18.0 METAL WORK (445)

In the years 2006 and 2007 there was no KCSE examination in Metalwork. When the examination resumed in the year 2008 it comprised, as in the previous years, a ***theory paper (445/1)*** marked out of 100% but scaled down to 60% and a ***project paper (445/2)*** constituting 40% of the overall marks.

18.1 CANDIDATES' GENERAL PERFORMANCE

The table below shows candidates performance in Metalwork in the year 2008. Performance statistics for the years 2003, 2004 and 2005 have also been given for comparison.

Table 23: Candidates' Overall Performance in Metal Work in the years 2008, 2005, 2004 and 2003

Year	Paper	Candidature	Maximum Score	Mean Score	Standard Deviation
2003	1		60	23.93	8.39
	2		40	33.28	5.68
	Overall	**358**	**100**	**57.23**	**12.22**
2004	1		60	22.29	9.27
	2		40	34.23	3.34
	Overall	**365**	**100**	**54.36**	**14.00**
2005	1		60	23.40	9.60
	2		40	34.90	3.24
	Overall	**311**	**100**	**57.74**	**12.00**
2008	1		60	23.62	6.95
	2		40	35.62	4.57
	Overall	**89**	**200**	**59.24**	**9.39**

From the table above, the following observations can be made:

18.1.1 There was hardly any difference in the mean score for ***paper 1 (445/1)*** in the year 2008 and the mean scores of years 2005, 2004 and 2003.

18.1.2 In ***paper 2 (445/2,*** the mean score improved by ***0.72*** from ***34.90*** in 2005 to ***35.62*** in the year 2008.

18.1.3 The overall mean score improved from ***57.74*** in the year 2005 to ***59.24*** in the year 2008.

18.1.4 The statistics for the year 2008 compare favourably with those for the years 2005, 2004 and 2003 despite the interruption in the years 2006 and 2007.

18.2 PAPER 1 (445/1)

In this part of the report, some analysis of the questions which were poorly performed in ***paper 1 (445/1)*** will be made. The questions include ***5, 7, 8, 13*** and ***15.*** It should be noted that the discussions will focus on the candidates' weaknesses, the expected responses and appropriate advice to teachers and students.

Question 5

(a) Explain the following faults as applied to gas welding:

(i) backfire;
(ii) flashback.

(b) State **two** causes of each of the faults in (a) above.

Candidates were required to explain the terms ***"backfire"*** and ***"flashback"*** and state two causes of each.

Weaknesses

Most candidates could only guess the meaning of each fault and ended up giving the wrong explanations and causes.

Expected Responses

(a)

(i) ***Backfire*** is a condition whereby the flame momentarily recedes back into the tip before being expelled with a loud (pop) sound.

(ii) ***Flashback*** on the other hand is a condition where the torch stays lit instead of expelling the flame.

(b) The causes of backfire include leaks, overheated torch, dirty tip and partially blocked tip by molten pool while flashback can be caused by improper pressure, overheated torch, faulty tip and kinked hoses.

Question 7

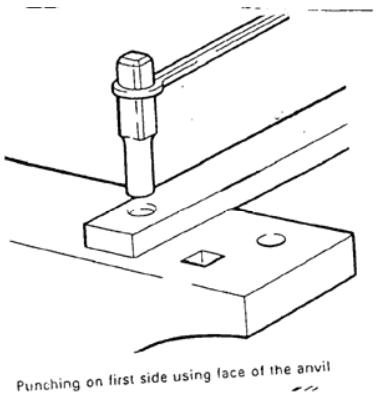
With the aid of labelled sketches, outline the steps of punching a hole in a metal bar on an anvil.

Candidates were required to illustrate how a hole is punched in a flat bar.

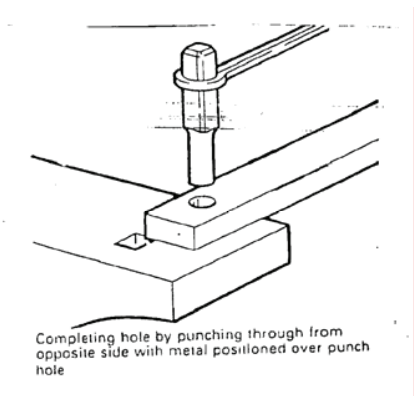
Weaknesses

Most candidates failed to bring out the difference in punching a hole in sheet metal and punching a hole in a metal bar. Some candidates also failed to illustrate their responses and left out some aspects like safety and correct placement of the work piece on the anvil.

Expected Responses



Punching on first side using face of the anvil



Completing hole by punching through from opposite side with metal positioned over punch hole

Question 8

(a) State **four** differences between soft soldering and brazing.

(b) Describe **three** methods of strengthening an edge of sheet metal.

Candidates were expected to list several differences between ***soft soldering*** and ***brazing*** and also describe three methods of strengthening a sheet metal edge.

Weaknesses

The majority of the candidates knew that soldering and brazing are both joining methods by heating. However, very few candidates were able to state the difference between the two processes. Both processes use different filler rods and flux and also require different working temperatures. A brazed joint is stronger than soldered joint. In part (b) of the question the methods of strengthening an edge of a sheet metal which include bending and flattening, wire edging and beading or false wire edging were not known to candidates.

Expected Responses

(a)

- Require different working temperatures.
- Both use different filter rods.
- Soldering – different flux.
- Brazed joint is stronger than soldered joint.

(b)

- By bending and flattening.
- By wire edging (bend over a wire and return it).
- By bending (bend over wire and remove it).

Question 13

(a) Name the most suitable metals for making each of the following items and state **two** reasons for each choice:
   (i) soldering wire;
   (ii) surface plate;
   (iii) twist drill.

(b) Illustrate each of the following forms of metal supply and state **two** applications of each form:
   (i) zed bar;
   (ii) angle bar;
   (iii) square pipe.

(c) Describe each of the following metal finishing processes:

   (i) bluing;
   (ii) lacquering;
   (iii) planishing.

The candidates' knowledge on various compositions and forms of materials was being tested in this question.

Weaknesses

Most of the candidates did not know the materials that constitute soldering wire, surface plate and twist drill and the reasons why each of these materials is used. Although part (b) of the question was straight forward, some candidates were not able to state where the various forms of metal are used. In part (c) of the question, the candidates displayed

limited knowledge in various finishing processes.

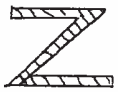
Expected Responses

(a) (i) ***Soldering wire:*** Alloy of tin and lead. It should have low melting temperature, low surface tension and high capillary resistance to corrosion.

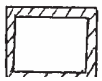
(ii) ***Surface plate:*** Cast iron should be self lubricating, have a hard surface and should be easy to make.

(iii) ***Twist drill:*** High speed steel. Should be resistant to rust, retain hardness even at high temperatures and should be hard.

(b)

(i)  For roofwork and window frames

(ii)  Steel structures and frames

(iii)  Furniture, fences, gates

(c)

(i) ***Bluing:*** A method of finishing metal articles using heat to achieve a corrosion resistant surface. Done by heating metal until colour changes to blue then dipping the work into light oil allowing it to cool.

(ii) ***Lacquering:*** A process of metal finishing using lacquer for preservation and beauty. The types of lacquer used include hot, gum cellulose and synthetic and is applied using a brush, dipping or spraying.

(iii) ***Planishing:*** It is a process of finishing by making even decorative dents on sheet metal using a planishing hammer and stake. The process includes annealing, picking, buffing and cleaning.

Question 15

(a) State **three** differences between cold and hot forging.

(b) Figure 5 shows a chain support eye to be made from a 6 mm silver steel rod.

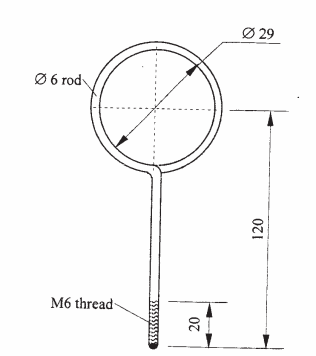


Figure 5

(i) Determine the total length of the rod
(ii) Outline the procedure of forming the eye
(iii) Outline the procedure of cutting the threads.

This question on forging required the candidates to state the difference between ***cold*** and ***hot*** forging and outline how certain operations in a given article are carried out.

Weaknesses

The most challenging part of this question was the calculation of the total length of the wire and the procedure of forming the eye.

Expected Responses

(a)
- Cold forging produces better finish than hot forging.
- Cold forging work hardens and leaves the work stressed.
- Cold forging requires ductile material and of small cross-section unlike hot forging.

(b) (i) Total Length

$$\text{Eye}: \ \pi D \text{where} D = 29 + 3 + 3 = 35$$

$$\pi \times 35 = \frac{22}{7} \times 35 = 110$$

$$\text{Straight part}: 102 - \left(\frac{22}{7} + 6\right) = 120 - 20.5 = 99.5$$

$$\text{Total length} = 100 + 99.5 = 209.5\text{mm}$$

(ii) Forming the Eye
- Mark the required length for the eye.
- Bend the rod to 90^0.
- Form the eye on anvil by start, further and closing.
- Hammer the eye on the anvil flat.

(iii) Cutting Thread
- Hold the work piece in the vice.
- Chamfer the end to be threaded.
- Select the correct die M6.
- Fix the die in the die stock.
- Adjust the die to maximum opening.
- Fit the die square at the end of the bar.

- Apply cutting lubricant.
- Start cutting the thread.
- Continue cutting and reversing to beak the chips.
- Remove the die.
- Adjust the depth of the cut.
- Repeat thread cutting until the right depth is achieved.

18.3 GENERAL COMMENTS

The poor performance by the candidates in all the questions cited above can mainly be attributed to poor tuition and lack of adequate exposure to appropriate practical work. Teachers are advised to ensure that all the topics in the syllabus are adequately taught and students should be given appropriate exercises for application of the skills learnt.

18.4 PAPER 2 (445/2)

As in the previous years, the Council designed a suitable project for this level together with a very comprehensive marking scheme. The subject teachers used the working drawings to supervise the fabrication of the project and also used the marking scheme to mark the projects. The assessment of the project did not require the involvement of external examiners.