

METALWORK 2

1. GENERAL COMMENTS

Generally, the standard of the paper was within the scope of the syllabus and compared favourably with that of the previous year

The performance of candidates as compared with that of previous years was not encouraging.

2. SUMMARY OF CANDIDATES' STRENGTHS

- (1) Majority of the candidates answered the required number of questions.
- (2) A few of the candidates answered the questions very well and scored high marks.

3. SUMMARY OF CANDIDATES' WEAKNESSES

- (1) Majority of the candidates could not sketch and label two parts of the ball pein hammer.
- (2) Wrong spelling of words made it difficult for examiners to understand what the candidates meant and therefore lost marks.

4. SUGGESTED REMEDIES

- (1) Students should be encouraged to practise how to sketch tools and equipment used in the workshop.
- (2) Tutors should mark students' exercises regularly and check their spellings.
- (3) Tutors should cover the prescribed syllabus and engage students in practical activities.

5. DETAILED COMMENTS

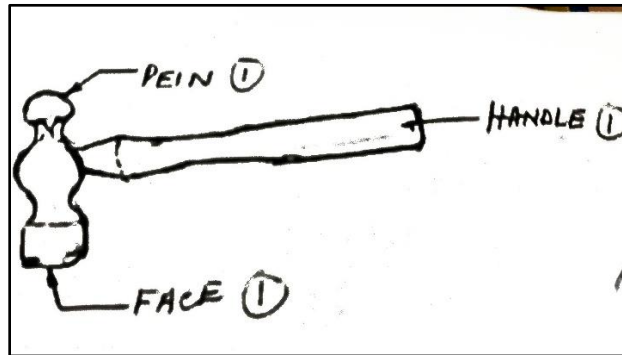
QUESTION 1

- (a) State the reason why chiselling is directed away from other workers.
- (b) (i) Sketch a ball pein hammer;
(ii) Label two parts of the hammer sketched in (b)(i).
- (c) State two workshop tests used to check the hardness of cast iron.
- (d) State one function of each of the following used in welding:
 - (i) Hand shield;
 - (ii) Chipping hammer.

This was a popular question and some candidates' performance generally was good.

- (a) Most candidates stated the reason why chiselling is directed away from other workers.
- (b) i – ii Majority of the candidates could not sketch and label two parts of the ball pein hammer. Some candidates sketched different hammers and instead of labelling two

parts of the sketch, they rather wrote the names of the parts on a different part of the answer booklet.



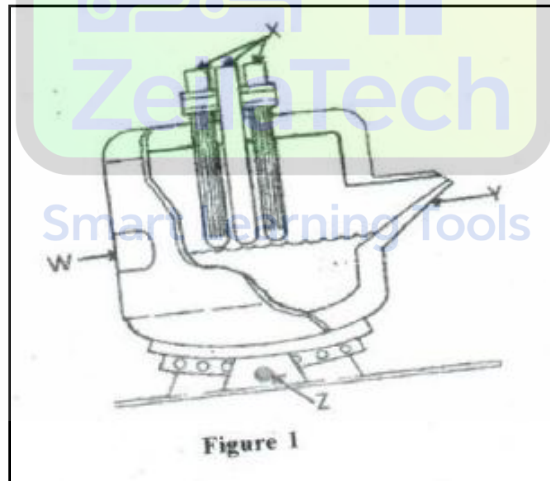
- (c) Some candidates were able to state two workshop tests used to check the hardness of cast iron.
- (d) A few candidates could not state one function of hand shield used in welding.

The expected answers include:

- To protect the face from hot sparks
- To protect the eyes from intense rays

QUESTION 2

- (a) The sketch in Figure 1 is a furnace.



- (i) Identify the type of furnace;
 - (ii) List the parts labelled W, X, Y and Z;
 - (iii) State the function of the part labelled X;
 - (iv) What is the finished product of the furnace?
- (b) State the function of the plug tap used in thread cutting.
- (c) State the use of a hot set-in forging process.

Most of the candidates did not answer this question. Those who answered it provided answers that were not convincing.

- (ai) Candidates failed to identify the furnace as an Electric Arc Furnace.
- (aia) The parts labelled W, X, Y and Z are: charging door, carbon electrodes/poles pouring spout and Trunion. Candidates' performance was poor.
- (aiia) The function of the part labelled X is to supply the required heat, majority of the candidates had it wrong.
- (b) A few candidates stated the function of the plug tap used in thread cutting. The plug tap is used to complete the thread of through holes and blind holes, to form the full threads to be very close to the bottom of the hole.
- (c) Candidates stated the use of hot set-in forging process; that is for cutting hot metals.

QUESTION 3

- (a) State one function of the clapper box of the shaping machine.**
- (b) State one function of each of the following parts of a pedestal grinding machine:**
 - (i) Tool rest;**
 - (ii) Wheel guard;**
 - (iii) Perspex shield.**
- (c) List three areas where design problems could be identified.**
- (d) State two analysis questions of economic importance in design work.**

This was a popular question. However, performance generally was not very good.

- (a) This part of the question demanded that candidates state one function of the clapper box. They failed to state that it can be used to hold the tool post and it enables the tool to cut on the forward stroke and be lifted on the reverse stroke.
- (b) (i) The tool rest of a pedestal grinding machine is either used to support tool for grinding or used to set over for grinding the front angle of the lathe cutting tool.
(ii) One function of the wheel guard of a pedestal grinding machine is it is used to protect the user of the machine from accidents by flying off broken wheels.

(iii) This part of the question was well answered. The Perspex shield on the grinding machine is used to protect users' eyes from grit particles.
- (c) Majority of the candidates listed three areas where design problems could be identified. For example, Hospitals, Homes, Markets, Schools, and Garages.
- (d) Some candidates could not state two analysis questions of economic importance in design work. Some of the expected responses should have been: Is the unit cheap? What will be the cost of the materials for making the unit?

QUESTION 4

- (a) (i) What is shrinkage in casting?**
- (ii) How can shrinkage be prevented in casting.**
- (iii) State one effect of shrinkage on casting.**
- (b) Explain in three steps the process of blueing a workpiece.**
- (c) List three forge fire tools.**

This was a popular question. Performance of candidates generally, was not encouraging.

- a) (i) Shrinkage in casting is a process whereby a cast product reduces in size upon cooling. Most of the candidates poorly answered this part of the question.
- (ii) Shrinkage can be prevented in casting by providing shrinkage allowance on the metal during cooling in the solid state. Majority of the candidates performed poorly.
- (iii) Some of the candidates could not state one effect of shrinkage on casting. The effects include; producing undersize finished products, lacking machining allowance and no allowance for fettling.
- b) Candidates explained in three steps, process of blueing a workpiece.
- c) The three forge fire tools candidates were to list include; tongs, poker, rake, shovel.

QUESTION 5

- (a) State one reason each why the following heat treatment processes are carried out on metals:**
 - (i) Normalizing;**
 - (ii) Annealing;**
 - (iii) Case hardening;**
 - (iv) Tempering.**
- (b) State the difference between drilling and reaming.**
- (c) State one suitable surface finishing process for each of the following:**
 - (i) Aluminium dishes;**
 - (ii) Bicycle frames;**
 - (iii) Sheet steel litter bins.**

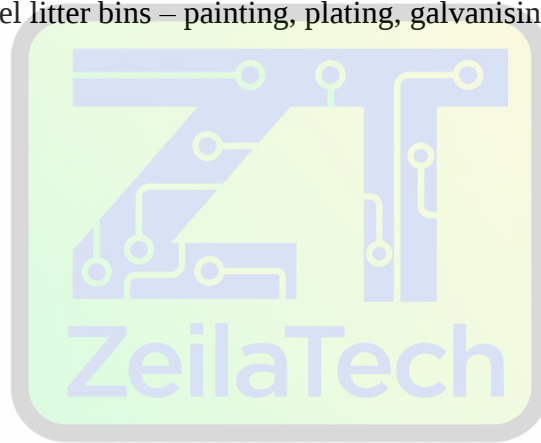
This was a popular question. However, candidates' performance was poor.

- a) Candidates could not state one reason each why the following heat treatment processes are carried out on metals:
 - (i) Normalising: – It is carried out to refine the grain structure after prolonged heating of the metal.
 - To relieve strains, stresses and fine cracks developed in the metal after heating.
 - To improve and restore fine grain structure.

- (ii) Case hardening: – It is carried out on mild steels to enable hard outer skin to be provided on the metal whilst the inner remains tough and soft.
- (iii) Tempering: – It is carried out on hardened metals to remove some of the extreme hardness and brittleness to enable the metal to be toughened.

Candidates rather than providing the above reasons stated the processes for heat treating metals using the above methods.

- b) A few candidates could state the difference between drilling and reaming. Drilling involves originating/creating a hole in materials using drills while reaming is a machining process carried out to enlarge an existing hole drilled.
- c) This part of the question demanded that candidates state one suitable surface finishing process for each of the following:
 - (i) Aluminium dishes – Anodising, polishing.
 - (ii) Bicycle frames – zinc coating, painting chromium plating.
 - (iii) Sheet steel litter bins – painting, plating, galvanising.



Smart Learning Tools

METALWORK 3

1. GENERAL COMMENTS

The standard of the paper compared favourably with that of the previous years.

Candidates' performance was good.

2. SUMMARY OF CANDIDATES' STRENGTHS

- (1) A great number of students successfully produced the circular parts of both pieces.
- (2) Majority of the candidates worked to accurate sizes.
- (3) All the candidates understood and interpreted the detailed drawings provided for the exercises.
- (4) All the candidates completed the exercise within the time allocated for the work.
- (5) Candidates observed safety rules to avoid accidents.
- (6) Candidates faithfully followed and adhered to the rubrics of the examination especially as regards the handling of their finished work.

3. SUMMARY OF CANDIDATES' WEAKNESSES

- (1) Candidates lack effective handling and use of bench and hand tools.
- (2) Most candidates failed to clean sharp edges to finish the artefact in safety condition.
- (3) Most candidates failed to follow basic and best practices usually resulting in poor work.
- (4) Inability to use appropriate measuring tools for accurate control of dimensions and sizes.
- (5) Inaccurate fitting/filing practices leading to mismatch of parts requiring final mating.
- (6) Candidates lack skills in lathe machining, hence, their inability to attempt the machining exercise i.e., Question 2.

4. SUGGESTED REMEDIES

- (1) Students should be encouraged to use all tools correctly when carrying out any exercise.
- (2) Students should be encouraged to adopt the habit of deburring finished work – for cleanliness and safety purposes.
- (3) Students should be taught the basic skills of metal working practice.
- (4) Candidates should be trained in the effective use and application of measuring tools to carry out measurements.
- (5) Candidates should be given sufficient exposure to enable them file well.

5. DETAILED COMMENTS

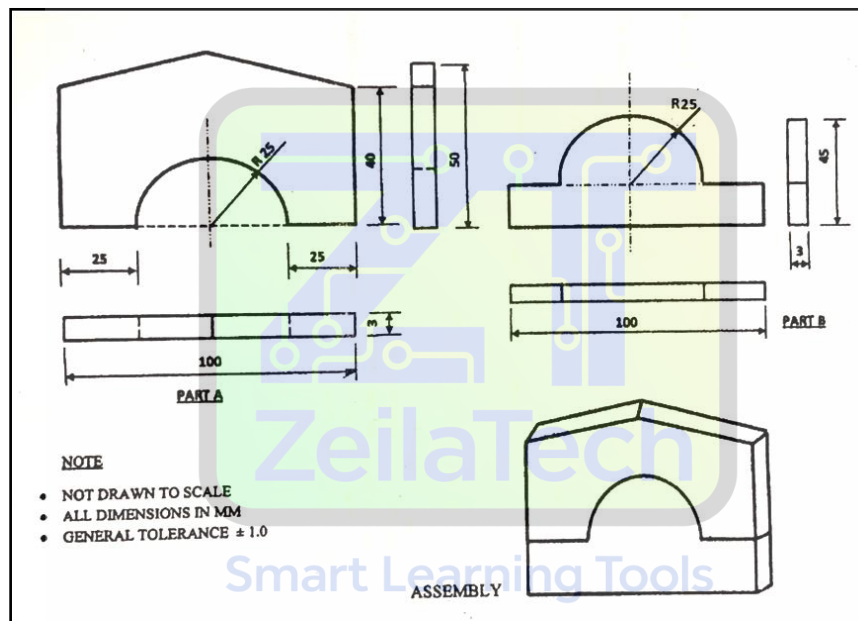
The paper consisted of two practical questions. Question 1 is a fitting exercise and Question 2 is a machining exercise and candidates were required to answer only one of the questions.

QUESTION 1

The following materials are supplied:

- (a) One flat mild steel plate, 105mm x 55mm x 3mm (2 off);
- (b) One cotton bag, 120mm x 120mm to enclose the finished work;
- (c) Two tie-on labels.

The diagram below shows the assembly and detailed views of each part of a fitting exercise. Using the materials supplied, prepare the parts and assemble the pieces.



Candidates were supplied with the following materials:

- (a) One flat mild steel plate 105mm x 55mm x 3mm – 2 off.
- (b) One cotton bag 120mm x 120mm to enclose the finished work.
- (c) Two tie-on labels.

Candidates were therefore required to use the above materials and prepare all the parts indicated in the detailed drawing for the fitting exercise and assemble all the pieces produced to give the product as shown in the assembly drawing.

Part A – Candidates were expected to first mark out the work outline per the dimensions given on the detailed drawing on one of the given pieces i.e. 105mm x 55mm x 3mm. After scribbling out, the candidates were required to dot punch through the scribbled outline of

the figure to make the outline more conspicuous. Obtaining the figure on the metal plate, candidates were expected to hacksaw through the dot-punched outline close to the finished size.

Candidates could chain drill through the semi-circular part of the workpiece and chisel out thereafter.

Alternatively, candidates could use a drill size big enough to drill a hole close to the outlined figure and hacksaw or chisel out thereafter. After drilling and cutting, candidates were expected to use appropriate rough file to file out the excess metal so that the workpiece could be completed to the required size using the smooth file.

Majority of the candidates were able to follow the right procedures as stated above to obtain the workpiece for Part A.

Part B – Similarly, candidates were required to mark out, dot punch the figure in the detailed drawing on the other flat mild steel plate supplied to candidates.

Again, candidates were expected to hacksaw or chisel through the dot punched outline to obtain a figure close to the specified dimensions of the detailed drawing.

Candidates were expected to complete the piece by smooth filing through cut out outline. Many candidates successfully followed the right procedures or steps to obtain the Part B. After completing the two pieces, candidates were required to assemble all the pieces together to realize the artefact shown in the detailed drawing.

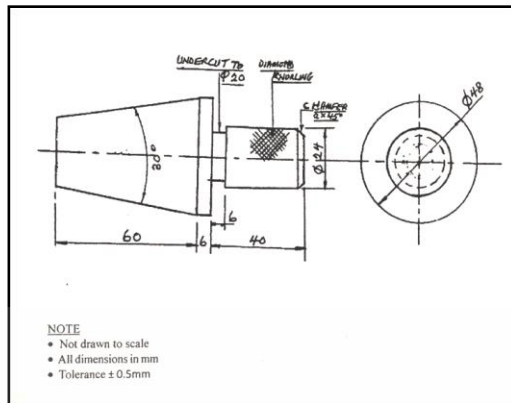
Many candidates met the expected requirement as regards the realization of the final product.

QUESTION 2

The following materials are supplied:

- (a) One-piece free cutting mild steel rod, Ø50mm x 110mm;**
- (b) One cotton bag, 120mm x 120mm to enclose the finished work;**
- (c) Two tie-on labels.**

The diagram below shows the detailed view of a machine part. Produce the part using the material supplied.



Candidates were supplied with the following materials:

- One-piece free cutting mild steel rod, $\text{Ø}50\text{mm} \times 110\text{mm}$;
- One cotton bag, $120\text{mm} \times 120\text{mm}$ to enclose the finished work;
- Two tie-on labels.

Candidates were therefore expected to use the rod supplied to produce the part indicated in the detailed drawing.

- Candidates were expected to set up the given rod in the lathe machine check and face the two ends to the specified length of 106mm from the detailed drawing.
- Candidates were again required to centre drill and hold the workpiece between centres to enable the outside diameter 48mm to be turned after facing the ends of the rod.
- From the RHS of the workpiece held between centres, candidates were required to further turn down to the diameter $24\text{mm} \times 40\text{mm}$ length.
- Again, from the length 34mm , the undercut diameter $20\text{mm} \times 2\text{mm}$ depth could be produced before setting off the compound slide of lathe machine to half of the included angle to cut the taper $30^\circ \times 60\text{mm}$ long from the LHS of the set up.
- Furthermore, candidates were expected to knurl the RHS of the rod to a length of 34mm using a diamond knurling tool to produce a medium finish on the workpiece.
- Once more, the candidates were required to further cut or form changer at the RHS of the knurled end using a form tool ground to the given 45° of the changer.
- Regrettably, no candidate attempted to produce or perform the exercise required in question 2.