THE NATIONAL EXAMINATIONS COUNCIL OF TANZANIA

CANDIDATES' ITEM RESPONSE ANALYSIS REPORT FOR THE CERTIFICATE OF SECONDARY EDUCATION EXAMINATION (CSEE) 2019

094 WELDING AND METAL FABRICATION

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Published by
National Examinations Council of Tanzania,
P.O. Box 2624,
Dar es Salaam, Tanzania

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FOREWORD

The National Examinations Council of Tanzania is pleased to issue the 2019 Form Four National Examination report on Candidates' Item Response Analysis for Welding and Metal Fabrication subject. The report has been written in order to provide feedback to the candidates, teachers, parents, policy makers and the public in general about the performance of the candidates in this subject.

The Certificate of Secondary Education Examinations (CSEE) marks the end of four years of Ordinary Level Secondary Education. It is a summative evaluation which, among other things, shows effectiveness of the education system in general and the education delivery system in particular. Essentially, the candidates' responses to the examination questions are strong indicators of what the education system was able or unable to offer to the candidates in their four years of Ordinary Level Secondary Education.

The analysis presented in this report is intended to contribute towards the understanding of possible reasons behind the candidates' performance in Welding and Metal Fabrication subject. The report highlights factors that made the candidates to perform well. Such factors include ability to identify requirements of the question and the candidates' adequate knowledge of the concepts related to the subject. Despite the good performance, the report also highlights factors which made some candidates to fail. Such factors include lack of adequate knowledge in relation to a particular concept, failure to interpret the requirements of the questions and poor command of the English Language. The feedback provided will enable the educational administrators, school managers, teachers, candidates and other stakeholders to identify proper measures to be taken in order to improve the candidates' performance in future examinations administered by the Council.

Finally, the Council would like to thank the Examination Officers and all others who participated in writing this report, reviewing and analyzing the data used in the report.

Dr. Charles E. Msonde
EXECUTIVE SECRETARY

1.0 INTRODUCTION

This report focuses on the analysis of the performance of the candidates in the Certificate of Secondary Education Examination (CSEE) 2019, in Welding and Metal Fabrication subject. The examination paper consisted of questions which intended to measure the candidates' competences, knowledge and skills on the subject contents stipulated in the 1994 syllabus of Welding and Metal Fabrication.

The paper consisted of three sections; A, B and C. Section A consisted of one multiple choice question with items (i) – (x) and carried a total of ten (10) marks. Section B comprised ten (10) short answer questions. The section carried a total of (60) marks. Section C consisted of three structured questions of which the candidates were required to answer any two (2) questions; each question carried fifteen (15) marks.

A total of 134 candidates sat for Welding and Metal Fabrication subject out of which, 47 (35.07%) candidates passed while 87 (64.93%) failed. This shows that, the performance in 2019 has decreased by 11.61 percent compared to 2018 performance in which out of 139 candidates who sat for the examination, 76 (54.68%) candidates passed while 63 (45.32%) failed. Generally, the performance of candidates in the Welding and Metal Fabrication subject was poor.

In this report the candidates' performance in each question was considered as weak, average or good if the percentage of candidates who scored 30 percent and above in the marks allocated for a particular question falls within the intervals of 0 to 29, 30 to 64 and 65 to 100 percent, respectively.

This report provides feedback on the performance of the candidates by showing what the candidates were required to do as well as their strengths and weaknesses in their responses. Samples of candidates' answers (extracts) have been used to show good and weak responses. It is expected that this report will be useful to teachers, candidates and other education stakeholders and will enable them to identify the areas where candidates faced learning difficulties and help them in making decisions for improving teaching and learning process. Figure 1 show overall performance of 134 candidates who sat for the CSEE 2019Welding and Metal Fabrication subject.

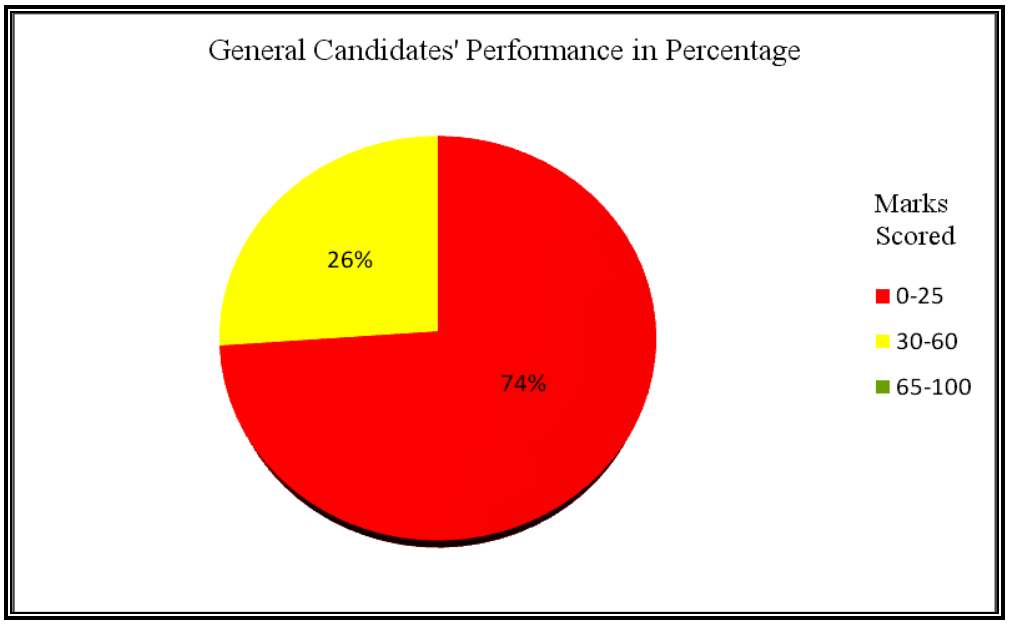


Figure 1: *The general candidates' performance in Welding and Metal Fabrication.*

Figure 1 shows that, the candidates' performance in this subject was average since only 26 percent were able to score 30 percent and above. This indicates that the candidates were not well prepared for examination or lacked concentrations on the subject matters.

2.0 ANALYSIS OF PERFORMANCE IN EACH QUESTION

2.1 SECTION A: OBJECTIVE QUESTIONS

2.1.1 Question 1: Various Topics

This question consisted of 10 multiple choice items (i) – (x) derived from various topics of the syllabus as follow, *Production of Welding Gases, Soft Soldering, Manifold system, Welding test, Blow pipe, Filler metal, Weld defects, Welding position, Electric Sheet Metal Fabrication* and *Resistance welding.* For each item, the candidates were required to choose the best alternative from among the given alternatives and write its letter beside the item number. Each item carried 1 mark, making a total of 10 marks.

The question was attempted by 134 candidates (100%), out of which 28 candidates (20.90%) scored from 0 to 2 marks, 85 candidates (63.43%) scored from 3 to 6 marks and 21 candidates (15.67%) scored from 7 to 10 marks. This analysis indicates that, the candidates' performance on this question was good

considering that 79.1 percent of the candidates scored 30 percent and above as shown in Figure 2.

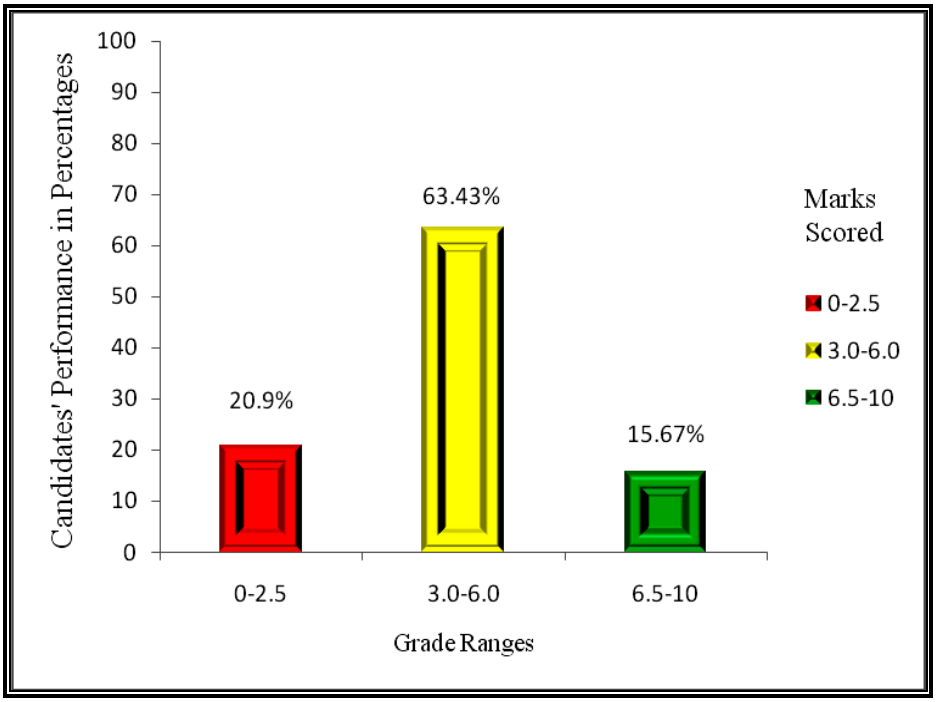


Figure 2: *The candidates' performance in percentage for Question 1*

Analysis of the Items

All the items were attempted by the candidates but those in which most candidates failed were (v) from the topic *Filler Metals* and (vi) from the topic *Soft Soldering.* The items which most of the candidates got correctly were (i) and (ii) from the topics *Production of welding gases* and *Gas Shielded Welding*, respectively.

The strength and weakness of candidates on the choice of correct answers for individual items in the question is analyzed as follows:

(i) Acetylene is the fuel gas which is most widely used in gas welding. What are the compound percentages of carbon and hydrogen contained?

A 90.3% carbon and 9.7% hydrogen
B 91.3% carbon and 8.7% hydrogen
C 92.3% carbon and 7.7% hydrogen
D 93.3% carbon and 6.7% hydrogen
E 94.3% carbon and 5.7% hydrogen

Item (i) was set from the topic *Production of Welding Gases*. The candidates' were required to identify the percentages of carbon and hydrogen contained in Acetylene gas. The question intended to measure candidates' ability to understand the quantity gas welding elements.
The correct answer was *C, 92.3% carbon and 7.7% hydrogen.* The candidates who opted for the correct response had adequate knowledge of elements that compound of Acetylene gas was contained in production of gas welding. However, the candidates who opted for the rest of the alternatives (A,B,D and E) did not understand the requirements of the question, especially on production of welding gases.

(ii) When you are joining two metals by using soldering, it is advisable to use flux. What is the major reason of using flux?

A It simplifies melting of filler metal
B It increases the melting temperature
C It increases metal oxide
D It avoids formation of oxide
E It increases corrosive resistance.

Item (ii) was composed from the topic *Soft soldering*. It require the candidates to give out reasons of applying flux during soldering processes. The item intended to measures candidates' ability to reason by using additive and protective material during soldering. Candidates were required to apply the knowledge of soft and hard soldering to answer this question.

The correct answer was *D, It avoids formation of oxide*. The candidates who opted for the correct response had good knowledge of soldering process. However, some of the candidates who chose destructor *B, It increases the melting temperature* and E, *It increases corrosive resistance* lacked knowledge of the functions of fluxes in soldering. Because, one of the characteristics required for flux to be used in soldering processes is low temperature and melting point. Moreover, the candidates who opted for the rest of destructors i.e. A and C, misunderstood the requirements of the question.

(iii) With reference to the manifold system, how would you tape the gases from the cylinders to the pipe line?

A By high pressure coupling pipe
B By low pressure coupling pipe

C By acetylene output regulator
D By oxygen output regulator
E By separable control hoses.

Item (iii) was extracted from the topic Manifold system. It tested the candidate's ability to understand the ways of taping gases from the cylinders connected in manifold system to the pipe lines.

The correct answer was *A, By high pressure coupling pipe.* Most of the candidates opted for the correct answer for this question. This indicates that, they had enough knowledge of gas welding manifold systems. Few remaining candidates who opted for the destructor B, *By low pressure coupling pipe,* thought that, the gas coming from the manifold system required to be reduced in pressure before being used. These contradict between the function of low pressure coupling used in manifold system and low pressure regulator used on the gas cylinder.

(iv) Testing of welded joints do not necessarily involve destroying of the component or structure. Which method is used in testing welded joints without destroying the component or structure?

A Visual inspection, tensile test, ultrasonic and liquid penetrate test
B Ultrasonic, eddy current, liquid penetrate and visual inspection test
C Eddy current, ultrasonic, visual inspection and bend test
D Liquid penetrate, visual inspection, eddy current and tensile test
E Visual inspection, impact liquid penetrate and ultrasonic test.

Item (iv) required the candidates to identify the method used in testing welded joints without destroying the components or structure. Candidates were required to apply knowledge of weld tests to answer this question.

The correct answer was *B, Ultrasonic, eddy current, liquid penetrate and visual inspection test*. The Candidates who opted the correct answer had knowledge of weld tests and its procedures. Those who opted for the rest of distractors (A, C, D and E) had insufficient knowledge of weld tests. They thought that, the *tensile test, bend test* and *impact test* are tests which have been done by destroying the components while the question insisted the type of test which can be done without destroying the component. The aim of this question was to

measure candidates' competence based on methods applied on weld-bead tests which do not involve destruction of the specimen.

(v) Blowpipes are essentially devices for mixing acetylene and oxygen gases during welding and cutting processes. Identify a problem that can occur as a result of using faulty blowpipe.

A Back fire
B Spatters
C Flashback
D Arc blow
E Explosion.

In item (v), the candidates were required to identify a problem that can occur as a result of using broken down blowpipe. To attempt this question the candidates were required to apply the knowledge of gas welding and equipment. The correct answer was *E, Explosion*. Most of the candidates responded correctly to this question. The candidates who opted for the correct answer had the knowledge and skills of backfire and flashback as experienced in gas welding operations. However, some candidates who opted for the rest of incorrect responses had inadequate knowledge of the topic *Gas Welding Accessories and Equipments*.

(vi) Electrode is a filler metal used during welding process for melting and defusing parent metals. What is the main function of flux as a coated material on the electrode?

A To keep the weld bed to cool slowly
B To prevent contamination of welded bead from atmospheric gases
C To prevent the welding from rusting
D To reduce crater at the end
E To protect cracks in the weld metal.

Item (vi) required the candidates to identify the main function of flux as a coated material on the electrodes. The aim of this question was to measure the candidates' ability of understanding the functions of flux coatings on filler metals.

The correct answer was *B, To prevent contamination of welded bead from atmospheric gases.* The candidates who opted for the correct answer had

knowledge of functions of flux coatings on electrodes used in electric arc welding processes. On the other hand, those who opted for the rest of distractors had poor understanding on the functions of coverings on electrodes. This implies that the candidates had inadequate knowledge of the topic *Filler Metals.*

(vii) Poor penetration, shallow crater, metal heaps up on plate with overlap, arc heaving unsteady spluttering sound in arc welding are a results of

A Too high voltage
B Too high current
C Too low current
D Correct voltage
E Correct current

Item (vii) was composed from the topic *Welding Defects*. The question aimed to measure the competence of candidates' ability to identify different types of weld defects, its causes and correction measures to be taken.

The correct answer was C, *Too low current*. The candidates who chose correct answer had enough knowledge of weld defects, causes and correction measures. They were able to identify that, tool flow current is a result of metal heaps on the welded metal and other defects. Those who opted for the rest of alternatives A, B, D and E lacked knowledge on the topic *Weld Defects*.

(viii) Welding positions gives an idea on the location of the work piece which is to be welded. Identify the appropriate four basic welding positions.

A Down hand, flat, horizontal and overhead
B Flat, horizontal, down hand and vertical
C Horizontal, ground, down hand and overhead
D Overhead, vertical, flat and down hand
E Vertical, horizontal, overhead and down hand.

In item (viii) the candidates were required to apply the knowledge of welding positions to identify the appropriate four basic welding positions. The correct answer was *E, Vertical, horizontal, overhead and down hand*. This answer was chosen by candidates who were conversant on welding positions. Those who opted for the remaining distractors A, B, C and D lacked knowledge of welding

positions in welding. They failed to remember that *flat* and *ground* are not welding positions.

(ix) All jobs which are fabricated from black iron sheet (mild steel sheet) are finally painted with red-oxide paint. What is the purpose of painting red oxide paint?

A for decoration
B for resisting heat
C for resisting rust
D for retaining water
E for good appearance

Item (ix) was composed from topic *Sheet metal processing*. It required the candidates to apply knowledge of sheet metal processing to identify the reasoning of painting. The aim of this question was to measure the candidates' ability of using paints in sheet metal processes.

The correct answer was *C, for resisting rust*. The candidates who opted for the correct alternative were familiar with sheet metal processes. They were aware that, the main purpose of painting red oxide paint is for resisting rust. Moreover, those who failed to respond correctly to this question lacked knowledge of sheet metal processes.

(x) Spot welding is among resistance welding processes used in metal joining. Which material will you prefer to use for manufacturing electrodes?

A Brass
B Copper
C Mild steel
D Lead
E Cast iron.

Item (x) tested the candidates' ability of understanding resistance welding process. The question aimed at measuring candidates' ability to select material for manufacturing electrodes.

The correct response was *B, Copper*. The candidates who opted for the correct alternative had sufficient knowledge of resistance welding and suitable

electrodes to be used. However, most of the candidates responded wrongly to this question. This implies that, those candidates lacked knowledge of spot welding and suitable material to be used for manufacturing electrodes.

2.2 SECTION B: SHORT ANSWER QUESTIONS

2.2.1 Question 2: Backfire and Flashback

This question had three parts, namely (a), (b) and (c). In part (a), the candidates were required to differentiate backfire from flashback during welding process. Part (b) required the candidates to identify three causes of backfire and flashback. Part (c) required the candidates to explain what should be done when backfire occurs. The question was attempted by 125 (93.3%) candidates.

The candidates' performance in is question was average. The analysis of the performance reveals that, 80 (64%) candidates scored from 0 to 1.5 marks, 30 (24%) candidates scored from 2 to 3.5 marks and 15 (12%) scored from 4 to 6 marks out of 6. Figure 3 illustrates the candidates' performance in this question.

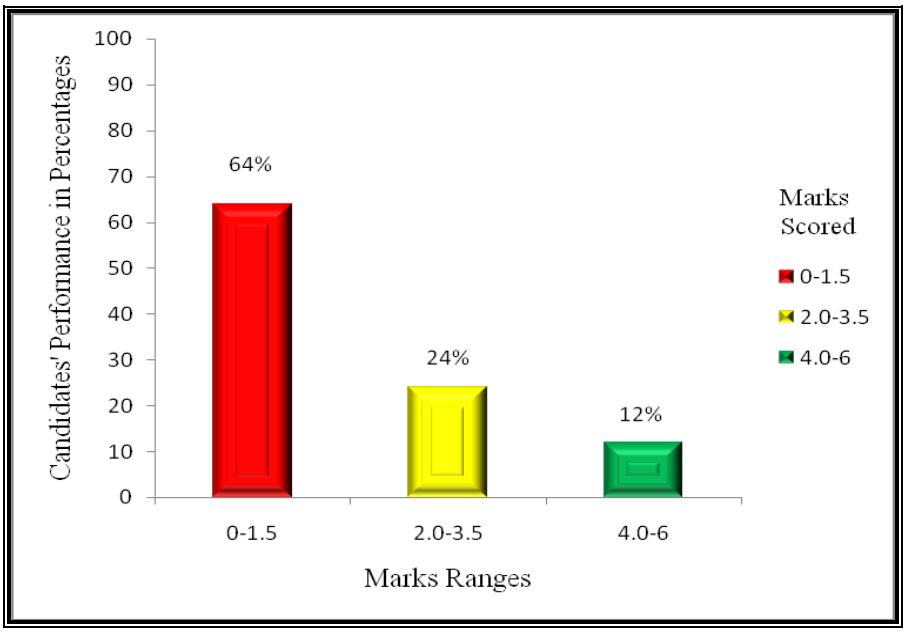
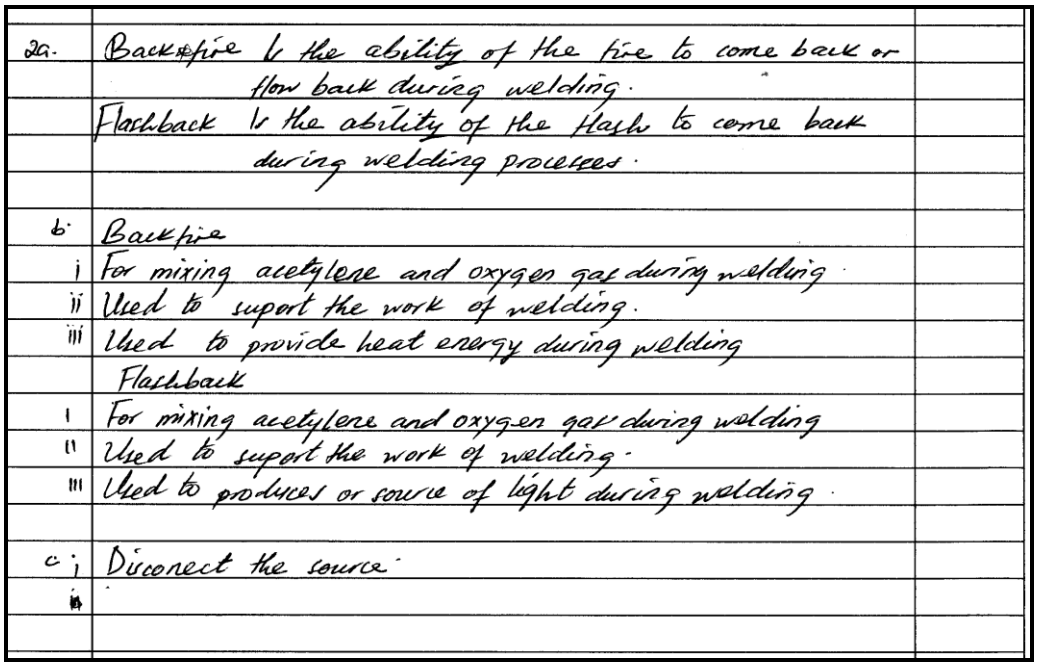


Figure 3: *The candidates' performance in question 2*

Most of the candidates (64%) who score poor marks in this question misinterpreted the question in almost all parts. In part (a) most of the candidates differentiated backfire from flashback as*; the minatory backward of gases to the torch pit that cause the flame to go out while flashback is the*

flammable gases that mixture with oxygen to the holes during the welding process which are absolutely wrong. Moreover, other irrelevant responses provided were; *the fire which used to put off another fire (Backfire)* while *flashback is the fire which will be putted off during another fire happen.* Such irrelevant responses indicate that, the candidates had limited knowledge of the subject matter, misconceived the question and failed to identify the requirements of the question.

In part (b), some of the candidates presented the causes as *mixing of acetylene and oxygen gases*, *high amount of temperature* and *acetylene output regulator* as the causes of backfire. However, other candidates identified flash back as low pressure and increasing of the metal oxide which are incorrect. In part (c), some of the candidates provided irrelevant responses while others mixed correct and incorrect ideas. These responses demonstrated candidates' inadequate knowledge of subject matters. Additionally, some of the candidates omitted this part despite that it was compulsory. Extract 2.1 is an illustration of the candidate whose responses were irrelevant.


2a. Backfire is the ability of the fire to come back or flow back during welding.
Flashback is the ability of the flash to come back during welding processes.

b. Backfire
i For mixing acetylene and oxygen gas during welding.
ii Used to suport the work of welding.
iii Used to provide heat energy during welding
Flashback
i For mixing acetylene and oxygen gas during welding
ii Used to suport the work of welding.
iii Used to produces or source of light during welding.

c. i Disconect the source.

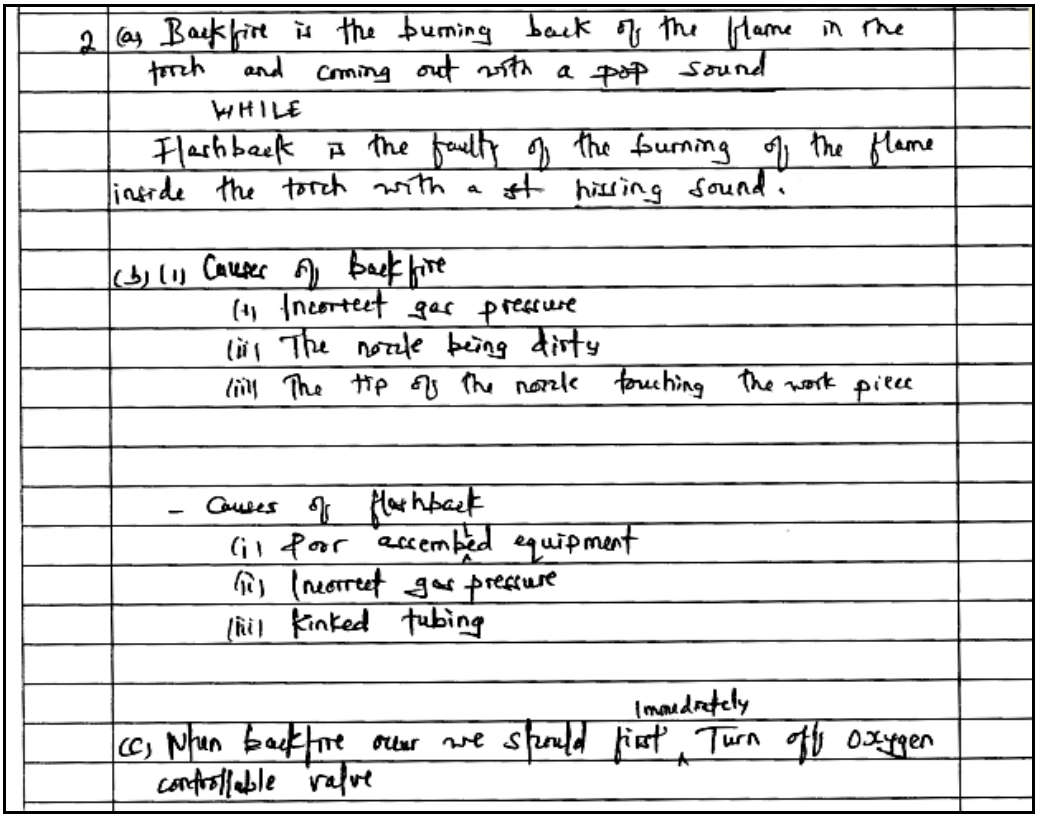
Extract 2.1 *A sample of poor response of the candidate in this question*

In Extract 2.1 the candidates misconceived the question in all parts therefore scored poor marks. For example; a candidate in part (a)(i) responded on the backfire as *it is are blowpipe or device for mixing acetylene and oxygen gases*

during welding and cutting process instead of flame distinguishes or snaps suddenly back inside the blowpipe or nozzle.

The candidates who score from 2 to 3.5 marks managed to provide correct answers to at least one part of the question. They exhibited a good knowledge on topic of *Backfire and Flashback.*

However, there were candidates who scored from 4 to 6 which is good marks. This category of the candidates who provided correct answers had an adequate knowledge of backfire and flashback. Others provided correct answers in both parts with one incorrect answer in each part or two incorrect answers in either part. Extract 2.2 shows a sample of response from a script of a candidate who provided correct answers for the differences, causes and remedies' of backfire and flashback during gas welding processes.


2 (a) Backfire is the burning back of the flame in the torch and coming out with a pop sound
WHILE
Flashback is the faulty of the burning of the flame inside the torch with a hissing sound.

(b) (i) Causes of backfire
(i) Incorrect gas pressure
(ii) The nozzle being dirty
(iii) The tip of the nozzle touching the work piece

- Causes of flashback
(i) Poor accembled equipment
(ii) Incorrect gas pressure
(iii) Kinked tubing

(c) When backfire occur we should first, Turn off Oxygen immediately controllable valve

Extract 2.2 *portrays a sample of good responses from the script of one of the candidate*

In extract 2.2 the candidate managed to provide correct responses to all parts (a), (b) and (c) of the question although some causes of flashback in part (b) were not sufficient hence failed to score the full marks.

2.2.2 Question 3: Hard soldering

This question had two parts (a) and (b) composed from topic of *Hard Soldering.* The candidates were required to outline six brazing procedures in part (a) and to identify six materials of filler metal used in part (b). The total marks allotted for this question were 6.

This question was attempted by 116 (86.6%) candidates of all who sat for the examination and 13.4 percent did not attempt the question. The data analysis indicates that, 92 (79.31%) candidates scored from 0 to 1.5 marks which is poor performance, 18 (15.52%) candidates scored from 2 to 3.5 marks which is average performance and 6 (5.17%) scored from 4 to 6 marks which is good performance. Figure 4 illustrates the candidates performance in this question.

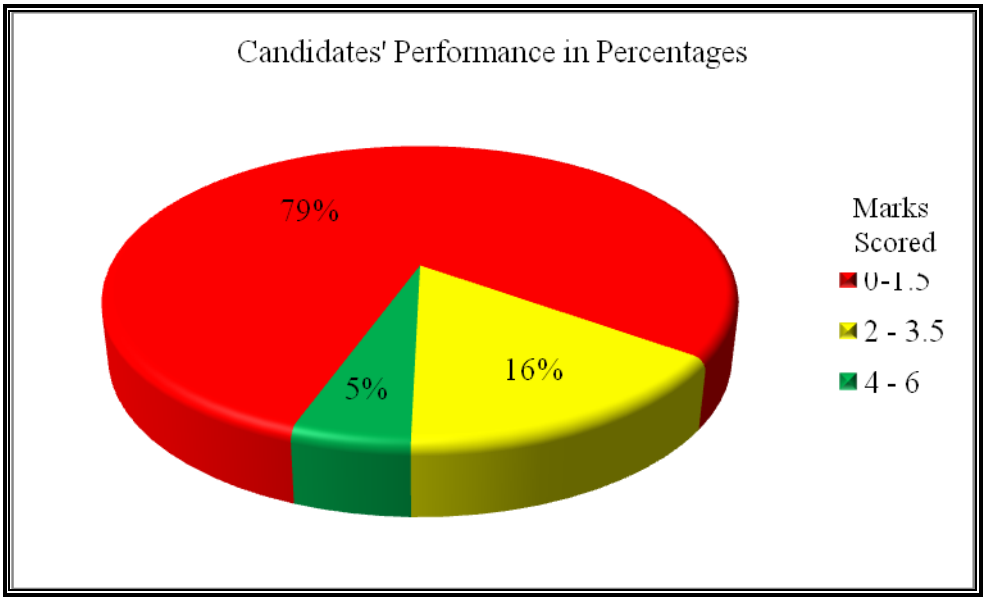
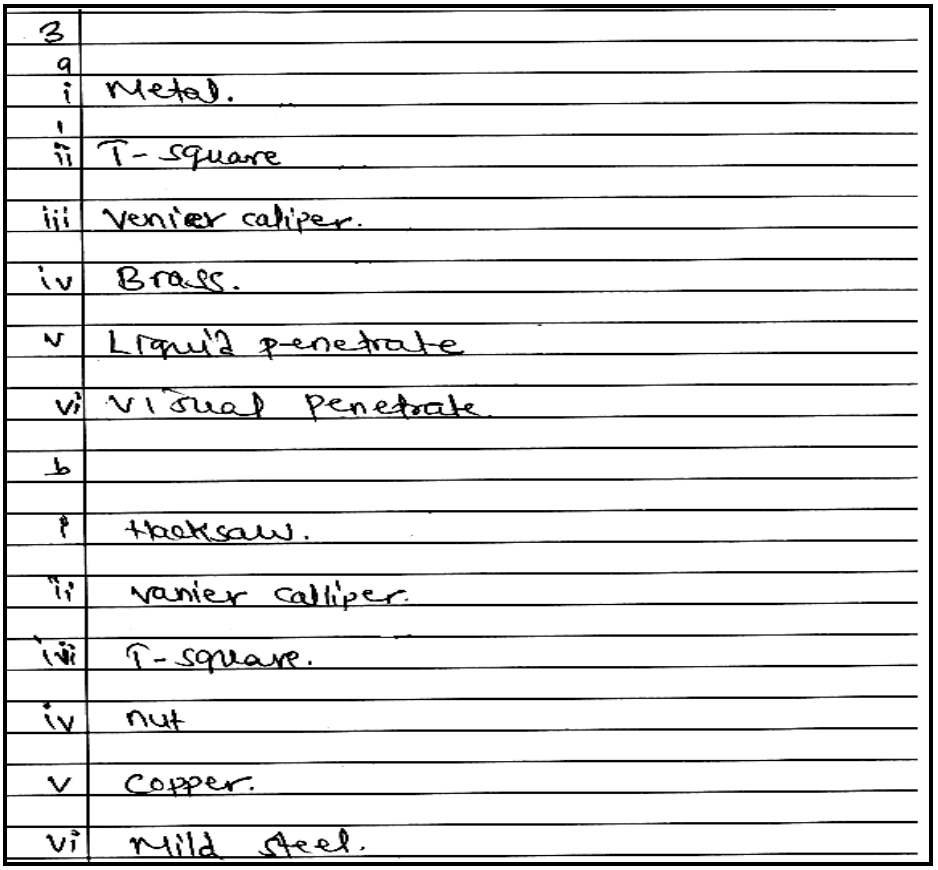


Figure 4: *The trend of candidates' performance in Question 3*

Figure 4 indicates that, performance in this question was poor since only 20.69 percent scored above 2 marks. The candidates' response analysis indicates that 79.31 percent of the candidates scored from 0 to 1.5 marks. These candidates misunderstood the requirements of the question therefore failed to provide correct responses to almost all parts of the question. In part (a), some of the candidates managed to outline few brazing procedures or filler metal materials but failed to complete the task.

Furthermore, some of the candidates in this group wrote nothing, while others failed to provide correct brazing procedures and materials of filler metals. For example, one candidate wrote: Brazing procedures as: *Thickness of materials, types of materials, Setting amount of current, types of position and types of electrode while for materials of filler metal wrote as types of electrode, copper, gap pool, molten slag, spatter and bar sheet.* The candidate seemed to be unfamiliar with the brazing process and filler materials used. Moreover, the responses provided are indication of candidates' inadequate knowledge of brazing processes. Extract 3.1 shows a sample of response from one of the candidates with poor performance in this question.

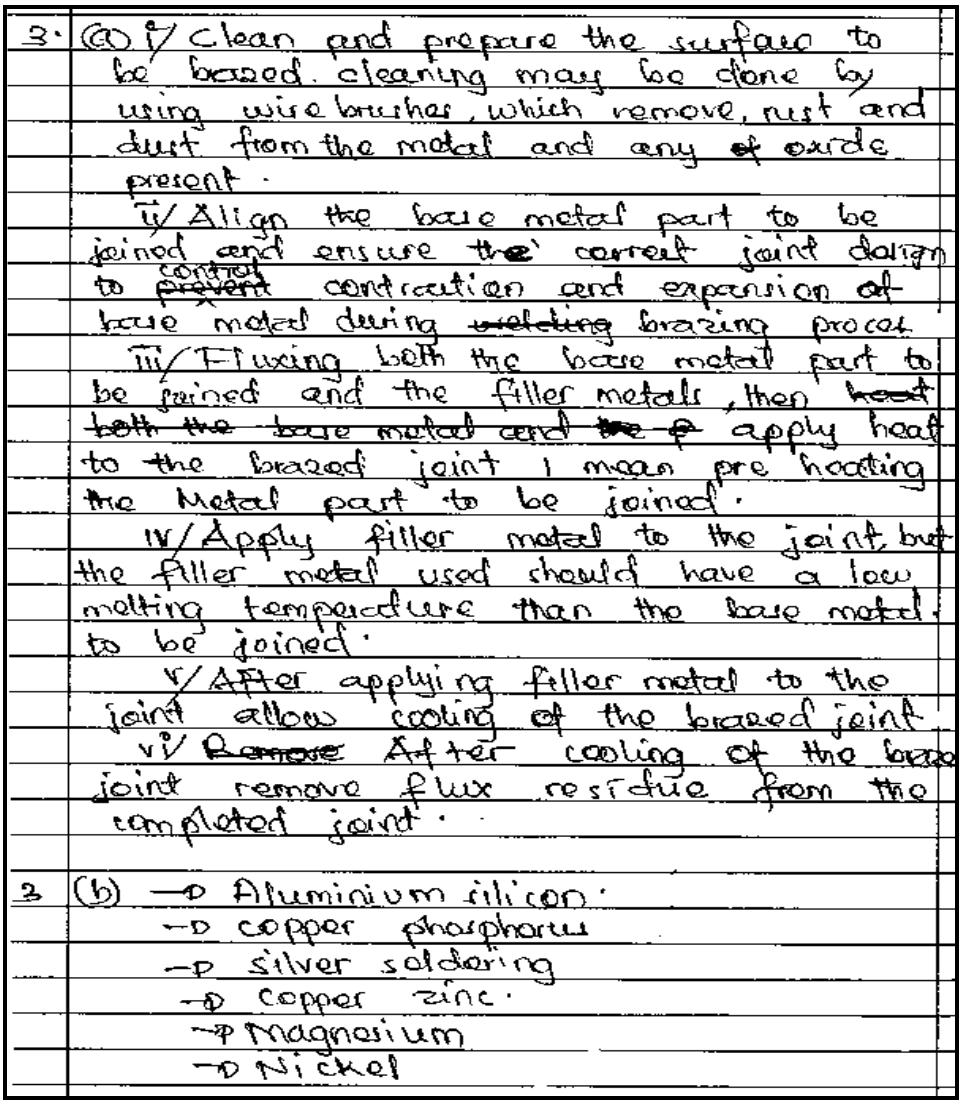


Extract 3.1 *A sample of the candidates' poor responses in question 3*

Extract 3.1 shows the responses of the candidate who failed in all parts of the question and in part (a) she/he wrote the working tool and types of welding test instead of brazing procedures therefore scored poor marks.

On the other hand, the candidates who scored from 2 to 3.5 marks were able to provide four to seven correct responses in part (a) and (b).

However, few candidates (5.17%) who attempted this question stated correctly the procedures of brazing and outlined the filler metal materials. Most of these candidates were able to state correct procedure as: *clean and prepare the surface to be brazed, fluxing both the base metal and filler metal surface by spraying or brushing, align the base metal parts to be joined and heating the joint, apply filler metal to the joint* and *remove flux residue from the completed joint.* Extracts 3.2 illustrates the responses given by one of the candidates who attempted well the question.


3. (a) i/ Clean and prepare the surface to be brazed. cleaning may be done by using wire brushes, which remove, rust and dust from the metal and any ~~of~~ oxide present.

ii/ Align the base metal part to be joined and ensure the correct joint design to ~~prevent~~ control contraction and expansion of base metal during ~~welding~~ brazing procedure.

iii/ Fluxing both the base metal part to be joined and the filler metals, then ~~heat both the base metal and the~~ apply heat to the brazed joint I mean pre heating the Metal part to be joined.

iv/ Apply filler metal to the joint but the filler metal used should have a low melting temperature than the base metal to be joined.

v/ After applying filler metal to the joint allow cooling of the brazed joint.

vi/ ~~Remove~~ After cooling of the brazed joint remove flux residue from the completed joint.

3 (b) → Aluminium silicon.
→ copper phosphorus
→ silver soldering
→ copper zinc.
→ Magnesium
→ Nickel

Extract 3.2: *shows a response of a candidate who gave correct answers to both parts of this question*

In extract 3.2, the candidate managed to outline brazing procedures as required in part (a). He/she also managed to identify materials of filler metals used in part (b) therefore scored high marks.

2.2.3 Question 4: Electric Arc Welding

This question was constructed from the topic of *Electric Arc Welding* under the subtopic of *Welding techniques*. In this question the candidates were required to study the figure given then (a) to mention the welding polarity represented and (b) to write down the components indicated.

The question was attempted by 130 (97%) candidates. Of all candidates, 32.31 percent scored from 0 to 1.5 marks, 25.38 percent scored from 2.0 to 3.5 marks and 42.31 percent scored from 4.0 to 6.0 marks. This analysis shows that, the performance in this question was good as 77.69 percent scored from 2.0 to 6.0 marks. Figure 5 portrays the candidates' performance in this question.

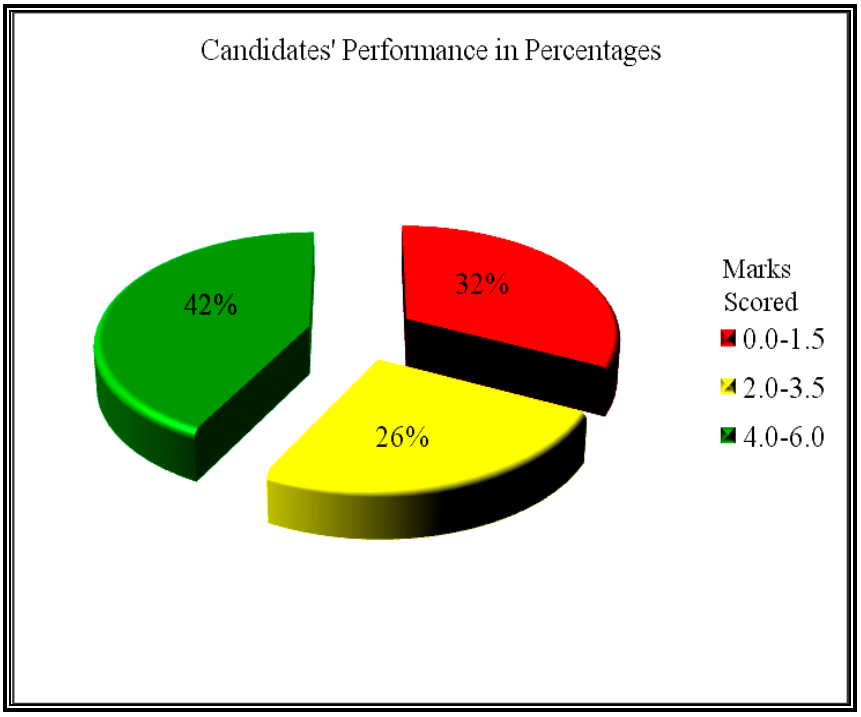
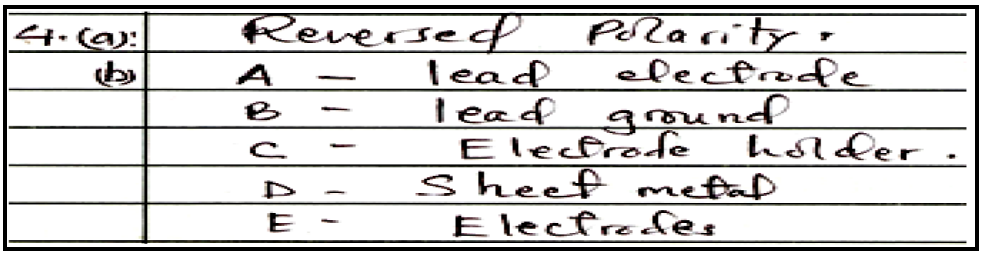


Figure 5: *The percentages of candidates' performance in question 4*

The analysis in Figure 5 indicates that, the candidates performance in this question was good since 68 percent scored from 2 marks and above. The candidates who scored from 2 to 6 marks in this question managed to name the type of welding polarity and components indicated on the figure. These

candidates were also able to name the elements of welding system drawn which are; *Direct Current Reverse Polarity (DCRP) or shortly called Reverse Polarity* and the name of elements are; *welding lead/electrode lead, return lead/ground lead, electric holder, work piece and electrode.*

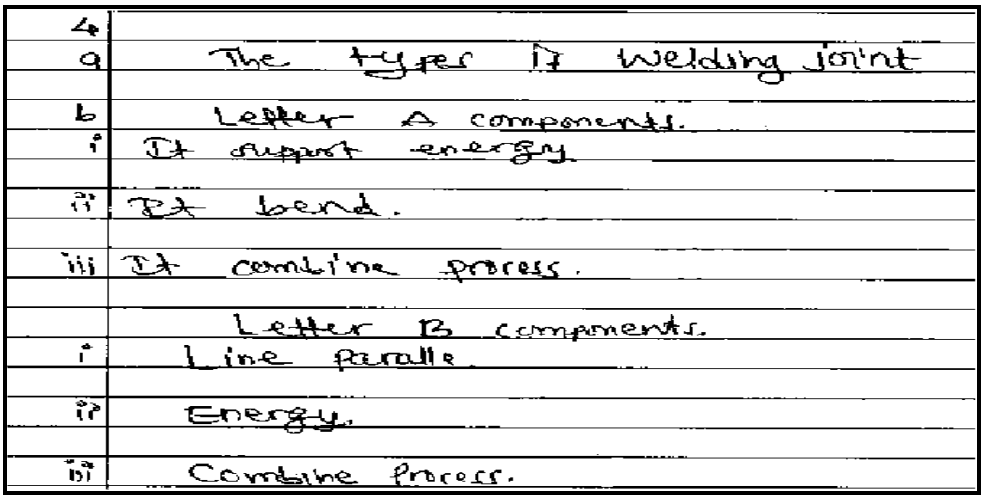
On the other hand, there were some candidates who failed to mention the types of polarity of welding systems but indicated some of the parts and therefore scored averagely. The variations observed from the candidates' scores depended on the Candidate's ability to give the name of polarity and naming the components indicated. Extract 4.1 illustrates one of the candidates who was able to provide the correct name of welding polarity and five basic items indicated in drawing.



Extract 4.1 *is a sample of good response in question 4*

Extract 4.1 shows that, the candidate managed to give correct type of welding polarity in part (a) and itemize the parts indicated by letter A to E.

However, 42 (32.31%) candidates had poor performance because their scores ranged from 0 to 1.5 marks. The candidates who score 0 marks failed to name correctly the type of polarity and elements of welding circuit. For example one candidate names the type of polarity as; *welding joint* and mentioned the functions of letters A and B of the elements instead of mentioned the parts indicated with letter A to B as the question demanded. On the other hand, the candidates who scored 0.5 to 1.5 marks were either able to name the welding polarity and few parts of the systems or mention one to three parts the welding systems. Extract 4.2 shows a sample of incorrect response from the candidate who scored low marks.



Extract 4:2 *is a sample of poor response in question 4*

Extract 4.2 shows that, a candidate failed to mention type of welding polarity in part (a) and itemize the components indicated by letters A to E for part (b).

2.2.4 Question 5: Arc blow

The question was composed from the topic of *Arc blow*. It required the candidates to enumerate six preventive measures to be taken in order to eliminate the arc blow. The question intended to measure candidates' ability to understand the phenomenon of arc and its correction measures. The total marks allotted for this question were 6.

The question was attempted by 111 (82.8%) candidates of all who sat for the examination. Out of which 76 (68.47%) candidates scored from 0 to 1.5 marks, 31 (27.93%) candidates scored from 2.0 to 3.5 marks and 4 (3.6%) candidates scored from 4 to 6 marks. This performance is summarized in Figure 5.

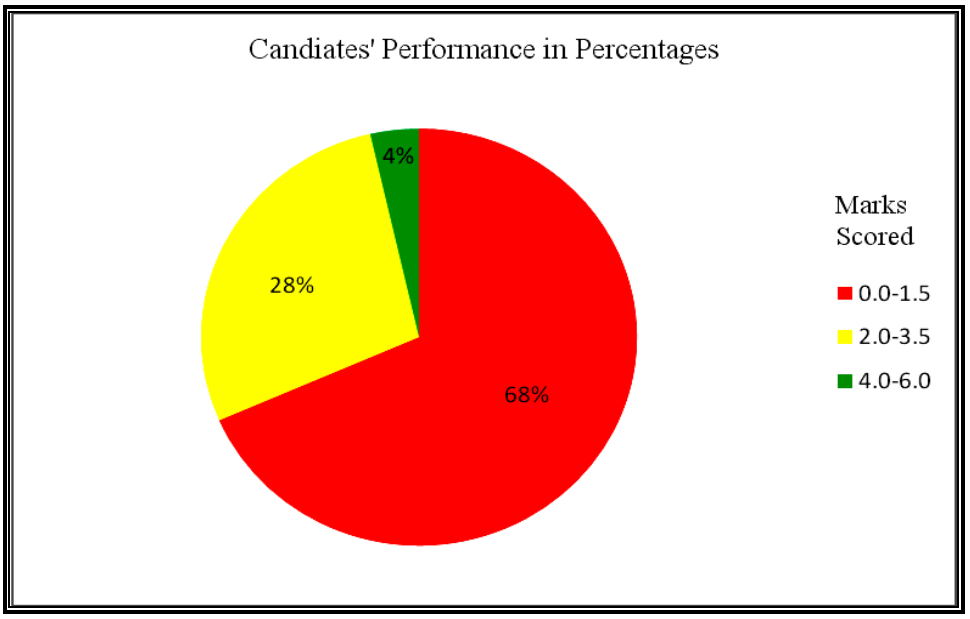
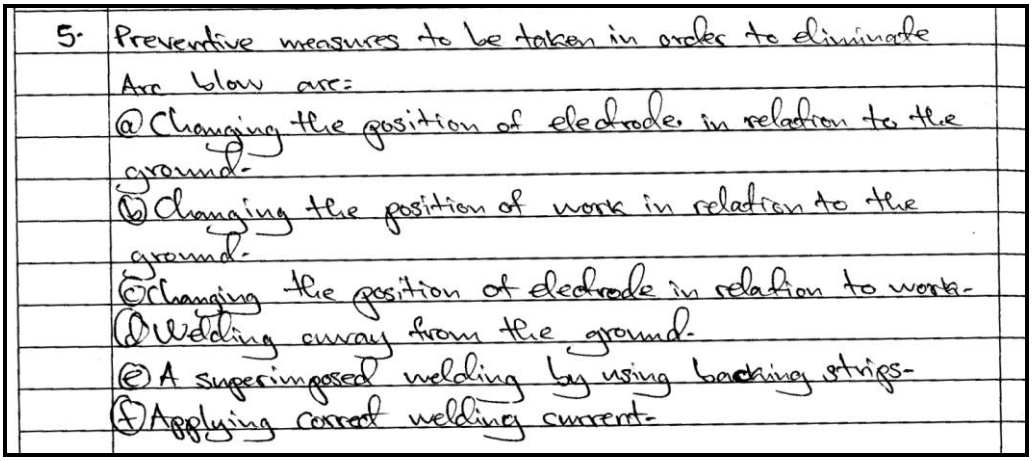


Figure 6: *The candidates' performance in question 5*

Figure 6 shows that, candidates' performance in this question was average since 31.53 percent of the candidates scored from 2.0 marks and above. The candidates' response analysis indicates that, candidates who scored good marks managed to itemize correctly preventive measures to be taken in order to eliminate arc blow during welding processes when using DC welding machine.

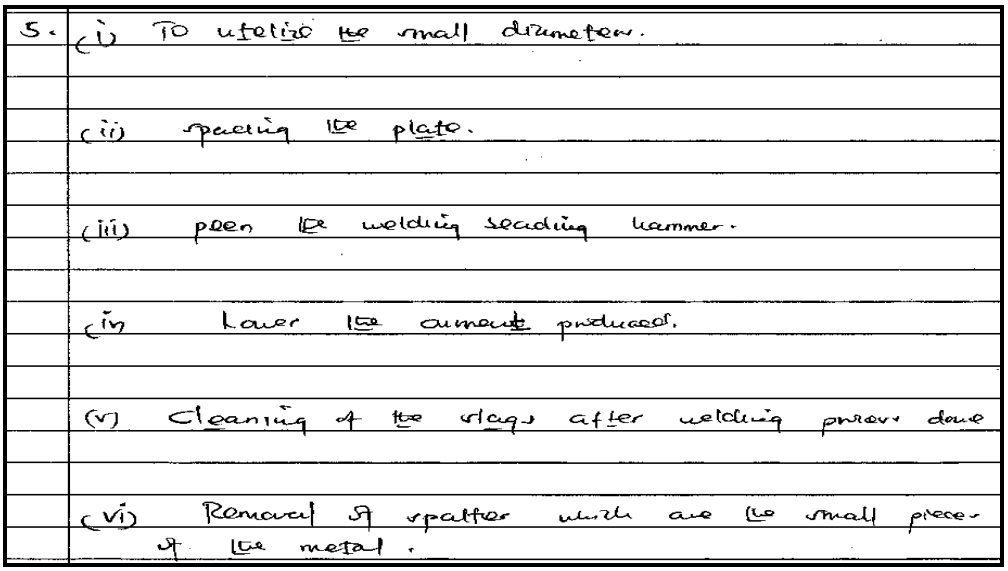
For example, one of the candidate who scored high marks managed to itemize correct reasons as: *superimpose welding by using backing strips* instead of *Use the back step method of welding*. Extract 5.1 shows a sample of correct response from the candidate who scored low marks.


5. Preventive measures to be taken in order to eliminate Arc blow are:-
(a) Changing the position of electrode in relation to the ground.
(b) Changing the position of work in relation to the ground.
(c) Changing the position of electrode in relation to work.
(d) Welding away from the ground.
(e) A superimposed welding by using backing strips.
(f) Applying correct welding current.

Extract 5.1 *shows a good response of a candidate who gave correct answers to the question*

Extract 5.1 shows that, the candidates managed to analyse preventive measures to be taken to prevent arc blow.

However, those who had little knowledge and partial understanding of the requirements of the question scored poorly from 0 to 1.5 marks because they failed to itemize fully preventive measures to a problem of arc blow as experienced with DC electric arc welding machines. These candidates either misunderstood the requirements of the question or lacked knowledge of arc blow and its causes. Poor performance of these candidates in this question reveals that they lacked knowledge and practical skills on the topic of *Arc Blow*. Extract 5.2 shows a sample of response from a script of a candidate who provided irrelevant answer to the question.


5. (i) To ufeting the small diameter.

(ii) spacing the plate.

(iii) peen the welding seading hammer.

(iv) Lower the current produced.

(v) Cleaning of the slags after welding proces done

(vi) Removal of spatter which are the small piece of the metal.

Extract 5.2 A sample of a poor candidates response

Extract 5.2 shows a sample of a candidate who failed to correctly respond to all parts of this question. This implies that, the candidate lacked knowledge about the concepts tested.

2.2.5 Question 6: Distortion

This question was composed from the topic of *Distortion*. It had two parts (a) and (b). Part (a) required the candidates to explain briefly the meaning of (i) preheating (ii) inter-pass heating (iii) post heating. Part (b), required the candidates to analyze three aims of pre-heating a component before commencing the welding process.

This question was attempted by 91 percent of all candidates who sat for this examination. The candidates' performance in this question can be categorized as average since 50.82 percent of all the candidates who attempted the question scored from 2 to 6 marks. Furthermore, 60 (49.18%) candidates scored from 0 to 1.5 marks indicating an unsatisfactory performance, 37 (30.33%) candidates scored from 2 to 3.5 marks which is an average performance and 25 (20.49%) candidates scored from 4 to 6 marks which is a good performance. Figure 7 shows the summary of candidates' performance in this question.

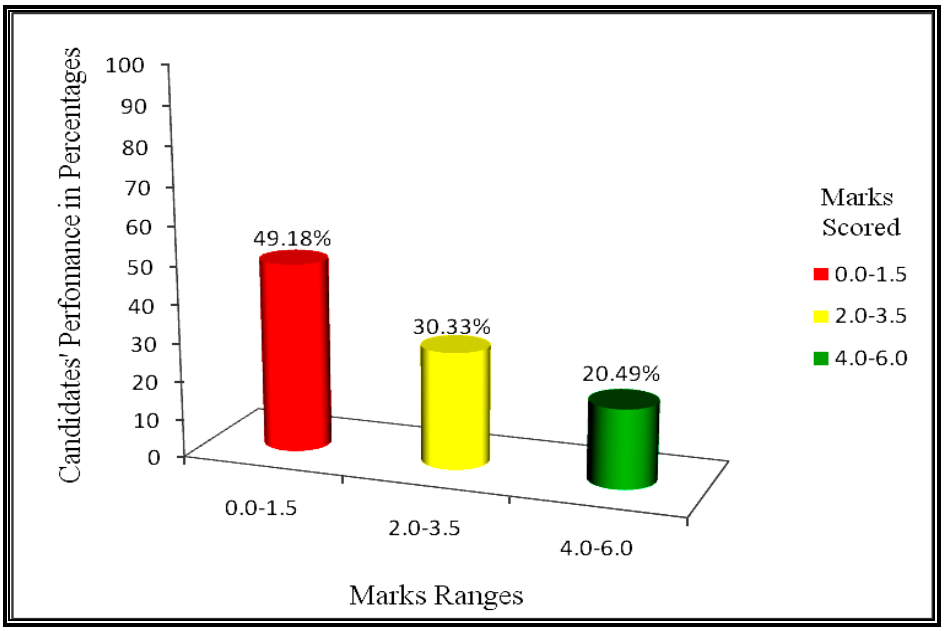
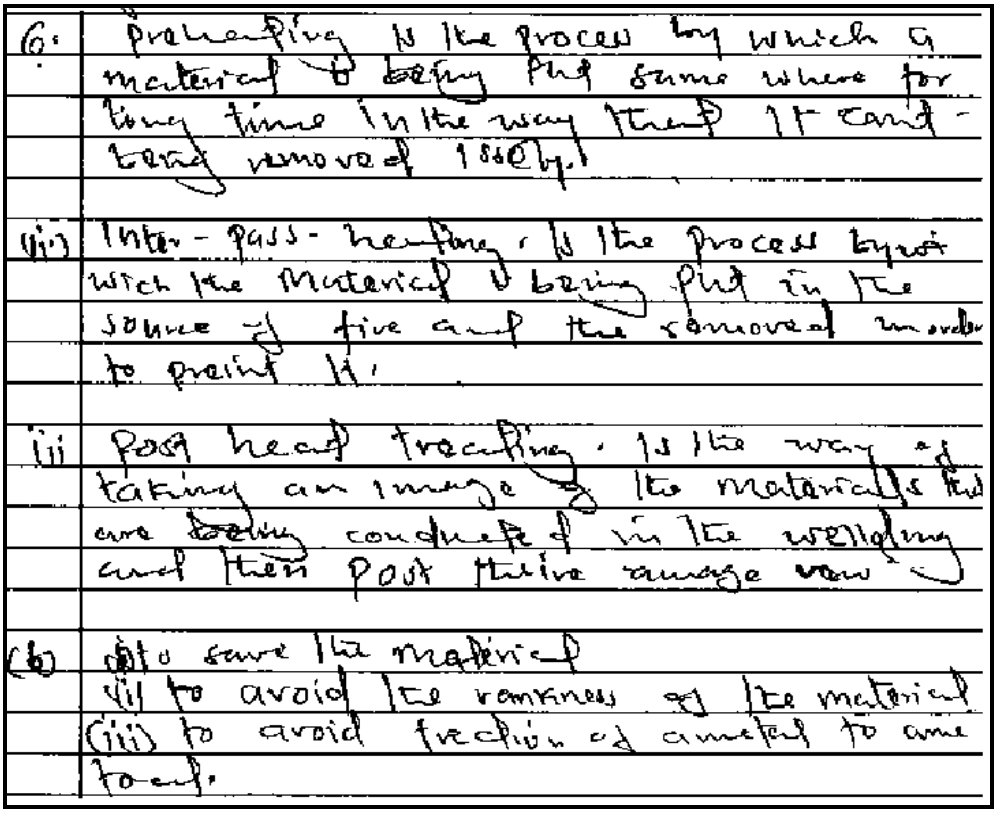


Figure 7: *A statically presentation of candidate's performance for Question 6*

The performance trend in figure 7 shows that, candidates' performance was average since 50.82 percent of the candidates scored above 2.0 marks. The candidates' response analysis reveals that candidates (49.18%) who performed poorly had inadequate knowledge of controlling distortion. Some of these candidates provided irrelevant answers. For example in part (a) (i) one of the candidate gave the definition of Pre-heating as *the processes by which separation of mixture in use heating to able surface can't enter tripod stand such evaporation, filtration* which is incorrect definition and didn't relate with the requirements of the question.

Moreover, in part (b) the candidates failed also to give the aims of pre-heating of a component before commencing the welding process instead he/she itemize

three tools used in workshop/laboratory. He/she provided aim as; *wire gauge, flat bottomed flask* and *surface*. Such candidates seemed to be unfamiliar with the methods used to control distortion as well as aim of preheating of a component before welding processes carried out. Extract 6.1 shows a sample of response from a script of a candidate who provided irrelevant answer to the question.


6. preheating is the process by which a material is being put some where for long time in the way that it can't be removed easily.

(ii) Inter-pass-heating, is the process by which the material is being put in the source of fire and the removed in order to paint it.

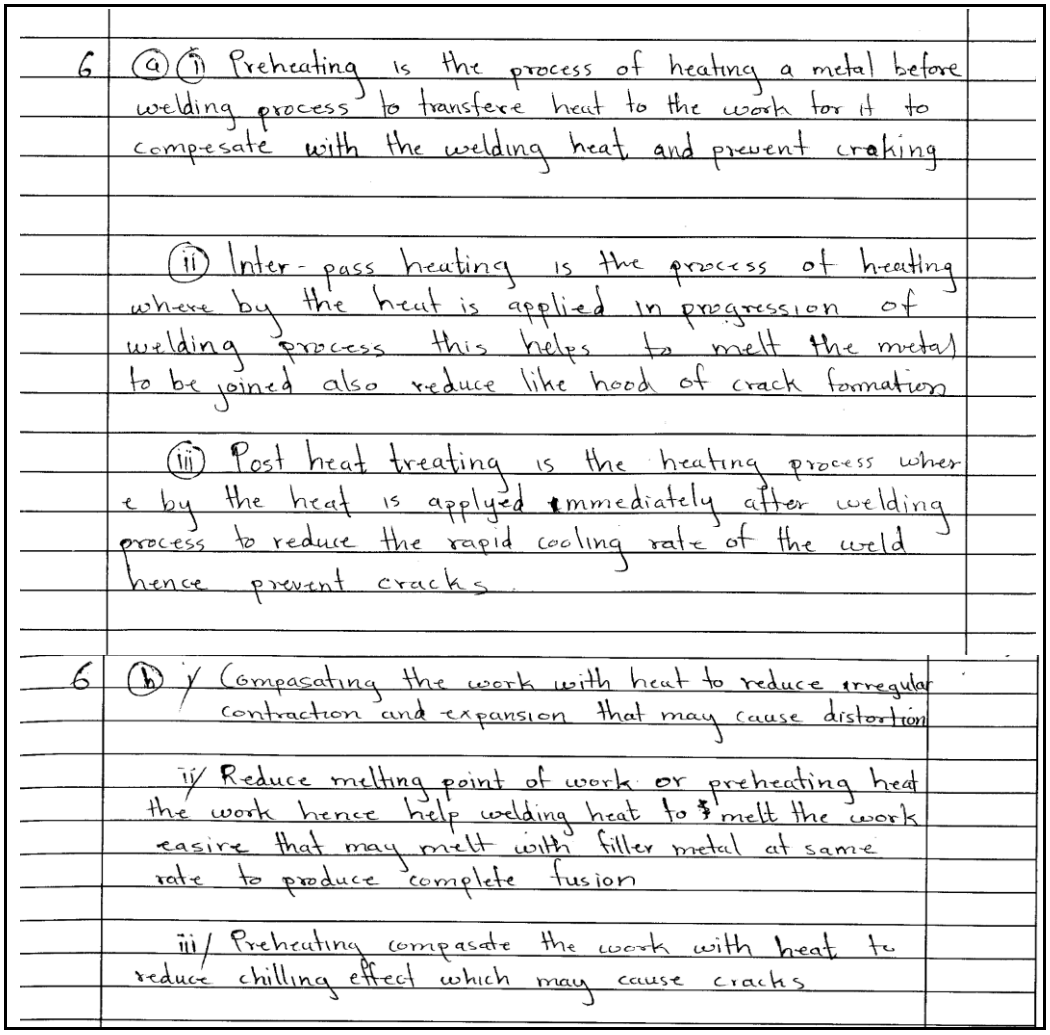
(iii) Post heat treating, is the way of taking an image of the materials that are being conducted in the welding and then post the live image now.

(b) (i) to save the material
(ii) to avoid the rankness of the material
(iii) to avoid fraction of a metal to one to...

Extract 6.1 *a sample of poor response from a script of one of the candidates*

In Extract 6.1 the candidate in part (b), wrote three aims of preheating as *to save materials, to avoid the rankness of the materials and to avoid fraction of a metal to.....* instead of *to reduce heat losses, to reduces cracking, to reduce the expansion, to burn out gases,* etc. Generally, the candidate lacked the knowledge of Gas welding and cutting processes, therefore scored poor marks.

Further analysis indicates that, the candidates who scored good marks (4 to 6) had enough knowledge of methods of controlling distortion and aim of preheating parent metal before welding processes. Thus, they managed to answer correctly all parts of the question. Extract.6.2 shows a good response of a candidate who outlined correctly the answers to the question.



Extract 6.2 portrays a sample of good response from the script of one of the candidates

In extract 6.2 the candidate was able to explain correctly the terms pre-heating, inter-pass heating and post heating as used in controlling distortion. Also gave the aims of preheating a components before welding processes are done for metal.

2.2.6 Question 7: Gas shielded welding

This question was composed from the topic of Gas shielded welding. The candidates were required to outline six differences between gas tungsten arc welding GTAW (TIG) and gas metal arc welding (MIG) process.

The question was attempted by 103 (76.9%) of all candidates who sat for this examination and 23.1 percent did not attempt it. The analysis of performance shows that, 87 (84.47%) candidates scored from 0 to 1.5 marks indicating an unsatisfactory performance, 15 (14.56%) candidates scored from 2 to 3.5 marks which is an average and 1 (0.97%) candidate scored 4 marks out of 6 which is a good performance. None of these candidates scored above 4.5 marks. Figure 8 is an illustration of these data.

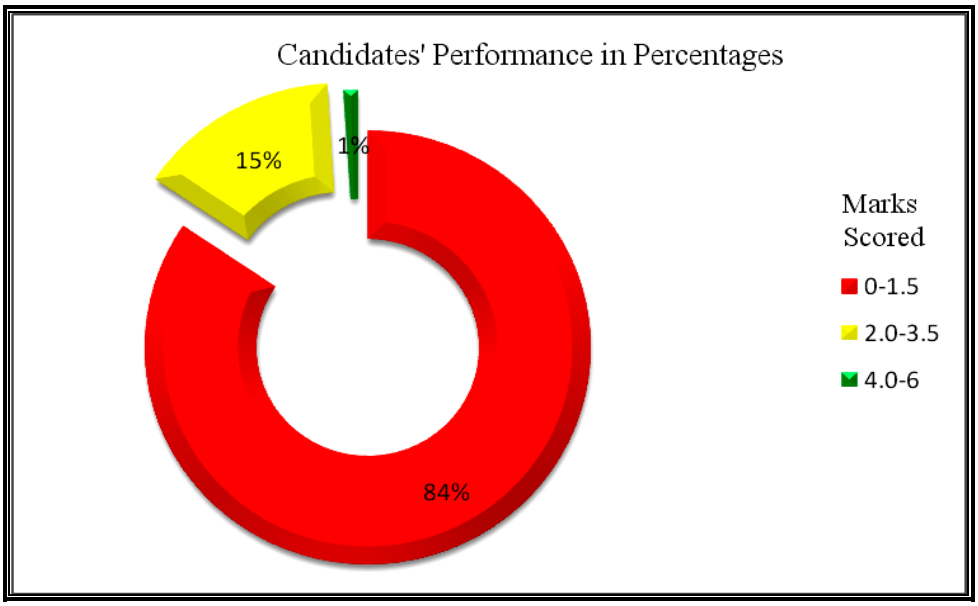
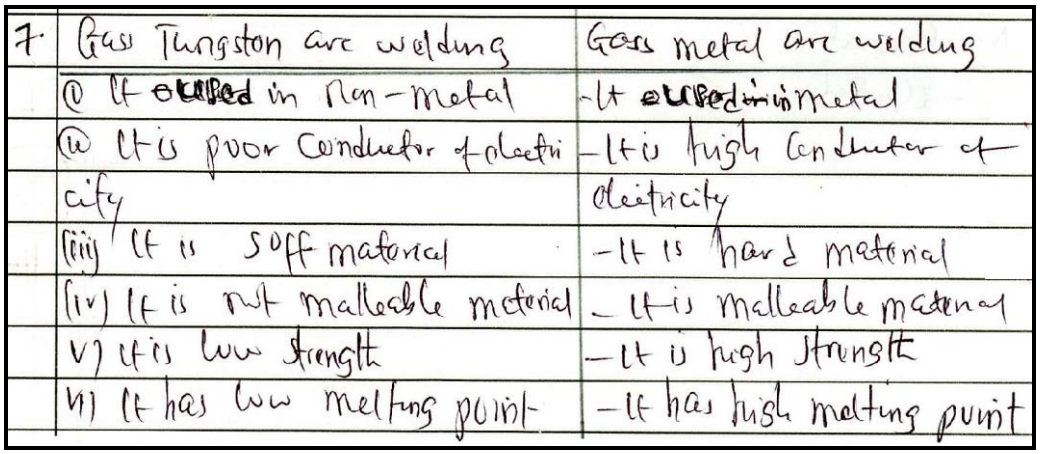


Figure 8: *The candidates' performance in Question 7*

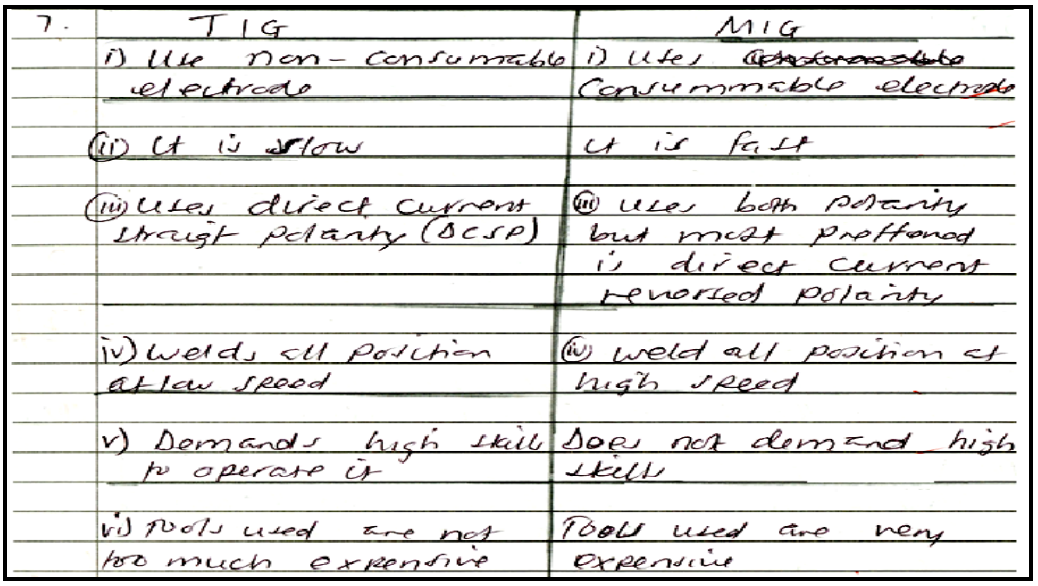
Generally, figure 8 indicates that, the candidates' performance in this question was poor. Furthermore, the candidates' item response analysis reveals that, candidates 87(84.47%) with poor performance had inadequate knowledge of *Gas shielded welding processes*, hence failed to delineate differences between gas tungsten arc welding (TIG) from gas metal arc welding (MIG). They were unable to outline the differences between the two processes whereby one uses non-consumable electrode while other use consumable electrode. Extract 7.1 shows a sample of response from a script of a candidate who provided irrelevant answer to the question.



Extract 7.1 is a sample of poor response from a candidates who failed to produce correct answers

In Extract 7.1 a candidate provided incorrect differences of gas tungsten welding (TIG) from Gas Metal arc welding (MAG). For example she/he wrote the *TIG used in non-metal* while *MAG used in metal* instead of *TIG uses a permanent non consumable tungsten electrode* while *MAG use consumable continuous electrode*, etc therefore scored poor marks.

Nonetheless, candidates who scored from 2 to 3 marks were able to mention few points on differentiating between Gas Tungsten arc welding (TIG) and Gas metal arc welding (MIG) but failed to give out correctly all six differences as the question demanded. These candidates exhibited that, they had partial knowledge of the topic *Gas Shield Arc Welding*. Failure of the candidates to analyse the differences proved that they misunderstood the processes. Extract.7.2 shows a responses of a candidate who managed to differentiate correctly some points between MIG and TIG welding processes.



7.	TIG	MIG
	i) Use non-consumable electrode	i) Uses consummable electrode
	ii) It is slow	It is fast
	iii) Uses direct current straight polarity (DCSP)	iii) Uses both polarity but most preffered is direct current reversed polarity
	iv) Welds all position at low speed	iv) Weld all position at high speed
	v) Demands high skill to operate it	Does not demand high skill
	vi) Tools used are not too much expensive	Tools used are very expensive

Extract 7.2 *portrays a sample of good responses from the script of one of the candidate.*

Extract 7.2 show that the candidate had good understanding on Gas shielded arc welding processes and provide correctly some of the responses therefore failed to score all 6 marks.

2.2.7 Question 8: Welding Positions

This question had two parts, (a) and (b). In part (a), the candidates were required to the candidates to study the given figure and illustrate what each letter i.e. A, B, C and D represents, and in part (b) the candidates were required to briefly explain how each method of starting and tricking of the arc works. The total marks allotted for this question were 6 marks.

The question was attempted by 126 (94%) of all candidates who sat for this examination and 6 percent did not attempt it. The analysis of candidates' performance shows that, 85 (67.46%) candidates scored from 0 to 1.5 marks indicating an unsatisfactory performance, 14 (11.11%) candidates scored from 2 to 3.5 marks which is an average performance and 27 (21.43%) candidates scored from 4 to 6 marks which is a good performance. Figure 9 present the summary of candidates' scores in this question.

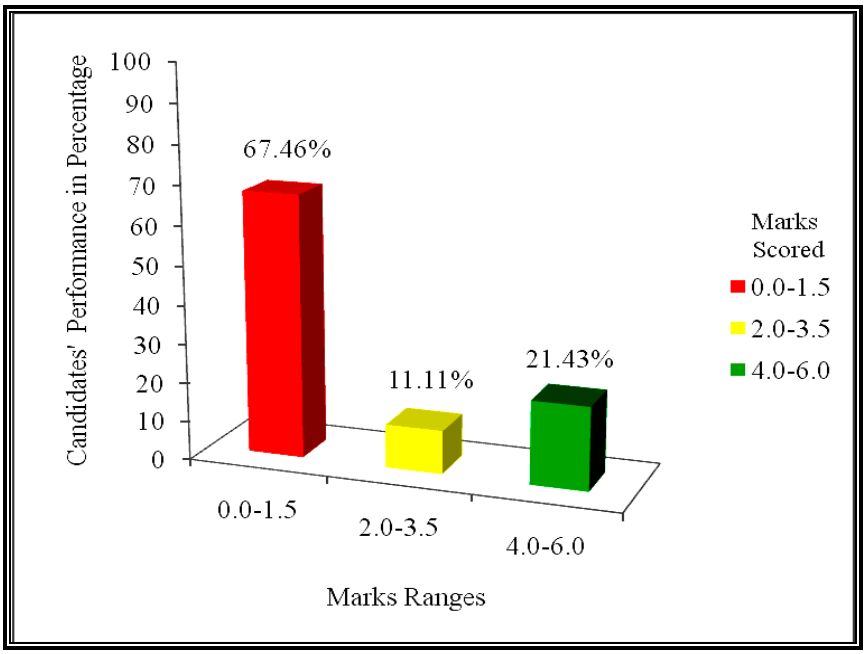


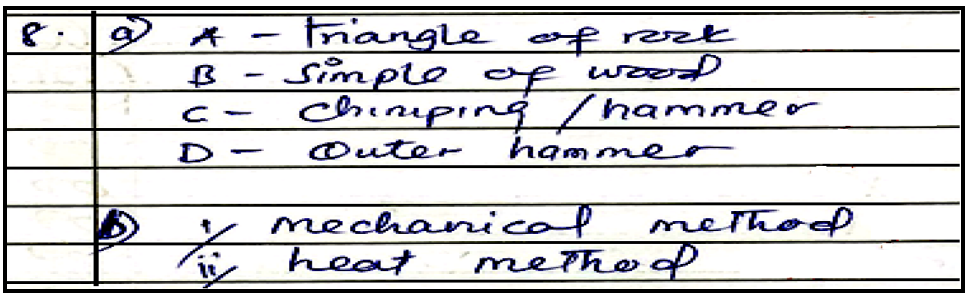
Figure 9: *The candidates' performance in question 8*

Figure 9 shows that the general candidates' performance in this question was average since 32.54 percent scored from 2.0 to 6.0 marks. The analysis of students' responses indicates that, majority of the candidates faced difficulties in answering all the parts of the question. The poor performance in this question was caused by failure of the candidates to understand the requirements of the question. For example, part (a) required the candidates to *name the parts indicated by letter shown in figure given*. Some of the candidates failed to use knowledge and skill of welding processes to identify the parts indicated by letters. This indicate that, the candidates lacked the knowledge on how welding profile looks like.

In part (b) the candidates failed to understand that; *Tapping method is the motion of the electrode brought straight down and withdrawn instantly* and *scratching method is the way whereby the electrode is moved at an angle to the plate in a scratching motion*. These method are used by experienced and beginner welders respectively.

Further analysis reveals that, most of candidates who attempted this question lacked knowledge of the different methods of welding techniques. Therefore provided incorrect answers to almost all parts of the question. Extract 8.1

shows a sample of poor response from the candidate who provided responses which does not match with the demand of the question.

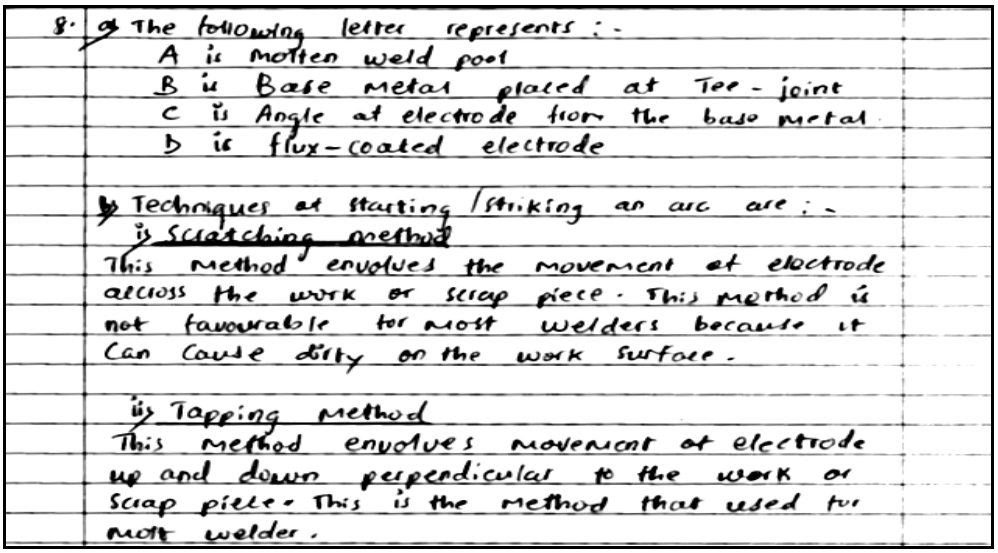

8. a) A - Triangle of rock
B - Simple of wood
C - Chinping / hammer
D - Outer hammer

b) i. mechanical method
ii. heat method

Extract 8.1 *shows a sample of poor response from a candidate who provided incorrect answers*

In Extract 8.1 a candidate wrote incorrect responses in all parts of the question. For example he/she name part A and B as *triangle of rock and simple of wood* respectively instead of *horizontal/vertical position* and *workpiece*. Also, he/she gave incorrect explanation in part (b).

However, a few candidates who scored from 2 to 3.5 marks were able to give correct response to some part of the question or mixed correct and incorrect responses by both parts. The candidates who scored from 4 to 6 marks exhibited a good understanding of the question. They were able to illustrate what each letter A, B, C and D represented and also briefly explain how each method of starting the arc works. They exhibited a good understanding on Electric arc Welding Accessories and Equipment topic as shown in Extract 8.2.


8. a) The following letter represents :-
A is molten weld pool
B is Base metal placed at Tee - joint
C is Angle of electrode from the base metal
D is flux-coated electrode

b) Techniques of starting / striking an arc are :-
i) Scratching method
This method envolves the movement of electrode accross the work or scrap piece. This method is not favourable for most welders because it can cause dirty on the work surface.

ii) Tapping method
This method envolves movement of electrode up and down perpendicular to the work or scrap piece. This is the method that used for most welder.

Extract 8.2: *shows a good response from a candidate*

In extract 8.2, a candidate named correctly item indicated by number A to D in part (a). Also, in part (b) she/he correctly explained the terms tapping and scratching methods and therefore had high performance.

2.2.8 Question 9: Pipe Welding

This question was composed from the topic of *Pipe welding*. It had two parts (a) and (b). In part (a), the candidate were required to describe the common welding position used in pipe welding. Part (b) required the candidates to identify three preparations to be done before pipe welding. The total marks allotted for this question were 6.

A total of 126 (94%) candidates attempted this question. The analysis of candidates' performance shows that, 121 (96.03%) candidates scored from 0 to 1.5 marks indicating an unsatisfactory performance and 5 (3.97%) scored from 2 to 3.0 marks. There were no candidate who scored above 3 marks. Figure 10 represents the performance of the candidates in question 9.

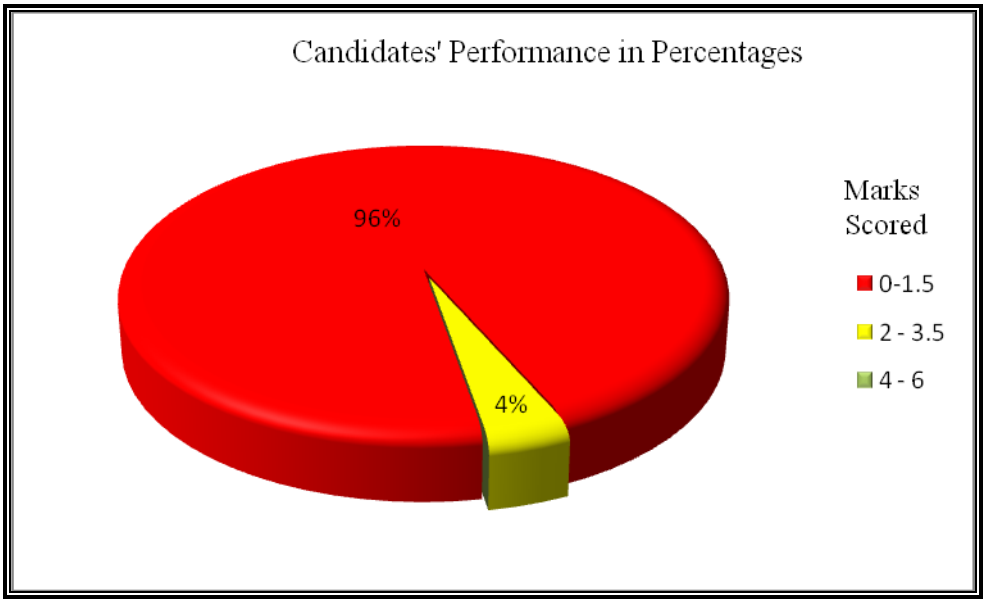
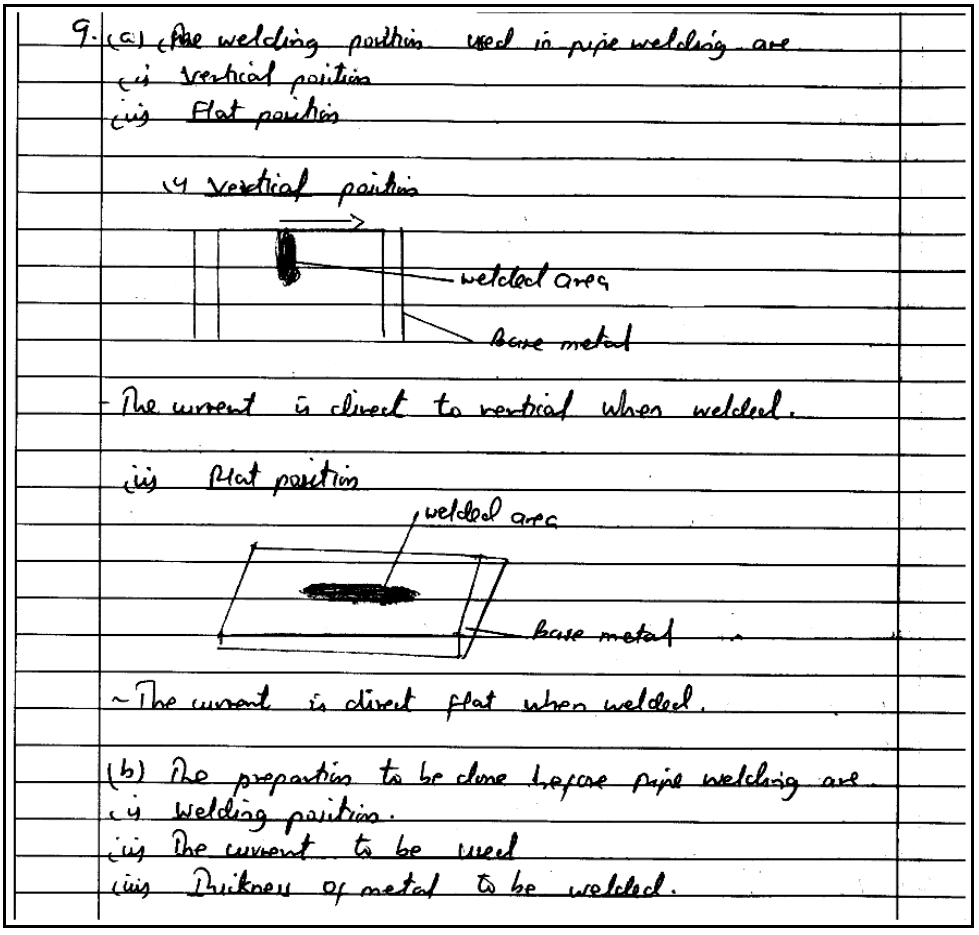


Figure 10: *The candidates' performance in question 9*

The analysis of data from figure 10 indicates that, the candidates' performance in this question was very poor, since majority (96%) scored from 0 to 1.5 marks and none scored above 3 marks.

Most of the candidates who performed poorly in this question lacked knowledge of the concept of Pipe welding processes. Others in this category misconceived or misinterpreted the question. These candidates were unable to describe common types of pipe welding which are; uphill and downhill welding process. For example in part (a), a candidate mentioned the two methods of pipe welding as vertical position and flat position instead of downhill and uphill welding position. On the other hand, in part (b) the candidate incorrectly identified three preparation to be done before pipe welding processes to be carried out with the points such as; *welding position, the current to be used* and *thickness of metal to be welded* instead of *the pipe must be cut in size, the edge should be prepared and joint aligned should be clamped securely*. The poor responses in this question indicates that, the candidates could not comprehend and adhere to the requirements of the question. Extract 9.1 shows a sample of response from a candidate who provided irrelevant answer to this question.



Extract 9.1: *is a sample of candidates' poor responses in question 9*

In Extract 9.1 a candidate failed in all parts of the question and in part (a) she/he gave the diagram of vertical and flat welding position instead of uphill and downhill position.

On the other hand, further analysis indicated that most of the candidates who attempted this question faced difficulties in answering part (a). The majority of the candidates misunderstood the requirements of the question as they provided normal welding position (flat and vertical) without considering that, for pipe welding only two types uphill and downhill welding position. Other candidates gave irrelevant responses in part (b) with the points such as; *secure the cylinder by using chain*, *remove the valve protecting the cup* and *remove the dust by using cracking method*. They failed to realize that, three preparations are to be done before pipe welding as "the pipe must be cut in size", "the edges should be prepared" and "the joint aligned" are the ones to be examined. Only few candidates gave one or two correct points in this part. Hence, there is only one candidate who scored 3 marks out of 6.

2.2.9 Question 10: Gas welding operations

This question was set from the topic of Gas welding operations. The question required candidates to give six points in comparing high pressure and low pressure oxy-acetylene welding.

This question was attempted by 108 (80.6%) candidates out of 134 who sat for the examination. The question required the candidates to compare the high pressure and low pressure of oxy-acetylene gas welding.

The analysis of candidates' performance shows that, 87 (80.56%) candidates scored from 0 to 1.5 marks which is an unsatisfactory performance, 17 (15.74%) candidates scored from 2 to 3.5 marks which is an average performance and 4 (3.70%) candidates scored from 4 to 6 marks which is a good performance. Figure 11 presents the candidate's performance in question 10.

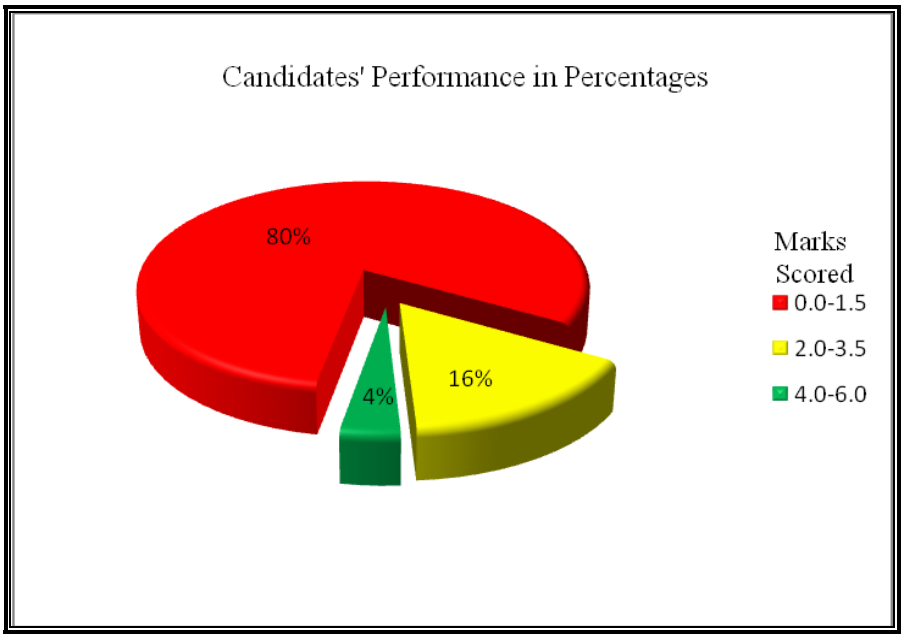
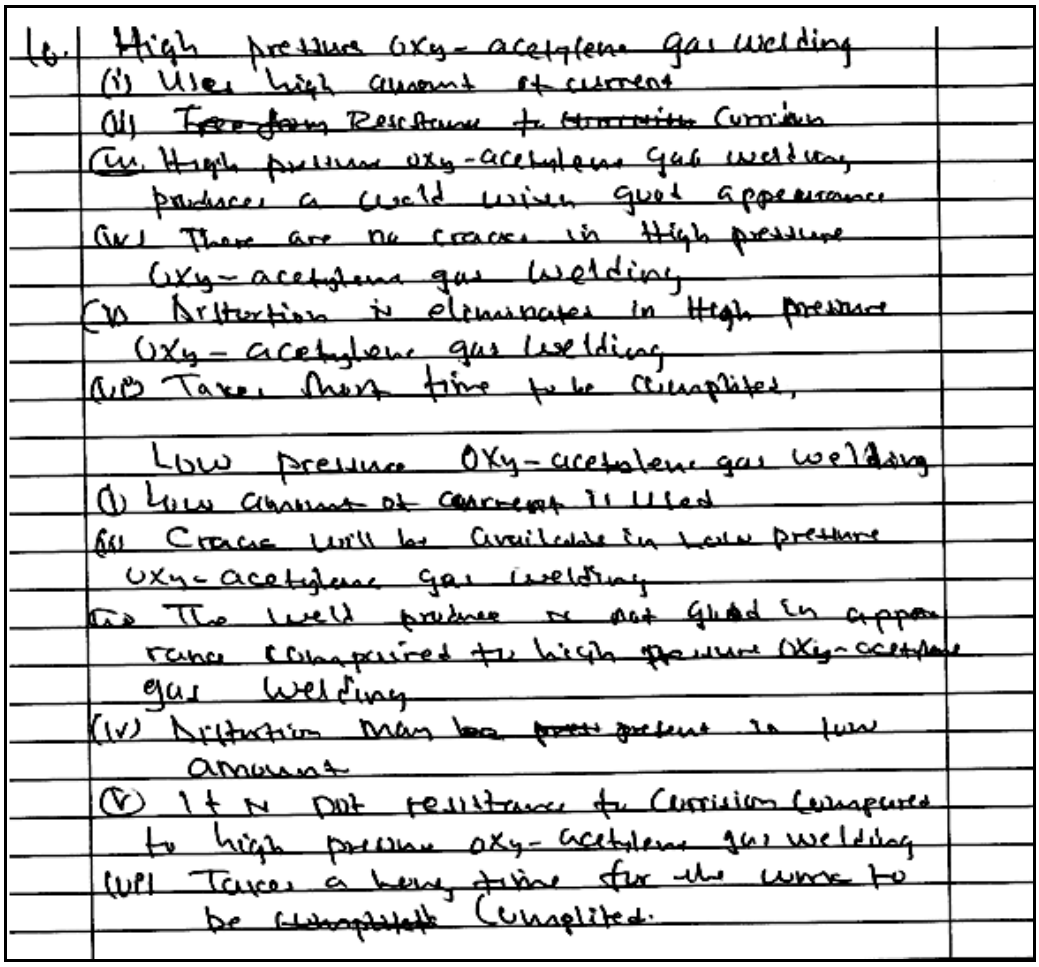


Figure 11: *The candidates' performance in question 10*

Figure 11 shows that, 80 percent of the candidates who attempted this question scored low (0 to1.5) marks, hence the general performance was poor. The mass failure of the candidates in this question can be associated with inability to understand the requirements of the question, thus providing irrelevant answers. For example, one candidate wrote:

- *High pressure and low pressure all both used in oxyacetylene gas welding*
- *High pressure and low pressure all both deals with pressure of gases in oxyacetylene gas welding*
- *High pressure and low pressure all both occur in oxyacetylene gas welding processes.*

This candidate failed to interpret the question. The candidate was required to compare high pressure and low pressure oxyacetylene gas welding. Extracts 10.1 illustrates the samples of responses of a candidate who failed to score good marks.



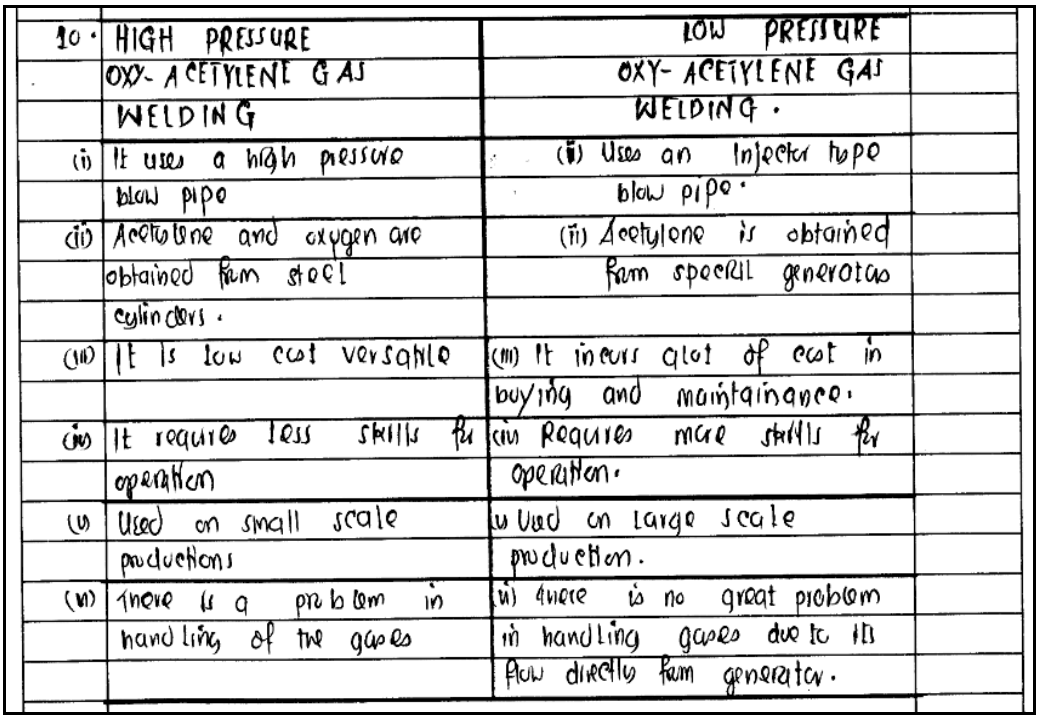
Extract 10.1 *shows the response of a candidate who failed to give correct answers to all parts of this question*

In Extract 10.1 the candidate provided incorrect comparisons between high pressure system and low pressure system.

On the other hand, 16 some of the candidates who scored averagely were able to respond partially by giving the six comparison points of the high pressure and low pressure oxyacetylene welding equipment. While others mixed correct and incorrect comparisons, therefore scored averagely.

On top of that, the candidates with a good performance (3.70%) were the ones who provided relevant responses, and met most the requirements of the question. These candidates proved to have clear understanding of the demands of the question, thus providing appropriate answer to all parts of the question.

Extracts 10.2 shows a sample of a candidate's responses with good performance in this question.



10.	HIGH PRESSURE OXY-ACETYLENE GAS WELDING	LOW PRESSURE OXY-ACETYLENE GAS WELDING.
(i)	It uses a high pressure blow pipe	(i) Uses an injector type blow pipe.
(ii)	Acetylene and oxygen are obtained from steel cylinders.	(ii) Acetylene is obtained from special generators
(iii)	It is low cost versatile	(iii) It incurs alot of cost in buying and maintainance.
(iv)	It requires less skills for operation	(iv) Requires more skills for operation.
(v)	Used on small scale productions	(v) Used on large scale production.
(vi)	There is a problem in handling of the gases	(vi) There is no great problem in handling gases due to it's flow directly from generator.

Extract 10.2 shows a good response of a candidate who gave correct answers to all parts of the question.

In extract 10.2 a candidate managed to provide correctly the comparisons of high pressure and low pressure systems hence scored good marks.

2.2.10 Question 11: Sheet metal operations

This question had two parts, (a) and (b). In part (a), the candidates were required to explain how to make a straight line on the sheet metal. Part (b) required the candidates to enumerate six sheet metal operations done in workshops. The total marks allotted for this question were 6.

The analysis of candidates' performance shows that, 56 (55.45%) candidates scored from 0 to 1.5 marks indicating an unsatisfactory performance, 35 (34.65.%) scored from 2 to 3.5 marks which is an average performance and 10 (9.90%) scored from 4 to 6 marks which is a good performance. The performance in this question can be categorized as average, since 44.55 percent scored from 2 to 6 marks. The performance of the candidates is presented in Figure 12.

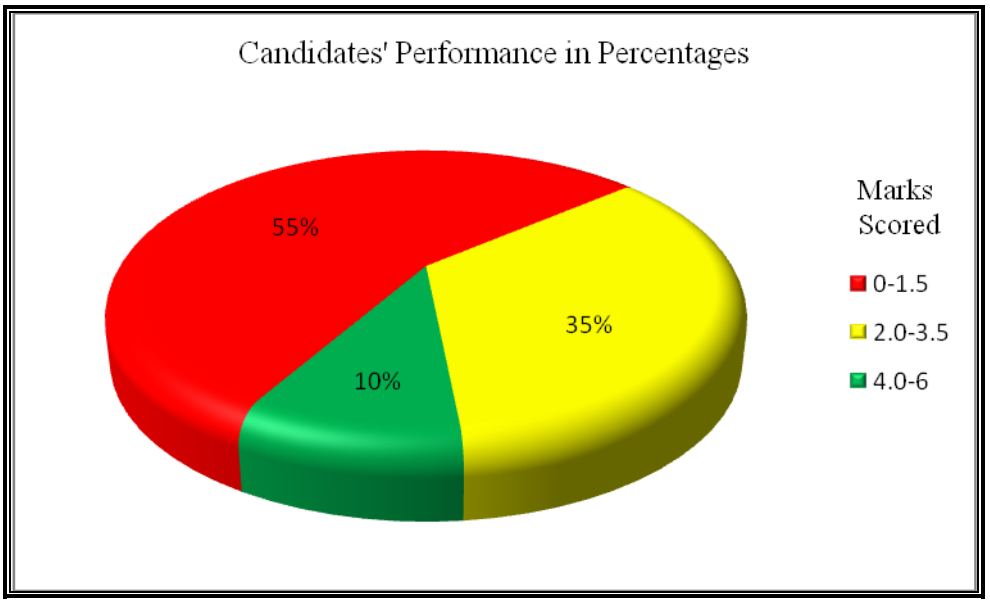
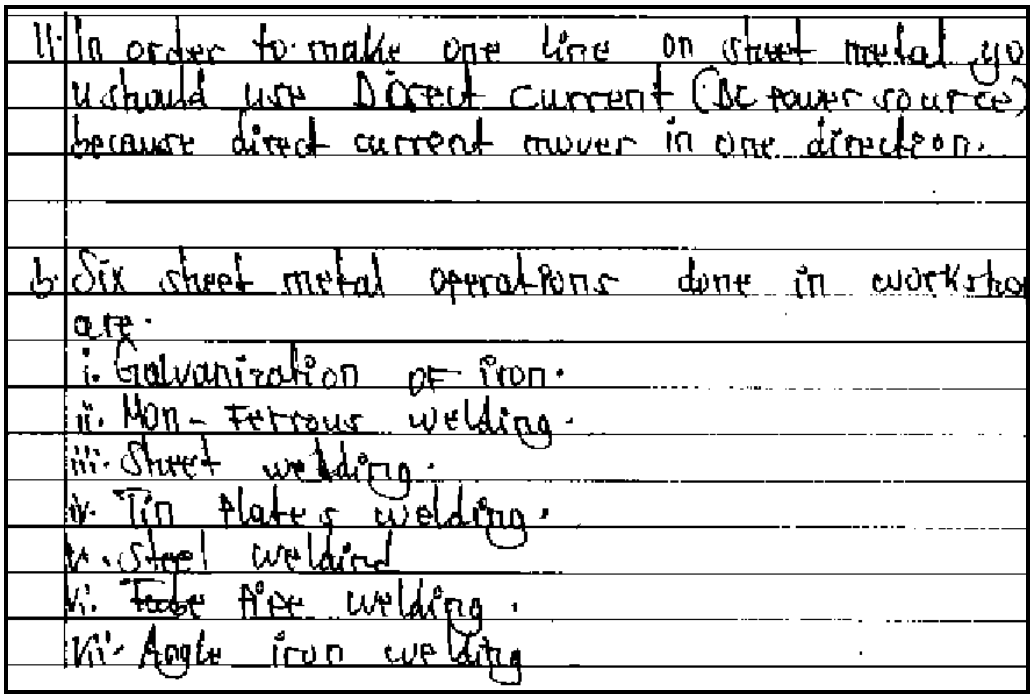


Figure 12: *The candidates' performance in question 11*

The percentages in Figure 12 show that, the general performance in this question was average, since 45 percent of the candidates scored 2 marks and above. The candidates' performance analysis shows that, 55.45 percent of the candidates scored from 0 to 1.5 marks. This performance reveals that, most of the candidates had insufficient knowledge of the topic *Sheet Metal Operation*. Candidates who performed poorly failed to give correct responses in both parts of the question. This implies that, they had insufficient knowledge and practical skills, since the question measured the ability of the candidates in practical use of tool and equipments on sheet metal operations. Extract 11.1 presents a sample of response from a script of a candidate who provided irrelevant responses.


11 a) In order to make one line on sheet metal you should use Direct current (DC power source) because direct current moves in one direction.

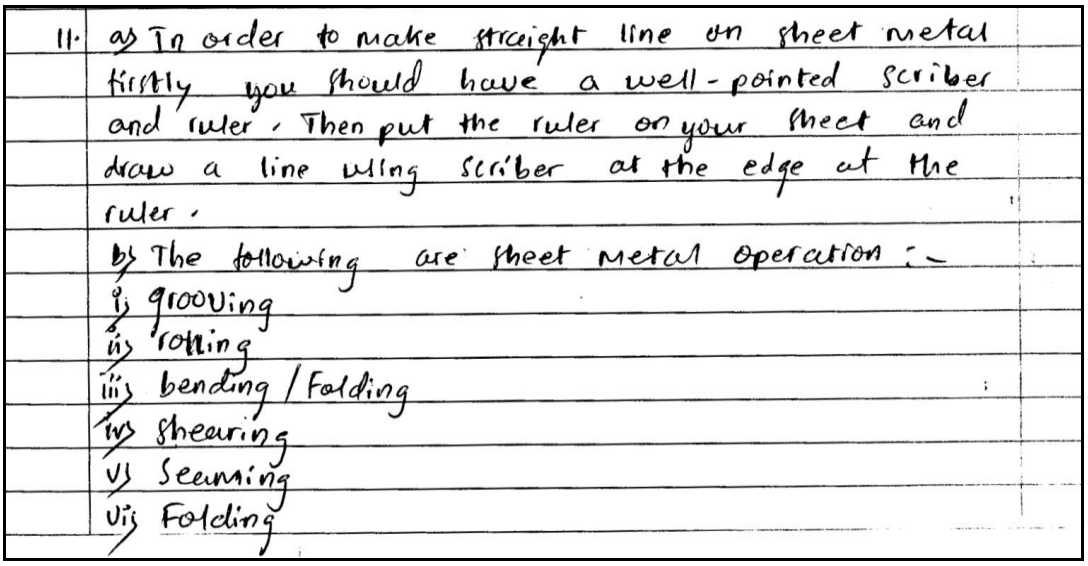
b) Six sheet metal operations done in workshop are:
i. Galvanization of iron.
ii. Non-Ferrous welding.
iii. Sheet welding.
iv. Tin plate welding.
v. Steel welding
vi. Footer fire welding.
vii. Angle iron welding

Extract 11.1: A sample of a poor response in Question 11

In extract 11.1, the candidate provided incorrect responses for all parts. For example, in part (b) she/he wrote types of operation based on welding processes instead of the processes of sheet metal done in workshop as the question demanded.

On the other hand, 35 percent of the candidates who scored averagely were able to explain briefly the way of making straight line on the sheet metal or list down operations done on workshop, but their answer were mixed with incorrect responses.

The candidates who scored good marks (4 to 6 marks) managed to give correct responses to both parts of the question. These candidates managed to explain briefly the method of sheet layout and enumerate six sheet metal operations. such as; *measuring and marking, laying out, cleaning, bending, stretch forming, Riveting, grooving, raising*, *Notching,* etc. Extract 11.1 and 11.2 presents a sample of response from a script of a candidate who provided relevant responses.


11. a) In order to make straight line on sheet metal firstly you should have a well-pointed scriber and ruler. Then put the ruler on your sheet and draw a line using scriber at the edge of the ruler.

b) The following are sheet metal operation :-

i) grooving
ii) rolling
iii) bending / Folding
iv) shearing
v) Seaming
vi) Folding

Extract 11.2 is a sample of a good response from one of the candidates

In Extract 11.2 the candidate managed to explain the procedure of drawing straight edge and the tool used to facilitate the process. Also, she/he itemize sheet metal operation as question demanded, hence scored good marks.

2.3 SECTION C: STRUCTURED QUESTIONS

This section consisted of three optional structured type question from the topic *Gas welding, Welding defects* and *Soldering*. The candidates were required to answer only two questions from this section of which each question carried 15 marks.

2.3.1 Question 12: Gas welding accessories and equipment

This question had three parts, namely (a), (b) and (c). In part (a), the candidates were required to give reason why acetylene and oxygen hose fittings are made with different colours and direction turns of screw threads. Part (b) required the candidates with the help of labeled sketch of blowpipe to describe three parts and their material made and in part (c), the candidates were required to analyze two stages involved in the burning of oxy-acetylene flame with a help of sketches.

The question was opted for by 92 (68.70%) of all candidates who sat for this examination. The analysis of candidates' performance shows that, 65 (70.65%) candidates scored from 0 to 4.0 marks indicating an unsatisfactory

performance, 23 (25%) candidates scored from 4.5 to 9.0 marks which is an average performance and 4 (4.35%) candidates scored from 9.5 to 15 marks which is a good performance. The analysis of the candidates' performance for question 12 is presented in Figure 13.

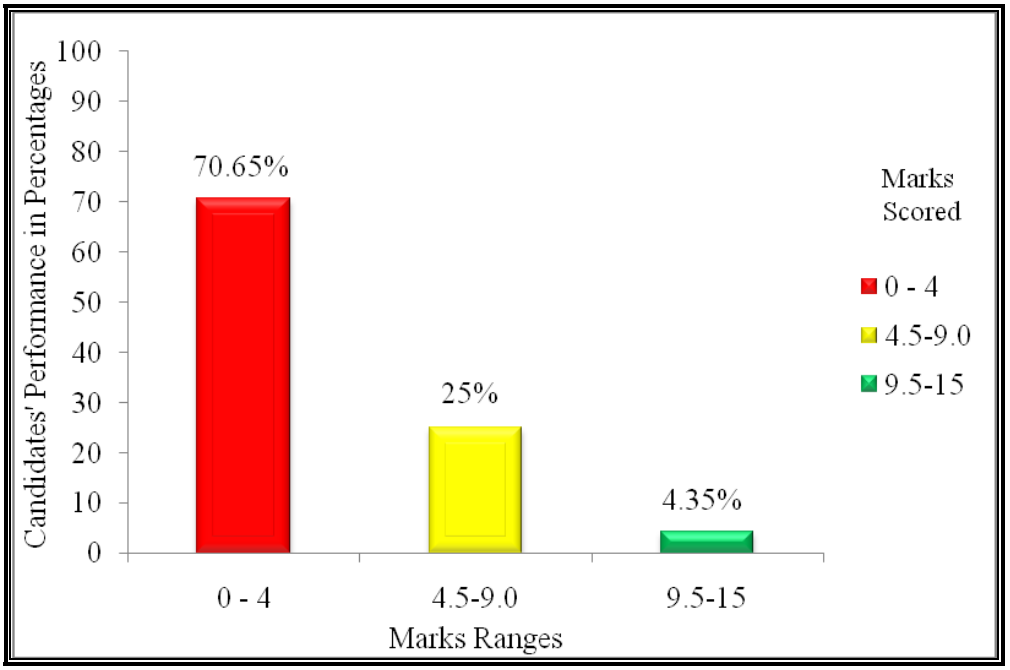


Figure 13: *The candidates' performance in question 12*

Figure 13 indicates that, the candidates' performance in this question was average, since 29.3 percent of the candidates scored from 4.5 marks and above. The candidates scored from 0 to 4 marks either misunderstood the requirements of the question or lacked knowledge of the oxyacetylene welding processes. Most of those who scored poor, for instance, gave either reasons of acetylene and oxygen hose fittings differences on colours and threads or drew the sketches and label few parts. This implies that, the candidates had insufficient knowledge and skills on gas welding accessories and equipment. Extract 12.1 shows a response given by a candidate who failed to give correct responses to most parts of the question.

12. To see this difference of colour because of to escape the dangerous or accident it may be acetylene and oxygen combine for colour and welder man to wear a oxygen mask to at the end of the day but the acetylen have it. So to see that this difference because of escape the accident because this have the light in welding number that welding used high electrical so may be to put on colour of the mask it to very dangerous for welder main.

B. i) Vertical position.
ii) horizontal inclined position
iii) horizontal fixed position

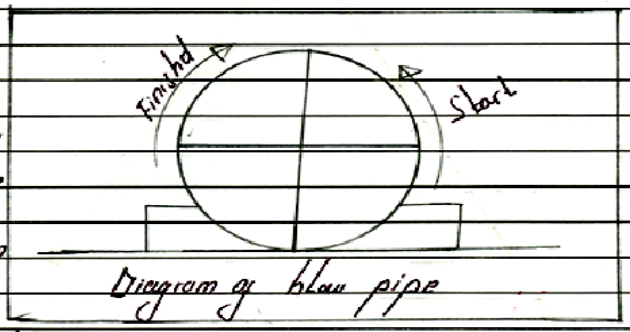


Diagram of blow pipe

C. There are two stages
i) Single stage - It reduce pressure in one stage
ii) two stage /double stage - It reduce pressure in two stage

(c)(i) First stage involves burning of acetylene gas C_2H_2 to produce carbon monoxide and hydrogen gas this is due to oxygen limitation in this zone its chemical equation is

$$C_2H_2 + O_2 \xrightarrow{\text{Heat}} 2CO + H_2$$

(ii) At second stage the carbon monoxide and hydrogen produced at limited supply of oxygen is oxidized to to excess in oxygen gas to this zone so oxidation of carbon monoxide produce carbon dioxide and oxidation of Hydrogen gas produce water. The equations are as follows.

$$2CO + O_2 \longrightarrow 2CO_2$$

$$2H_2 + O_2 \longrightarrow 2H_2O$$

So the overall equation of combution of acetylene is

$$2C_2H_2 + 5O_2 \longrightarrow 4CO_2 + 2H_2O$$

Extract 12.1: *a sample of poor responses of the candidates' in question 12*

In Extract 12.1 a candidate failed to describe the reasons why acetylene and oxygen hose fitting made with different colours and direction turns of screw threads. Also, she/he failed to balance the chemical reactions of the gases, hence scored poor marks.

On the other hand, some candidates (25%) had an average performance (4.5 to 9.0 marks). These candidates responded correctly to some items in each part of the question. However, their responses comprised some minor errors such as incorrect explanations and incorrect drawings. Majority managed to mention the parts of sketches and listed some of the factors to distinguish the hosepipe. However, the weakness were mostly noted in part (c) whereby, some of the responses were not well organized and consisted of chemical reactions of acetylene and oxygen gas. For example in part (c), one candidate wrote:

(i) Dark stage

$C_2H_2 + 0_2 \longrightarrow CH_2 + CO_2$

(ii) Combustion stage

$O_2 + CH_2 + 2CO_2 \longrightarrow C_2(OH)_2 + CO_2$

Instead of:

(i) First Stage

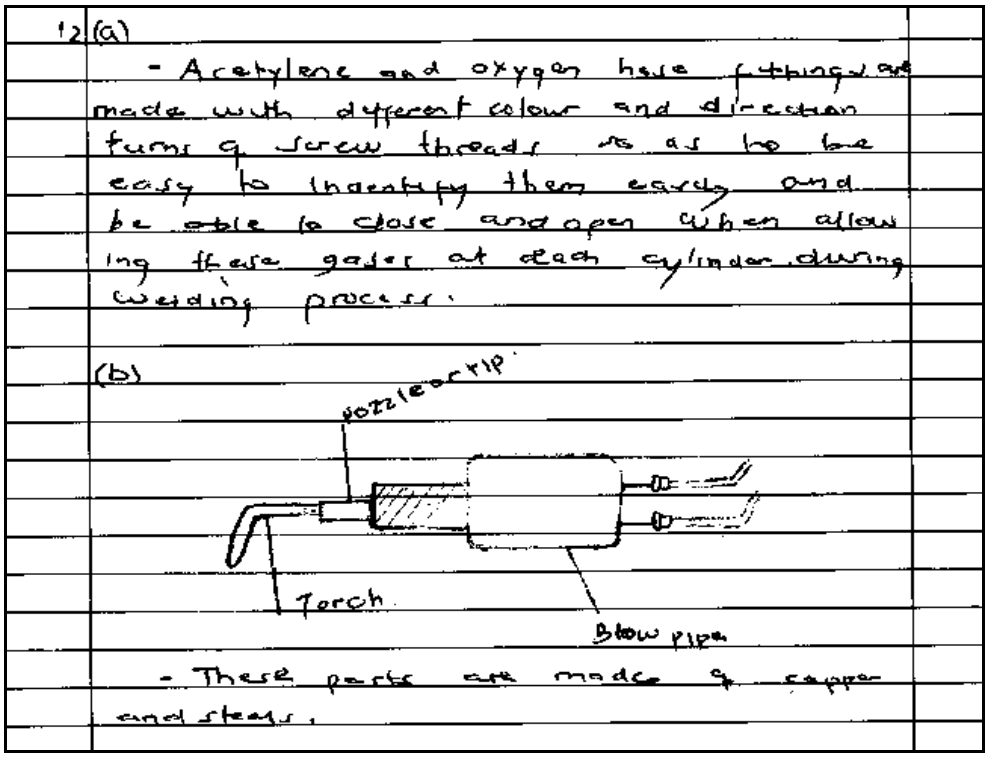
$2C_2H_2 + 2O_2 \longrightarrow 4CO_2 + 2H_2$

(ii) Second stage

$2C_2H_2 + 5O_2 \longrightarrow 4CO_2 + 2H_2O$

This indicate that, the candidate lacked knowledge of chemical reaction of oxygen and acetylene gas when burnt.

However there were only 4 (4.35%) candidates who performed well by scoring above average (4.5 to 11.5 marks). These candidates were able to give out correctly the reasons who acetylene and oxygen hose fittings were made with different colour in part (a) and describing the parts of blow pipe in part (b). Extract 12.2 illustrates such a case.



Extract 12.2: *A sample of a candidate's relatively good response in question 12*

Extract 12.2 shows that in part (a), the candidate managed to give correct reasons why the acetylene hose differs in colour with oxygen hose, she/he was able to provide two correct part of blow pipe in part (b) but failed to analyse two stages of chemical reaction of the combustion of oxy-acetylene flame in part (a). Therefore failed to score full marks.

2.3.2 Question 13: Welding defects

This question had four parts, namely (a), (b) and (c). In this question the candidates were required to identify the causes and remedies of spatter, distortion and overlapping as welding defects.

The question was opted by 69 (51.5%) of all candidates who sat for this examination and 48.3 percent did not opted this question. The analysis shows that, 37 (53.62%) candidates scored from 0 to 4.0 marks and 32 (46.38%) candidates scored from 4.5 to 9.0 marks. No candidates who scored from 9.5 to 15 marks. Figure 14 illustrates the case.

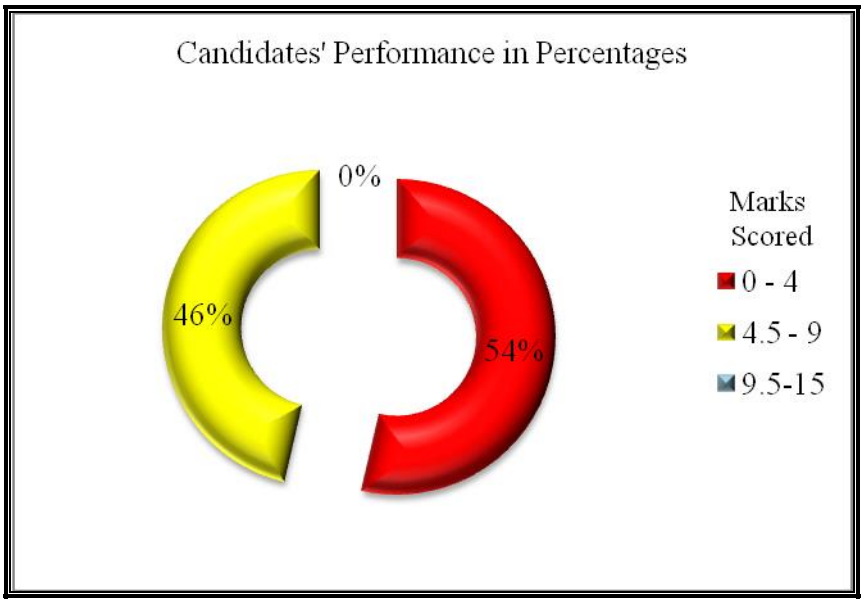
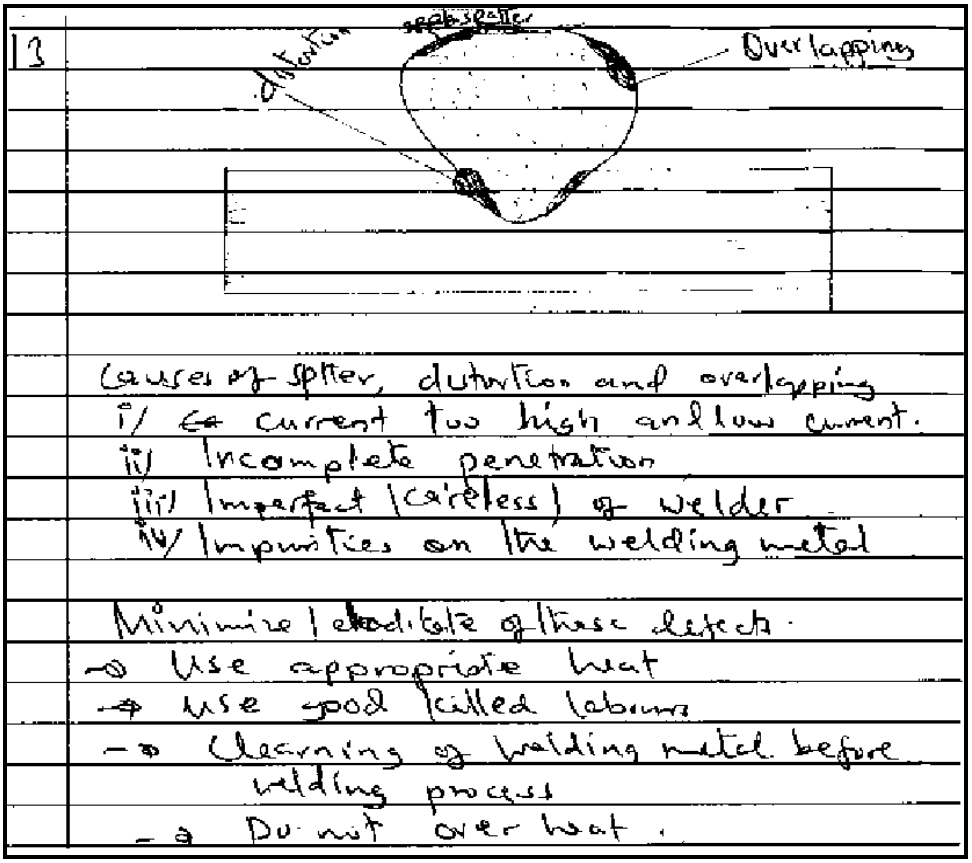


Figure 14: *The candidates' performance in question 13*

Figure 14 shows that, the candidates' performance in this question was average since 46 percent of candidates scored above 4.5 marks. The analysis of candidates' responses indicates that, majority of the candidates (54%) faced difficulties in answering all the parts of the question. Most of them misinterpreted the question and provided irrelevant responses. For example, in part (a) the majority failed to write the causes of spatter on welded parts, others provided the sketch which is irrelevant. Some of the wrong responses on the causes of spatter were such as; *current too low, welding speed high, incorrect setup of the electrode and too small size of electrode* which are totally wrong. In part (b), some of the wrong causes of distortion provided were; *specific heat, the coefficient of expansion, lack of welding sequences* and *the parent metal* also the remedies as *use suitable welding speed, set correctly the angle of electrode* and *suitable size of electrode.* These candidates failed to understand exactly the causes and remedies of spatter and distortion in welding processes.

Also, part (c) of this question some candidates failed to understand the demand of the question. Most of them gave the irrelevant causes and remedies of overlapping during welding process. For example; candidate wrote caused as; *by type of joint, using large flame, caused by improper selection of metal and blow pipe mix acetylene and oxygen gas during welding and cutting processes* while another candidate gave the responses of remedies such; as *use proper selection o f metal, take accurate dimension, etc* which are not correct. These

responses indicates that the candidates had poor knowledge of welding defects which may have been attributed by lack of enough practices in welding processes hence failed to recall the causes and remedies of difference welding defects. Extract 13.1 is a sample answer from the script of a candidate with poor performance.

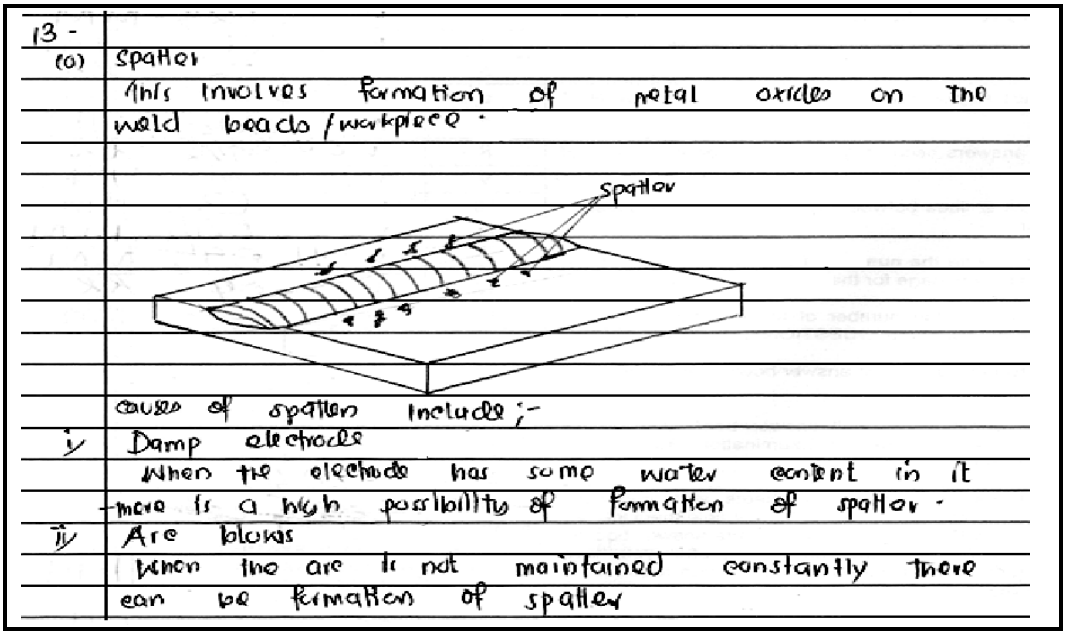


Extract 13.1 shows a sample of responses from a candidate who provided incorrect answer.

In extract 13.1, the candidate provided incorrect causes of welding defects. For example; in part (a) she/he wrote causes of spatter as too high and too low of current incomplete penetration, impurities of the welding metal etc, instead of damp electrodes, arc blow, too long arc length, too high arc voltage etc. This indicate that, a candidate lacked knowledge of the causes of the welding defects hence scored low marks.

Furthermore, some of the candidates managed to provide correct responses on part (a) and (c) but failed to give the remedies of defects of welding process in

part (b) and therefore provided irrelevant responses such as; *by tack welding, peen the sheets by using hammer, avoid the use of large diameter electrode,* etc. These responses indicate that, the candidates had partial or lack enough practices in welding processes especially on defects detection. Extract 13.2 is a sample answer from the script of a candidate with average performance.



(iii) High voltage.
The high voltage supply to workpiece and electrode can result into spatter.

(iv) Dirt on the workpiece.

Remedial measures to avoid spatter

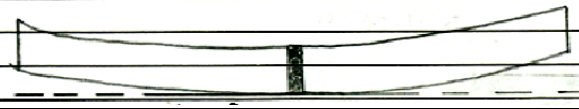
i) There should be a stable flow of arc along the weld bead.

(ii) A welder should not employ a damp electrode.

(iii) There should be a moderate supply of voltage

(iv) Proper cleaning of weld joint and workpiece.

(b) Distortion.
Distortion is the difference in the position and shape of the sheets/metal before and after the welding process. Distortion is caused by the contraction of weld as it cools. Distortion can either be longitudinal, traverse and also angular.



13

(b) The causes of distortion include ;-

i) Low ductility of the bead.

ii) Rapid rate of cooling

iii) Too small diameter electrodes.

iv) Improper clamping and fixtures.

- Remedial measures against distortion ;-

i) Mount the plates to be be weld in a jig.

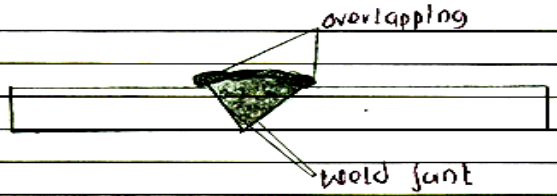
ii) By tack welding.

iii) Arrange the plates to be weld, slightly out of alignment.

iv) Poon the sheets by using hammer.

(c) Overlapping

This involves fumation of weld bead over the workpiece instead of the weld joint.



13

(c)

- Causes of overlapping ;-

i) Improper joint design.

ii) Inappropriate welding position.

iii) Too high voltage.

iv) Too long arc length.

Remedial measures against overlapping ;-

i) Ensuring a proper joint design before welding.

ii) Avoid the use of large diameter electrodes.

iii) Ensure a moderate length of arc.

iv) A minimum voltage should be employed.

Extract 13.2: A sample of a responses from a candidates' who scored average performance

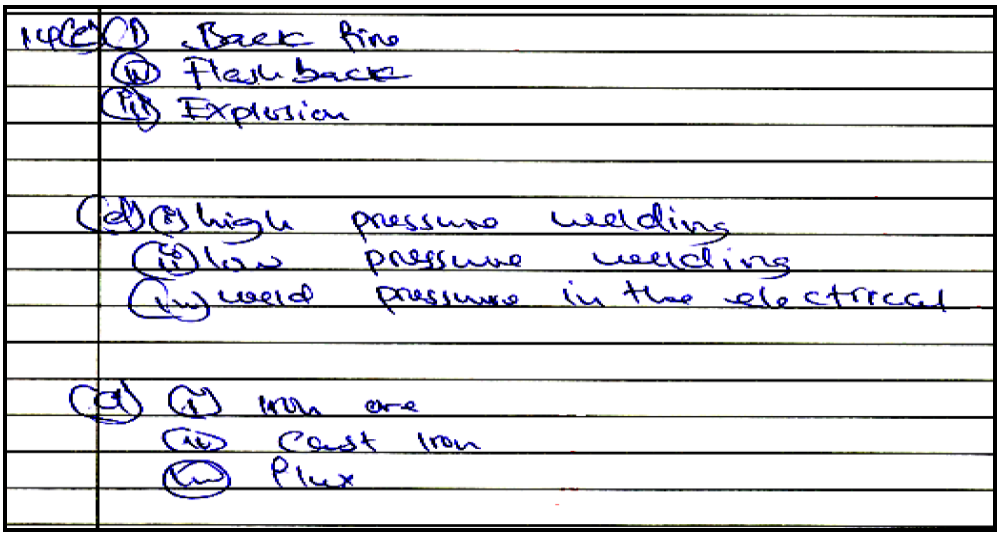
Extract 13.2 shows the responses of the candidate with average marks as he/she identified causes and remedies of welding defects in part (a)(b) and (c) with some irrelevant responses. For example in part (a)(iv) the candidate wrote the causes of spatter as dirt on the workpiece which is wrong. Also she/he explain distortion in part (b) as the difference in the position and shape of the sheets/metal before and after the welding processes which is also not correct. This indicates that, the candidate had partial knowledge in welding defects.

2.3.3 Question 14: Soft Soldering

This question was composed from the topic of Soft soldering. It consisted of four parts (a), (b), (c) and (d). Part (a) required the candidates to briefly explain the use of soldering bath and wiping. Part (b) required the candidates to elaborate three applications of the flux in soldering. Part (c), the candidates were required to identify three applications of soldering iron and part (d) required candidates to state three methods used to produce soldering joint.

The question was opted by 51 (38.1%) of all candidates who sat for this examination. All 51 (100%) candidates scored from 0 to 3 marks. No candidate scored above 3 marks. These scores show that, the overall performance in this question was poorly performed since 100 percent of the candidates who attempted this question scored below 4 marks. The candidates who scored from 0 to 4 marks failed to understand the requirement of the question. Their answers revealed that, they were not knowledgeable enough on the topic *Soft Soldering*. For example, one candidate in part (d) stated the procedure of soldering joint as; *used to join aluminum, joining non-ferrous metal* and *joining soldering iron* instead of *Touch method, spray method, induction method, dip and wave method, resistance method* etc. This implies that the candidates had insufficient knowledge of the topic.

Generally, it was noted that, the failure in this question was contributed by various reasons including: low ability to recall application of *soldering bath, wiping, soldering gun (iron)* and *flux*. Also lack of practical skills on soldering processes sited as another cause for their failure. Extract 14.1 represents a poor response from one of the candidates.



Extract 14.1: *A sample of the candidate's poor responses in question 14*

Extract 14.1 shows the responses of the candidate who failed to provide correct answers to all parts of the question. For example, in part (d) she/he failed to state methods used to produce soldering joint. She/he wrote; *high pressure welding, low pressure welding* and *weld pressure in the electrical* instead of *soldering iron method, touch method, spray method, induction method*, etc hence scored low marks.

3.0 ANALYSIS OF CANDIDATES' PERFORMANCE IN EACH TOPIC

Generally, the performance of the candidates in all topics was average because nine (9) topics out of fourteen (14) were performed with average marks or above average. The highest performance in this paper was that of the multiple choice question whose items were derived from different topics. The candidates' performance in this question was 85%. Obviously, the good performance in this question was the result of the candidates' adequate knowledge, ability to understand the requirements of the question and the nature of the items.

The topics which were averagely performed were: *Distortion (51%), Sheet Metal operation (44.55%), Back fire and Flash back (36%), Electric Arc welding and equipment (32.54), Arc Blow(32%), Gas welding accessories and equipment* and *Weld Defects (29.3%).* The other topics had poor performance as follows: *Hard Soldering (21%), Gas welding operation (20%), Gas shielded welding(16%), Pipe welding (4%)* and *Soft Soldering (0%).* (See appendix A and B)

The weakness shown by the candidates in the poorly performed topics included; inability to interpret the questions and to provide logical and clearly stated answers. Generally, the candidates exhibited very low level of knowledge and practical skills in topics under structured questions in section C. The performance in some of the questions in this section was poor. The candidates exhibited weakness in sketching responses for questions of higher order or questions which required explanations.

4.0 CONCLUSION

The candidates' performance in the Welding and Metal Fabrication examination (CSEE) 2019 was average since 35.07 percent of the candidates score 30 percent and above. Most of those candidates had good performance in question 1 and 2. On the one hand, the candidates' good command of English language, adequate knowledge of the subject matter as well as ability to understand the requirements of the questions were the pillars upon which their good performance is credited. On the other hand, the candidates' inadequate knowledge of the subject matter, poor command of English language, inability to identify the requirements of the questions, lack of good drawing skills and poor essay writing skills were the root causes of candidates' poor performance. The analysis of the candidates' overall performance per topic is presented in Appendix B while the comparison of the candidates' grade between 2018 and 2019 is presented in Appendix C.

5.0 RECOMMENDATIONS

In order to improve the performance of the candidates in this subject, the following are recommended:

(a) The students should be guided and encouraged to read various Welding and Metal Fabrications books so as to improve their knowledge and skills. Improved knowledge and skills will help them to avoid providing partial and fragmented answers.

(b) Teachers should make sure that, all topics analysed with in the syllabus are well covered so as to enable candidates to have wider knowledge, practical skills and understanding of the questions asked. For example; the performance of 00 percent of the candidates from the topic Soft Soldering denoted that, the topic was either not well taught or not understood by the majority of the candidates.

(c) All topics/sub-topics which have practical parts, should be taught perfectly in both theory and practical.

(d) Teachers should provide candidates with adequate exercises tests and examinations which measure candidates' competence in various theories and practical skills.

(e) Follow - up on the learning and teaching processes in schools made by academic masters, head of schools Educational Quality Assurers and other education stakeholders should be directed at identifying, re-dressing and or eliminating the shortfalls mentioned in this report.

(f) Seminars and workshops should be organized so as to equip teachers with knowledge and new teaching skills. Indeed, by sharing experiences with teachers from different schools, one's teaching methods will be greatly improved.

Appendix A

Table 18: The Performance of the Candidates in Each Topic

S/N	Topic	Question Numbers	Percentages of Candidates who Scored an Average of 30 % and Above	Remarks
1	Multiple Choice Question (Various Topics)	1	79.1	Good
2	Electric Arc Welding	4	68	Good
3	Distortion	6	51	Average
4	Weld defects	13	46	Average
5	Sheet metal operations	11	44.55	Average
6	Backfire and Flashback	2	36	Average
7	Welding Positions	8	32.54	Average
8	Arc blow	5	32	Average
9	Gas welding accessories and equipment	12	29.3	Average
10	Hard soldering	3	21	Poor
11	Gas welding Operations	10	20	Poor
12	Gas shielded welding	7	16	Poor
13	Pipe Welding	9	4	Poor
14	Soft Soldering	14	0	Poor

Appendix B

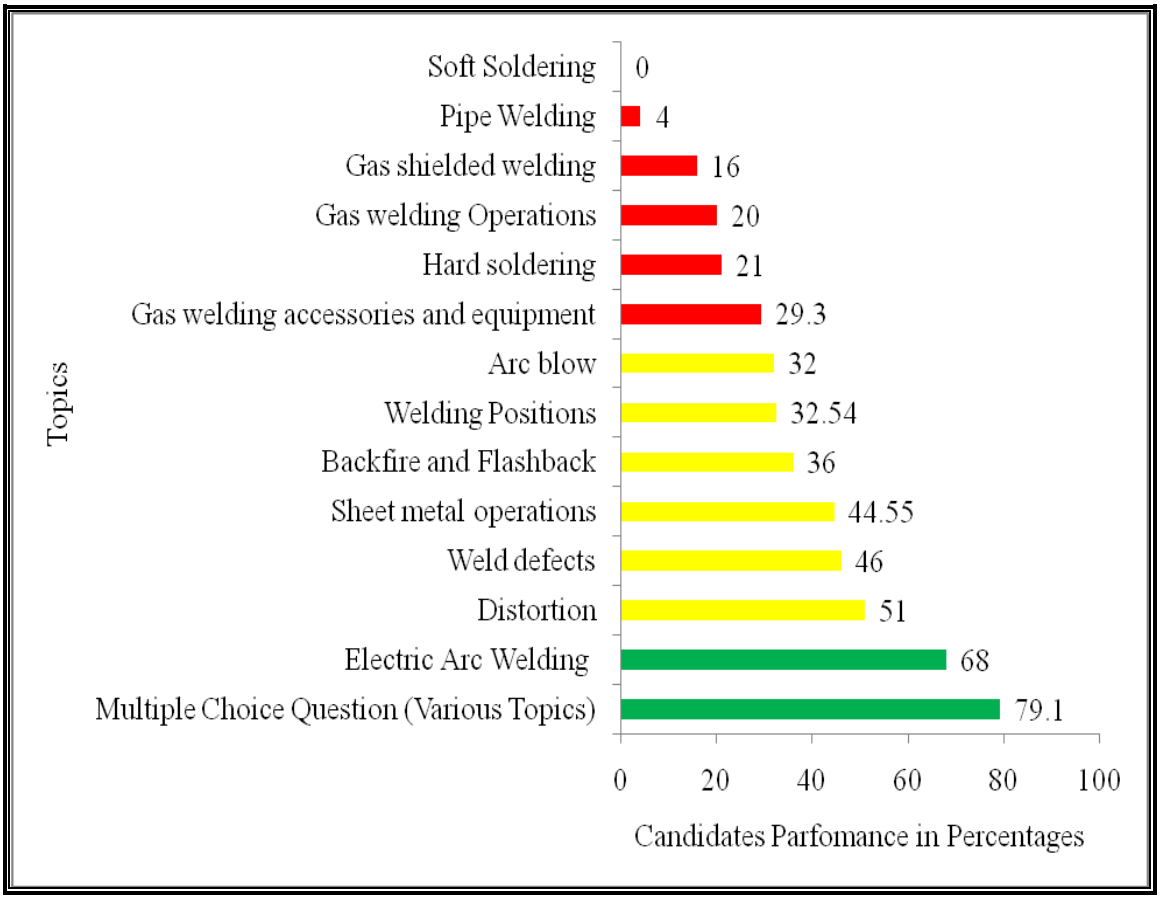


Figure 16: *The candidates' Performance Topic Wise*

Appendix C

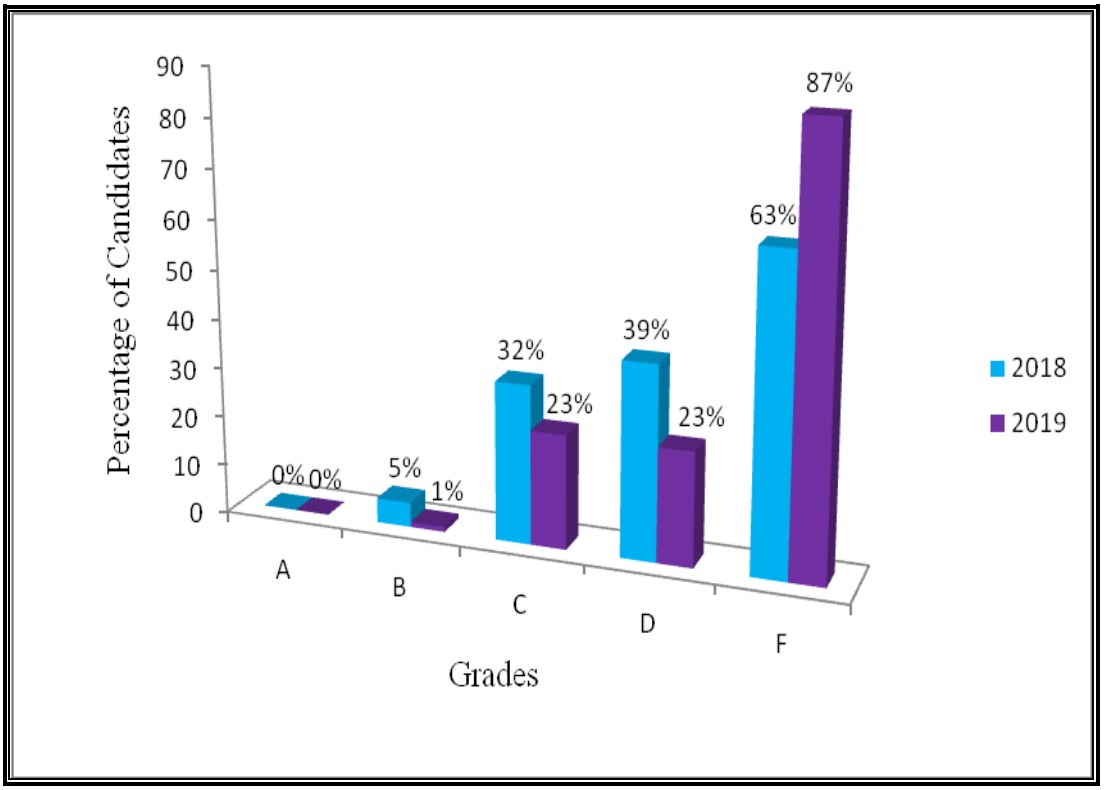


Figure 18: *Comparison of the Candidates' Grade between 2019 and 2018*