Candidate Name	Centre Number	Candidate Number

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

METAL TECHNOLOGY AND DESIGN 4055/1

PAPER 1 Theory, Drawing and Design

SPECIMEN PAPER 3 hours

Additional materials:
- Answer paper
- Drawing paper **A2** size (1 sheet)
- Standard drawing equipment

TIME: 3 hours

INSTRUCTIONS TO CANDIDATES

Write your name, centre number and candidate number in the spaces provided on the top of every paper used.

Section A: Structured questions.

Answer **all** questions.

Write your answers on the spaces provided.

Section B: Free response questions.

Answer **two** question only from the chosen option.

Write your answer on the separate answer paper provided.

Section C

Answer **both** questions **11(a)** and **11(b)**.

Answer these questions on the **A2** drawing paper provided.

At the end of the examination, fasten together your answer sheets to **Sections A** and **B** and place them within your folded drawing paper for **Section C**.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.

You are advised to spend no longer than **45 minutes** on **Section A** and no longer than **45 minutes** on **Section B**.

Except where pictorial views are used, **all** diagrams are in **first** angle projection.

This question paper consists of 13 printed pages and 3 blank pages.

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SECTION A [40 Marks]

Answer **all** questions in this section.

1 **(a)** Name the features illustrated in **Fig 1.**

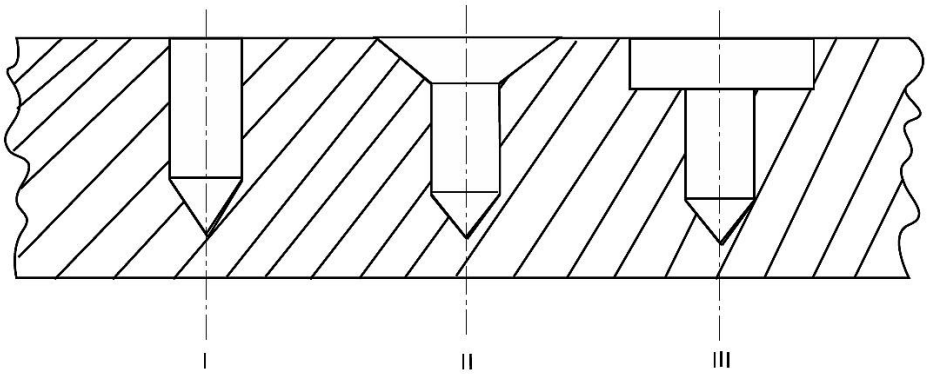


Figure 1

[3]

(b) Illustrate graphically the differences between a bolt and screw. [2]

(c) List **three** factors to specify when buying rivets.

_____

_____

_____ [3]

(d) Explain why copper is widely used for making connection in electrical circuits.

_____

_____

_____ [2]

2 **(a)** Define the following terms:

(i) Brittleness_____

_____

(ii) Ductility_____

_____

(iii) Hardness_____

_____

(iv) Elasticity_____

_____

(v) Toughness_____

_____ [5]

(b) **Figure 2** shows a workshop tool. Identify the tool and state its use.

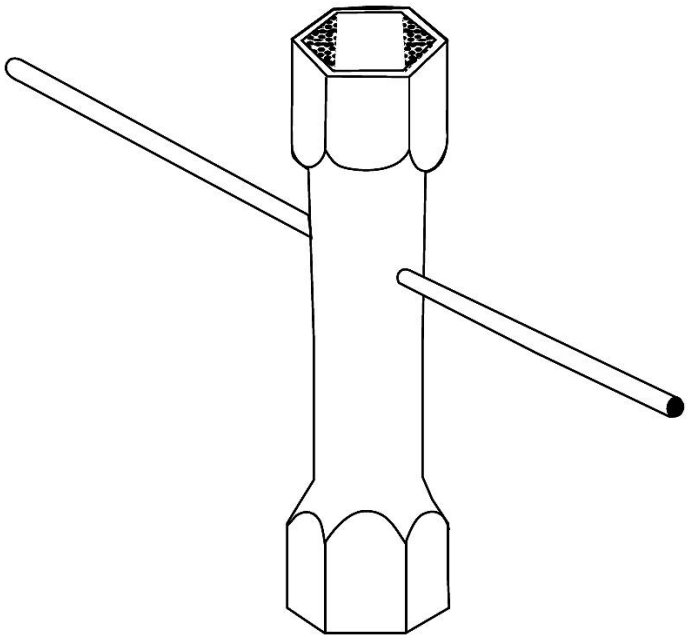


Figure 2

[2]

(c) High speed steel is an alloy containing 14-18% of tungsten.

Name **two** tools that can be made out of this metal.

Tool 1 _____

2 _____ [2]

(d) Give the meaning of B.D.M.A.S

_____

_____

_____ [1]

3 **(a)** A sheet of iron is coated with Zinc.

(i) Name the process _____

_____ [1]

(ii) Give the reason for the coating_____

_____ [1]

(b) Briefly explain the use of a solid nut_____

_____

_____ [2]

(c) Distinguish between High Carbon steel and mild steel.

_____

_____

_____

_____

_____ [2]

(d) **Figure 3** shows some components used in electrical and electronic circuits. Identify the symbols labelled **(i)-(iv)**. [4]

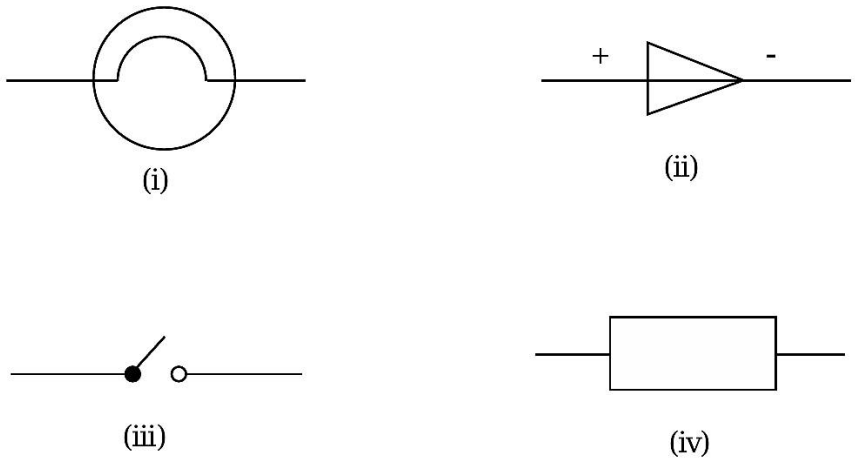


Figure 3

4 **(a)** Identify **two** regular maintenance activities which can be done in fitter's vice.

_____

_____ [2]

(b) Name **one** material commonly used to manufacture a fitter's vice.

_____ [1]

(c) A chisel head is spread by hammering over a long period.

(i) Explain the danger associated with this.

_____

_____ [1]

(ii) Suggest a possible way of correcting the problem.

_____

_____ [1]

(d) You have planned to start a welding business at your local growth point. State any **three** factors that you may consider important before you start your business.

_____

_____

_____ [3]

(e) Give **two** advantages of using auto CAD in drawing and design.

_____

_____ [2]

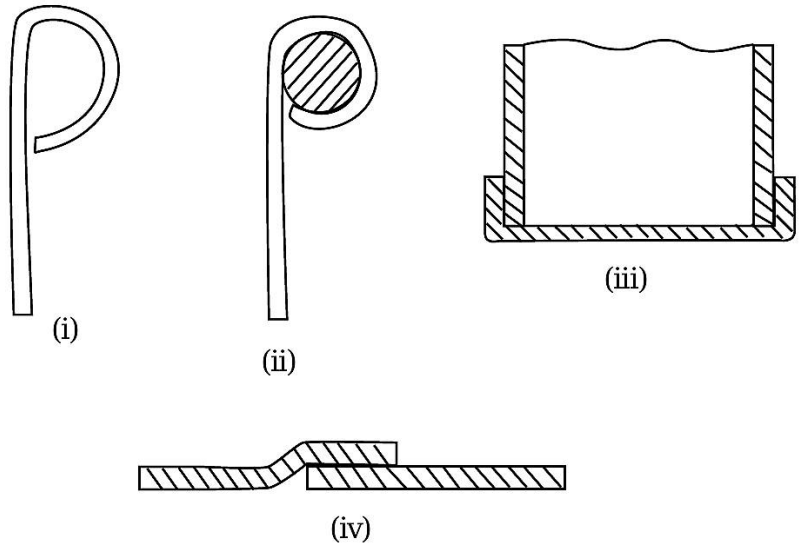
Section B

Answer any **two** questions from this section on separate answer sheets provided.

SHEET METAL/BEATEN METAL TECHNOLOGY

5 **(a)** Name the most appropriate tool for marking out lines on tinplate. [1]

(b) Identify the joints and features illustrated below:



[4]

Figure 4

(c) A student is to produce a tray with a wired edge, if the diameter of the wire to be used is 6mm. Calculate the allowance of the wired edge. [2]

(d) **(i)** Explain why aluminium, brass and copper are used in beaten metalwork. [2]

(ii) Describe how aluminium is annealed. [2]

(iii) With the aid of sketches explain how you would mark out for hollowing on 1000mm diameter disc. [4]

FORGE/FOUNDRY TECHNOLOGY

6 **(a)** Name the correct fuel to use when forging. [1]

(b) On what portion of the anvil should chiselling be done? [1]

(c) Sketch the following forge tools:

(i) Hardie,

(ii) Flatter. [4]

(d) With the aid of sketches describe the process of forge welding. [3]

(e) With reference to casting, state the uses of the following furnaces:

(i) Cupola,

(ii) Crucible. [2]

(f) State the uses of the following casting equipment:

(i) Spruce pins and risers,

(ii) Rammer,

(iii) Crucible tong,

(iv) Spoon tool. [4]

7 **(a)** State the use of tongs. [2]

(b) Name a tong used to:

(i) pick up hot pieces of metal from the fire,

(ii) hold heavy square or rectangular sections,

(iii) hold thin metal sections. [3]

(c) Show in sketch form the use of top and bottom fullers. [3]

(d) State **two** safety precautions necessary when forging. [2]

(e) Describe with the aid of sketches how the eye on a porker is marked out and made from a **10** mm square mild steel bar. [5]

8 **(a)** Which **two** properties are important for metals used in beaten metal technology? [2]

(b) With the aid of sketches describe the sinking process. [3]

(c) State any **two** purposes of planishing. [2]

(d) Shown in **Figure 5** are welding defects.

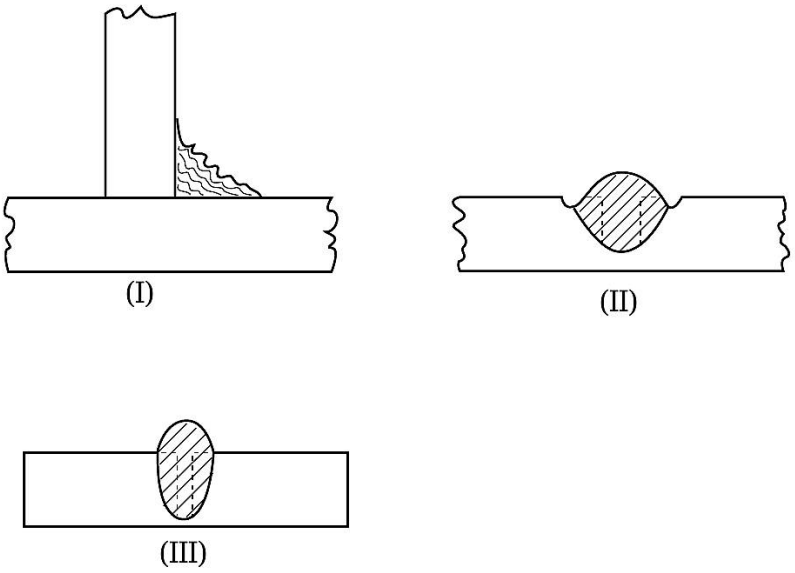


Fig. 5

(i) Name the defects numbered I to III. [3]

(ii) Explain the cause of each of the **three** defects. [3]

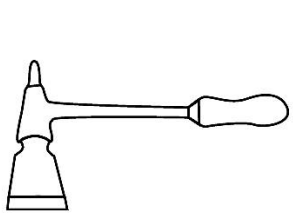
(e) Show by means of sketches butt joint preparations on the following metal sections:

(i) thin sheet of metal 3mm,

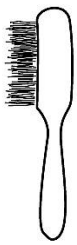
(ii) 8 mm thick mild steel plates. [2]

WELDING TECHNOLOGY

9 **(a)** Name the **two** welding accessories shown in **Figure 6**.



(i) _____



(ii) _____

Fig. 6

[2]

(b) Explain how you can minimise the following welding defects.

(i) Slag inclusion

(ii) Excessive spatter

(iii) Undercut [3]

(c) **(i)** Name the flux used when soldering electrical and electronic connections. [1]

(ii) Give the alloying elements of silver solder. [3]

(iii) Explain how you would remove unwanted spots of soft solder from a joint. [2]

(iv) **Figure 7** below shows metal arc welding process. Label the parts **A** to **D**. [4]

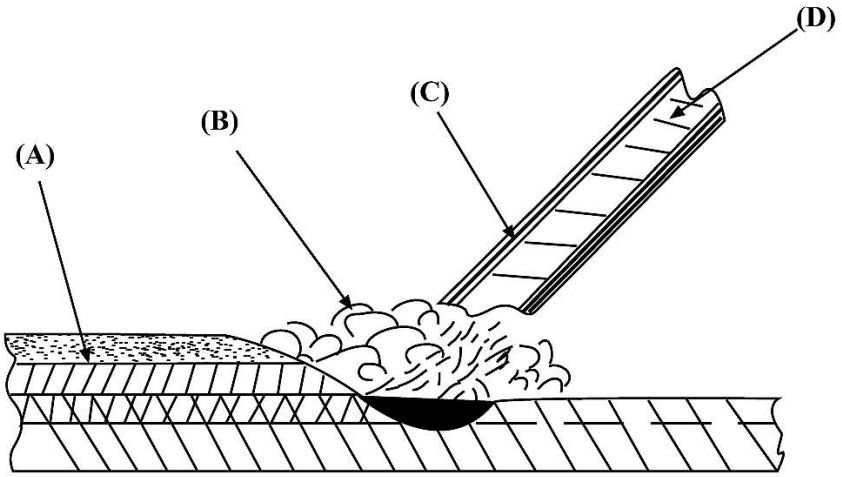


Figure 7

MACHINING TECHNOLOGY

10 **(a)** List **three** types of drilling machines. [3]

(b) Identify an alloy and a metal which should be machined without the use of cutting oil. [2]

(c) With particular reference to machines, define maintenance. [2]

(d) **(i)** Name **two** methods of holding work for turning. [2]

(ii) State how the size of the lathe machine is determined. [1]

(e) Give **two** examples of horizontal milling cutters. [2]

(f) Given the formula $D=\frac{10\,005}{\pi N}$, calculate the maximum diameter of the grinding wheel that can be used on a surface grinding machine with a spindle speed of 2300 rev/min and the cutting speed 1520m/mm.

Where: S, is the cutting speed
D, = maximum diameter of the wheel
Π = 3.14
N = spindle speed. [3]

Section C

Answer all questions in this section on the drawing paper provided. You are advised to spend **1½** hours on this section. One sheet of **A2** drawing paper is to be used. Use only one side of the paper. Set the paper with the long edge to the top of your drawing board. Use the space to the right of the vertical line to make sketch in answer to Question **11(a)**. Use the space to the left of the vertical line for Question **11(b)**.

11 An indexing attachment for a drilling machine is illustrated in the exploded pictorial drawing in **Figure 7**. The spindle **Part B** is a close fit in the diameter bore through the body **Part A**, whilst the operating handle **Part C** is screwed onto the outer end of the spindle.

In use, the attachment is bolted to a drilling machine table and a three-jaw or four-jaw lathe chuck is screwed on the spindle nose. The chuck can then be rotated by the handle and locked in six positions at intervals of **60°**, thus permitting a round bar to be mounted for drilling, at **60°** intervals around its circumference.

Certain features of the device have been omitted for the purpose of this examination. Some measurements were left to your own discretion.

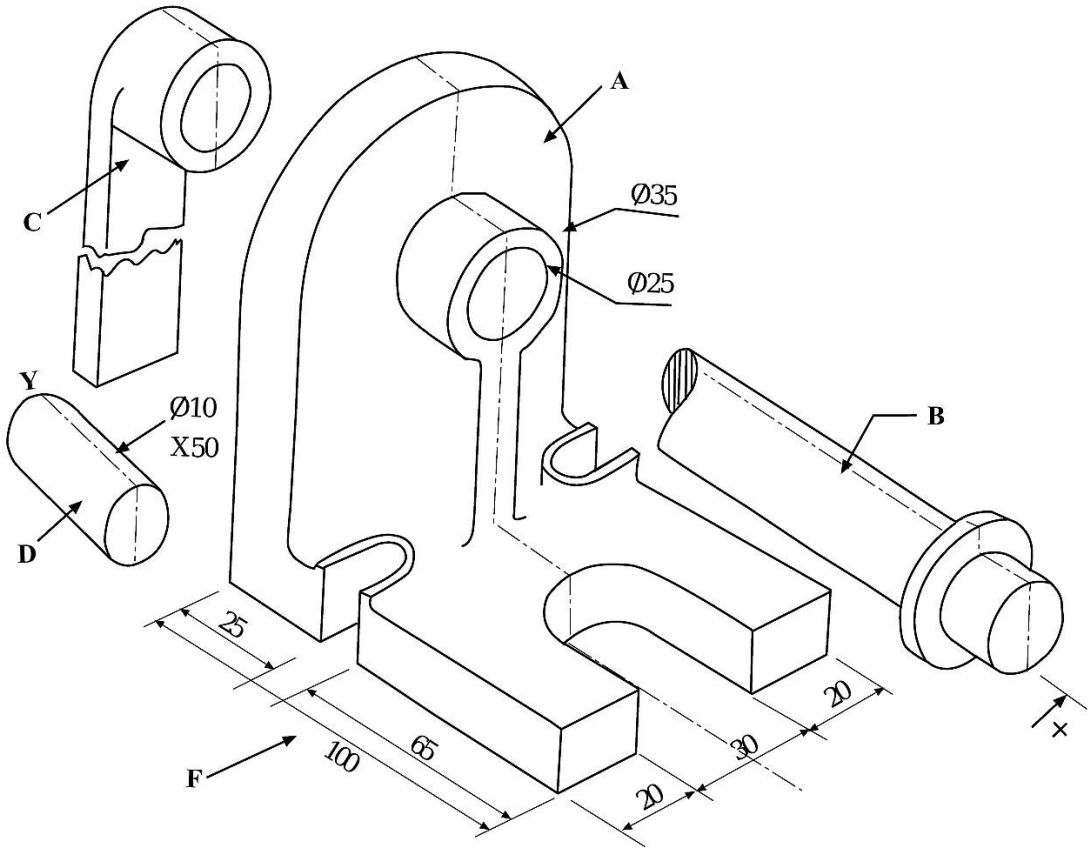


Fig. 8

(a) Design:

(i) a method of locking Part **C** to Part **B**. [5]

(ii) attaching handle Part **D** to Part **C** to provide easy turning of Part **C**. [5]

(iii) providing easy grip to Part **D**. [4]

(b) Draw full size either **first angle** or **third angle** orthographic projection.

(i) a sectional front elevation as seen looking in the direction of arrow **F**. [8]

(ii) an end elevation as viewed in the direction of arrow **E**. [8]

TOTAL **[30]**

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