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Engineering (Double Award) 48501

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Unit 1: Written Paper

Final

Mark Scheme

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1 A picture of a 'hibachi' or 'fire-pot' style of barbecue is shown in Figure 1.

(a) In the spaces below, correctly describe the *function* of each labelled part.

Hearth: Answers such as:

- Contains the hot charcoal
- Holds the fire
- Provides heat for cooking
- Directs the heat upwards
- Stops hot charcoal from escaping

[One mark per point made Max 2]

Handle: Answers such as:

- Allows the hot grill to be adjusted safely
- Made from non-conducting material
- Made from an insulating material
- Positioned away from direct heat

[One mark per point made Max 2]

Body: Answers such as:

- Support structure of BBQ
- Provides air space beneath fire grate
- Traps hot ash

[One mark per point made Max 2] *(6 marks)*

1(b) Look at **Figure 1** opposite. Identify the manufacturing method used for the body of the barbecue **and** name a material suitable for that process.

(i) Manufacturing method: Answers such as:

- Moulding
- Casting

Material: Answers such as:

- Cast Iron
- Cast steel

NB. Aluminium is not acceptable.
1 mark for the manufacturing method and 1 mark for the material *(2 marks)*

1(b) (ii) Explain why the properties of the material used to form the body of the barbecue are suitable.

Explanation including two points from answers such as:

- can be moulded into intricate shapes
- resists high temperatures
- stands up to weather & corrosion better than sheet steel would
- a relatively cheap production process
- low maintenance

[one mark per point made max 2]

(2 marks)

1 (b) (iii) Identify and explain **one** disadvantage of this design of barbeque for the user **and** suggest a solution.

Identify disadvantages – answers such as:

- Very low to ground
- Uncomfortable to cook on
- Takes a long time to get ready to cook
- Makes smoke when lighting
- Gets grimy in use (1)

solutions such as (1 mark for a simple solution, 2 marks for a qualified solution):

- Stand it on a raised plinth
  [made from fire proof material such as bricks, stone, concrete, metal]
- Lengthen legs, to make it higher
- Use a lighting chimney to create a forced draught (2)

(3 marks)

1(c) The charcoal burning barbecue shown in **Figure 1** needs to be stable when in use.
In the spaces below:
identify the strengths and weaknesses in the stability of this design.
suggest improvements to the design of the barbecue.

Candidates should provide logical answers comprising:

- Simplistic phrasing and unrelated statements……..…….. 1
- Simplistic phrasing and related statements…… .2
- Logical structured answer possibly some punctuation and grammar Inaccuracies. .3
- Well written accurate answer, which demonstrates the stated requirements. 4

NB. Good English in bullet points or continuous prose equally acceptable.
Correct one-word answers get 1 Mark

(4 marks)

1 (d) The heat of the fire in **Figure 1** is adjusted by allowing more or less air to reach the fire. Such a system is known as a damper.

Using notes and sketches in the space below, describe one way the heat output of the fire can be adjusted.

Sketches and notes illustrating a mechanism, which can control air flow such as: a linear sliding or rotary vent design comprising:

- a fixed element
- a moving element
- a method of retaining the moving element
- a method of controlling the air flow
- a method of operating the damper

(5 marks)

[Total 22]

2 Modern barbecues are designed to be easy and safe to use.

2 (a) In the spaces below, identify **and** explain the following:

Select from features such as:

<u>Ease of use</u>
- gas powered
- wheels
- made from stainless steel
- built in storage

<u>Safety</u>
- a lid to cover the fire
- Solid strong stable construction

(2)

[one mark per point max 2]

Each backed up with an explanation such as:
- being able to cover the hot area keeps children and family pets away from potential danger
- cannot be easily overturned
- quick lighting with a minimum of mess
- heats up quickly & cools down quickly
- wheels alow easy & safe transport while still hot
- stainless steel allows easy cleaning & good resistance to corrosion (4)

[2 marks per explanation max 4]

(6 marks)

2(b) Using notes and sketches, adapt the drawings below to show how the control wheel can be securely attached to the given shaft.

Marks awarded for relevant points such as:

Retaining the control wheel on the shaft by use of devices such as:

- Screw threads
- Circlips
- Washers and split pins

AND

Locking the control wheel to the shaft by use of devices such as:

- Taper or split pins through wheel and shaft
- Use of lock nuts
- Modifications to shaft and wheel to accept locking washers.

[5 marks for info in sketch or note form]

(5 marks)

[Total 11]

3

Figure 3, shows a modern charcoal fired barbecue, fabricated from mild steel.

Study **Figure 3** to answer the questions following.

3 (a) A small section of the cooking grill labelled **X** in Figure 3 is shown below.
In the spaces below, identify the different processes used to manufacture the grill.

Answers such as:

- identify the materials required
- identify the forms of material required
- cutting materials to size
- forming the materials into shape
- physically jointing component parts
- drilling
- welding
- riveting

[one mark per point made up to a max of 6]

(6 marks)

3 (b) The hearth of the barbecue shown in **Figure 3** is made from 2mm mild steel (low carbon) sheet, which has been cut to shape, bent and joined.

One quarter of the 'development or net' of the hearth is shown below.

3 (b) (i) Describe a suitable process of marking out this net accurately on steel sheet.

Traditional methods using such instruments or skills as:

- Engineer's square
- Engineer's rule
- Engineer's blue
- Scriber
- Selection or creation of a datum edge

OR

Modern skills such as:

- Direct transfer from computer screen
- Dry or etching run on laser cutter to check fit of component on sheet material.

[one mark per point, max 2 – or one mark for a simple description, 2 marks for a full description]

(2 marks)

3 (b) (ii) Explain in detail how the part would be accurately cut out.

Traditional methods such as:

- Guillotine
- Pneumatic shears or nibbler
- Jig saw

OR

Modern methods such as:

- Industrial laser
- CNC puncher profiler
- Plasma cutter

[one mark per point, max 2– or one mark for a simple explanation, 2 marks for a full explanation] *(2 marks)*

3 (b) (iii) Identify a suitable method of making the folds in the cut out 'net' **and** explain how it is done.

Identify the use of machines and tools such as:

- Pan folder / bender
- Folding bars
- Fly press
- Computer controlled folding/bending machine
- CNC press brake (1)

Explanation covering two from points (or one mark for a simple explanation, 2 marks for a full explanation) such as:

- Set at required angle of bend
- Clamp sheet between holding jaws
- Align fold line with folding element
- Operation of mechanism to initiate fold.
- Application of judicious force by hand or hammer
- Advantages of automated machine if used (2)

(3 marks)

3 (c) Describe a *fastening system* capable of joining the mild steel (low carbon) sheet, to create a heat proof joint.

Identifying an edge fastening system such as:

Drilling holes… (1)

For one of the following

- Steel rivets
- Nuts & bolts
- Self tapping screws

Or

- Welding (1)
-

NB If welding selected full marks gained only if a type of welding is identified.
NB joint must be fireproof therefore soldering & brazing are not acceptable

(2 marks)

[Total 15]

4

(a) Using the information given in Figure 4, complete the given diagram in Figure 5 by drawing a sectioned view on 'AA' **and** adding two major dimensions to a suitable convention. Show the hole through the boss with an M8 screw thread, using the correct convention.

Marks for:

- Cross section of tube (1)
- Cross section of boss (1)
- Screw thread convention (1)
- Dimensions to suitable convention. (1)
- Correct use of hatching (1)

[One mark per feature added to drawing]

(5 marks)

4 (b) Use the information below to complete the table by inserting the *code letter* (A to J) in the appropriate space above.

Order	Operation	Tools / Equipment	Description
1	Flux the joint area	Borax / Sifbronze Water Brush and bowl (E)	Mix into a thin paste and apply to both parts. (C)
2	Fit parts together	Hands and fingers (H)	Insert boss step into the hole in the square tube (F)
3	Apply hard solder alloy	Snips / Pliers Brazing rod Tweezers (A)	Cut and position a small piece of rod touching both parts of the clamp body (J)
4	Heat the joint	Blow torch Welding torch Brazing hearth (D)	Heat the clamp gently to dry the flux, then more vigorously to melt the rod so that it flows around the joint. (B)
5	Clean finished joint	Hand file Emery cloth (G)	Remove excess melted flux and remove oxide layer produced by heating. (I)

NB some candidates may write out all the information in each code box – this is acceptable for the mark. One mark for each correct code letter in the right space, as above.

(10 marks)

[Total 15]

5
A ‘meat thermometer’ has a sensor mounted at the end of a pointed probe, which is plunged into the meat to measure its internal temperature.

(a) Shown below is a circuit diagram of a potential divider, configured to act as a heat sensor. Correctly identify the **three** electronic components labelled.

5 (a) (i) Thermistor *(1 mark)*

5 (a) (ii) Resistor *(1 mark)*

5 (a) (iii) Variable resistor / potentiometer *(1 mark)*

5 (b) Identify a suitable output device for the thermometer **and** explain how it would indicate that the meat is at the right temperature.

Output device - Select one from devices such as:

- Light bulb
- LED
- Sounder
- Liquid Crystal display
- Seven segment display
- Meter (1)

Explanation to match chosen output such as:

- Light bulb / LED lights up when a certain temperature is reached
- Sounder goes off when a certain temperature is reached
- LCD / SSD / meter gives a graduated display indicating actual temperatures (2)

1 mark for a simple explanation, 2 marks for a full explanation

(3 marks)

[Total 6]

6 The use of modern technology has made great changes in the way a product is engineered.

For any engineered product you are familiar with, identify **two** stages of its production **and** for each explain the changes use of modern technology has made.

Answer in the spaces below.

Identify two from:

- design
- marketing
- production planning
- material supply & control
- processing / production
- assembly / finishing
- packaging and dispatch (2)

[one mark per stage max 2]

Explanation

Two from such answers as:

- Design – can now be done on computer screens & prototypes made and tested much more quickly.

- Marketing – use of e-commerce / on-line sales / etc.

- Production planning – use of virtual systems planning the production steps & material Requirements / machinery needed / etc.

- Material supply & control – systems such as: JIT ordering, Computerised quality testing / control, best quality material found at best price through searching on line, etc.

- Processing / production – use of robotics, automated machine processes etc

- Assembly & finishing – automatic assembly lines / robotic painting system / electrostatic spraying etc.

- Packing & Dispatch – use of bar code recording systems for serial numbers, customer addresses etc. Use of modern materials such as bubble wrap, expanded polystyrene moulded to customise shapes for packaging.

[2 marks per explanation max 4] 1 mark for a simple/limited explanation, 2 marks for a full explanation (4)

(6 marks)

[Total 6]

[Paper total 75]