THE NATIONAL EXAMINATIONS COUNCIL OF TANZANIA

CANDIDATES' ITEM RESPONSE ANALYSIS REPORT FOR THE CERTIFICATE OF SECONDARY EDUCATION EXAMINATION (CSEE) 2015

092 WORKSHOP TECHNOLOGY
(For School Candidates)

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FOREWORD

The National Examinations Council of Tanzania is pleased to issue the 2015 Form Four National Examination (CSEE) 2015 report on Candidates Item Response Analysis on Workshop Technology subject. The report has been written in order to provide a feedback to students, teachers, parents, policy makers and the public in general about the performance of the candidates in this subject.

The Certificate of Secondary Education Examination marks the end of four years of Ordinary Level Secondary Education. It is a summative evaluation which, among other things, shows the 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 students in their four years of Ordinary Level Secondary Education.

The analysis presented in this report is intended to contribute towards understanding of possible reasons behind the candidates' performance in 092-Workshop Technology subject. The report highlights the factors that made the candidates perform well. Such factors include ability to identify the requirement of the question and candidates' adequate knowledge on the concepts related to the subject. Despite the good performance, the report also highlights factors which made some candidates fail. Such factors include the lack of adequate knowledge in relation to a particular concept, failure to interpret the requirement of the questions and poor English Language command. The feedback provided will enable the educational administrators, school managers, teachers, students and other stakeholders to identify proper measures to be taken in order to improve the candidates' performance in future examinations administered by the Council.

The National Examinations Council of Tanzania will highly appreciate comments and suggestions from teachers, students, education quality controllers, curriculum developers and the public in general, that can be used in improving future Examiners' reports.

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

Dr. Charles E. Msonde
EXECUTIVE SECRETARY

1.0 INTROUCTION

This report focused on the performance of the candidates in the Certificate of Secondary Education Examination (CSEE) 2015 in 092 Workshop Technology subject. The examination paper consisted of questions which intended to measure candidates' competences, knowledge and skills on the subject contents stipulated in 1994 Workshop Technology syllabus.

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 comprises of ten (10) short answer questions. The section weighed a total of (30) marks. Section C consisted of five (5) structured questions of which candidates were required to answer only three (3) questions. Each carried twenty (20) marks.

The analysis of examination result shows that the general performance in this examination was good. Among the candidates who sat for the examination, 155 candidates (54.77%) passed while 128 candidates (45.23%) failed. Further analysis reveals that, the candidates' performance in CSEE in 2015 for 092 Workshop Technology has improved by 22.5 percent when compared to 32.2 percent who passed the examination in 2014.

The candidates' performance in each question was considered as weak, average or good if the percentage of candidates who scored 30 percent or more of the marks allocated for the particular question, falls within the intervals of 0 to 29, 30 to 44 and 45 to 100 respectively.

The report contains the analysis of the performance of the candidates in each question. It provides feedback to the Educational stakeholders on the performance of the candidates by showing what the candidates were required to do as well as their strength and weakness in their responses. Samples of candidate's answers (extracts) were used to show their good and poor response. It is expected that this report will be useful to teachers, students and other Educational stakeholders to enable them to identify the areas where candidates faced learning difficulties and to make decision for improving the teaching and learning process of Workshop Technology subject.

2.0 ANALYSIS OF THE CANDIDATES' PERFORMANCE IN EACH QUESTION

2.1 Section A

2.1.1 Question 1: Various Topics

This question consisted of ten (10) multiple choice items (i) –(x) derived from various topics (Production of Engineering Materials, Heat Treatment, Lubricants and Limits and Fits). For each of the items, the candidates were required to choose the correct answer from among the given alternatives and write its letter beside the item number.

This question was attempted by 283 candidates (100%) of which, 42.8 percent scored from 5 to 10 marks, 30.7 percent scored from 3 to 4 marks and 26.5 percent scored from 0 to 2 marks as illustrated in the Table 1. The general performance on this question was good as 73.5 percent of the candidates scored average mark and above (from 3 to 10 marks).

Table 1: The candidates' performance in question 1

Scores	Candidates		Remarks
	Number	Percentage (%)	
0 – 2	75	26.5	Weak
3 – 4	87	30.7	Average
5 – 10	121	42.8	Good
Total	**283**	**100.0**	

All the items were attempted by the candidates but most of them opted for the correct answers in items (i), (iii), (iv), (v), (vi), (viii) and (x). The items in which most candidates failed were (ii), (vii) and (ix).

In item (ii), the candidates were required to identify the process through which austenite steel can be transformed to martensite steel. The correct answer was E 'rapidly cooling'. Most of the candidates opted for B 'slow cooling.' The candidates failed to recall the fact that, when steel is heated to a critical temperature, it changes to austenite steel which can be transformed to martensite steel by rapid cooling.

In item (vii), the candidates were required to identify the metallurgical name of steel which has carbon content of 0.8 percent. The correct answer was E 'eutectoid steel' but most of the candidates opted for B 'hypereutectoid steel'. The candidates confused the two terms because of their partly likeness in spelling.

In item (ix), the candidates were required to choose the material used to make cold chisels. The correct answer was D 'high carbon steel' but most of the candidates opted for C 'mild steel'. These candidates failed to associate the purpose of the chisel which is to cut other metals and the hardness and hardenability of high carbon steel, which make it a suitable material for making chisels.

2.2 Section B

2.2.1 Question 2: Lubricant

This question required the candidates to outline three purpose of using cutting lubricants. The question was attempted by 275 candidates (97.2%) out of which, 50.5 percent scored full 3 marks, 22.6 percent scored from 1.5 to 2 marks, 8.7 percent scored 1 mark and 18.2 percent scored 0 mark. The analysis in Figure 1 indicates that, the performance for this question was good as 73.1 percent of the candidate scored from 1.5 to 3 marks.

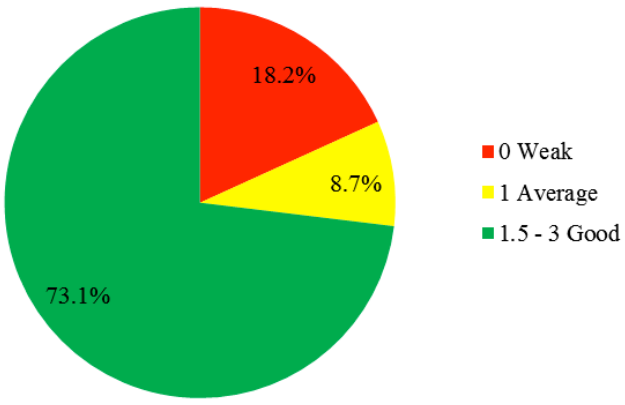
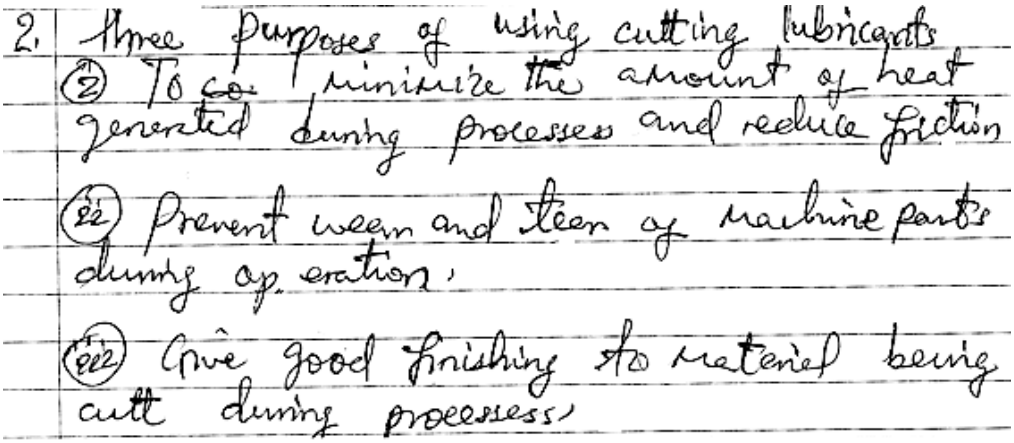


Fig 1: The performance of candidates in question 2

The candidates who scored from 2 to 3 marks correctly outlined two or three purposes of cutting lubricants. They exhibited good knowledge on the selection and application of lubricants as shown in extract 2.1.

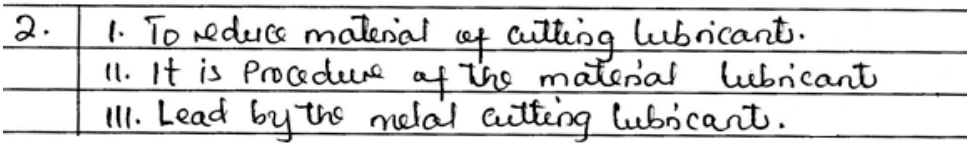
Extract 2.1



Extract 2.1 shows that the candidate outlined correctly three purposes of cutting lubricants as required by the question.

The candidates who scored 1 mark outlined only one purpose of cutting lubricants. Those who scored 1.5 marks were able to outline correctly one purpose and outlines partially correct the second one. However, the candidates who scored 0 mark failed to outline the purposes of cutting lubricants. Some candidates wrote the purposes which apply for general lubrication of machine parts instead of the purposes of using cutting lubricants. These candidates confused between cutting lubricant and machine lubricant. Additionally, few candidates stated the properties of lubricant instead of the purpose of cutting lubricants. Extract 2.1 shows a sample of a response from a script of a candidate who failed to fulfill the requirement of the question.

Extract 2:2



In Extract 2.2, the candidate wrote sentences ending with the word lubricants but not outlining the purpose of cutting lubricants.

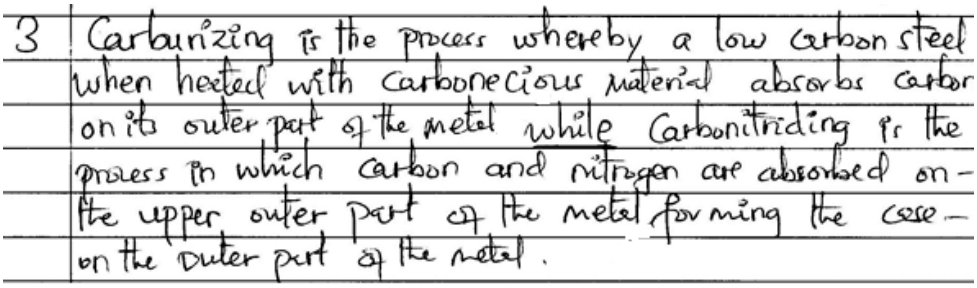
2.2.2 Question 3: Heat Treatment

This question required the candidates to differentiate carburizing process from carbonitriding process.

The question was attempted by 219 candidates (77.4%) of which, 22.4 percent scored full 3 marks, 28.3 percent scored 1.5 marks and 49.3 percent scored a zero mark. This trend of data analysis indicates that the candidates' performance was good.

The candidates who scored 3 marks were able to differentiate between carburizing process from carbonitriding process. They portrayed good knowledge on the heat treatment topic. Extract 3.1 gives a sample of a good response from one of the candidates.

Extract 3.1

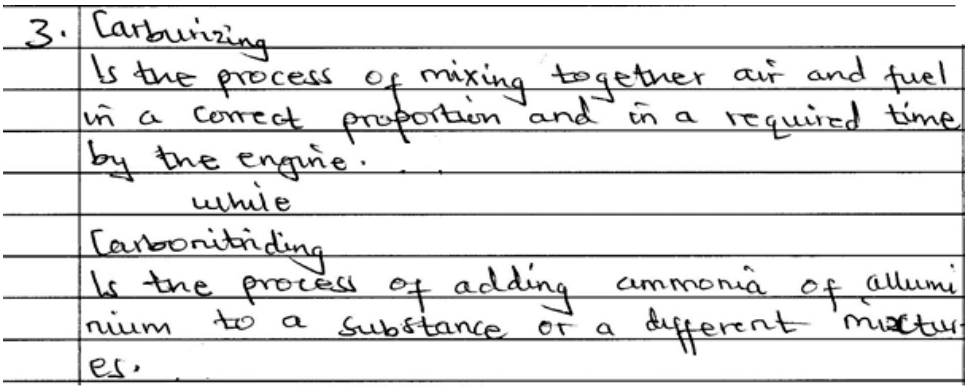

3 Carburizing is the process whereby a low carbon steel when heated with carbonecious material absorbs carbon on its outer part of the metal while Carbonitriding is the process in which carbon and nitrogen are absorbed on the upper outer part of the metal forming the case on the outer part of the metal.

Extract 3.1 shows that the candidate was able to differentiate carburizing process from carbonitriding process.

Some of the candidates scored 1.5 marks because they managed to explain only one of the two processes without showing the difference of the two processes.

On the other hand, there were candidates who scored a zero mark. Among them, there were those who related the term carburizing process with carburizing flame used in welding process. One stated that, 'carburizing is a process of changing the shape of any material'. These candidates had wrong concepts on the terms carburizing and carbonitriding. Extract 3.2 illustrates a poor response from a candidate.

Extract 3.2


3. Carburizing
Is the process of mixing together air and fuel in a correct proportion and in a required time by the engine.
while
Carbonitriding
Is the process of adding ammonia of alluminium to a substance or a different mixtures.

In Extract 3.2, the candidate related the term carburizing with the mixing of the air and fuel in the engine and carbonitriding with adding ammonia to a substance. Both answers were not correct.

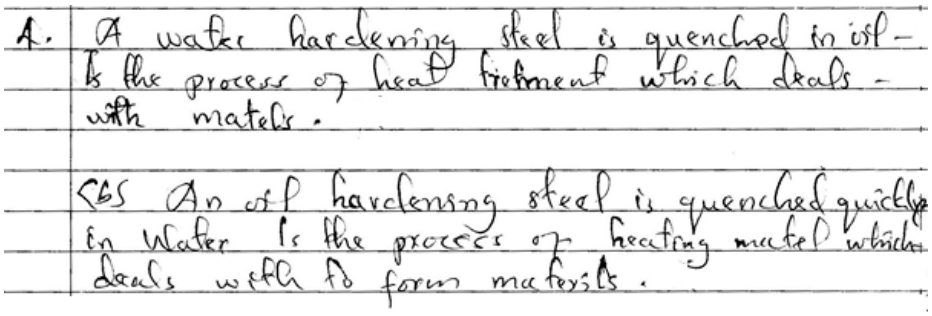
2.2.3 Question 4: Heat Treatment

The question had two parts; (a) and (b). In part (a), the question required the candidates to give the expected results when a water hardening steel is quenched in oil. Part (b) required the candidates to give the expected results when an oil hardening steel is quenched quickly in water.

The question was attempted by 238 candidates (84.1%) of which, 82.8 percent scored 0 mark, 1.2 percent scored 1 mark and 16 percent scored from 1.5 to 3 marks. This data analysis indicates that the question was poorly done.

The candidates who scored 0 mark failed to give the expected result when a water hardening steel is quenched in oil and an oil hardening steel is quenched quickly in water. One candidate answers as (a) 'it does not return to its original shape', (b) 'it will cool' while another candidate wrote answers as (a) 'it has high melting point' and (b) 'it has lower melting point'. They could not recall the effects of the cooling medium used for heat treatment depending on their specific heat capacity. The correct answers were as follows: (a) When water hardening steel is cooled in oil it cools slowly and does not attain the maximum hardness. (b) When an oil hardening steel is rapidly quenched in water it may develop cracks. Extract 4.1 is a sample of a response from a script of a candidate who did not comply with the question demand.

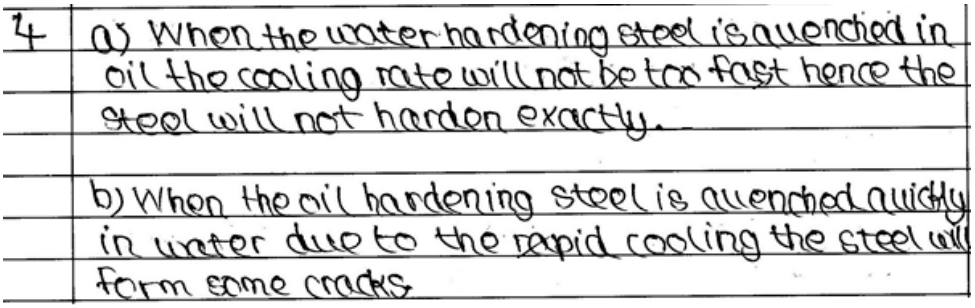
Extract 4.1



In Extract 4.1, the candidates wrote unclear definitions of the terms 'water hardening steel' and 'oil hardening steel' instead of writing the expected results when those metals are cooled using the cooling medium stated in the question.

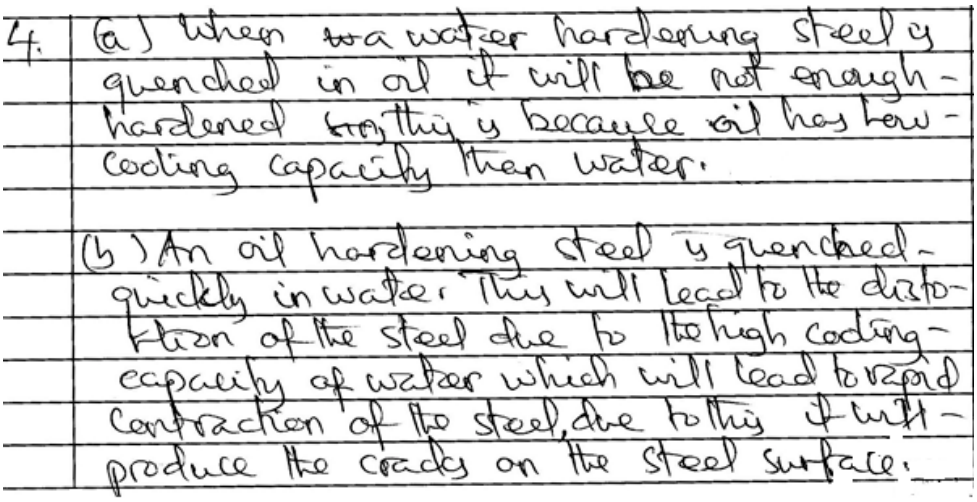
Some the candidates who scored from 1 to 1.5 marks, mentioned correctly the result when a water hardening steel is quenched in oil and failed to mention the results when an oil hardening steel is quenched quickly in water. Other candidates gave answers which were partly correct in both parts. Moreover, few candidates (1.7%) who scored 3 marks out of 3 allotted marks, were able to mention the results after cooling those steels in oil and water. Extract 4.2 and extract 4.3 shows the samples of good responses to the question.

Extract 4.2



In Extract 4.2, the candidate correctly mentioned the results of cooling the two metals in the named cooling medium.

Extract 4.3


4. (a) When a water hardening steel is quenched in oil it will be not enough-hardened because this is because oil has low-cooling capacity than water.

(b) An oil hardening steel is quenched-quickly in water. This will lead to the distortion of the steel due to the high cooling-capacity of water which will lead to rapid contraction of the steel, due to this it will-produce the cracks on the steel surface.

In Extract 4.3, the candidate was able to state the effects of cooling a water hardening steel in oil and an oil hardening steel in water.

2.2.4 Question 5: Identification of Metals

This question required the candidates to list down three methods commonly used in identifying metals.

The question was attempted by 277 candidates (97.9%) of which, 55.6 percent of the candidates scored from 2 to 3 marks, 12.3 percent scored 1 mark and 32.1 percent scored 0 mark. The data in Table 2 shows that the candidates' performance in this question was good because the percentage of candidates who scored average mark and above was 67.9.

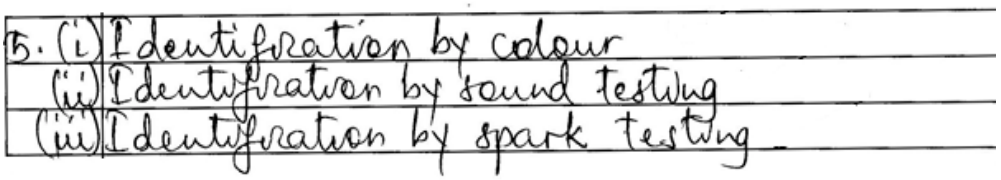
Table 2: The performance of the candidates in question 5

Scores	Candidates		Remarks
	Number	Percentage (%)	
0	89	32.1	Weak
1	34	12.3	Average
2 – 3	154	55.6	Good
Total	**277**	**100.0**	

The candidates (35.7%) who scored 3 marks were able to correctly list three methods of three methods of identifying metals as per question

demand. Furthermore, the candidate who scored from 1 to 2 marks some managed to list one method while others listed two methods which are used in identifying metals. Extract 5.1 shows a good response from one of the candidates.

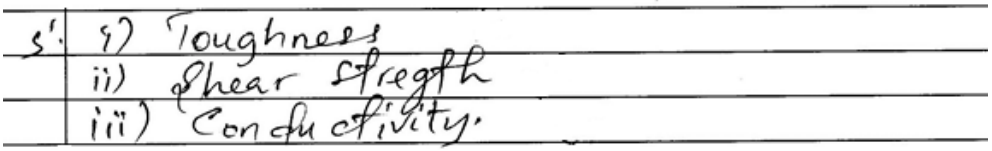
Extract 5.1



In Extract 5.1 the candidate listed correctly the three methods of identifying metals.

The candidates who scored 0 mark failed to recall and list the methods used to identifying metals. Some candidates did not comprehend the question demand as a result they wrote the types of metals such as cast iron, wrought iron, steel, copper and aluminium instead of methods of identifying metals while others wrote the properties of metals as depicted in the Extract 5.2

Extract 5.2



Extract 5.2 shows that the candidate misinterpreted the question hence listed the properties of metals instead of the common methods of identifying metals.

2.2.5 Question 6: Production of Engineering Materials

This question required the candidates to identify the alloy being obtained by the combination of the given metals. In (a) 88% copper, 10% tin and 2% zinc, in (b) 89.5% copper, 10% tin and 0.5% phosphorus and in (c) 67% nickel, 30% copper, 1.4% iron, 1% manganese, 0.1% silicon and 0.2% carbon.

The analysis shows that a total of 252 candidates (88.7%) attempted this question. It was noted that, 69.4 percent scored a zero mark, 26.2 percent scored 1 mark and 4.4 percent scored 2 marks. No candidates scored full

marks in this question. According to this data, the question was averagely performed. Figure 2 shows that the performance of candidates in this question was average because 30.6 percent passed.

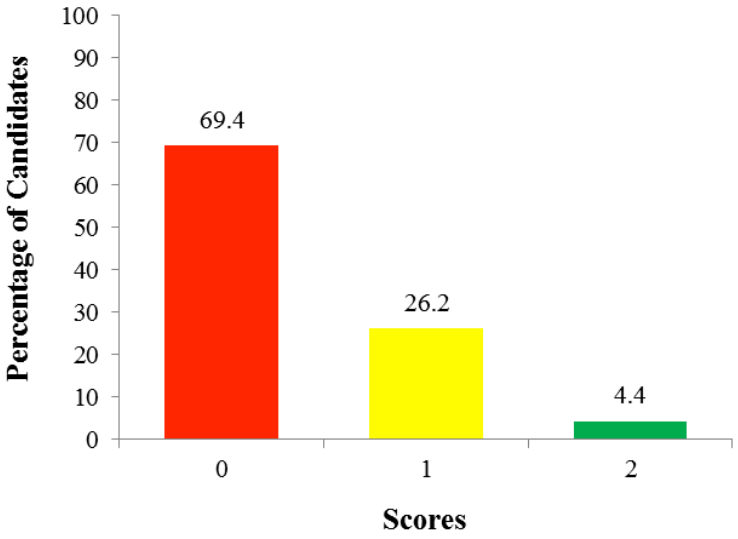
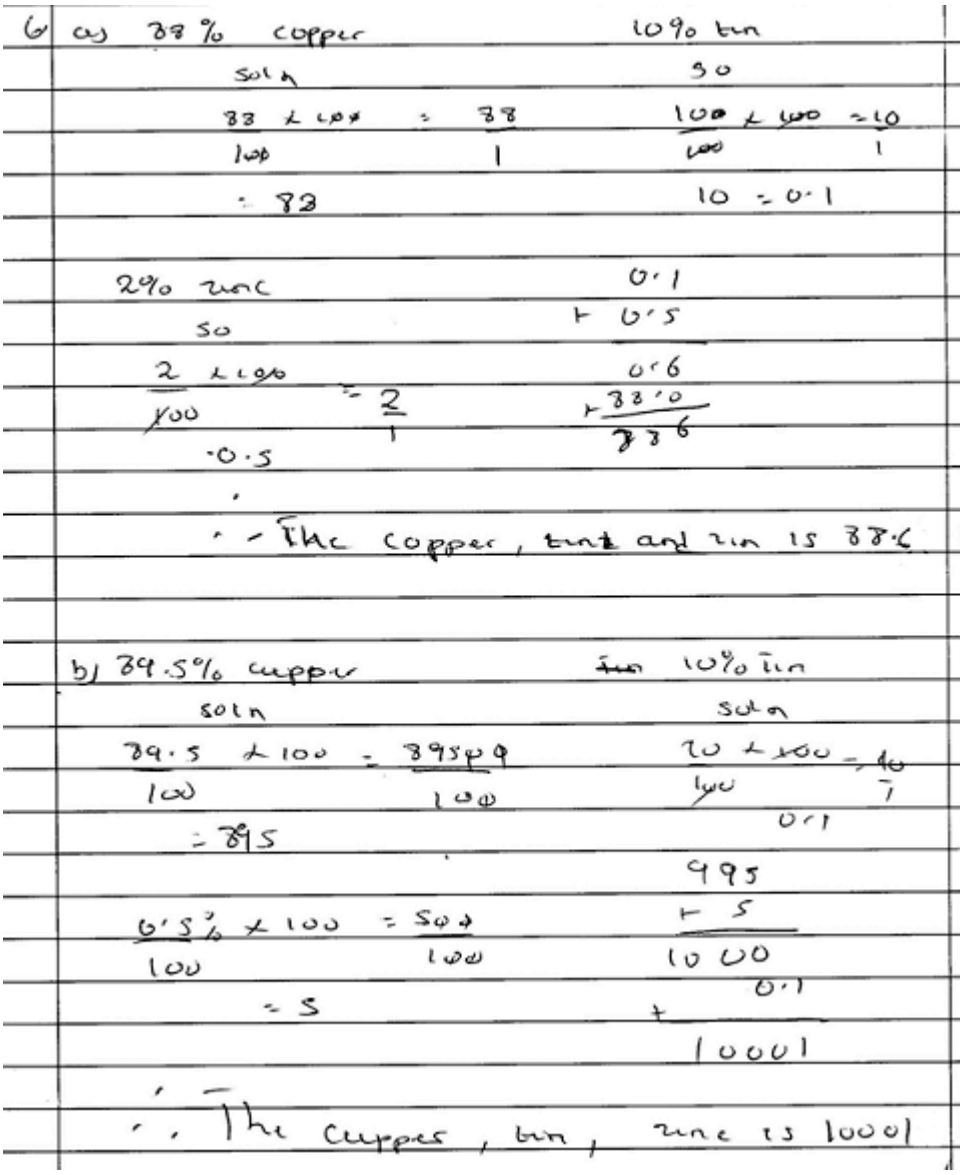
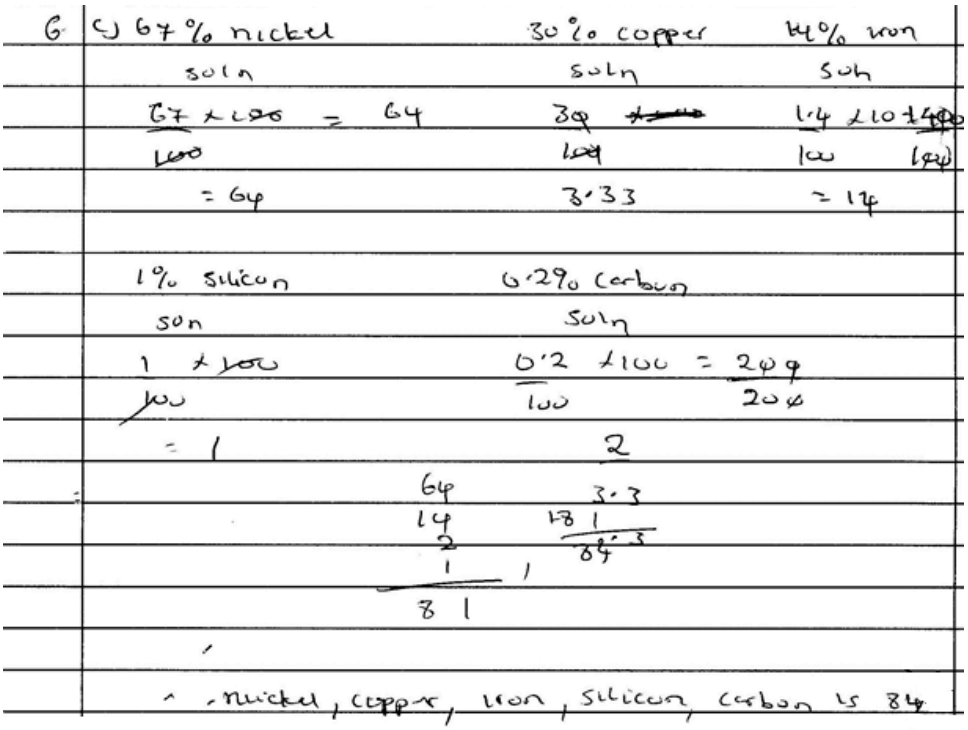


Figure 2: The candidates' performance in question 6

The candidates who scored a zero mark failed to identify the alloys obtained by the combination of the given metals. There were candidates who understood the requirement of the question but mentioned the alloys which are not formed by the metals mentioned in the question. The correct answers were (a) gun metal, (b) phosphor bronze and (c) monel metal. Many candidates mentioned brass as the alloy obtained in (a) because of the presence of copper and zinc which are the major constituent of bass, but neglected the third element (tin). In part (b) and (c) the candidate gave different incorrect answers; for example, the answers from three candidates were; 'copper alloy', 'hypoeutoid steel' and 'phosphorus alloy' for (b) and 'silicate alloy' 'hyperutoid steel' and 'manganese alloy' for (c). Furthermore, some candidates had misconception of the question as they performed calculations using the percentages of metals given in the question instead of mentioning the names of alloys formed by the metals as shown in Extract 6.1.

Extract 6.1

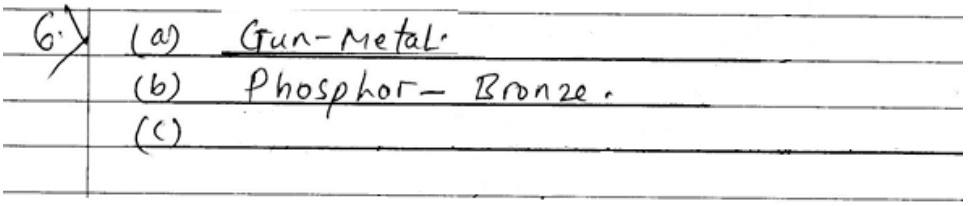

6 a) 88% copper
10% tin
soln
90
88 x 100 = 88
100 1
100 x 100 = 10
100 1
= 88
10 = 0.1
2% zinc
so
2 x 100 = 2
100 1
0.5
0.1
+ 0.5
0.6
+ 88.0
88.6
∴ The copper, tin and zinc is 88.6
b) 89.5% copper
10% tin
soln
soln
89.5 x 100 = 8950
100 100
= 895
20 x 100 = 10
100 1
0.1
995
+ 5
1000
0.1
+
10001
0.5% x 100 = 50
100 100
= 5
∴ The copper, tin, zinc is 10001



In Extract 6.1, the candidate failed to comprehend the question thus performed some calculations which were not required by the question.

Few candidates scored from 1 to 2 marks. Some of these candidates named correctly the formed alloys in (a) but failed to name the alloy in (b) and vice versa while others named the alloys formed in parts (a) and (b) but failed to name the alloy formed in part (c) of the question. Extract 6.2 is a sample answer of a candidate who performed well in this question.

Extract 6.2



In Extract 6.2, the candidates named correctly two alloys formed by the given metals and left part (c) unanswered.

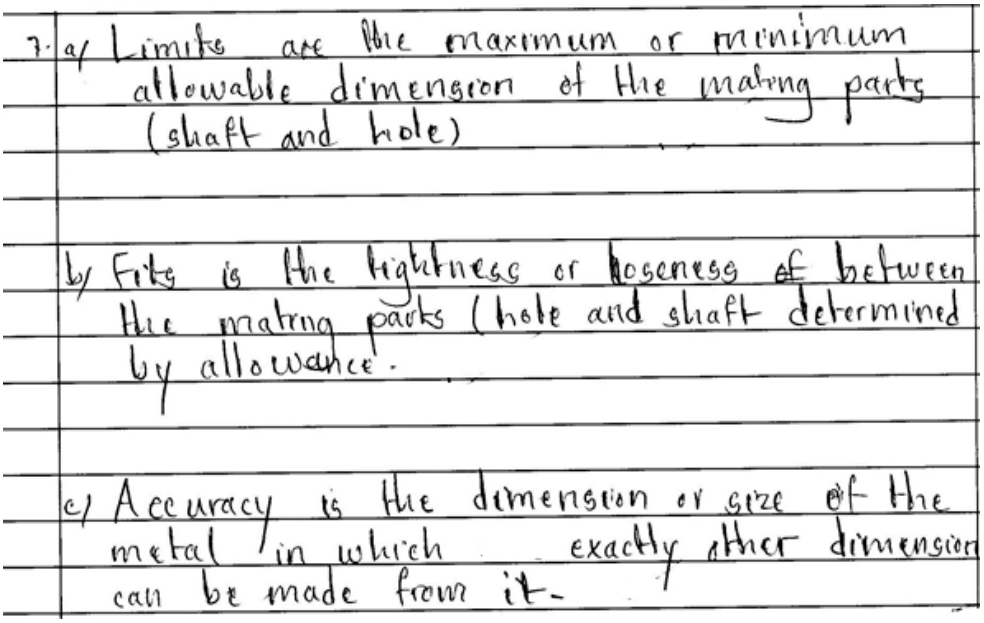
2.2.6 Question 7: Limits and Fits

This question required the candidates to define 'limits', 'fits' and 'accuracy' as used in relation to production of engineering components.

The question was attempted by 263 candidates (92.9%) of which, 24.3 percent scored from 2 to 3 marks, 30.1 percent scored 1 to 1.5 marks, and 45.6 percent scored from 0 to 0.5 marks. This trend of data analysis shows that the candidates' performance in this question was good.

The candidates who scored from 2 to 3 marks, some of them either defined only two terms correctly, or two terms correctly and one term partially, while others correctly defined all the terms. Those who defined three terms correctly understood the question demand and they had adequate knowledge on this topic. Extract 7.1 is a sample answer from a candidate who provided a good response.

***E*xtract 7.1**


7. a/ Limits are the maximum or minimum allowable dimension of the mating parts (shaft and hole)

b/ Fits is the tightness or looseness of between the mating parts (hole and shaft determined by allowance.

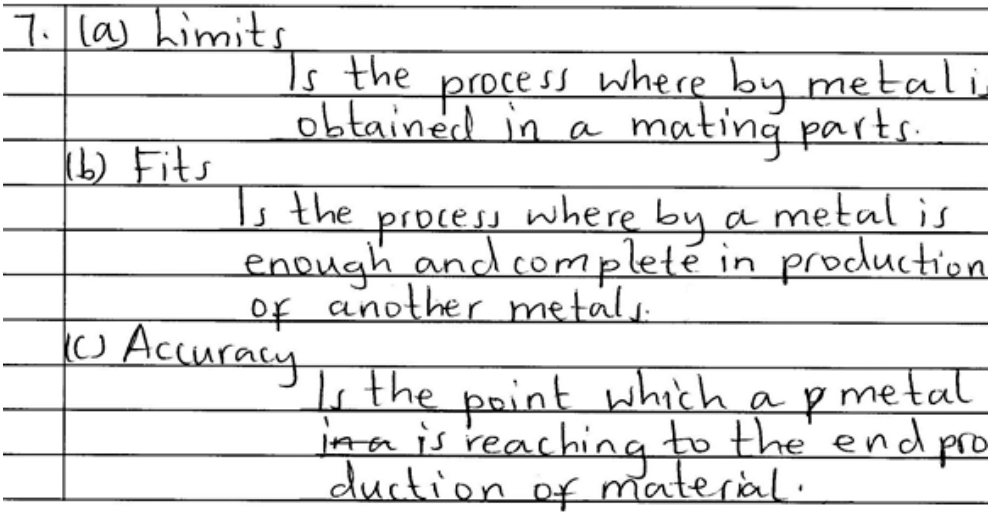
c/ Accuracy is the dimension or size of the metal in which exactly other dimension can be made from it.

In Extract 7.2, the candidate defined the terms limits, fits and accuracy as per question demand.

However, the candidates who scored 1 to 1.5 marks, some managed to define one term among the three while others defined one term correctly and second term partially.

The candidates who scored a zero mark could not define 'limits', 'fits' and 'accuracy' as they are used in relation to production of engineering component. Few candidates (1.1%) who scored 0.5 marks managed to define one term partially. The candidates lacked knowledge in the topic of limits and fits. Extract 7.1 illustrates the case.

Extract 7.2



Extract 7.2 shows that the candidate could not write the correct definitions of limits, fits and accuracy.

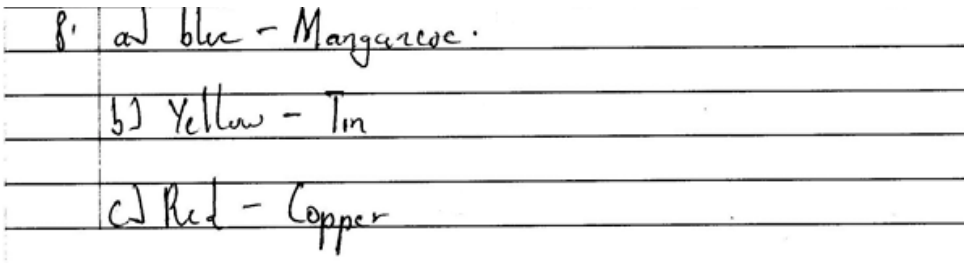
2.2.7 Question 8: Identification of Metals

This question required the candidates to identify metals by blue, yellow and red colour coding.

The question was attempted by 242 candidates (85.5%). The analysis of data shows that, this question was poorly performed as 96.3 percent scored 0 mark, 3.3 percent scored 1 mark, and 0.4 percent scored 2 marks out of 3.

The candidates who scored 0 mark failed to identify the metals coded by using blue, yellow and red colors. Few candidates (3.7%), scored from 1 to 2 marks. Most of the candidates lacked adequate knowledge in metal identification topics especially the identification by colour coding. Extract 8 is a sample of poor answer**.**

Extract 8



Extract 8 shows that the candidate failed to identify the metals by their colors codes.

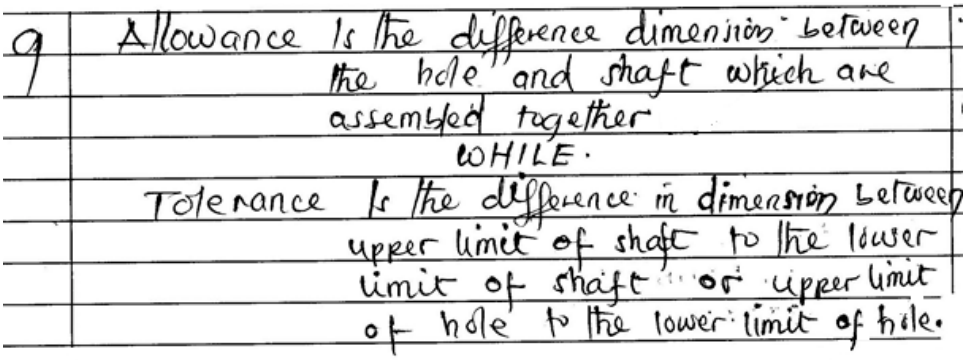
2.2.8 Question 9: Limits and Fits

This question required the candidates to differentiate the term allowance from tolerance.

The question was attempted by 259 candidates (91.5%) of which, 51 percent scored from 2 to 3 marks, 17 percent scored from 1 to 1.5 marks, 32 percent scored from 0 to 0.5 marks. Furthermore 8.5 percent of the candidates did not attempt this question.

The candidates who scored from 2 to 3 marks some explained clearly by giving the meaning of both terms, but failed to point out their difference, hence failed to score full 3 marks. Other candidates (47.5%) who scored 3 marks were able to differentiate allowance from tolerance correctly as shown in extract 9.1.

Extract 9.1

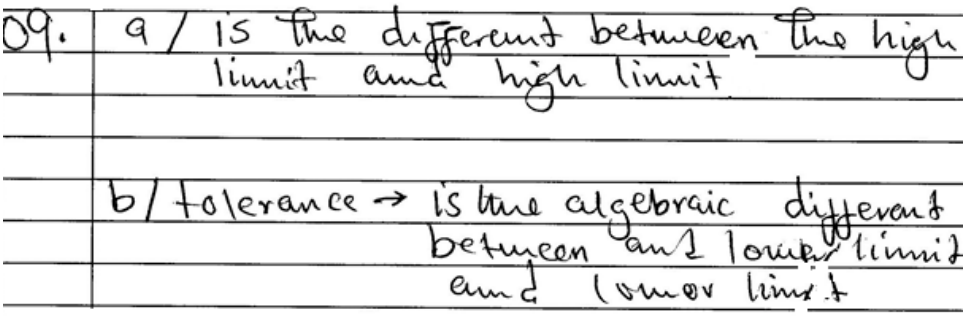


In Extract 9.1, the candidate explained the difference between allowance and tolerance as applied in limits and fits.

On the other hand, the candidates who scored 0 to 0.5 mark, failed to differentiate the term allowance from tolerance. One candidate wrote the difference of allowance and tolerance as 'allowance is the uniform deviation from the basic size dimension while tolerance is the difference of the upper real limit of shaft and hole' whereas another candidate wrote the difference between the two as 'allowance is the allow of the tool to fit without shacking while tolerance is the fit which the tool fit and allow the tool to play.' Moreover, another candidate stated the difference between allowance and tolerance as 'allowance is a material that is used in a carbonic material in production of steel while tolerance is the material that have used in making high speed steel of metal.' The candidates lacked adequate knowledge on the subject matter.

The candidates who scored from 1 to 1.5 marks their answers had few relevant points hence failed to score full 3 marks. Extract 9.2 is a sample of poor answer from one of the candidates.

Extract 9.2



Extract 9.2 shows that the candidate failed to differentiate allowance from tolerance as he /she instead, defined the terms wrongly by applying undetermined limits of dimensions i e 'between the high limit and high limit' and 'between lower limit and lower limit'.

2.2.9 Question 10: Lubricants

The question required the candidates to state three factors that may lead to the decision of using grease as a lubricant.

The question was attempted by 268 students (94.7%) whereas, 80.2 percent scored a zero mark, 14.9 percent scored 1 mark, and 4.9 percent scored 2

marks. This data shows the performance of this question was weak. Figure 3 is an illustration of candidates' good performance.

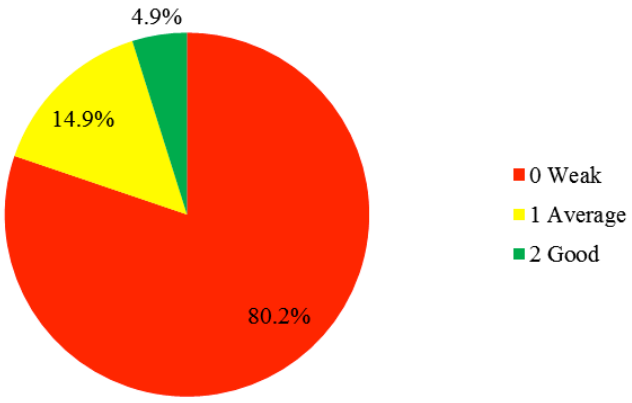
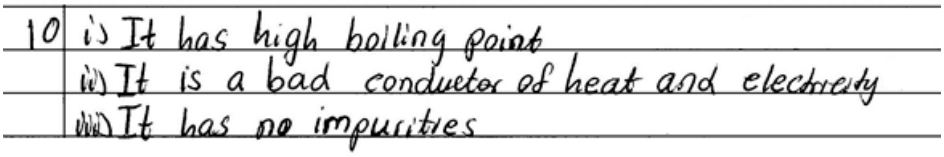


Figure 3: The performance of candidates in question 10

The candidates who scored 0 mark were unable to state three factors that may lead the decision of using grease as lubricant. For example one candidate stated the factors as follows: (i) Grease has low viscosity (ii) It has oiliness property (iii) Not much expensive.

The correct answers for this question were (i) Where high pressure and slow speeds are employed. (ii) In situations where it is necessary to prevent the oil from being thrown out from the bearing. (iii) In bearing and gears that work at high temperatures. (iv) When it is desirable to lessen the attention that a bearing require. (v). To minimize the dry start wear if the machine has frequent start and stop. The answers such as 'cheaper' and 'easily available' from one of the candidates who scored a zero mark shows that, the candidates lacked adequate knowledge on the applications of various lubricants. Extract 10 is a sample of a poor response.

Extract 10


10 i) It has high boiling point
ii) It is a bad conductor of heat and electricity
iii) It has no impurities

Extract 10 shows that the candidate mentioned the properties of oil instead of the factors of choosing grease and not oil for a particular application.

The candidates who scored from 1 to 2, marks some were able to state one factor while others managed to state two factors out of the three. These candidates had inadequate knowledge on the lubricants topic.

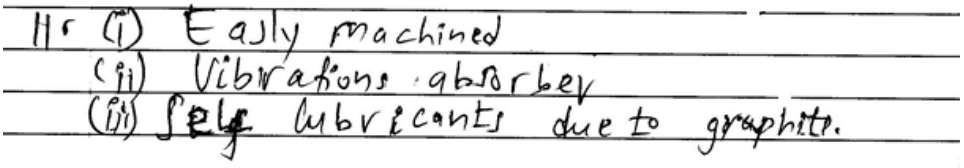
2.2.10 Question 11: Production of Engineering Materials

The candidates were required to give three reasons of why cast iron is extensively used in industries for manufacturing components and machine parts.

The analysis shows that, a total of 249 candidates (88%) attempted this question of which, 32.9 percent scored from 2 to 3 marks, 27.3 percent scored 1 mark and 39.8 percent scored 0 mark. Furthermore, 11.9 percent omitted this question. The general performance of the candidates in this question is good as the percentage of the candidates who scored average marks and above is 60.2.

The candidates who performed well in this question scored from 2 to 3 marks. Some of these were able to give two reasons and others gave three reasons of why cast iron is extensively used in industrial for manufacturing components and machine parts. The candidates exhibited good knowledge on the properties and practical applications of cast iron. Extract 11.1 shows a good response from a candidate who performed well in this question.

Extract 11.1



Extract 11.1 shows that the candidate gave the reasons of extensive use of cast iron in manufacture of machine components.

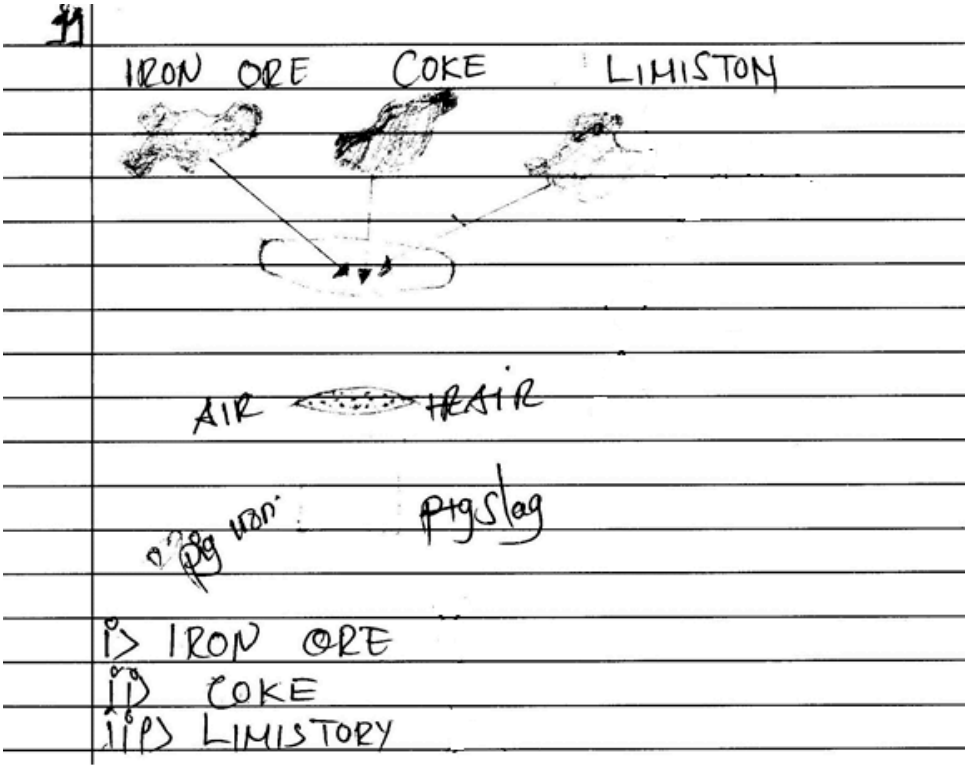
The candidates who scored 1 mark gave one reason and failed to give the other two. These candidates had inadequate knowledge on the properties of cast iron which makes it suitable in manufacturing processes.

Further analysis shows that, the candidates who scored a zero mark, did not manage to give three reasons of the extensive use of cast iron in

manufacturing industries. One of the candidate gave the reason of extensive use of cast iron as (i) 'it can resist its hardness constantly' (ii) 'it contains iron which has been heated to become tough', (iii) 'it contains high alloying elements' while another candidate gave the reasons as (i) 'it if ductile' (ii) 'it is easy to clean' (iii) 'it is resistance to heat attack.' All these answers were not correct.

However, few candidates had misconception in the question such that they explained the process of obtaining cast iron from the furnace instead of enumerating the reasons of why cast iron is extensively used in industries for manufacturing components as depicted in the Extract 11.2.

Extract 11.2



In Extract 11.2, the candidate drew sketches to show the process of producing cast iron and mentioned the three raw materials instead of giving the reasons for extensive use of cast iron in industries.

2.3 Section C

2.3.1 Question 12: Heat Treatment

This question had five parts namely (a), (b), (c), (d) and (e). The question required the candidates to:

(a) Describe how to perform the following:
  (i) Liquid carburizing
  (ii) Gas carburizing
(b) State the purpose of tempering a piece of steel.
(c) Mention four factors that will affect the temperature at which a piece of steel is tempered?
(d) Explain what will happen to steel if tempering time is
  (i) too long
  (ii) too short.
(e) Outline four reasons for hardening of steel component.

This was an optional question which was attempted by 122 candidates (43.1%) out of 283 candidates. Out of them, 34.4 percent of the candidates scored 0 mark, 47.6 percent scored from 0.5 to 5 marks while 9.8 percent of the candidates scored from 6 to 8.5 marks and 8.2 percent of the candidates scored from 9 to 14 marks. This question had poor performance because most of the candidates (82%) scored below the average marks.

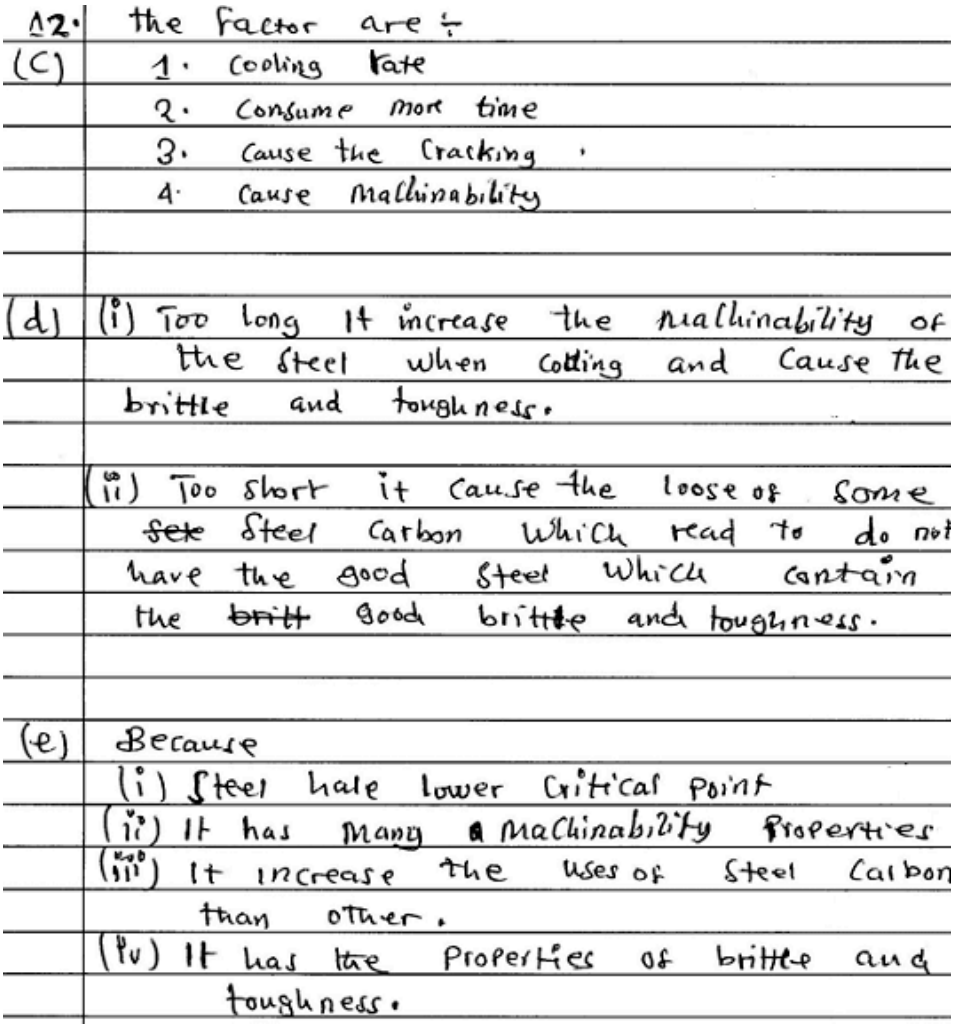
The candidates who scored a zero mark failed to comprehend the question hence could not correctly described how liquid carburizing and gas carburizing processes are performed. They failed also to provide correct answers to other parts of the question. Some candidates gave definitions which were not asked, for example one candidate instead of enumerating the factors considered that will affect the choice of tempering temperature, he/she defined the term ‘tempering.’ This was due to lack of knowledge and skills on heat treatment as illustrated in Extract 12.1.

Extract 12.1

12. (a) (i) Liquid Carburizing is the Process of Pre Pare the ~~Car~~ accetelyne gas by Combine ~~the~~ Carbon and oxygen gas and then Condensation from gas to liquid.

(ii) Gas Carburizing is the Process of Prepare ~~the~~ gas of accetylene gas which can be prepared ~~by~~ Combine the Carbon and oxygen gas to form the gas carburizing. ~~It~~ Which have more accetelyne than oxygen gas.

(b) The ~~Pour~~Purpose of tempering a piece of Steel is The Process of heating a metal steel low ~~above~~ the Critical Point and then quenching it to the oil and air to the medium. the ~~Pourpe~~ The Purpose is to ~~end~~ Increase the Machinability of the Steel.

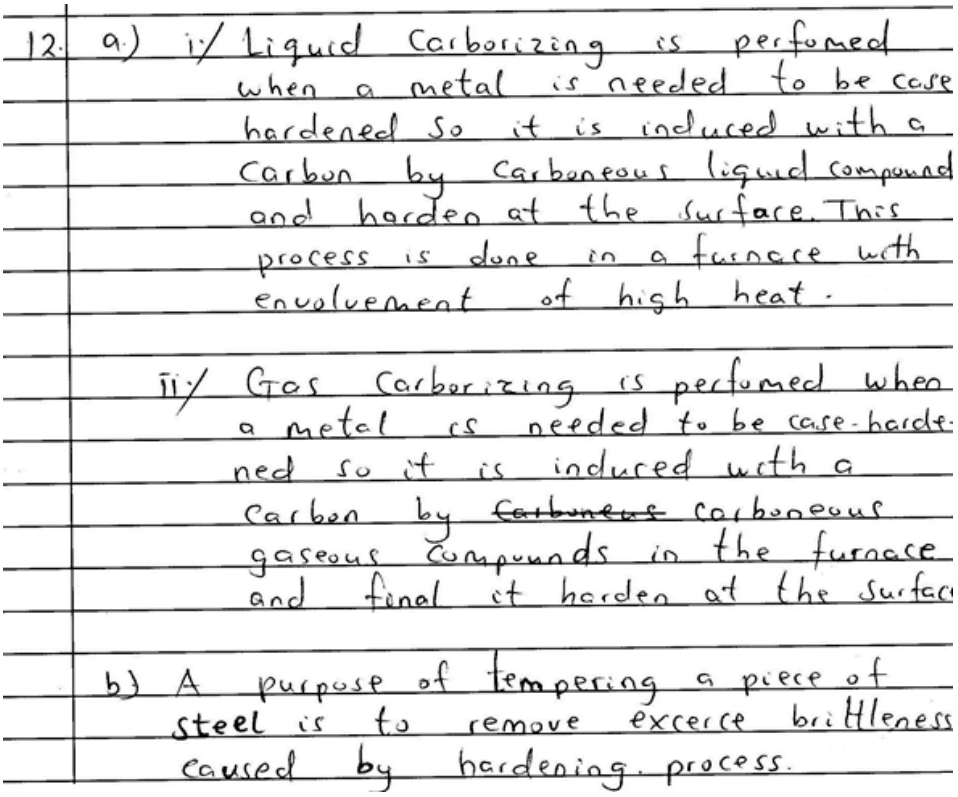


In Extract 12.1, the candidate failed to respond correctly to the question. For example in part (a) the candidate related the carburizing process which is a heat treatment process with liquefaction of gases.

The candidates who scored low marks (0.5 to 5) marks were able to provide correct answers to few parts of the question and left other parts unanswered. They lacked the required knowledge on most of the concepts in the question items. Those who scored average marks (6 to 8.5), some attempted few parts while others attempted all parts but got correct answers in few parts of the question. These candidates also had insufficient knowledge on the Heat Treatment topic.

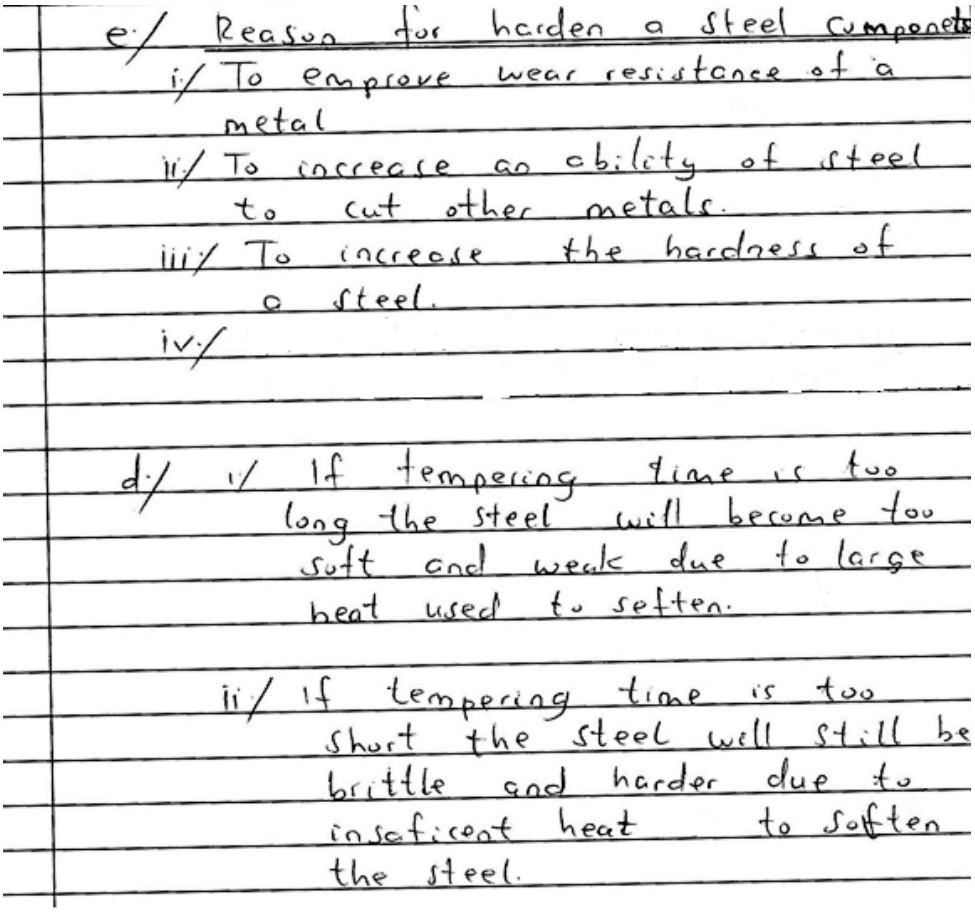
Moreover, the analysis indicates that, the candidates who scored from 9 to 14 marks understood the requirement of the question, therefore applied their knowledge and skills on the topic of heat treatment to provide correct response to most parts of the question. Extract 12.2 shows a good response from one of the candidates.

Extract 12.2


12. a.) i.) Liquid Carborizing is perfomed when a metal is needed to be case hardened so it is induced with a carbon by carboneous liquid compound and harden at the surface. This process is done in a furnace with envolvement of high heat.

ii.) Gas Carborizing is perfomed when a metal is needed to be case-harde-ned so it is induced with a carbon by ~~carboneus~~ carboneous gaseous compounds in the furnace and final it harden at the surfac

b) A purpose of tempering a piece of steel is to remove excerce brittleness caused by hardening process.



Extract 12.2 shows that the candidate described correctly the carburizing process and stated the purpose of tempering.

2.3.2 Question 13: Limits and Fits

The question had three parts namely: (a), (b) and (c). In part (a) the candidates were given data and were required to calculate the upper and lower limits of hole and shaft, the tolerances of both hole and shaft and to state the class of fit. In part (b) the candidates were required to name the systems of tolerance limits. In part (c) the candidates were given the hole and shaft dimensions and required to calculate upper and lower limit of hole and shaft diameter, hole and shaft tolerance, maximum clearance and minimum clearance.

The analysis of candidates' performance in the question shows that, 234 candidates (82.7%) attempted this question of which, 36.3 percent scored from 9 to 20 marks, 26.5 percent scored from 6 to 8 marks and 37.2 percent

scored from 0 to 5 marks, The performance of this question was good as indicated in Figure 4.

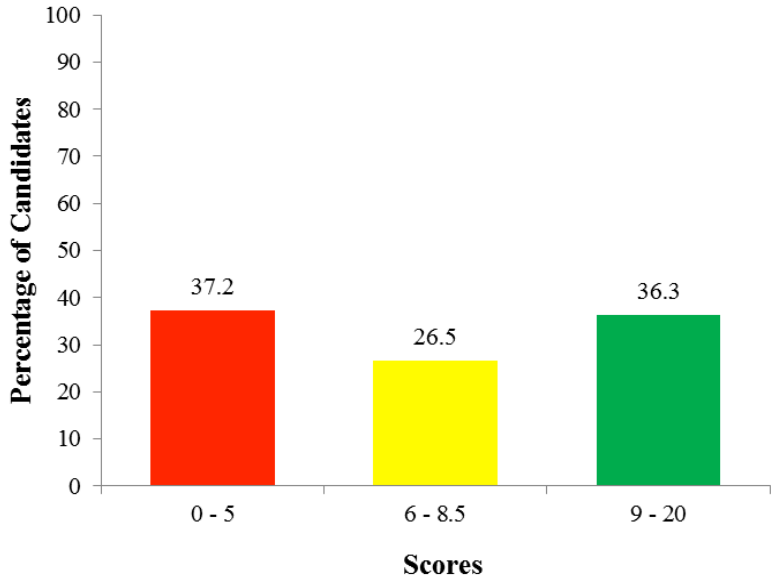


Figure 4: The performance of candidates in question 13 in percentages.

The analysis shows that, the candidates who performed well in this question were able to interpret the data, identify the formulae and calculate the quantities or dimensions required by the question. These candidates had sufficient knowledge and skills on how to manipulate some calculations in the topic of Limits and Fits. Extract 13.1 portrays a sample of a good response from one of the candidates.

Extract 13.1

13 (a) Nominal size = 40mm

$H_8 = \frac{39}{1000}, \frac{0}{1000}$ $H_8 = 0.039$ 0.000

$f_7 = \frac{-25}{1000}, \frac{-50}{1000}$ $f_7 = -0.025$ -0.050

(i) Upper limit of the hole

Nominal size = 40mm + 0.039

40.039mm

The upper limit of the hole is 40.039mm

Lower limit of the hole.

Nominal size = 40mm

Lower limit = 40mm + 0.000mm

Lower limit of the hole is 40.000mm

(ii) Upper limit of the shaft

Nominal size = 40mm

Upper limit = 40mm − 0.025mm

The upper limit of the shaft is 39.975mm

Lower limit of the shaft

Nominal size 40mm

lower limit = 40mm − 0.050

lower limit of the shaft is 39.950mm

(iii) Hole tolerance

Hole tolerance = upper limit of hole − lower limit of hole

tolerance = 40.039mm − 40.000mm

The Tolerance of the hole is 0.039mm

3a(iii) Tolerance of shaft

Tolerance = upper limit of shaft − lower limit of shaft

Tolerance of shaft = 39.975 − 39.950

Tolerance of the shaft is 0.025 mm

(iv) Class of fit

Maximum allowance = large hole − small shaft

Max allowance = 40.039 mm − 39.950 mm

The maximum allowance is 0.089.

Minimum allowance = small hole − large shaft

Minimum allowance = 40.000 mm − 39.975

Minimum allowance is 0.025

The class of the fit is clearance fit since both allowance are positive

(b) - Bilateral tolerance

- Unilateral tolerance

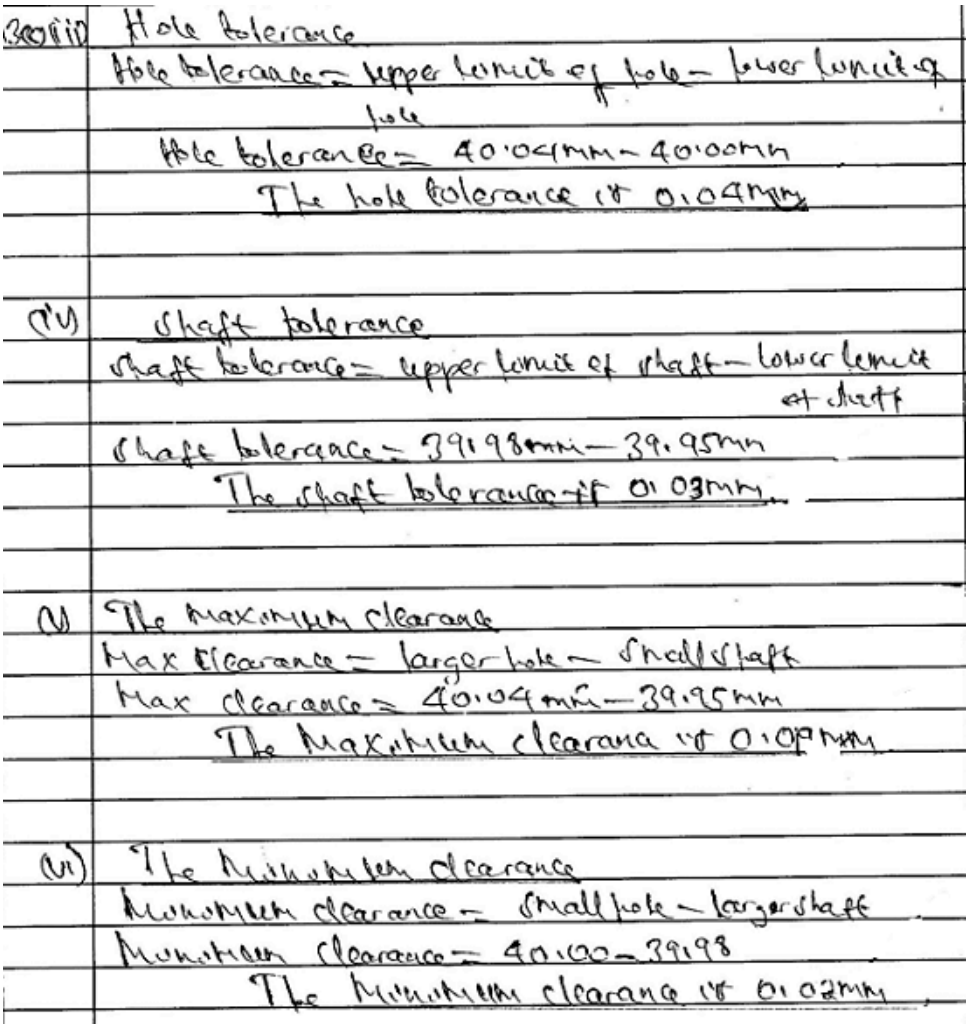
(c) (i) Upper limit of the hole diameter and lower limit of the upper limit of the hole diameter is 40.04 mm

The lower limit of the hole diameter is 40.00 mm

(ii) Upper and lower limit of shaft diameter

Upper limit of shaft diameter is 39.98 mm

lower limit of shaft diameter is 39.95 mm

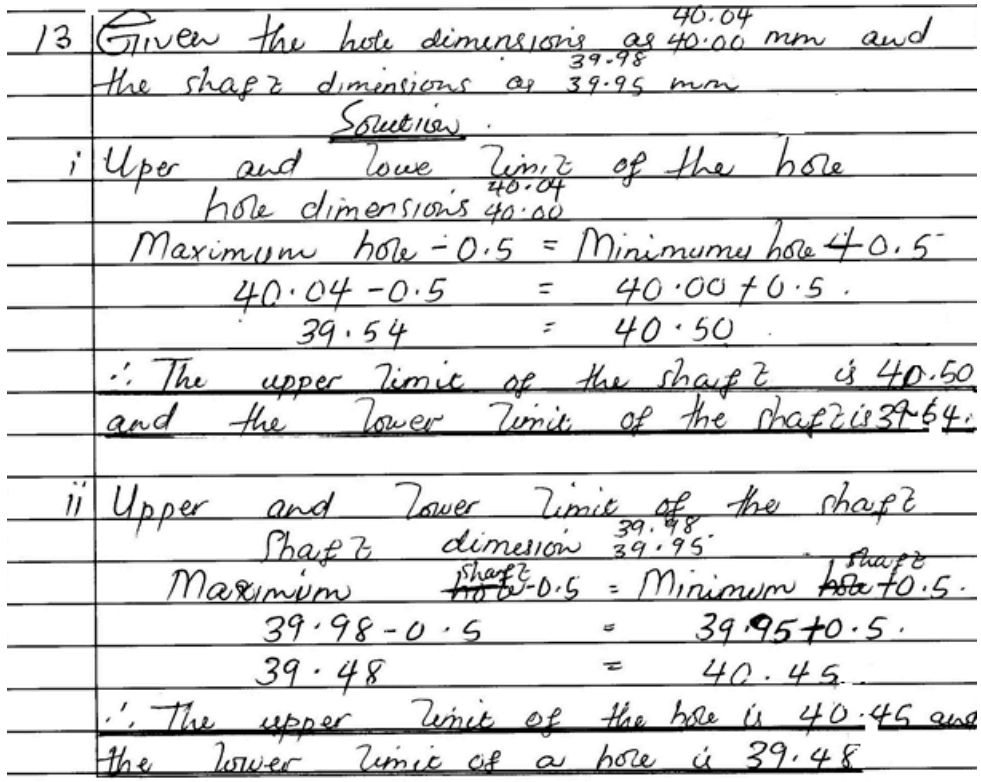


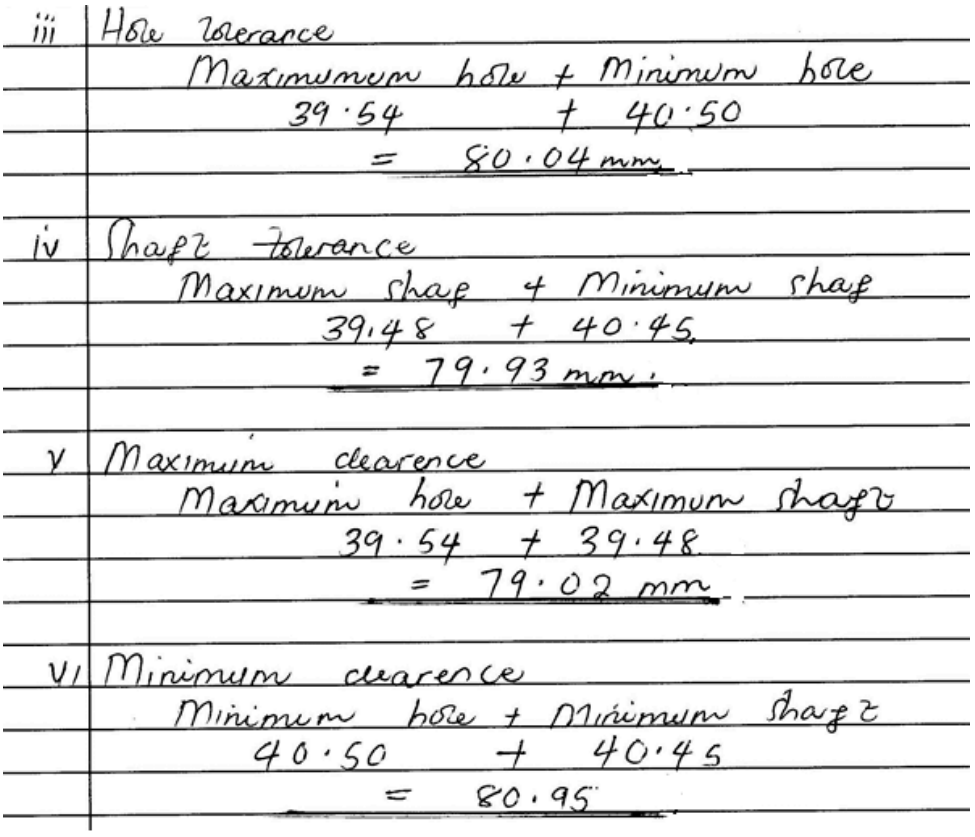
In Extract 13.1, the candidate interpreted correctly the data and symbols given hence, calculated the required dimensions and got the correct answers.

Further analysis shows that, the candidates who scored from 1 to 5 marks interpreted correctly the data given, but some had problem of interchanging the formula. Other candidates managed to apply the correct formula but failed to substitute the required values thus obtained wrong answers in many parts. These candidates lacked sufficient computational skills. Furthermore, the candidates who scored from 6 to 8.5 identified the correct formula, substituted the values correctly, calculate and obtain the correct answer in some parts but failed in others.

However, the candidates who scored 0 mark failed to interpret the given data and to translate the symbols used in hole and shaft systems of fits. They could not recall the formulae and substitute the values to calculate the required dimensions. These candidates lacked knowledge and skills in the topic of Limits and Fits. Extract 13.2 portrays a sample of a poor response from a script of a candidate.

Extract 13.2





Extract 13.2 shows that the candidate used wrong formula to calculate the required dimensions hence, obtained incorrect answers.

2.3.3 Question 14: Production of Engineering Materials

This question required the candidates to:

(a) List down five chemical elements found in plain carbon steel.

(b) Identify five properties that occur to steel when addition of alloying elements is done.

(c) Name three categories of plain carbon steel and their ranges of carbon content in percentages.

(d) Define the terms:
   (i) Casting of metals.
   (ii) Rolling of metals.

(e) (i) Outline four types of iron ores found in the earth`s crust.
   (ii) Explain two methods commonly used in extracting (mining of iron ores) in the earth`s crust.

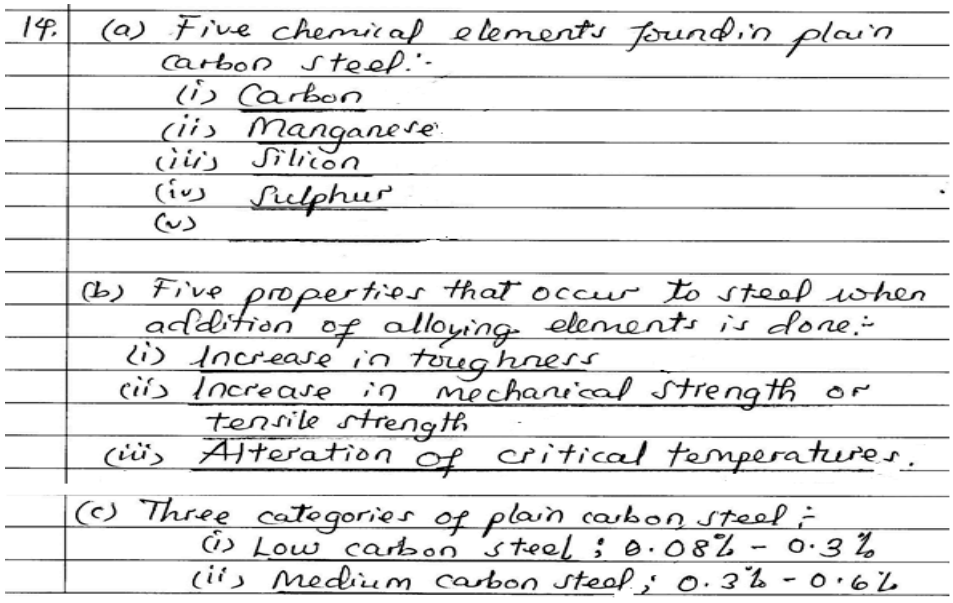
The data analysis shows that a total of 229 candidates (80.9%), attempted the question. It was noted that, 23.6 percent scored from 9 to 17 marks, 22.3 percent scored from 6 to 8.5 marks and 54.1 percent scored from 0 to 5.5 marks whereas 54 candidates did not attempt the question. Table 3 shows that the performance of the candidates in this question was good because, the percentage of candidates who performed average and above was 45.95 percent.

Table 3: The performance of candidates in question 14

Scores	Candidates		Remarks
	Number	Percentage (%)	
0 – 5.5	124	54.1	Weak
6 – 8.5	51	22.3	Average
9 - 17	54	23.6	Good
Total	**229**	**100.0**	

The candidates who scored from 10 to 17 marks responded correctly to most parts of the question. They were able to list the chemical elements, name the categories of plain carbon steel, outline the types of iron ores and their methods of mining but failed to complete few items in some parts of the question as shown in extract 14.1.

Extract 14.1


14. (a) Five chemical elements found in plain carbon steel:-
(i) Carbon
(ii) Manganese
(iii) Silicon
(iv) Sulphur
(v)

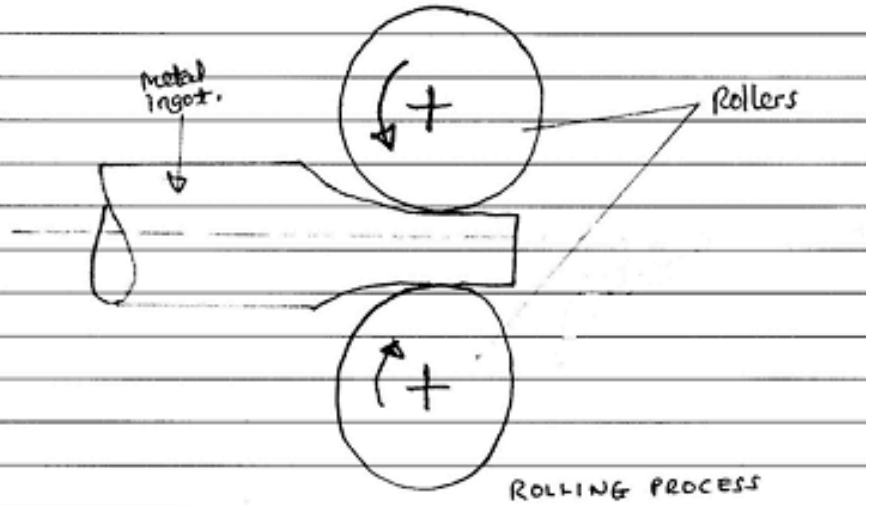
(b) Five properties that occur to steel when addition of alloying elements is done:-
(i) Increase in toughness
(ii) Increase in mechanical strength or tensile strength
(iii) Alteration of critical temperatures.

(c) Three categories of plain carbon steel:-
(i) Low carbon steel; 0.08% - 0.3%
(ii) Medium carbon steel; 0.3% - 0.6%

14 (c) (iii) High carbon steel (Tool steel) ; 0·6% - 1·5%

(d) (i) Casting of metals is the process of pouring a molten metal or alloy in the special prepared cavity called MOULD so as to obtain different shapes of articles.

(ii) Rolling of metals is the process of forming different shapes of material by reducing the cross section of the metal ingots through rollers.



(e) (i) Four types of iron ores found in the earth's crust

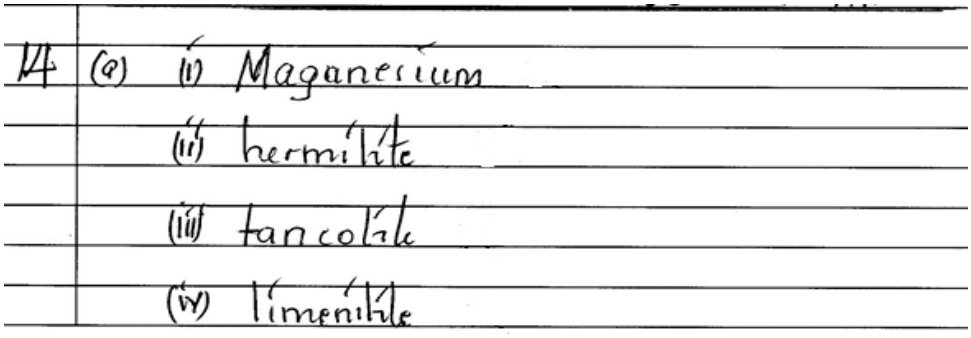
Hematite ; 70% of iron (Fe_2O_3)
Magnetite ; 73% of iron (Fe_3O_4)
Limonite ; 60 - 62% of iron ($Fe_2O_3 \cdot 2H_2O$)
Siderite ; 40% of iron ($FeCO_3$).

In Extract 14.1, the candidates named the categories of plain carbon steel and defined the terms 'casting' and 'rolling' of metals. Similarly he /she listed four chemical elements and three properties that occur to steel instead of five in each. Furthermore he/she could not explain two methods of extracting iron ores.

The candidates who scored from 6 to 8 marks provided correct answers to two or more parts of the question. Those who scored from 0.5 to 5.5 marks were able to provide correct answers to few parts of the question. These candidates had insufficient knowledge on the subject matter.

Moreover, the analysis of candidates' performance shows that the candidates who scored 0 mark could not give correct answer to all parts of the question. These candidates failed to interpret the question; for example, one candidate wrote three heat treatment processes; 'gas carburizing', 'liquid carburizing' and 'flame hardening' instead of three categories of carbon steel which are low carbon steel (0.02% – 0.3% carbon), medium carbon steel (0.31% to 0.60 carbon) and high carbon steel (0.61% - 1.5% carbon) as required by the question. These candidates exhibited lack of adequate knowledge on the topic of Production of Engineering Materials. Extract 14.2 is a sample response from a candidate who failed to meet the question demand.

Extract 14.2



(v) hexnitride

(b) (i) Brass alloy

(ii) Bronze alloy

(iii) hard alloy

(iv) Braze alloy

(v) Steel alloy.

(c) (i) Staright oil: %

(ii) Soluble oil: %

(iii) Rainfall oil: %

(d) (i) casting of metals. is an cast iron in the non-ferrous metal

(ii) Rolling of metal - is an drill chuck in the ~~non~~-ferrous metal

(e) (i) cast iron

(ii) pca iron

(iii) wrong iron

(iv) lead

Extract 14.2 shows that, the candidate failed to comprehend to the question demand thus, wrote names of alloys instead of identifying the properties of steel after addition of alloying elements. The candidate also named the types of oil instead of mentioning the categories of plain carbon steel. He/she as well failed to define the terms casting and rolling processes.

2.3.4 Question 15: Heat Treatment

The question required the candidates to sketch a heating and cooling curve and explain the behavior changes that take place when steel is heated to 900˚C and then left to cool. The candidates were required to explain this behavior changes by pointing out the changes that goes on along the curve during heating/cooling of steel specimen with respect to time and temperature range.

The question was opted by 119 candidates (42%) of which, 36.1 percent scored from 9 to 17.5 marks, 13.5 percent scored from 6 to 8 marks and 16.8 percent scored from 0.5 to 5 marks whereas 33.6 percent scored a zero mark. According to this data, the question was performed well as 49.6 percent scored average and above. Figure 5 is an illustration.

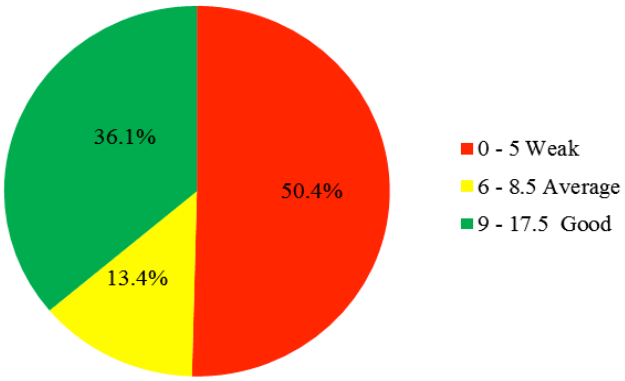


Figure 5: The performance of candidates in question 15

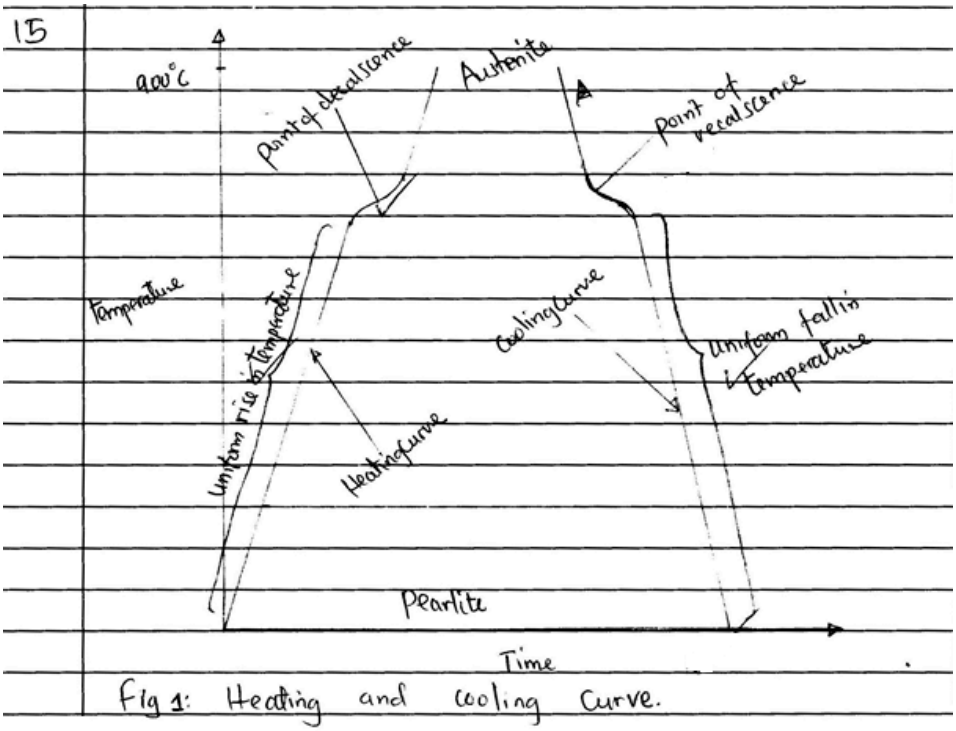
There were candidates who scored good marks from 9 to 17.5. These candidates correctly comprehended the question demand thus, they managed to draw the curve, locate important points or intervals and give explanations of behavior changes as shown in extract 15.1.

Extract 15.1

5. Heating and cooling curve is a diagram which contain infurmations about the changes which takes plaw when a plain carbon steel is heated and cooled.

The condition in which a plain carbon steel exist before heating process is called pearlite. As the heating process proceeds a pearlite starts to change into the mixture of ferrite and pearlite particles, it continue to undergo changes (melt) into a stage of the mixture of ferrite and austinite, this stage occur when a lower critical temperature is reached. when a critical temperature is reached about 90% a pearlite changes completely into austinite state. At the point at which a pearlite change completely into a austinite stage is called a point of decalscence. The heated steel exist in austenite state until a cooling process is applied on it.

On cooling process, the austenite changes to stage of the mixture of the cementite and austenite, this occur when a lower critical temperature is reached. As a cooling process proceeds the mixture changes into a stage of a mixture of pearlite and ferrite and finally it changes completely into pearlite state. At a point at which austenite is changed completely into a pearlite stage is called a point of recalscence. These are changes which takes place when a plain carbon steel is heated to 900°C and left to cool. See the heating and cooling curve below.

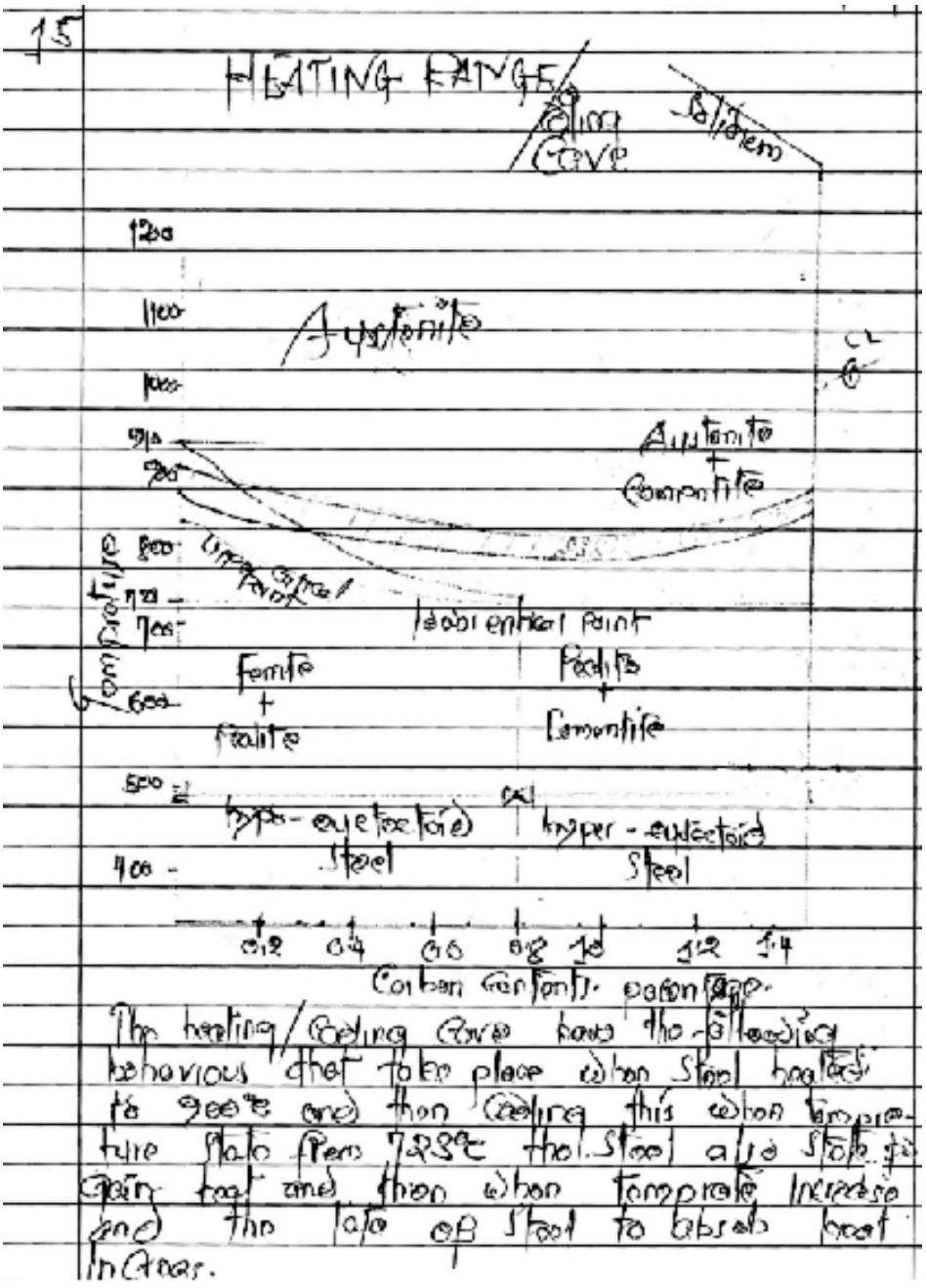


In Extract 15.1, the candidate explained the behavior changes, drew correctly the heating and cooling curve and indicated the parts of a curve.

The candidates who scored low marks (from 0.5 to 5) some were able to mention or explain few steps while others drew incomplete sketches without explanations. Further analysis shows that, the candidates who scored average marks (from 6 to 8) were able to draw the complete curve, but some could not label all parts while others interchanged the positions between decalescence and recalescence points.

However, the candidates who scored a zero mark failed to draw the correct sketch of the heating/cooling curve. They could not remember important points such as austenite, recalescence and decalescence where normally the behavior changes occur with respect to temperature and time. Some interchanged it with the iron and carbon thermal equilibrium diagram as shown in Extract 15.2.

Extract 15.2



In Extract 15.2, the candidate drew an iron and carbon thermal equilibrium of steel instead of a heating and cooling curve of steel.

2.3.5 Question 16: Production of Engineering Materials and Lubricants

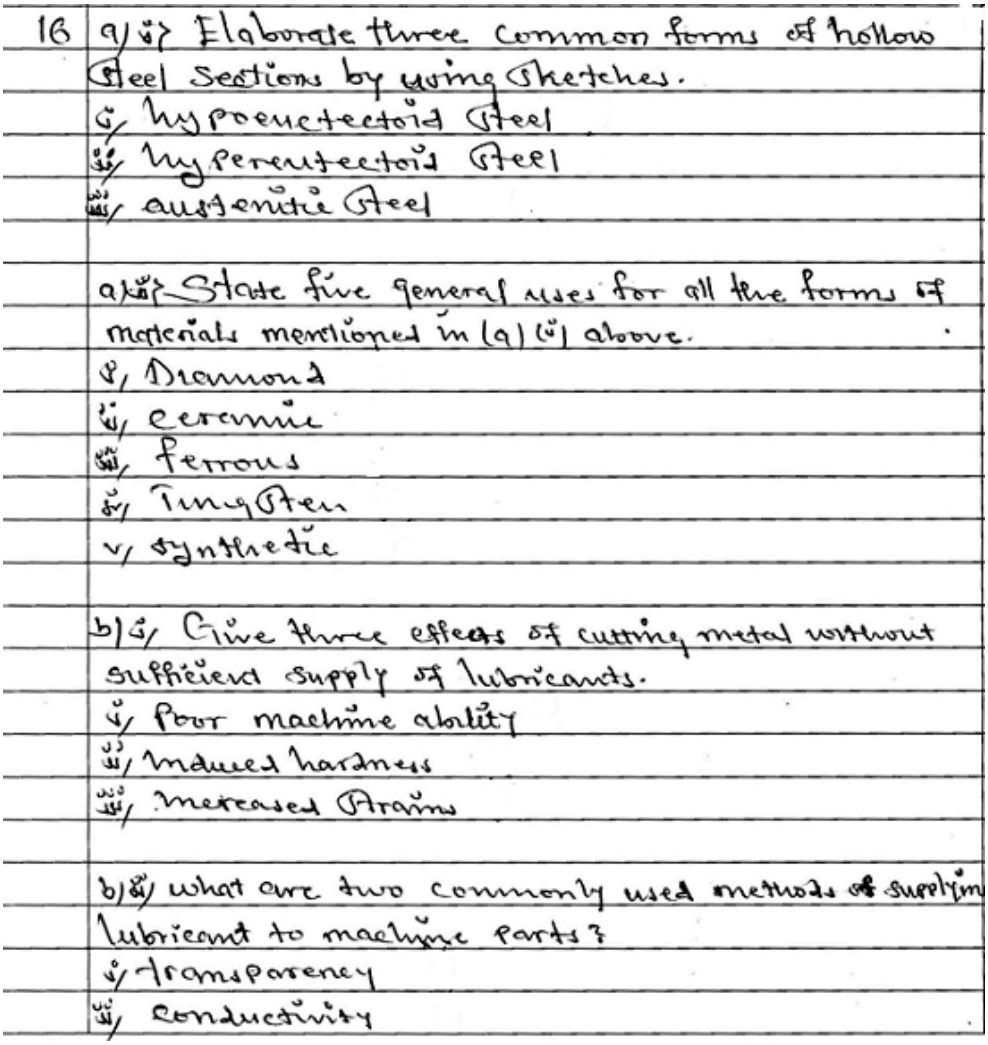
The question had parts (a) and (b). In part (a) (i), the candidates were required to elaborate by using sketches three common forms of hollow steel sections and in (ii) to state five general uses for all the forms of material mentioned in (a) (i). In part (b) candidates were required to: (i) Give three effects of cutting metal without sufficient supply of lubricant and (ii) Write the two commonly used methods of supplying lubricant to machine parts.

The question was opted by 87 candidates (30.7%) of which, 21.8 percent scored 0 mark, 55.2 percent scored from 1 to 5, 16.1 percent scored from 6 to 8 marks and 6.9 percent scored from 11 to 13 marks. According to these data this question was poorly performed.

Among the candidates who scored low marks were those who scored 0 mark and those who scored from 1 to 5 marks. Those who scored from 1 to 5 marks some answered correctly few items in either part (a) or (b), or in both parts while others just mentioned three common forms of hollow sections but could not draw sketches and enumerate all five uses for the forms of materials.

The candidates who scored a zero mark failed to provide correct response to the question. They failed to elaborate common forms of hollow steel sections, its uses and the effects of cutting metal without lubricant. Some mentioned the types of lubricants instead of the methods of supplying lubricants to machine parts as required in part (b)(ii) of the question. These candidates might be lacking knowledge on Production of Engineering Materials and Lubrication. Extract 16.1 shows a poor response.

Extract 16.1


16 a) (i) Elaborate three common forms of hollow steel sections by using sketches.
(i) hypoeutectoid steel
(ii) hypereutectoid steel
(iii) austenitic steel

a) (ii) State five general uses for all the forms of materials mentioned in (a) (i) above.
(i) Diamond
(ii) ceramic
(iii) ferrous
(iv) Tungsten
v) synthetic

b) (i) Give three effects of cutting metal without sufficient supply of lubricants.
(i) Poor machine ability
(ii) Induced hardness
(iii) Increased Strains

b) (ii) what are two commonly used methods of supplying lubricant to machine parts?
(i) Transparency
(ii) Conductivity

Extract 16.1 shows a response of a candidate who was not able to state the requirements of the common forms of hollow steel and uses as well as to state the effects of cutting metal without supply of lubricants.

A number of candidates (23%) who scored from 6 to 13 marks provided relevant response to some parts of the question. Some elaborated the three common forms of hollow steel sections and stated their uses but could not give the effects of cutting metal without sufficient supply of lubricant. Other candidates gave three effect of insufficient lubricant during metal cutting but failed to mention the methods of supplying lubricant to machine parts. Extract 16.2 is a sample response from a candidate who relatively performed well in this question.

Extract 16.2

16. (b)

(i) Wearing of the machine. When the two moving parts are moving relative to each other they cause a friction force between two parts that leads to wear of machine parts if there is no lubricant used to avoid friction.

(a)

(i) The three common forms of hollow steel sections are as follows.

(a) Tabular (Tubed) round hollow steels.

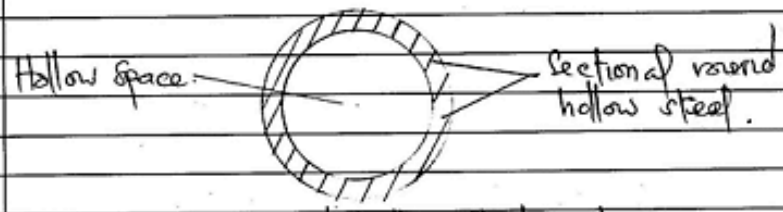


Diagram: Round hollow steel section.

(b) Rectangular hollow section steels.

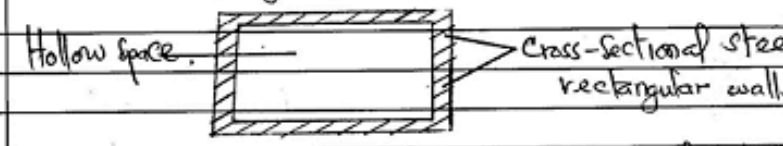
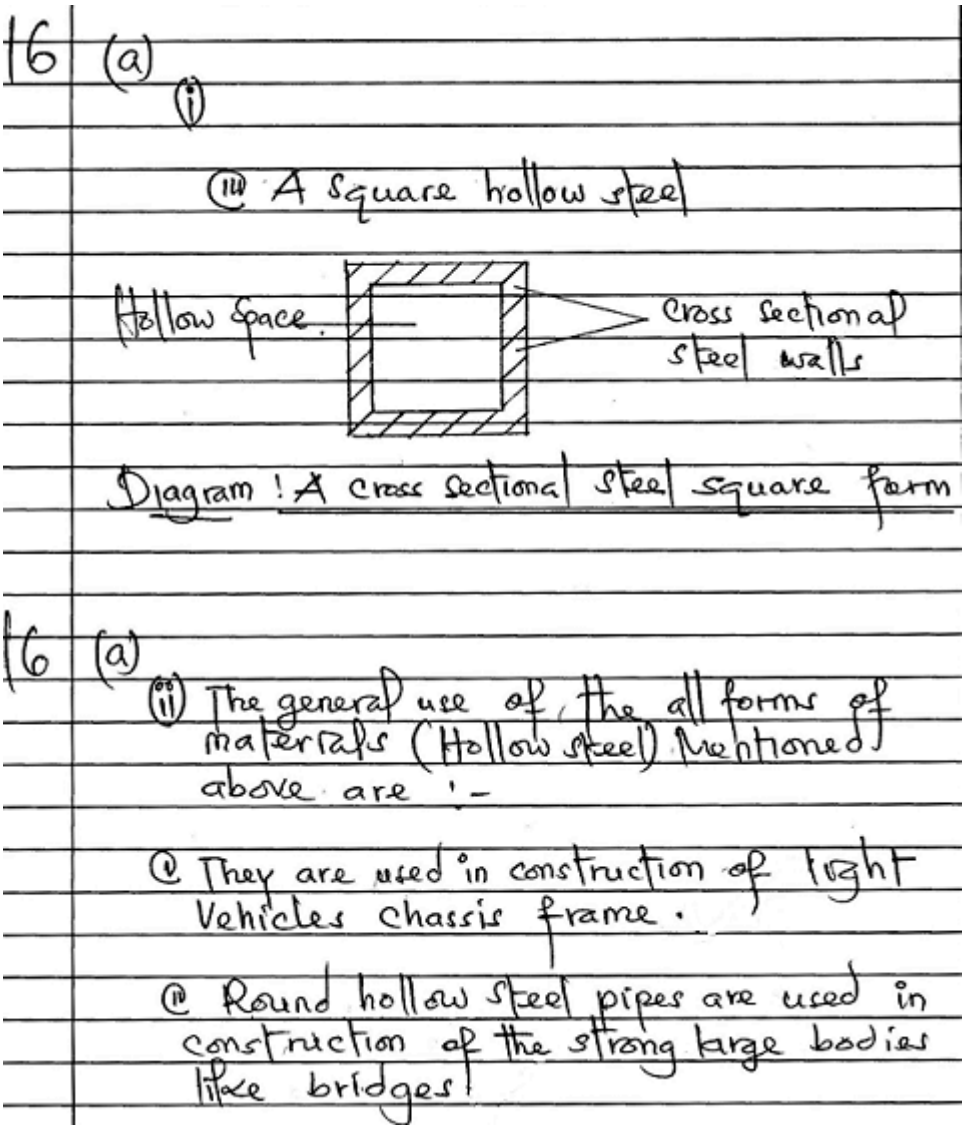


Diagram: A sectional View of Rectangular hollow steel.



In Extract 16.2, the candidate elaborate the common forms of hollow of steel using sketches, stated two of their uses and gave the effects of cutting metals without sufficient lubricant.

3.0 THE CANDIDATES PERFORMANCE IN EACH TOPIC

To obtain the performance of candidates topic wise, the average percentages have been calculated for the topics which repeated in more than one (1) question. The analysis of the candidates performance topic wise indicate that, the candidates performed well in the topics of Limits and Fits (61.7%) and Lubricants (50.4%). The candidates' good performance was attributed by their good knowledge and correct interpretation of the

questions in these topics. It was also revealed in the analysis that, the topics which were averagely performed are Production of Engineering Materials (39.9%), Identification of Metals (35.6%) and Heat Treatment (33.9%). The candidates exhibited inadequate knowledge and lacked the required skills when answering some of the questions in these topics. Moreover, comparison of candidates' performance per topic between 2014 and 2015 has been made taking into consideration that, in 2014 the ranges of weak (red colour), average (yellow colour) and good performance (green colour) in percentages were 0-29, 30 – 49 and 50 to 100 respectively,(see appendix B).

4.0 CONCLUSION AND RECOMMENDATIONS

4.1 Conclusion

In general, the performance of the candidates in this examination (CSEE) in Workshop Technology was good because in most of the questions (10 questions) the candidates scored above average and performed averagely in one question out of sixteen questions, (see appendix A). The analysis of the candidates' performance has been done on the questions which were performed well, those with average performance and those which were performed poorly. A question was categorized as weakly performed, average or good performed if the percentage of candidates who scored 30 percent or above of the marks in a particular question was 0-29, 30-44 and 45-100% respectively.

Factors which affected the candidate's performance and made them fail to score good marks included candidate's insufficient knowledge on the topics tested. This may have been contributed by failure of candidates to make revision for all the topics covered, lack of candidates' seriousness in technical subjects and scarcity of technical subjects teachers in Technical Secondary schools. Moreover some of the candidates could have performed better but due to English language barriers their performance was affected.

4.2 Recommendations

Based on the observation made through the analysis of the candidates' performance, the following points are put forward in order to improve the performance in 092- Workshop Technology subject.

(a) Students should be advised to read the question(s) carefully so as to identify the requirement of the question(s) before attempting.

(b) Candidates should be encouraged to improve their ability in reading and writing in English Language through reading English books, and involving in essay writing.

(c) Students should be encouraged to revise all topics across the syllabus in their normal study time and during preparation for examinations.

(d) Many exercises, assignments, quizzes, tests and tasks should be given to candidates during teaching and learning process so as to promote their ability in performing and understanding of the subject through learning by doing.

Appendix A

Summary of Candidates' Performance Question Wise in Workshop Technology Subject CSEE 2015.

S/N	Topic	Question Number	Percentage of Candidates Who Scored 30% or More	Remarks
1	Cutting lubricants	2	81.8	Good
2	Engineering Materials Production of Engineering Materials Limits and Fits (Various Topics)	1	73.5	Good
3	Limits and Fits	9	68	Good
4	Identification of metals	5	67.5	Good
5	Limits and Fits	13	62.8	Good
6	Production of Engineering Materials	11	60.2	Good
7	Limits and Fits	7	54.4	Good
8	Heat Treatment	3	50.7	Good
9	Heat Treatment	15	49.6	Good
10	Production of Engineering Materials	14	45.9	Good
11	Production of Engineering Materials	6	30.6	Average
12	Engineering Materials and Lubricants	16	23	Weak
13	Lubricants	10	19.8	Weak
14	Heat Treatment	12	18	Weak
15	Heat Treatment	4	17.2	Weak
16	Identification of Metals	8	3.7	Weak

Appendix B

Summary of Candidates' Performance Topic Wise in Workshop Technology Subject CSEE 2015.

S/N	Topic	2014			2015		
		Number of Questions	Percentage of Candidates Who Scored 30% or More	Remarks	Number of Questions	Percentage of Candidates Who Scored 30% or More	Remarks
1	Multiple Choice Question (Various Topics)	1	67	Good	1	73.5	Good
2	Properties of Metals	1	63.7	Good	-	-	-
2	Limits and Fits	2	38	Average	3	61.7	Good
3	Lubricants	2	22.9	Weak	2	50.8	Good
4	Production of Engineering Materials	5	32.6	Average	4	39.9	Average
5	Identification of Metals	-	-	-	2	35.6	Average
6	Heat Treatment	4	34.4	Average	4	33.9	Average
8	Hand tools	1	28.4	Weak	-	-	-