

Scrap metal has a value and as such can be sold and money gained can be returned to the company as a financial benefit

Production machinery has a second hand value and as such can be sold on to smaller or starter companies to the benefit of both seller and buyer

Reducing waste means that fewer raw materials are being used in the production process, thus saving the company money on the purchase of raw materials and disposal cost of the waste.

*1 mark for a limited response to one of the points above*

*2 marks for a limited response to two of the points above*

At this level, candidates express straightforward ideas clearly, if not always fluently. Arguments stray from the point on occasion or may be presented weakly. There may be many or a number of errors of grammar, punctuation and spelling.

*3 marks for a good response to one point and a limited response to another*

*4 marks for good response to two of the points above*

At this level, candidates express complex ideas fluently and clearly. Sentences and paragraphs follow on from one another smoothly and logically. There may be occasional or few/no errors of grammar, punctuation and spelling. For full marks, a candidate's response must meet these criteria.

*(4 marks)*