*Teacher Resource Bank*

# GCSE Engineering

## Additional Sample Questions



**aqa.org.uk**

The Assessment and Qualifications Alliance (AQA) is a company limited by guarantee registered in England and Wales (company number 3644723) and a registered charity (registered charity number 1073334). Registered address: AQA, Devas Street, Manchester M15 6EX.
*Dr Michael Cresswell*, Director General.

44225

| Surname | | Other Names | |
|---|---|---|---|
| Centre Number | | | Candidate Number | | | | | | | | | |
| Candidate Signature | | | | | | | | | | | | |

| For Examiner's Use |
|---|
| |

General Certificate of Secondary Education **Version 0.2**
WEB SPECIMEN PAPER

**ENGINEERING**
**UNIT 1**

Exam code: **Web specimen 1**

**Written Paper**

Date tbc Time tbc

**For this paper you must have:**
- a pen, a pencil, a ruler, eraser, pencil sharpener and coloured pencils.

Time allowed: 1 Hour

## Instructions
- Use black ink or ball - point pen. Use pencil only for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- Answer the questions in the space provided.
- Do all rough work in this book. Cross through any work you do not want to be marked.
- Show the working of your calculations.

## Information
- The maximum mark for this paper is 75.
- The marks for questions are shown in brackets.
- The questions in Section A relates to the context referred to in the preparation sheet that was previously issued.
- You are reminded of the need for good English and clear presentation in your answers. Quality of Written Communication will be assessed in question 1 (e).

| For Examiner's Use | | | |
|---|---|---|---|
| Question | Mark | Question | Mark |
| 1 | | 6 | |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |
| Total (Column 1) → | | | |
| Total (Column 2) → | | | |
| **TOTAL** | | | |
| Examiner's Initials | | | |

## SECTION A

You should answer this question.

**1** A photograph of a typical angle grinder is shown below.

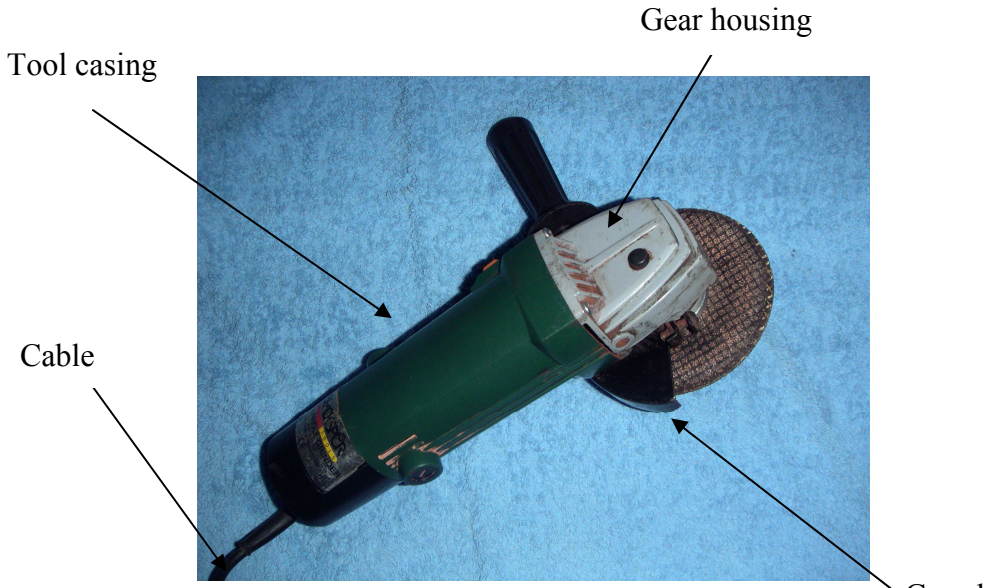



Fig.1

(a) In the spaces below correctly identify what each labelled part does.

Gear housing…….

Guard……

Cable…….

Tool casing…….. (4)

(b) Look at the angle grinder in Fig.1. For each labelled part suggest a suitable material **and** give a reason for your choice. [avoid repetition of answers]

Gear housing Material……

Why it is suitable……

……

**Question 1 (b) continues on next page**

**Question 1(b) continued**

Guard material……

Why it is suitable ……

…….

Cable material……

Why it is suitable…….

…….

Tool casing material ……

Why it is suitable……

…….. ... (8)

(c ) Suggest **two** pieces of personal protective equipment that should be worn when using the angle grinder shown in Fig.1 **and** describe how they protect the user.

PPE 1……...

Protection……

……

PPE 2……...

Protection…….

…… (4)

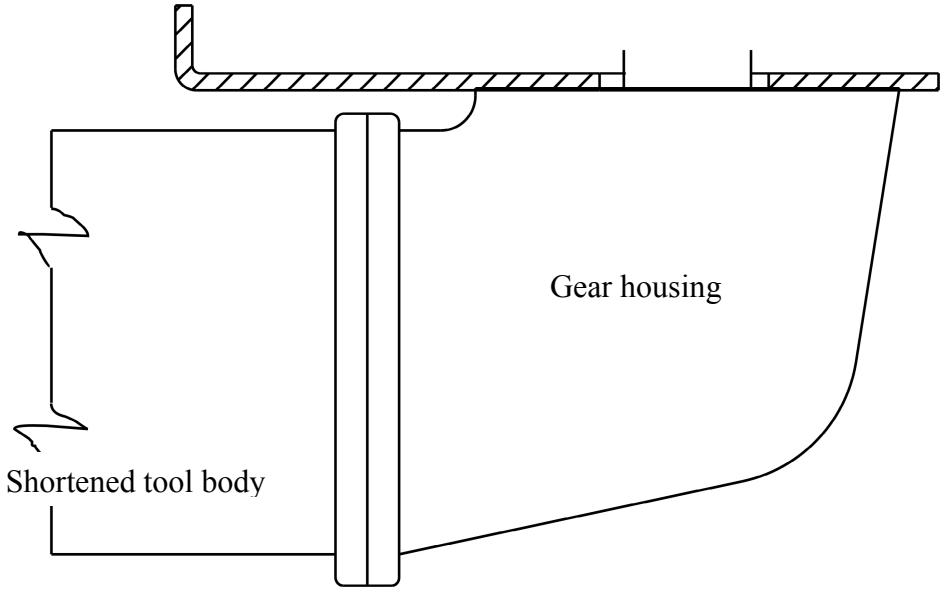
**Question 1 continues on next page**

**Question 1 continued**

1(d) A simplified view of an angle grinder is given below.

Complete the partly cross-sectioned drawing of the angle grinder. Showing how the abrasive disc shown in question Fig.1would be attached to the drive spindle of the power tool. Label the parts you draw.

Section through Guard




[Sketch max 3… Labels max 2] (5)

(e) Explain how the abrasive disc shown in question Fig.1 is securely tightened for safe use.

…….

…….

…….

…….

…….

…….(4)

**(25 Marks)**

2. Many power tools are powered from rechargeable batteries. Describe one advantage and one disadvantage of this type of power tool.

(a) Advantage. ……

……

Disadvantage. ……

…… (2)

The circuit diagram below is of the output stage of a typical transformer used to recharge power tools.

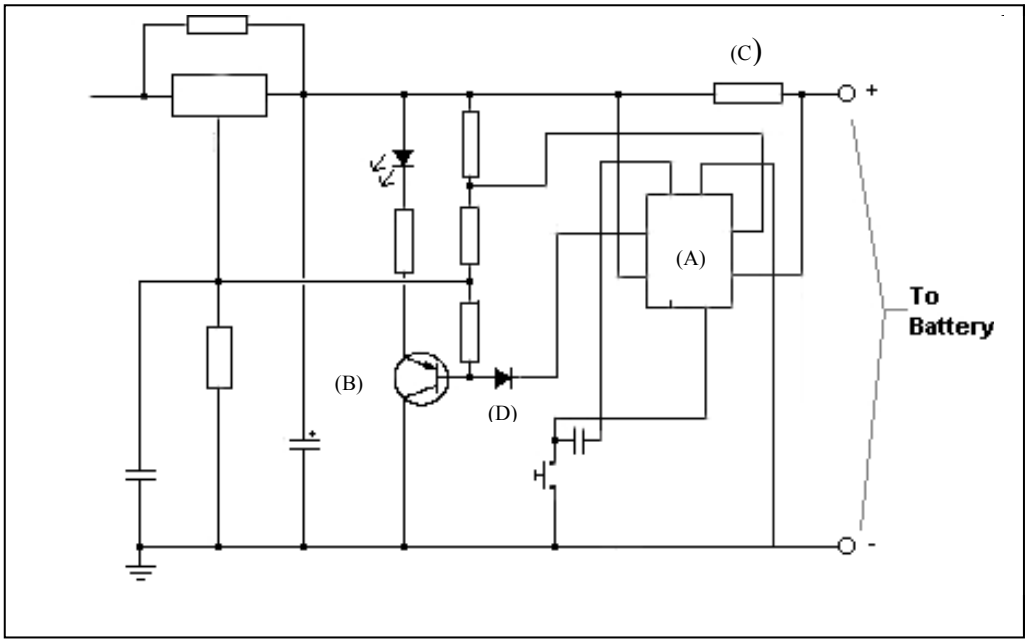



Fig.2

(b) In the spaces below identify the labelled parts.

(A)……..

(B)…….

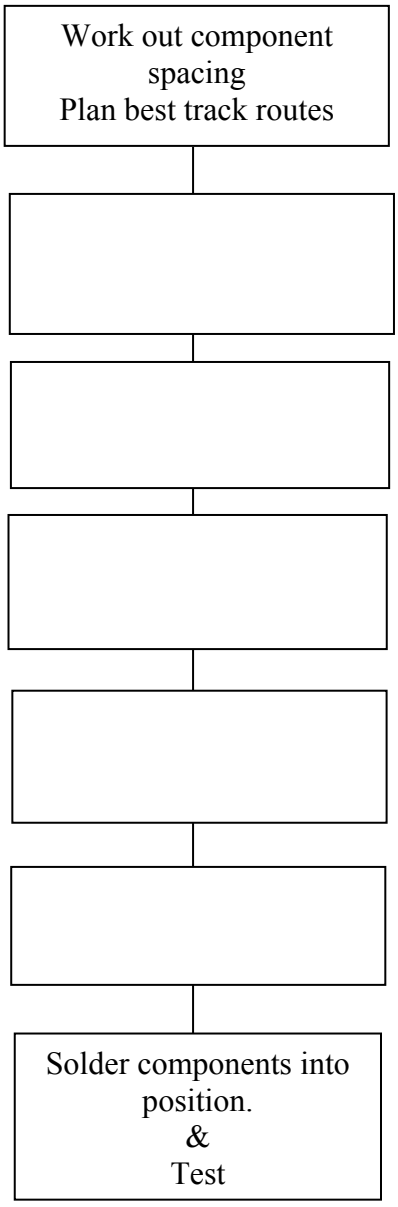
(C)…….

(D)……. (4)

**Question 2 continues on the next page.**

**Question 2 continued.**

(c ) Complete the block diagram shown below to identify the processes needed to convert the circuit diagram shown in Fig.2 into a **'one off'** prototype Printed Circuit Board (PCB) complete with electronic components.




(5)

## SECTION B

**(11 Marks)**

3. Shown below is a basic power drill.
Study the image very carefully and then answer the questions below.


Fig.3

(a)

(i) Identify the process used to form the outer casing of this type of power tool.

Forming process ……

(ii) Use notes and sketches to describe the process used to form the outer casing of this type of power tool.

(5)

**Question 3 continued.**

(b) Name a polymer suitable for the outer casing of the power drill shown in Fig.3 **and** identify **one** property of the that polymer.

Suitable polymer ……

Property…….……

…… (2)

(c ) It is important that hand held power tools such as the drill shown in Fig.3 can be held securely when being used. Describe **two** ways that grip can be improved. One example has been provided.

Grip can be improved by: Providing a well designed handle.

Grip can be improved by: ……

……..

Grip can be improved by: ……

……..(2)

(d ) Explain how the manufacturer would achieve one of the improvements described above.

……..

……

……

……(2)

**(11 marks)**

4. The two parts of a power tool casing are called 'shells' in the plastic moulding industry.

(a) Identify **two** methods of joining the shells together so that they can be disassembled later.

Method 1……...

……..

Method 2 ……..……

……..……....(2)

(b) Compare the two joining methods chosen in 4 (a) above, identify **one** advantage and disadvantage of each.

Advantage of method 1 …….

…….

Disadvantage of method 1 ……..

…….

Advantage of method 2…….

…….

Disadvantage of method 2…….

……. (4)

**(6marks)**

5. The drawing below, shows a simplified view of the bottom part of a tool-box.

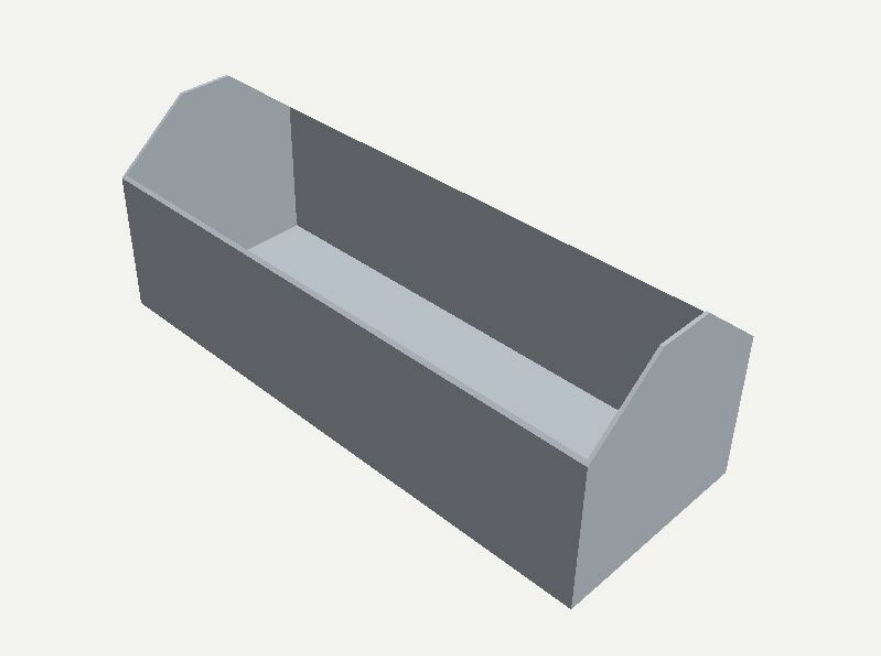
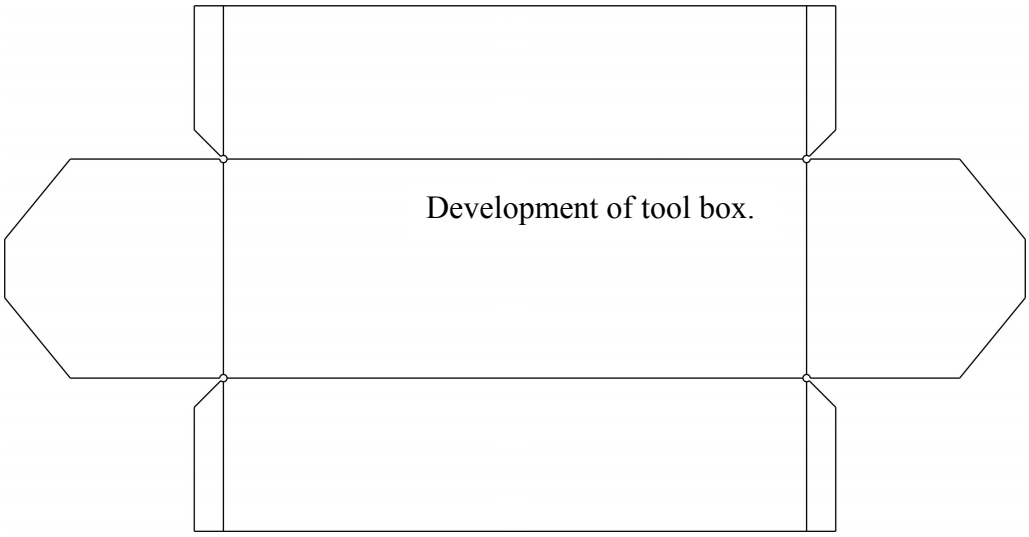


Fig.4

Construction Material: **Mild Steel Sheet** [1.5 mm thick]

Method of construction: **Fabrication**




**Question 5 continues on the next page.**

**Question 5 continued.**

In the table provided, create a Production Plan listing **five** major operations needed to convert flat sheet steel into the tool box shown in Fig.4.
Some parts have been done for you, select the others from the given list and insert the identification letter in the appropriate box.

| **Order** | **Operation** | **Tools and Equipment** | **Description of task carried out**. |
|---|---|---|---|
| **1** | | Straight edge<br>Scriber<br>Engineer's square | |
| **2** | | | Provide clearance for the sides and the ends of the toolbox to fold up together without distortion. |
| **3** | | Guillotine<br>Snips<br>File<br>Emery cloth | . |
| **4** | Make folds | | |
| **5** | | Pop rivets<br>Traditional rivets<br>Hammer and Set<br>Spot welder | |

Use the information given in the boxes below to complete the Production Plan.

Make holes at the corners of the toolbox base. (A)

Remove waste material, burrs and other sharp hazards so that the metal can be handled without the risk of cuts. (B)

Cut to shape and create 'Safe-edges.' (C)

Join the corners. (D)

Press brake
Pan bender
Use of jigs. (E)

Raise the ends and the sides of the toolbox into position. (F)

Mark out design. (G)

Use either mechanical or fusion methods to give the toolbox strength and rigidity. (I)

Centre punch
5mm dia. drill bit
Pillar or hand drill. (J)

Select or create 'datum' side and draw the development accurately. (H)

**(10 Marks)**

6. (a) Give **two** structural reasons why mild steel is a suitable material for a tool-box.

Reason 1…….

……

Reason 2…….

……(2)

(c) Identify **the** major problem, which may result from using mild steel **and** how it can be overcome.

…….

…….

…….

…….(2)

(c ) Give **one** example of the way New Technology has been applied to cutting flat sheet steel in industry **and** describe how it operates.

…….

…….

…….

…….

…….

…….

…….

……. (4)

**Question 6 continues on the next page.**

**Question 6 continued.**

(d ) Explain **one** positive and negative effect, which the use of Modern Technology has had on engineering industries.

Positive effect ……

……

Negative effect ……

……

Describe two situations where modern technology is used in the production of portable power tools.

Situation 1…….

……

Situation 2 …….

……(4)

**(12 marks )**

**End of questions**

**Total 75**

| Surname | | Other Names | |
|---|---|---|---|
| Centre Number | | | | | | Candidate Number | | | | |
| Candidate Signature | | | | | | | | | | |

For Examiner's Use

General Certificate of Secondary Education **Version 0.2**
WEB SPECIMEN PAPER

**ENGINEERING**
**UNIT 3**

Exam code: **Web specimen 1**

**Written Paper**

Date tbc Time tbc

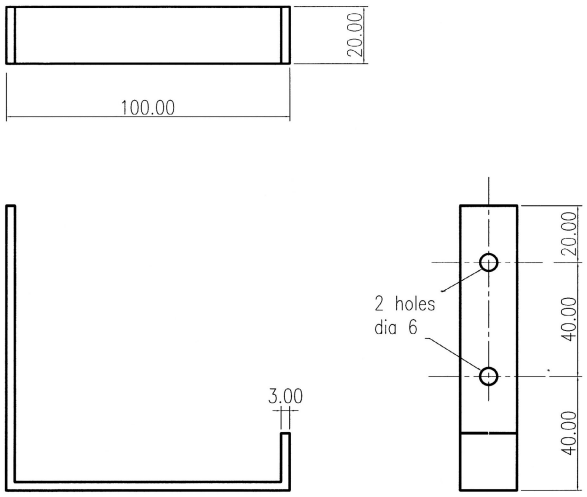
**For this paper you must have:**
- a pen, a pencil, a ruler, eraser, pencil sharpener and coloured pencils.

Time allowed: 1 Hour

## Instructions
- Use black ink or ball - point pen. Use pencil only for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- Answer the questions in the space provided.
- Do all rough work in this book. Cross through any work you do not want to be marked.
- Show the working of your calculations.

## Information
- The maximum mark for this paper is 75.
- The marks for questions are shown in brackets.
- The questions in Section A relates to the context referred to in the preparation sheet that was previously issued.
- You are reminded of the need for good English and clear presentation in your answers. Quality of Written Communication will be assessed in question 1 (e).

| For Examiner's Use | | | |
|---|---|---|---|
| Question | Mark | Question | Mark |
| 1 | | 6 | |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |
| Total (Column 1) → | | | |
| Total (Column 2) → | | | |
| **TOTAL** | | | |
| Examiner's Initials | | | |




Notes: Drawing not to scale All dimensions in mm
Material: BDMS Tolerance on hole positions: ± 0.04
Gen. Tolerance: ± 0.1

**Fig. 1. Bracket**

**1 (a)(i)** The Bracket shown in fig.1 is a general purpose storage bracket that may be used for things such as ladders or bikes. An initial quantity of 250 are made and sent to the DIY stores. A further 250 are manufactured and distributed two days later. Explain this type of production method

Production method _____

_____

_____

*( 2 marks)*

**1 (a)(ii)** The Bracket proves to be popular with DIY shops and a large order is placed for 100,000. What type of production method would then be used.

Production method _____

_____

_____

*(1 mark)*

**1 (a) (iii)** What type of machine would be used to manufacture the 100,000 Brackets?

_____

_____

_____

*(2marks)*

**1 (b) (i)** Explain how the positions of the holes may be checked against the tolerance quickly **and** accurately by an unskilled worker during manufacture.

_____

_____

_____

_____

(*2 marks*)

**1 (b) (ii)** Mild Steel has been chosen as the material for the Bracket. State **two** properties of this material that make this a suitable choice.

1. _____

_____

2. _____

_____

(*2 marks*)

[10 marks]

**Q2** Construct a flow chart in the space below to show how a single prototype Bracket, shown in Fig.1., would be made in your school/college workshop.
Use standard flow chart symbols.

*(6 marks for correct sequence)*
*(4 marks for correct symbols)*

[10 Marks]

**Q3 (a)** The Bracket, shown in Fig. 1, is to be made from Mild Steel which if left untreated may corrode. Describe **one** way of preventing this.

**3 (a) (i)** Method. _____

(*1 mark*)

**3 (a) (ii)** Description of process.

_____

_____

_____

_____

(*3 marks*)

**3 (a) (iii)** State **one** advantage of the method you have described.

_____

_____

(*1 mark*)

**3 (b)** State **two** health and safety hazards to be considered when performing the Process you have described.

**3 (b) (i)** Hazard 1_____

Method of controlling the risk of harm posed by the hazard.

_____

_____

_____

*(2marks)*

**3 (b) (ii)** Hazard 2 _____

Method of controlling the risk of harm that may be caused by the hazard.

_____

_____

_____

*(2 marks)*

[9 Marks]

**Q4** The simple circuit, shown in Fig.2 below, contains four components shown as Symbols.

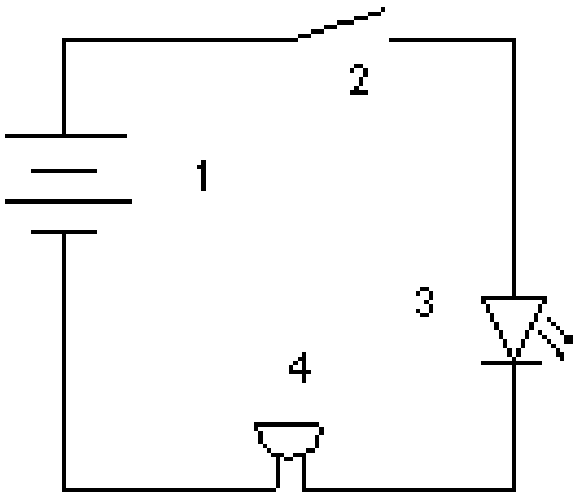



**Fig. 2 Simple circuit**

**Q4 (a)** Name the components labelled 1 to 4.

1_____
2_____
3_____
4_____

*(4 marks)*

**Q4 (b)** The component labelled 2, in the circuit in Fig. 2, could be adapted to allow the circuit to operate as an intruder alarm.
Explain how this could be done.

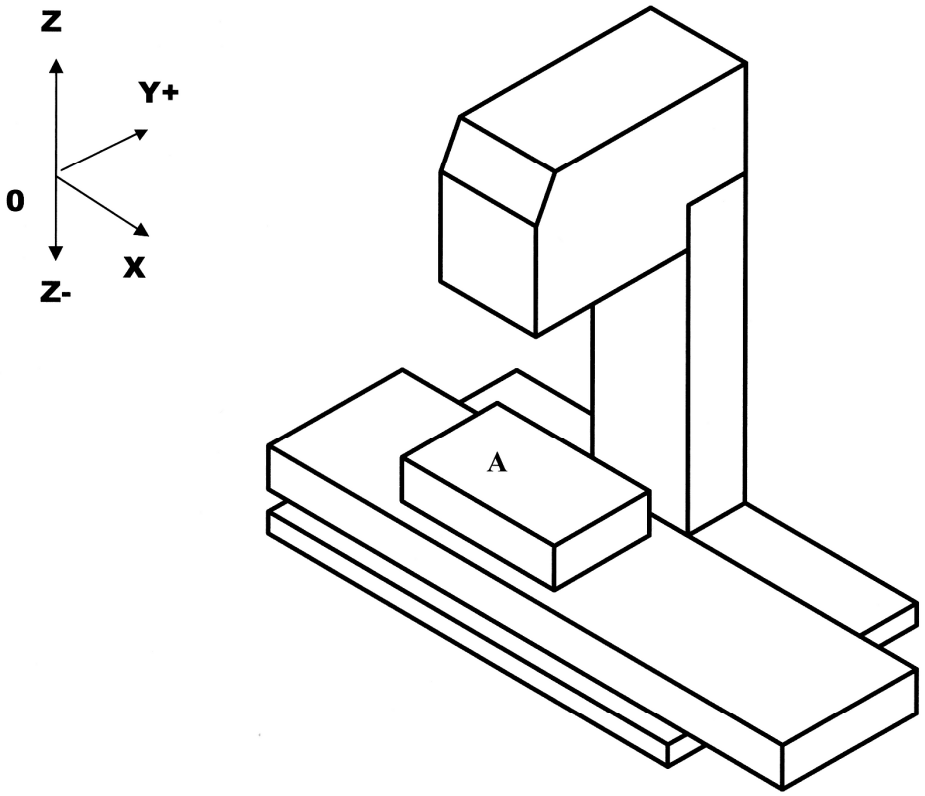
_____
_____
_____
_____

*(2 marks)*

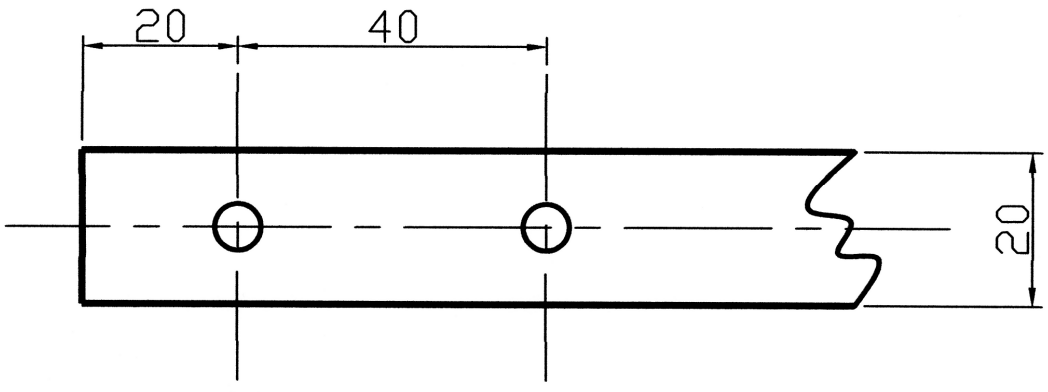
[6 marks]

**Q5**

The diagram below shows the arrangement of a CNC milling machine, and its three axes.




The block of material to be machined is shown as **A** in the diagram above.
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.




Datum: lower left hand corner (LLHC). Thickness: 3mm
Dia of holes: 6mm

**Fig. 2 Portion of Bracket**

**Q5 (a)** The table relates to the moves necessary to drill the holes in the Bracket, shown in Fig.2

| **Operation** | **x co-ordinate** | **y co-ordinate** | **z co-ordinate** |
|---|---|---|---|
| **Move to start** | +20 | +10 | +15 |
| **Plunge to depth** | +20 | | -4 |
| **Raise cutter** | | +10 | +15 |
| **Move to** | +60 | +10 | |
| **Plunge to depth** | +60 | | -4 |
| **Raise cutter** | | +10 | +15 |
| **Return to datum** | 0 | | +15 |

*(1 mark for each missing value)*
*(6 marks)*

**Q5 (b)** What is meant by CAD/CAM **and** how could it be used in the manufacture of the Drilled holes in Fig.2.

**Q5 (b) (i)** What is CAD/CAM _____
_____
_____

**Q5 (b) (ii)** How is it used _____
_____ _____
_____ _____
*(4 marks)*
[10 Marks]

**Q6 (a)** Give **two** advantages of a CNC Router or Milling machine when cutting profiled slots in large number of components.

Advantage 1_____
_____
_____

Advantage 2_____
_____
_____
*(4 marks)*

**Q6 (b)** Give **two** reasons why it is essential to prove a CNC Part Program before starting to manufacture a batch of a 1000 components.

1. _____
   _____

2. _____
   _____

*(2 marks)*

[6 Marks]

**Q7 (a)** Large engineering companies use Computer Integrated Manufacturing (CIM) to make products and components. From your own experience of working in your school/college workshop give **three** examples of how this system has led to improved efficiency.

Example 1 _____
_____
_____

Example 2 _____ _____
_____
_____

Example 3 _____
_____ _____
_____ _____

*(6 marks)*

**Q7 (b)** Explain, briefly, the difference between Computer Integrated Manufacturing (CIM) and Flexible Manufacturing Systems (FMS).

_____
_____
_____
_____
_____

*(3 marks)*

[9 Marks]

**Q8 (a)** PLC's are extensively used in industry. What do the letters PLC stand for?

_____

*(1 mark)*

**8 (b)** Many electrical/electronic products contain a microcontroller. Explain how a microcontroller works in a product that you are familiar with.

_____
_____
_____
_____
_____
_____
_____
_____

*(4 marks)*

**8 (c)** The term "smart material" has become part of the engineer's language. What does the term mean? State **one** application of a smart material.

Meaning _____
_____
_____
_____

*(2 marks)*

Application _____
_____

*(1 mark)*

[8 Marks]

**Q9 (a)** Discuss in some detail **two** ways in which energy may be saved during a manufacturing process.

_____
_____
_____
_____
_____
_____
_____

*(4 marks)*

**Q9 (b)** Explain, giving **two** examples, the benefits to a company of recycling and waste management.

_____
_____
_____
_____
_____
_____
_____

*(4 marks)*

[8 Marks]