



**General Certificate of Secondary Education
June 2012**

Engineering (Double Award) 48503

(Specification 4850)

Unit 3 Application of Technology

Final

Mark Scheme

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1 (a) Name the features shown in Figure 1 above.

1 mark for each correct response

A Flat or square
B Screwthread
C Chamfer

(3 marks)

1 (b) What do each of the following symbols and abbreviations mean?

1 mark for each correct response

MATL – Material
NTS – Not to scale
M/C – Machine
Ø - Diameter

(4 marks)

1 (c) Give two examples of where an exploded view of an object may be used.

1 mark each for two of the following

Maintenance manuals for machines and equipment
Workshop / Service manuals for car maintenance
Spares catalogues, etc
Instruction sheets for assembly of machinery and equipment
Any other valid answer

(2 marks)

[9 marks]

2

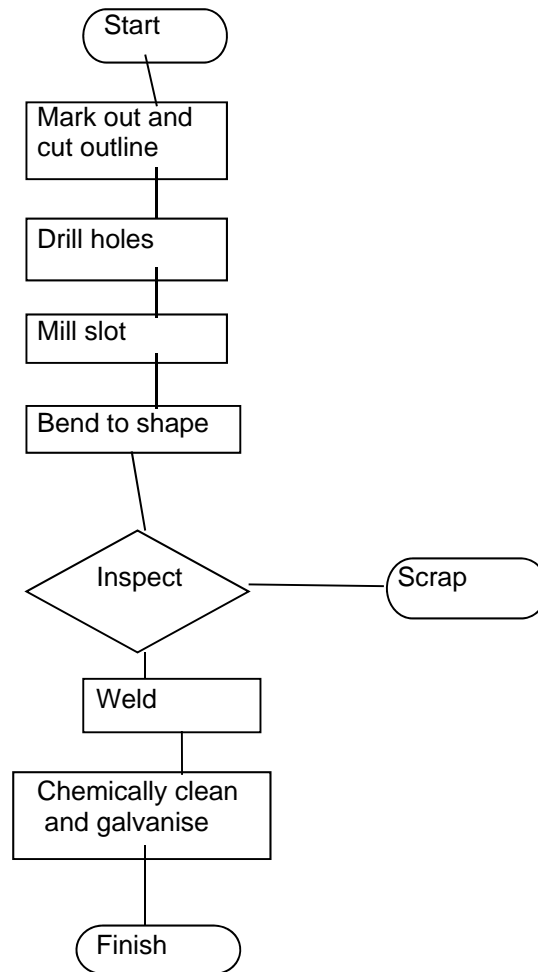
Use the shapes, below, to construct a flow chart showing the sequence of manufacturing a single prototype bracket. Use the space opposite for your flow chart.

1 mark for each descriptor in the correct sequence.

If integrity of scheme is correct but boxes are misplaced deduct only for misplaced boxes

If integrity of scheme is not correct only award marks for correct place in flowchart

Note inspect and scrap descriptor may be used after the weld process.

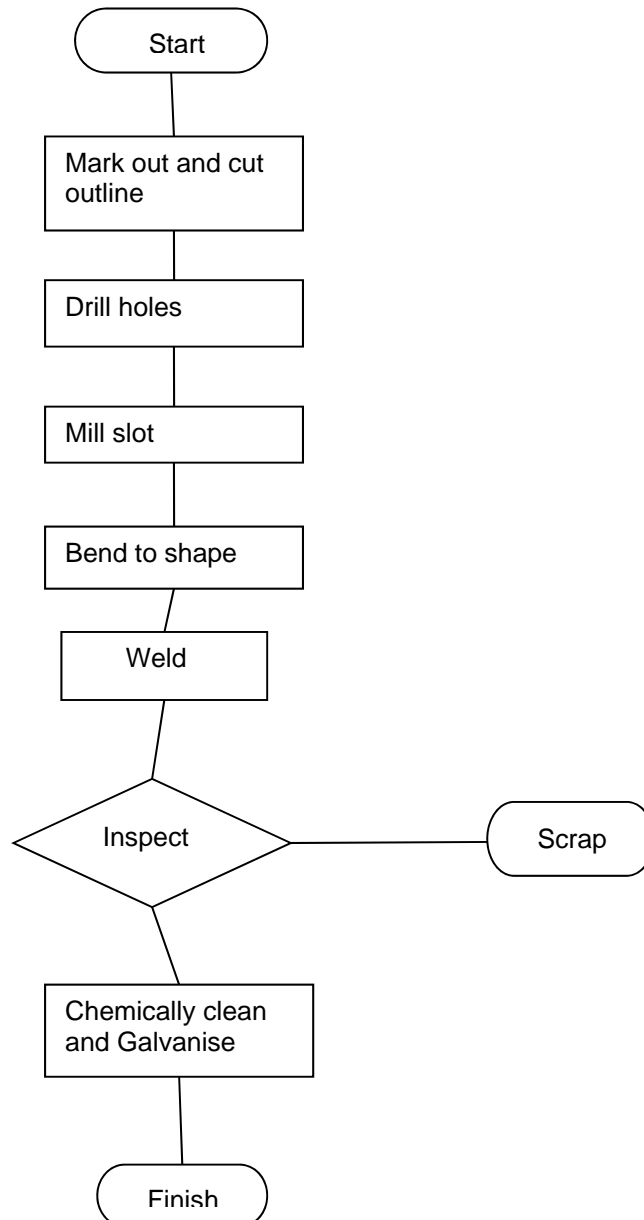


(10 marks)

[10 marks]

Q2 Alternative Answer

1 mark for each descriptor in the correct sequence. **Note inspect and scrap descriptor may be used after the weld process.**



(10 marks)
[10 marks]

- 3 (a) Welding can be hazardous. State two personal safety precautions to be taken when welding.**

2 marks each for two of the following:

Protection of eyes – helmet or shield with UV and IR filters
Protection of face – helmet or shield to protect from hot metal particles
Protection of hands – leather or heat resistant gloves
Protection of body – leather or heat resistant aprons
Protection of feet – stout leather or heat resistant footwear
Protection from fumes and gases – ensure well ventilated work area
Any other valid response

(4 marks)

- 3 (b) The bracket in figure 2 is to be used in a washing machine. Galvanised low carbon steel has been chosen as the preferred material. Suggest a suitable alternative ferrous metal that could be used and explain why you think low carbon steel has been chosen.**

1 mark for an alternative ferrous metal

Stainless steel

3 marks for a good explanation of choice including at least two points from those below

2 marks for a limited explanation with two points from below

1 mark for a limited explanation with one point from below

Cost – low carbon steel is cheap

Availability – widely available in many different sizes (width and thickness)

Workability – easily cut, bent to shape and to weld

Corrosion protection – galvanising gives sufficient protection for the average life span of a washing machine

Strength – to withstand vibrations, etc.

(4 marks)

- 3 (c) The hole positions on the bracket are critical. Explain how these could be checked quickly and accurately on a production line.**

2 marks for a full explanation of a method from those below

1 mark for a limited explanation

By using a specially made Go/No Go gauge that could be used by an unskilled operator on the production line.

By using a fully automatic computer controlled system using a stylus or lasers.

Digital Vernier Caliper

(2 marks)

[10 marks]

- 4 (a) A manufacturer needs to make 200 000 of the blanks shown in figure 4. Name a machine that could do this and explain how it would make them.**

Note: this would not be a milling machine.

1 mark for naming a machine from those below:

Brake press
Laser cutter
Water jet
Plasma cutter

2 marks for a good description of the process

1 mark for a limited description of the process

Brake press – specially designed Press tool that would, in one cycle of the press, blank out the outline shape, pierce the holes and slot (and bend to shape).

Laser cutter water jet - Computer controlled laser beam/water jet cuts out holes and slot followed by cutting out the profile

(3 marks)

- 4 (b) The production process described above would be carried out by one machine over a period of four days. What type of production method is this?**

1 mark for the correct response

Batch production

(1 mark)

- 4 (c) Complete the table below to show the co-ordinates to which the cutter needs to go to start and finish the machining of the holes and slot in figure 4 on page 8.

1 mark for each missing value

Operation	X co-ordinate	Y co-ordinate	Z co-ordinate
Move to start of hole 1	10	10	10
Drill hole 1	10	10	-4
Exit hole 1	10	10	10
Move to hole 2	50	10	10
Drill hole 2	50	10	-4
Exit hole 2	50	10	10
Move to start of slot	30	40	10
Plunge to depth	30	40	-4
Move to end of slot	30	90	-4
Exit slot	30	90	10
Return to datum	0	0	0

(6 marks)

[10 marks]

- 5 (a) The re-designed bracket, in figure 4, uses more than double the material of that in Figure 2 but the cost of production and the energy used in manufacture was halved. Discuss an environmental issue for and against this strategy.**

Advantages: Cost savings, more profit to the company, lower selling price, more competitive,
Reduction in energy use, less impact on global warming, smaller carbon footprint.

Disadvantages: Greater material usage, depleting natural resources, increased imports of iron ore contribute to global warming.

1 mark – a very limited explanation covering at least 2 points above
2 marks – a limited explanation covering at least 3 points above.
3 marks – a good explanation covering at least 2 points above.
4 marks – a good explanation covering at least 3 points above.

In addition to the above the Quality of Written Communication will also be assessed in this response as follows:

<p>Level 1 Candidates express straightforward ideas clearly, if not always fluently. Arguments stray from the point on occasion or may be weakly presented. There may be many or a number of errors of grammar, punctuation and spelling.</p>

<p>Level 2 Candidates express complex ideas very clearly and fluently. 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 be within this band.</p>

(4 marks)

- 5 (b) (i) Explain what is meant by a sustainable energy source.**

2 marks for a good explanation
1 mark for a limited explanation

A sustainable energy source is one that can be replaced easily and quickly after it has been processed.
Renewable/replaceable

(2 marks)

- 5 (b) (ii) Give one example of a non-sustainable energy source.**

1 mark for one of the following:

Coal
Gas
Oil

(1 mark)

5 (c) Explain why the government is encouraging the use of sustainable energy sources.

Candidates should note:

Government commitment to lowering carbon emissions

Increasing reliance on foreign sources of energy poses security issues

Increasing cost of imported fuels

Finite resources of coal

Any other valid response

1 mark – a limited response to one of the points above

2 marks – a limited response to two of the points above or good response to one point

3 marks – a good response to one point and a limited response to another

4 marks – a good response to two of the points above

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(4 marks)

[11 marks]

6 (a) Name the two moving parts in Figure 6.

1 mark for each of the following:

Piston – Accept also Ram/Pneumatic arm or Cylinder Head
Return spring

(2 marks)

6 (b) Explain how the single acting cylinder in the diagram above works. Refer to ports A and B.

4 marks for a full explanation covering all points below
3 marks for a limited explanation covering 3 points
2 marks for a limited explanation covering 2 points
1 mark for identifying one of the points

Pressurised hydraulic fluid enters the cylinder via port A.
The piston is forced to move against the spring towards the right.
The air behind the piston escapes via port B as the piston moves to the right.
When the hydraulic pressure is released the return spring moves the piston to the left and the fluid returns to its reservoir.

(4 marks)

[6 marks]

7 (a) A micro-controller is an essential part of many domestic appliances.

7(a)(i) What is a micro-controller?

2 marks for a good explanation
1 mark for a limited explanation

A micro-controller can be considered as a self contained system with a processor, memory and peripherals, or distinct IC, used as an embedded system with limited inputs and outputs, typically switches, solenoids, LEDs, etc.

(2 marks)

7(a)(ii) Give one example of what it does in a domestic appliance.

2 marks for a clear example
1 mark for a limited explanation

Controls the functions of the appliance, i.e. washing cycle of the machine, to include: washing, rinsing, spinning and in some cases drying.
Interpret inputs and modify outputs depending upon appliance.

(2 marks)

7 (b) Give three examples of where robotic systems are used in the Oil, Gas and Nuclear industries.

2 marks each for up to three clearly explained examples
1 mark each for limited explanations

Oil drilling rigs e.g. underwater deep sea maintenance
Handling toxic and radioactive materials
Hazardous environments, e.g. emergency rescue systems
Maintenance of radioactive plant and equipment, etc.
Any other valid response.

(6 marks)

[10 marks]

- 8 (a) Computer Integrated Manufacture (CIM) is widely used in the car manufacturing industry. Explain what CIM involves.**

4 marks for a good explanation with at least three points from the list below

3 marks for a good explanation with at least two points from the list below

2 marks for a limited explanation with at least two points from the list below or a good explanation of one point

1 mark for a limited explanation with at least one point from those below

The complete integration of the manufacturing process

Precise procurement of parts and components just-in-time via computers

Continual monitoring, and adjustment where necessary, of all aspects of production via computers

Incorporates CAD/CAM and Robotics all controlled via a linked network

Computer Assisted Process Planning is an integral part of CIM

(4 marks)

- 8 (b) (i) Racing cars use a wide variety of composite materials in their manufacture. What is meant by a “composite” material?**

2 marks for a clear explanation

1 mark for a limited explanation

A composite material is one that is a combination of two or more materials physically or mechanically bonded together (not chemically)

(2 marks)

- 8 (b) (ii) Give one example of a composite material**

1 mark for naming a composite

Glass Fibre Reinforced Plastic (GFRP)

Kevlar

Any other valid composite

(1 mark)

- 8 (b) (iii) Give two reasons why composite materials are used in racing car manufacture**

1 mark each for two from the following

Composites, especially polymer based, have good strength to weight ratio

Easily formed into complex aerodynamic shapes

Good impact resistance

Good corrosion resistance#

Uses less fuel

Any other valid response

(2 marks)

[9 marks]