



THE UNITED REPUBLIC OF TANZANIA
MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY
NATIONAL EXAMINATIONS COUNCIL OF TANZANIA



**STUDENTS' ITEMS RESPONSE ANALYSIS
REPORT ON THE FORM TWO NATIONAL
ASSESSMENT (FTNA), 2024**

MECHANICAL ENGINEERING



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090 MECHANICAL ENGINEERING

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FOREWORD

This report presents Students' Items Response Analysis (SIRA) on Form Two National Assessment in Mechanical Engineering subject which was conducted in 2024. The report aims to provide comprehensive feedback to educational stakeholders on students' performance in the Mechanical Engineering subject.

The Form Two National Assessment (FTNA) is a formative evaluation which intends to monitor students' learning and provide feedback that teachers, students and other educational stakeholders can use to improve teaching and learning processes. The report reveals that students performed well in the topic of Workshop Management and Safety Rules, Workshop Tools and Equipment, Engineering Materials, and Metalwork Technology. However, the students had average performance in the topics of Metalwork Technology and Engineering Materials. The details of the students' performance are clearly presented in the Appendix.

The analysis indicates that the average performance of students was due to difficulties in understanding the question requirements, as well as limited knowledge and skills in certain tested subject areas. Limited proficiency in English language also contributed to the observed performance outcomes. Conversely, students' strong performance was attributed to their ability to identify question requirements, sufficient subject knowledge, and strong English language proficiency. The justification of the poor or good performance is well demonstrated in this report using extracts.

The Council believes that this report will guide educational stakeholders in improving teaching and learning processes to achieve desired instructional objectives. The Council appreciates the efforts made by all who in one way or another contributed to the preparation of this report.



Dr. Said A. Mohamed
EXECUTIVE SECRETARY

1.0 INTRODUCTION

This report evaluates the students' performance on the Form Two National Assessment (FTNA) in Mechanical Engineering subject, which was conducted in 2024. The assessment evaluated the competencies attained by Form Two students as outlined in the Mechanical Engineering Secondary Education Syllabus issued in 2019.

The Mechanical Engineering assessment was divided into three sections: A, B, and C, comprising a total of 10 questions. The students were required to answer all the questions for each section. Section A and C had 15 marks each while section B had 70 marks. Question 1 consisted of ten (10) multiple choice items constructed from four topics. These topics are Workshop Tools and Equipment, Metal Work Technology, Engineering Materials and Workshop Management and Safety Rules. Each item carried one (1) mark. Question 2 consisted of five (5) matching items derived exclusively from the topic of Engineering Materials. Each item worth one (1) mark.

Section B had seven (7) short answer questions constructed from three topics, which were Workshop Management and Safety Rules, Engineering Material and Metal Work Technology. Each question carried 10 marks. Section C had one question constructed from the topic of Metal Work Technology.

The analysis indicates that the overall performance in the Mechanical Engineering in 2024 was satisfactory, with 234 (78.00%) of the students passing. The students' performance grade wise was as follows: A - 6 (2.00%), B - 35 (11.67%), C - 121 (40.33%) and D - 72 (24.00%). However, 66 (22.00%) students failed by scoring grade F. The 2024 students' performance has increased by 2.23 per cent when compared to 2023 in which 286 (75.07%) students passed.

The performance of the students in this report has been grouped into three categories which are weak, average and good. The categories are based on the percentages of students who scored weak, average and above in range of 0-29, 30-64 and 65-100 marks respectively. The students' performance is illustrated with figures and tables, where red, yellow, and green colours denote weak, average, and good performance, respectively.

2.0 ANALYSIS OF THE STUDENTS' PERFORMANCE IN EACH QUESTION

This part analyses performance of the students based on the scores obtained in each question. It covers the type of questions, topic from which the questions were extracted, competencies tested, the requirements of each question and the percentages of the students who had good, average or weak performance based on their responses in each question.

2.1 SECTION A: OBJECTIVE QUESTIONS

This section comprised of two questions carrying a total of 15 marks. Question 1 consisted of 10 multiple-choice items constructed from various topics. The topics included *Workshop Tools and Equipment*, *Engineering Materials*, *Metal Work Technology* and *Workshop Management and Safety Rules*. Each item carried one (1) mark. Question 2 included five (5) matching items from the topic of *Engineering Materials* and each item worth one (1) mark.

2.3.1 Question 1: Multiple Choice Items

This question consisted of ten multiple-choice items (i-x). The students were instructed to choose the correct answer from the given alternatives by writing its letter in the box provided.

The question was attempted by 300 (100%) students whose scores were as follows; 66 (22.00%) students scored from 0 to 2 marks, 222 (74.00%) scored from 3 to 6 marks and 12 (4.0%) scored from 7 to 10 marks. Generally, students' performance in this question was good since 165 (78.80%) students scored from 3 to 10 marks. This performance is summarized in Figure 1.

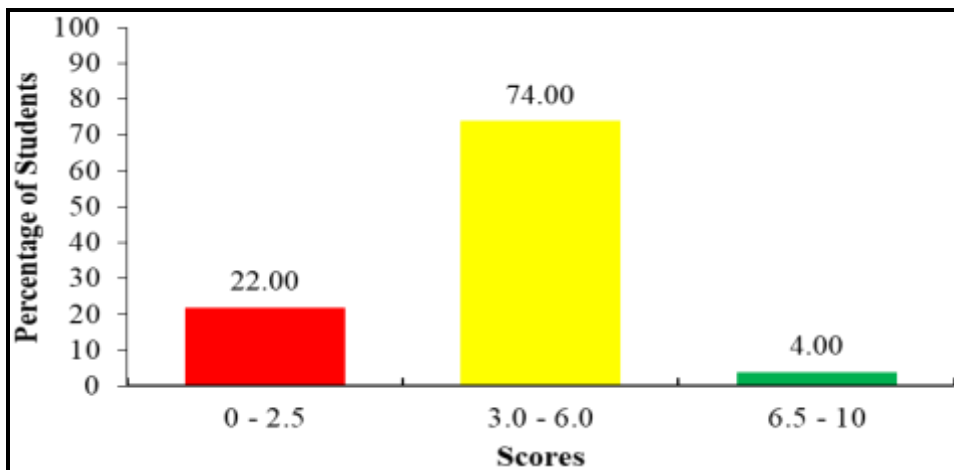


Figure 1: The Students' Performance in Question 1

Item (i) was extracted from the topic of *Workshop Tools and Equipment*. The students were tested on how to apply their knowledge to identify the letters A, K and R on grinding wheel where the grinding disc labelled 'WA36K5R17'. The question was as follows:

During the mechanical engineering practical session, the teacher provided the grinding disc labelled WA36K5R17. What does the alphabet A, K and R indicated in the disc represent?

- A Abrasive, Prefix and B Abrasive, Grain and Bond Grade
C Abrasive, Grade and Bond D Abrasive, Structure and Prefix

The correct alternative was C: *abrasive, grade, and bond*. Students correctly identified that letter 'A' represented the abrasive material used in the grinding wheel. They also understood that letter 'K' signifies the bond grade, which indicates the strength of the bond between the abrasive particles. Moreover, they were aware that letter 'R' represents the wheel structure, which refers to the distribution density of the grit in the wheel. Students who selected incorrect alternatives (A, B, and D) were confused by terms such as prefix, grain, and structure which are commonly associated with grinding wheels. They did not know that *prefix* might be a letter, which in a grinding wheel does not relate to alphabet A, K or R. Furthermore, they confused the words *Grain* and *structure* since these words are commonly employed when demonstration of grinding wheel is made.

Item (ii) was extracted from the topic of *Workshop Management and Safety Rules*. It assessed students' awareness in managing accident when occurs in

workshop. The question was:

The Form Two students were doing practical in a workshop. Suddenly an accident occurred whereby one of the students fell in the grinding machine. In such incidence who is the responsible person to be notified about an accident?

- | | | | |
|----------|---------------------------------|----------|-----------------------------|
| <i>A</i> | <i>The immediate supervisor</i> | <i>B</i> | <i>The subject teacher</i> |
| <i>C</i> | <i>The medical doctor</i> | <i>D</i> | <i>Class representative</i> |

The correct alternative was *A, The immediate supervisor*. Only few students chose this response. These students understood that the immediate supervisor could attend any arising issue in the workshop immediately as compared to other professional. Students who selected option *B The subject teacher* misunderstood that the teacher is not the primary supervisor in the workshop, and notifying him/her might cause delays compared to informing the workshop supervisor. The student who chose *C The medical doctor* failed to understand that a doctor is a health professional who practices medicine in the hospital which might be far from the school environment.

Furthermore, some students lacked knowledge and opted incorrect alternative *D Class representative*. They did not understand that a class representative is an individual in the class who is also a participant in the workshop and may not be as knowledgeable as supervisor.

Item (iii) was set from the topic of Metal Work Technology. It assessed the students' knowledge on welding techniques. The question was:

Rightward and leftward are two techniques which can be used in joining metal process by using gas welding. Why are rightward techniques merely applied than leftward techniques?

- | | |
|----------|--|
| <i>A</i> | <i>The process is suitable for welding thin plates</i> |
| <i>B</i> | <i>The process is suitable for welding both thin plates and thick plates</i> |
| <i>C</i> | <i>The process is suitable for welding thick plates</i> |
| <i>D</i> | <i>The process is suitable for joining dissimilar metals</i> |

The correct answer was *C The process is suitable for thick plates*. The students who chose this option understood that the rightward welding has several advantages over leftward welding including faster speeds, less distortion and more cost-effective use of filler rod and gas. It is easier to achieve fusion at the weld root using this method. The student who selected

alternative *The process is suitable for welding thin plates*, appear to misunderstood the correct application of welding techniques. Rightward welding is generally not suited for thin plates, as it does not provide enough heat for deep penetration, making it less effective for thicker materials. However, students who selected the incorrect alternative *B the process is suitable for welding both thin and thick plates*, misunderstood that welding techniques are best suited for different material thicknesses. The rightward technique is typically used for thick plates as it provides more heat and penetration, while the leftward technique is more appropriate for thin plates. Students who selected the incorrect alternative *D The process is suitable for joining dissimilar metals* were unaware that joining dissimilar metals depends on factors such as filler material and flame characteristics, not the welding torch direction.

In item (iv), the students were required to give reason why a cast iron is unfit for construction of bridge, compared to steel. The item tested the students' knowledge in the application of *Engineering Materials*. The question was:

Why is cast iron unfit for construction of a bridge, compared to steel?

- A It is brittle due to presence of austenite element*
- B It is brittle due to presence of ferrite element*
- C It is brittle due to lack of ferric material*
- D It is brittle due to presence of carbon element*

The correct alternative was *D It is brittle due to presence of carbon element*. Only a few students selected this correct response. These students correctly identified that cast iron is brittle primarily because of its high carbon content. The high carbon content in cast iron leads to the formation of graphite flakes, which reduce its ductility and make it more prone to break under stress, compared to steel. Thus they understood that presence of carbon makes cast iron brittle.

Those who selected incorrect alternative *A It is brittle due to presence of austenite element* failed to understand that austenite is a phase in steel, not cast iron and this does not makes cast iron brittle. They were not aware that inclusion of carbon, especially in the form of graphite, is what leads to brittleness. Generally, the students had sufficient knowledge on material properties. For those who chose *B It is brittle due to presence of ferrite element* misinterpreted the nature of the material. They did not know that ferrite is a phase found in both iron and steel but does not directly relates to

the brittleness of cast iron. Furthermore, the students who opted for incorrect alternative *C It is brittle due to lack of ferric material*, failed to understand that brittleness of cast iron is due to its microstructure especially the graphite content.

Item (v) was set from the topic of *Workshop Tools and Equipment*. The item tested students' knowledge on proper setting of hacksaw blade to prevent jamming or blade teeth. The question was;

Which of the following is a proper setting used to prevent jamming or binding of hacksaw blade teeth?

- | | |
|-------------------|--------------------|
| <i>A Kerf set</i> | <i>B Swarf set</i> |
| <i>C Rasp set</i> | <i>D Wavy set</i> |

The correct alternative was *D Wavy set*. The students who chose the correct answer had a good understanding of the specific terms and techniques associated with tool works. They understood that the *wavy set* is the slight outward bend or angle of the teeth on a hacksaw blade designed to prevent the blade from bending or jamming while cutting. For those students who opted for *B swarf set* failed to understand that *swarf set* refers to the chips or debris produced during cutting.

On the other hand, the students who selected *C Rasp set* did not know that rasps are typically hand tools used for shaping or smoothing surfaces.

The students who opted for *A Kerf set* were not correct since kerf set, is for setting the teeth on a crosscut saw to prevent the saw from binding as it cuts through the wood.

Item (vi) was extracted from the topic of *Engineering Material*. The students were required to select the proper porous material for retaining the amount of heat on construction of iron smelting furnace. The question was:

The contractor needs porous materials to retain the amount of heat on construction of iron smelting furnace. Which one is an appropriate material needed for the construction?

- | | |
|-----------------------|----------------------|
| <i>A Steel casing</i> | <i>B Fire bricks</i> |
| <i>C Clay</i> | <i>D asbestos</i> |

The correct answer was *B Fire bricks*. The students who chose the correct

answer demonstrated a good understanding of materials designed for high-heat environments. They recognized that due to their porous structure firebricks are specifically engineered to withstand and retain high temperatures, making them ideal for use in furnaces and kilns.

Students who incorrectly selected alternative *A Steel Casing* did not realize that steel casing is ineffective at retaining heat in extreme conditions. Additionally, they did not know that steel can deform or lose its structural integrity at very high temperatures, making it unsuitable for a smelting furnace.

The students who chose *C Clay* did not understand that clay can crack or break down under high heat, reducing its effectiveness for such application. The students who selected *D Asbestos* demonstrated a lack of knowledge about appropriate materials. Asbestos is no longer commonly used, as it is not as effective as firebricks in heat retention and is also hazardous to health.

Item (vii) was set from the topic of *Workshop Tools and Equipment*. It tested students' ability to select proper tools for taking measurements. The question was:

Form Two students were required to draw circles which are beyond the capacity of a compass. Which alternative instrument may be used?

- | | |
|--------------------|-----------------------|
| <i>A Callipers</i> | <i>B Divider</i> |
| <i>C Trammels</i> | <i>D Height Gauge</i> |

The correct answer was *C Trammels*. The students who chose the correct answer demonstrated a good understanding of different drawing tools, since they recognized that trammels are specifically designed to draw large circles or arcs that surpass the size limitations of a standard compass.

The students who chose *B Divider*, failed to understand that a divider is primarily used for marking distances or measuring segments between two points. These students misunderstood the purpose of the tool.

On the other hand, students who selected *A Callipers*, did not understand that callipers are used for measuring distances or diameters. Those who chose *D Height Gauge*, failed to understand that height gauges are typically used for measuring vertical distances and are not suitable for drawing circles. This choice reflects a misunderstanding of the height gauge's purpose.

Item (viii) was extracted from the topic of *Workshop Management and Safety Rules*. It tested students' understanding on electrical outbreak. The question was:

The following are the factor which attribute to the outbreak of electrical fire except.

- A poor quality of electrical installation of wiring*
- B application of electric rodent repellents in the cable*
- C poor maintenance of some of the fire hydrant*
- D unsystematic of dumping of wooden packing material*

The correct answer was *B application of electric rodent repellents in the cable*. The students who selected B understood that using rodent repellents on cables could potentially damage the cables which might increase the risk of electrical fires.

The students who chose *A poor quality of electrical installation of wiring*, were incorrect as they failed to understand that faulty wiring, overloaded circuits, or substandard installation can certainly lead to electrical hazards. They were not aware that these issues are contributing factors to electrical fires.

Students who chose option *C poor maintenance of fire hydrants* misinterpreted the question. Although poor maintenance of fire hydrants is a concern for firefighting effectiveness, they did not understand that it does not directly contribute to the outbreak of electrical fires. Finally, the students who chose *D unsystematic dumping of wooden packing material*, lacked sufficient knowledge of the topic. While wooden packing materials can pose a fire hazard when improperly stored, they are not specifically linked to electrical fires.

Item (ix), was set from the topic of *Workshop Management and Safety Rules*. It tested the students' awareness on direct impact of risks in workshop. The question was:

Which one of the following is a direct factor having impact on the risks associated with executer in the workshop?

- A Make sure the floor is uneven*
- B Have the floor cleaned extra often*
- C Make sure the workplace is tidy*
- D Have the floor safety signed and marked*

The correct answer was alternative A, *make sure the floor is uneven*. The students who chose the correct response demonstrated understanding on the direct relationship between the physical conditions of the workshop floor and the risks posed to workers. They recognized that an uneven floor can create tripping hazards, causing falls, accidents and other injuries, making it a direct risk factor in the workplace. Students who selected incorrect answers were misled by the concepts of cleanliness, tidiness, and signage, which enhance safety but do not directly address the hazards of an uneven floor. These students failed to understand the term "direct" in the context of the question and therefore they wrongly focused on general safety practices that had indirect effects on reducing risks, rather than focusing on the immediate, tangible hazards in the environment.

Item (x), was set from the topic of Workshop Tools and Equipment. It required the students to identify the tools used for dressing and trueing an abrasive grinding wheel. The question was:

Which of the following is used for dressing and trueing an abrasive grinding wheel on a tool and utility grinder?

- | | |
|-----------------------------------|---------------------------------------|
| <i>A Diamond tool dresser</i> | <i>B Abrasive stick wheel dresser</i> |
| <i>C Huntington wheel dresser</i> | <i>D Truing wheel dresser</i> |

The correct answer was A *Diamond tool dresser*. The students who chose the correct answer (A) demonstrated understanding of tool applications as they recognized that a dresser is used to dress and true abrasive grinding wheels. They also understood that diamonds, being harder than the abrasive material on the wheel, can effectively reshape and clean the surface.

Those who chose the incorrect option B *Abrasive stick wheel dresser*, displayed a lack of familiarity with the tools. They did not grasp that abrasive stick dressers are intended for cleaning and reshaping certain grinding wheels but are less accurate than diamond dressers, particularly for finer or more specialized grinding tasks. Selecting this answer suggests confusion about the

specific functions and applications of various tools.

The students who selected *C Huntington wheel dresser*, were incorrect because they did not understand that the Huntington wheel dresser is primarily used for truing grinding wheels in rougher.

For those who chose the incorrect option *D Truing wheel dresser*, did not understand the term "dresser." They did not realize that truing wheel dressers are usually not used for dressing and truing an abrasive grinding wheel, rather they used in less precision tasks thus they were not the best choice for maintaining a high-performance grinding wheel.

2.3.2 Question 2: Matching Items

This question consisted of five matching items derived from the topic of *Engineering Materials*. The question required the students to match the properties of engineering material in **List A** with the corresponding metallic element in **List B** by writing a letter of the correct response in the table provided.

List A	List B
(i) <i>The ability of metal to withstand deformation under compression without rupture</i>	A. Toughness
(ii) <i>Measure the amount of energy the material can absorb before failure taken place</i>	B. Hardness
(iii) <i>The ability of material to resist deformation</i>	C. Malleability
(iv) <i>The ability of material to withstand elongation under tension without rupture</i>	D. Stiffness
(v) <i>The ability of material to sustain load without distortion.</i>	E. Brittleness
	F. Ductility
	G. Resistance
	H. Strength

A total of 300 (100%) students attempted question 2. The results of their scores indicate that 212 (70.67%) students scored from 0 to 1.0 mark, 87 (29.00%) students scored from 1.5 to 3.0 marks, and only 1 (0.33%) student scored 4 marks. Generally, the students' performance on this question was poor since only 88 (29.33%) students scored average and above. Figure 2 illustrates the given results.

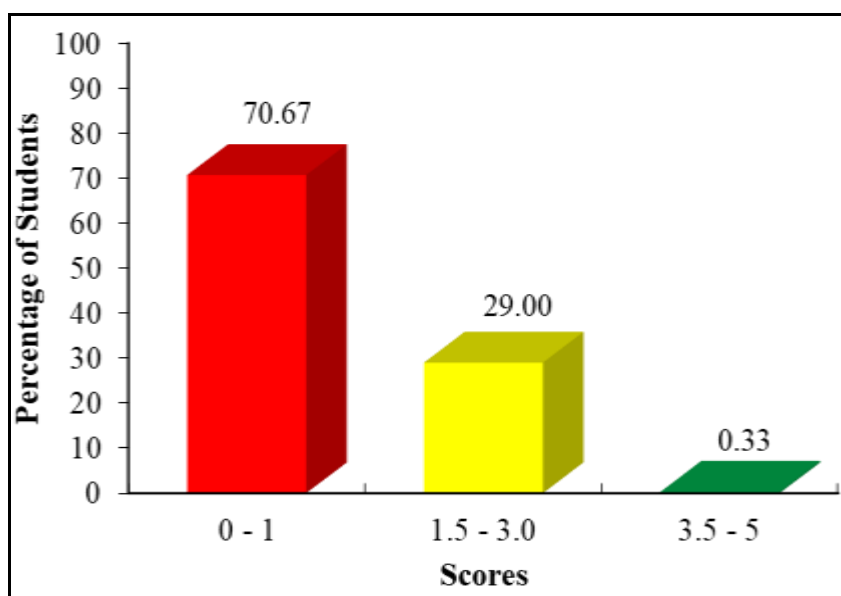


Figure 2: *The Students' Performance in Question 2*

Item (i) required the student to identify the ability of metal to withstand deformation under compression without rupture. The correct response was C, *Malleability*. The student who matched the items correctly understood that, malleability is the ability of a metal to withstand deformation under the compression without rupture.

Most of the students misinterpret and matched with F, *Ductility*. They did not know that ductility refers to the ability of a material to sustain significant plastic deformation before fracture. Those who chose incorrect answer E *brittleness* did not know that, brittleness describes the property of a material that fractures when subjected to stress but has a little tendency to deform before rupture.

In item (ii), the students were required to match the correct property which measure the amount of energy a material can absorb before failure takes place. The correct match was A, *Toughness*, the students who chose the correct property understood that toughness measures the amount of energy that material can absorb before failure taken place. Other students incorrectly selected option H *Strength*, confusing it with toughness. They did not know that strength refers to ability of the material to withstand load, it encompasses various types of strength including; tensile strength and compressive strength.

In item (iii) the students were required to identify the property of material with ability to resist deformation. The correct answer was D *Stiffness*. Those

who chose the correct response recognized that, stiffness refers to an ability of materials to resist deformation under an applied force. Some students confused *stiffness* with *H strength*, even though strength refers to ability of materials to withstand an applied force they were supposed to recognize that, stiffness refers to how resistant the material withstand deformation. Other students selected *A Toughness*, they did not know that though both stiffness and *toughness* are material properties, but they describe different aspects of how a material responds to force or stress. They also failed to recognize that toughness refers to a material's ability to absorb energy and deform plastically before fracturing.

In item (iv) the students were required to match, the ability of a material to withstand elongation under tension without fracture. The correct answer was *F, Ductility*. The students who chose the correct answer were able to link the correct property as they understood that ductility refers to the ability of a material to sustain significant plastic deformation before fracture. Students who matched with option *E Brittleness* were unaware that brittleness describes materials that easily break or crack.

Item (v) required the students to match the property of material which sustain loads without distortion. The correct answer was *H, Strengths*. Some students achieved to associate a correct property with the term given. They knew that strength is a property of material to withstand load. On the other hand, most of student who chose the incorrect selections matched the item with *G Hardness*. These students did not understand that hardness is the ability of materials to resist deformation, indentation or scratches.

2.2 SECTION B: SHORT ANSWER QUESTIONS

This section comprised of seven (7) short answer questions. The questions were constructed from the topics of *Metal Work Technology, Engineering Material, Workshop Management and Safety Rules and Workshop Tools and Equipment*. Each question carried 10 marks, making a total of 70 marks for the whole section.

2.2.1 Question 3: Workshop Management and Safety Rules

This question had two parts namely (a) and (b). In part (a), the students were required to provide reasons why students are encouraged to observe personal, equipment and environmental safety during learning in the workshop. Part (b)

required them to observe seven reasons of safety rules in industry. The question was:

- (a) *Why students are encouraged to observe personal, equipment and environment safety during learning in workshop?*
- (b) *Why safety rules should be observed in industries? Give seven reasons*

The analysis shows that the question was attempted by 300 (100%) students. The scores indicate that, 40 (13.33%) students scored from 0 to 2.5 marks, 36 (12.00%) students scored from 3.0 to 6.0 marks, and 224 (74.67%) students scored from 6.5 to 10 marks. These data are summarized in Figure 3.

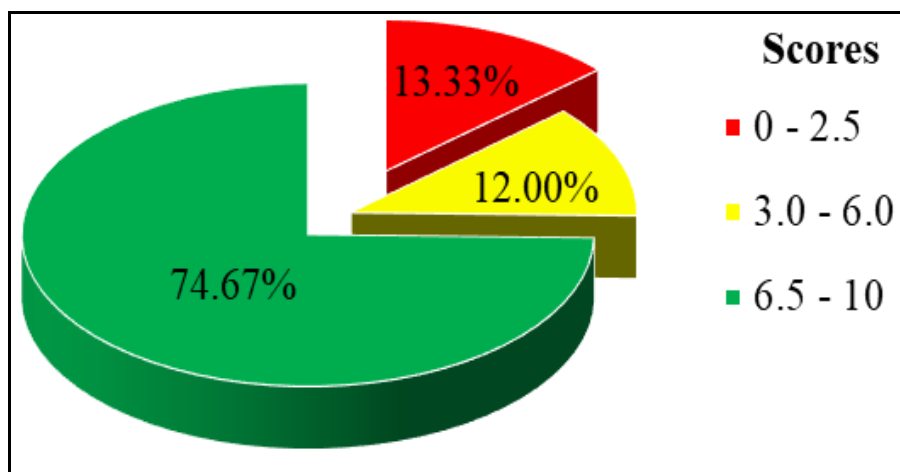


Figure 3: *The Students' Performance in Question 3*

Figure 3 indicates that, the general students' performance on this question was good because 86.67 percent scored from 3.0 to 10 marks. Students who scored high marks in part (a) effectively explained safety precautions related to personal safety, equipment, and the environment. These students demonstrated a clear understanding that safety practices are critical for preventing accidents and injuries, protecting both individuals and others around them in the workshop environment. Similarly, in part (b), they successfully provided the required reasons, as demonstrated in Extract 3.1. Extract 3.1 provides an example of a well-written response from a student who performed well on this question.

3. (a) Why students are encouraged to observe personal, equipment and environment safety during learning in workshop?

(i) Personal safety

There has to be personal safety so as to avoid self harming during learning in workshop.

(ii) Equipment safety

This is required so as to avoid accidents in the workshop and those accidents which would lead to destruction of machines found in the workshop.

(iii) Environmental safety

The environment has to be observed so as also to avoid accidents or to avoid the risks of getting accidents.

(b) Why safety rules should be observed in industries? Give seven reasons.

(i) Avoiding accidents so as to ensure the generally safety of the industry.

(ii) Prevention of improper working of machines; machines have to be maintained like cleaning, daily check-up and other so as to avoid improper working of machines.

(iii) Ensuring the production of goods in good quality; when equipments are well protected there will be production of goods in a good quality.

- (iv) Ensuring there's no poor electrical installation of wiring; sometimes poor electrical installation wiring occurs due to improper addressing of the industries/workshop that would lead to electric fire.
- (v) Preventing of leakage and damages to the machines; therefore there should be high technology and understanding on control of tools and machines.
- (vi) Avoid low production; when there will be low production means that even the functioning of machines and tools is low there we should maintain our machines for high production.
- (vii) Avoiding self-harming; so as to make sure that there's safety to everyone so as to avoid accidents to oneself e.g. falling, eye distraction, and others.

Extract 3.1: A sample of good responses to Question 3

Extract 3.1 shows a sample of the correct responses by a student who managed to address correctly both parties of the question. In part (a), he/she provided correct reasons as why to observe personal, equipment and environment safety during learning in workshop. In part (b), he/she provided seven reasons of observing safety rules in industry.

On the other hand, 12.00 percent of the students scored average marks (3.0 - 6.0) on this question, suggesting that they had insufficient knowledge about the topic. In part (a), these students were able to provide responses for one or two items but not all. Many gave partial answers, such as explaining personal safety and vice versa. Similarly, in part (b), they provided partial responses that led them to score average marks. Other students in this category provided repetitive reasons among of the seven reasons required hence scored average marks.

However, 13.33 percent of the students scored poorly (0 - 2.0) marks on this question. In part (a), some students were unable to provide accurate responses to the terms mentioned. For example, one student wrote incorrect phrases such as *reepain body*, *redecing accident*, and *good inviroment*, instead of explaining personal safety as measures, equipment safety and environmental safety. On responding to part (b) one student wrote that *because dance in industries* and *because eating food industries*. The students in this group

misunderstood the question and provided irrelevant reasons. This indicates that students did not fully understand the importance of adhering to safety rules in industrial environments. Extract 3.2 provides an example of poor performance from of the students.

3. (a) Why students are encouraged to observe personal, equipment and environment safety during learning in workshop?

(i) Personal safety
Because of respect body X

(ii) Equipment safety
Reducing accident X

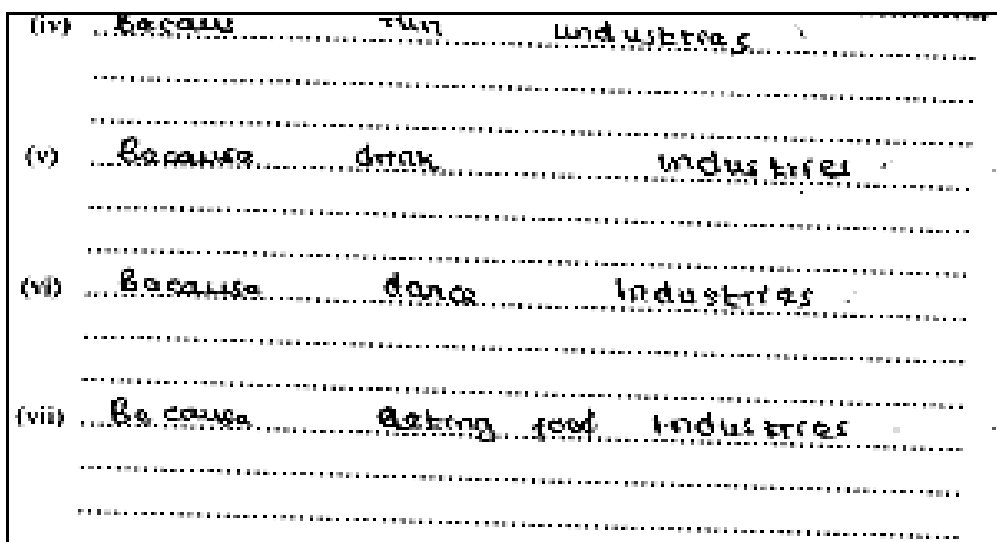
(iii) Environmental safety
good environment X

(b) Why safety rules should be observed in industries? Give seven reasons.

(i) Because donot put oil in of workshop X

(ii) Because do not rat industries X

(iii) Because do not play industries X



Extract 3.2: A sample of poor responses to Question 3

In Extract 3.2, the student provided irrelevant responses to all parts of the question.

2.2.2 Question 4: Workshop Management and Safety Rules

This question was constructed from the topic of Workshop Management and Safety Rules. The question assesses competence in understanding safety in the workplace, specifically regarding hazard recognition, and the importance of safety protocols, ability to deal with specific safety measures related to equipment and machinery and the ability to identify and explain risks and the importance of safety practices in preventing accidents. The question was:

- (a) *What is the difference between safety and health hazard?*
- (b) *What will happen when safety rule in workshop will not be observed?
Give three points.*
- (c) *Why the following safety precautions are important when operating a machine?*
 - (i) *Wearing safety glasses.*
 - (ii) *Not wearing loose clothes.*
 - (iii) *Keeping the machine and surrounding floor area clean.*
 - (iv) *topping the machine to measure work or clean the machine.*
 - (v) *Not operating a machine until you understand its control,*
 - (vi) *Not operating the machine if the machine guard is removed.*

The question was attempted by 300 (100%) students. The analysis indicates that, 48 (16.00 %) students scored from 0 to 2.5 marks, 21 (7.00 %) scored

from 3.0 to 6.0 marks, and 231 (77.0 0%) scored from 6.5 to 10 marks. These data are presented in Figure 4.

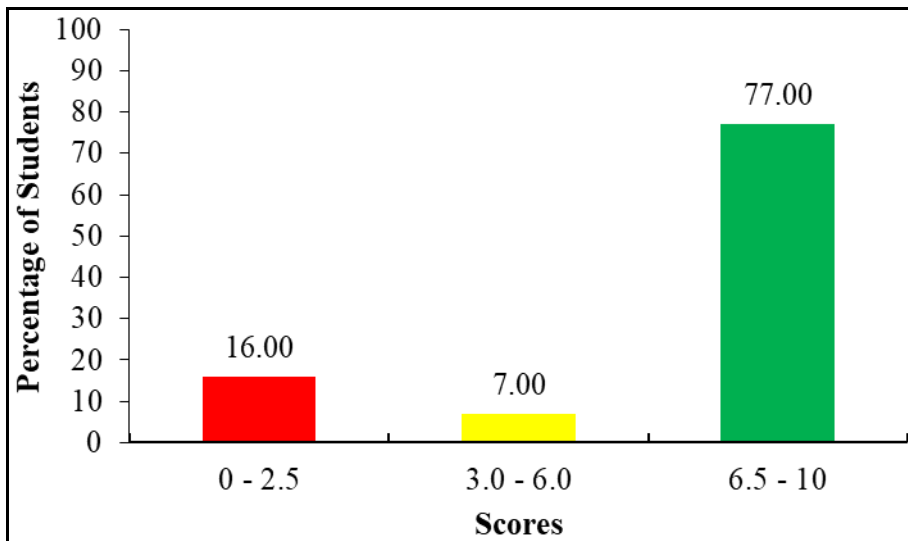


Figure 4: *The Students' Performance in Question 4*

Figure 4 indicates that the students' performance in this question was good as 252(84.00%) scored from 3.0 to 10 marks.

The data indicates that 77.00% of the students achieved high marks (6.5–10). In part (a) the students correctly responded that safety is concerned with effect of sudden reaction to severe condition (acute hazard) or a condition of being safe from accident whereas health hazard is concerned with effect to long term deterioration to a prolonged exposure to milder adverse condition (chronic hazards).

In part (b), students highlighted the consequences of neglecting workshop safety rules, including serious accidents, loss of time and wages, reduced production efficiency, poor-quality output, lowered worker morale, and equipment failure. Their detailed explanations highlighted a good understanding of the importance of safety practices.

In part (c), students demonstrated knowledge of machine safety precautions. They explained several safety measures such as, the need for; safety glasses to protect against debris and sparks, avoiding loose clothing to prevent injuries, and maintaining cleanliness to avoid slips and ensure efficiency. Additionally, they emphasized the importance of the machine guard as a critical safety measure that prevents severe injuries. Their responses exhibited

a mastery of the knowledge on the topic of *Workshop Management and Safety Rules*. Extract 4.1 shows a sample of a correct response from the student who scored high marks.

4. (a) What is the difference between safety and health hazard?
Safety are the measures which people must follow in order to avoid accidents while Health hazard these are the effects that cause danger to human body.
- (b) What will happens if safety rules in a workshop are not observed? Give three points.
- (i) Various accidents will occur, these accidents may be slipping, electrical shock which might cause death.
 - (ii) Low production of goods; If the machines are destroyed the working ability will be low.
 - (iii) Low efficiency of machines, This is influenced by not cleaning the machines after use.
- (c) Why the following safety precautions are important when operating a machine?
- (i) Wearing safety glasses.
To cover the eyes, from flying objects when performing grinding and drilling operations, to ensure the eyes are free from the light emitted when performing welding.

(ii) Not wearing loose clothing.

To ensure the machines do not grip the clothing, in order to ensure the safety of a person, because if the machine grips the clothing, it would be hard to remove from the machine, always is normally cause death.

(iii) Keeping the machine and surrounding floor area clean.

To ensure that the machines are working very efficiently by removing the dust and to avoid slipping due to the presence of cutting fluids on the floor.

(iv) Stopping the machine to measure work or clean the machine.

To ensure that all the particles and impurities found on the machine are removed in order to make sure that the machine doesn't work according to its operation.

(v) Not operating a machine until you understand its controls.

To ensure that a person has gained all the knowledge of operating the machine, in order to ensure that a person may not have confusion on the controls.

(vi) Not operating a machine if safety guards are removed.

To ensure that the person is safe from the damage which may be caused by machine ~~for~~ which lacks safety guards in order to avoid accidents.

4. (a) What is the difference between safety and health hazard?
 Safety are the measures which people must follow in order to avoid accidents while health hazard these are the effects that cause danger to human body.
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 To cover the eyes, from flying objects when performing grinding and drilling operations, to ensure the eyes are free from the light emitted when performing welding.
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 To ensure the machines do not grip the clothing, in order to ensure the safety of a person, because if the machine grips the clothing, it would be hard to remove from the machine, always it normally cause death.
 - Keeping the machine and surrounding floor area clean.
 To ensure that the machines are working very efficiently by removing the dust and to avoid slipping due to the presence of cutting fluids on the floor.
 - Stopping the machine to measure work or clean the machine.
 To ensure that all the particles and impurities found on the machine are removed in order to make sure that the machine doesn't work according to its operation.
 - Not operating a machine until you understand its controls.
 To ensure that a person has gained all the knowledge of operating the machine, in order to ensure that a person may not have confusion on the controls.
 - Not operating a machine if safety guards are removed.
 To ensure that the person is safe from the damage which may be caused by machine when which lacks safety guards in order to avoid accidents.

Extract 4.1: A sample of good responses to Question 4

Extract 4.1 shows a sample response from a student who gave correct response to all parts of this question. He/she had knowledge about the subject matter tested in all parts of the question.

The analysis show that 7.00 percent of students scored average marks (3.0-6.0) in this question. In part (a), many students provided partial responses by

addressing safety but failed to explain health hazards adequately. Some students managed to correctly explain health hazards but provided incorrect explanations for safety, indicating gaps in their comprehension. This suggests that students in this category had a partial understanding of the differences between safety and health hazards.

In part (b), some students demonstrated average performance by offering a few correct points about the consequences of not observing workshop safety rules. However, their answers often included repeated or incomplete responses, reflecting limited understanding and lacked skills on explaining safety measure.

In part (c), some students managed to identify and explain the importance of a few safety precautions, such as wearing safety glasses or keeping the work area clean, but their responses were incomplete. They failed to address all six-safety precautions effectively, which limited their overall performance. This average performance across all parts of the question indicates that the students had a partial understanding of the topic.

Additionally, 16.00 percent of students scored poor marks (0 - 2.5) demonstrating a limited understanding of key safety concepts and workshop practices. In part (a), these students were unable to differentiate between safety and health hazards. They did not understand that, safety refers to the practices, procedures, precautions put in place to prevent accidents, injuries, and damage while working with machinery and health hazard are factors or conditions that can potentially harm the health of an individual, either through short-term or long-term exposure. They failed to link safety to immediate risks, overlooking the short and long-term effect of health hazards and provided irrelevant examples.

In part (b), students gave unclear or repetitive responses, failing to mention critical outcomes such as accidents, equipment failure, reduced productivity and worker morale. Most of them misunderstood the question and offered unrelated or overly general explanations without identifying distinct impacts.

In part (c), students failed to give reason why safety precautions are important when operating a machine. They were not aware that, safety precaution gives a many benefits such as; safety precautions prevent the operator eyes from flying metallic chips, prevent loose clothing to be caught by revolving or rotating machine parts and prevent workshop attendant from slippery due to

wet floor. Their responses highlighted a significant gap in understanding essential safety principles, which are focused on hands-on reinforcement of workshop safety practices. Extract 4.2 provides a sample of poor performance from a student who failed to answer correctly this question.

4. (a) What is the difference between safety and health hazard?
 Safety is the risk that an injury should be health is important necessary the reason while health hazard this is danger should have to cause the body to make these different.

(b) What will happens if safety rules in a workshop are not observed? Give three points:
 (i) If person accident in a workshop should be person to make person accident to increasing the danger happen if safety
 (ii) To help person to availability take should be promoting the cause in the operation in a workshop
 (iii) If promoting the good equipment equipment safety in the workshop in reason different.

(c) Why the following safety precautions are important when operating a machine?
 (i) Wearing safety glasses.
 Wearing safety glasses it need the person to make it needed at all 1. reason there are also to increase wearing safety
 (ii) Keeping the machine and surrounding floor area clean.
 to maintain the machine and surrounding floor are clean to reason their machine availability should be can machine making establishment
 (iv) Stopping the machine to measure work or clean the machine.
 To maintain the machine to measure work if reason they are good to person should be enable to person making establishment can be measured x x
 (v) Not operating a machine until you understand its controls.
 To improve the operating machine work from to make should be by using
 (vi) Not operating a machine if safety guards are removed.
 They are operating a machine if safety guards are removed

Extract 4.2: A sample of poor responses to Question 4

Extract 4.2 highlights a student's irrelevant responses to all parts of the question, reflecting a clear lack of understanding of the subject matter.

2.2.3 Question 5: Engineering Materials

The question tested the students' knowledge, to differentiate and explain

engineering material properties. The question was:

- (a) *Distinguish between mechanical and physical properties of engineering material by giving five examples in each.*
- (b) *What is the difference between physical strength and chemical strength of metals as applied in engineering materials?*

The question was attempted by 300 (100%) students, from which 161 (57.67%) scored from 0 to 2.5 marks, 71 (23.67%) scored from 3.0 to 6.0 marks, and 68 (22.67%) scored from 6.5 to 10 marks.

Generally, the students' performance in this question was average, since 46.34 percent of the students scored average and above. This performance is summarized in Figure 5.

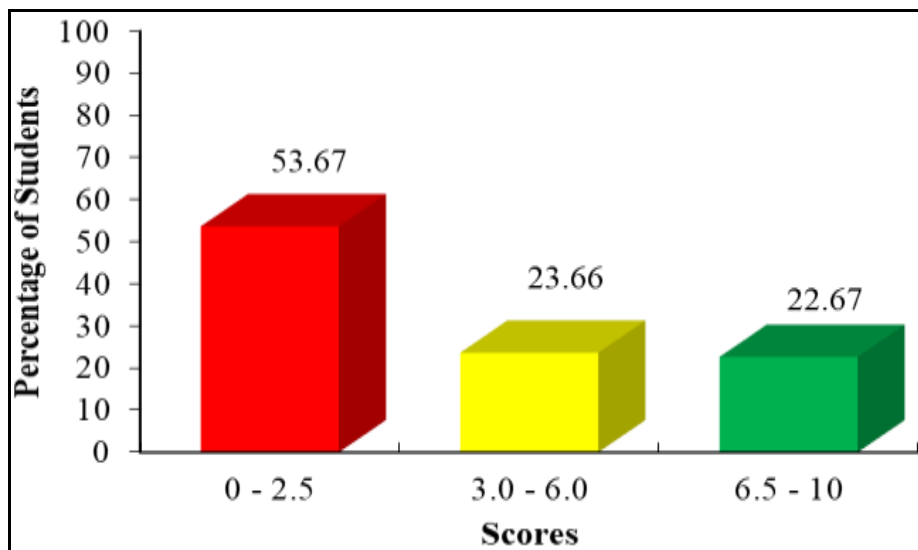


Figure 5: *The Students' Performance in Question 5*

The 22.67 percent of the students who scored good marks (6.5–10) in this question showed a good understanding of the concepts and accurately distinguished between mechanical and physical properties with precise examples. They identified key mechanical properties like toughness, hardness, and elasticity, and physical properties such as density and thermal conductivity.

In part (b), most of the students provided accurate responses in differentiating physical and chemical strengths of material in a given context. Their good performance indicated familiarity with the topic and demonstrated their

competence in understanding the assessed concept. Extract 5.1 is an example of a good responses from one of the students' script.

5. (a) Distinguish between mechanical and physical properties of engineering material by giving five examples in each.

Mechanical properties are the factors or makeup that make the material behave in various cases or event while physical properties are the properties that are seen or identified through observation and testing. Examples of mechanical properties are Toughness, Stiffness, Ductility, Malleability and strength. Physical properties include size, length, colour, code, appearance and spark testing.

(b) What is the difference between physical strength and chemical strength of metals as applied in engineering properties materials?

Physical strength is the ability of a material to resist surface loads physically or due to physical factor while chemical strength is a ability of a material to sustain loads chemical or due to chemical factor like the presence of elements phosphorus etc.

Extract 5.1: A sample of good responses to Question 5

In Extract 5.1, the student provided accurate responses to both parts (a) and (b).

On the other hand, 23.67 percent of the students scored average marks (3.0-6.0) in this question. In part (a), some of them provided partial responses by giving one or two examples in each case hence could not score all marks. Similarly, in part (b), some of the students gave partial responses, defining physical strength in the context of engineering materials but failed to distinguish it from chemical strength. This reflects insufficient understanding of the question and the related concepts, resulting in an average performance. It was also observed that 53.67 percent of students scored poorly (0-2.0) on this question. In part (a), many failed to distinguish between mechanical and physical properties of engineering materials. For instance, one student incorrectly defined *mechanical properties is a branch of mechanical*

engineering dealing with machine design and gave irrelevant examples like manufacturing and aerospace. Similarly, physical properties were incorrectly defined as materials used to produce properties, with examples like hardness and ductility, which are mechanical properties. The poor performance was due to the inability to define and distinguish mechanical properties from physical properties. This indicates significant knowledge gaps in engineering materials.

In part (b), some of the students could not differentiate between physical and chemical strength of metals in engineering materials. For instance, they defined physical strength as "a material used to make strength" and chemical strength as "a material that creates strength." This highlights confusion and a lack of understanding of basic concepts, as seen in Extract 5.2 which shows a poor response from the student who failed to answer this question.

5. (a) Distinguish between mechanical and physical properties of engineering material by giving five examples in each.

Mechanical is the branch of mechanical engineering that deals with the design, construct and use of machine. X

Example of mechanical manufacture

- ψ Automotive X
- ψ Aerospace X
- ψ Marine X
- ψ Thermal X

while

Physical properties of engineering material is the material

(b) What is the difference between physical strength and chemical strength of metals as applied in engineering properties materials?

Physical strength is the material that used not make strength X

while

Chemical strength is the material that used make strength.

Extract 5.2: A sample of poor responses to Question 5

In Extract 5.2, a student was unable to distinguish between mechanical and physical properties of engineering materials. He/she failed to give examples for mechanical and physical properties of an engineering materials in part (a). In part (b), the students failed to differentiate between physical strength and

chemical strength of metals.

2.2.4 Question 6: Metal Work Technology

This question was composed from the topic of *Metal Work Technology*. It had two parts, (a) and (b). Part (a) required the students to draw and label six main parts of oxyacetylene welding plant. Part (b), required them to give three advantages and disadvantages of oxyacetylene welding plant. The question was;

- (a) *Draw and label six main parts of oxyacetylene welding plant.*
- (b) *What are three advantages and disadvantages of oxyacetylene welding compared with other process?*
 - (i) *Advantages.*
 - (ii) *Disadvantages*

The statistics show that 300 (100%) students attempted this question, from which 104 (34.70%) scored from 0 to 2.5 marks, 79 (26.30%) scored from 3.0 to 6.0 marks and 117 (39.0%) scored from 6.5 to 10 marks. Figure 6 presents the students' performance in this question.

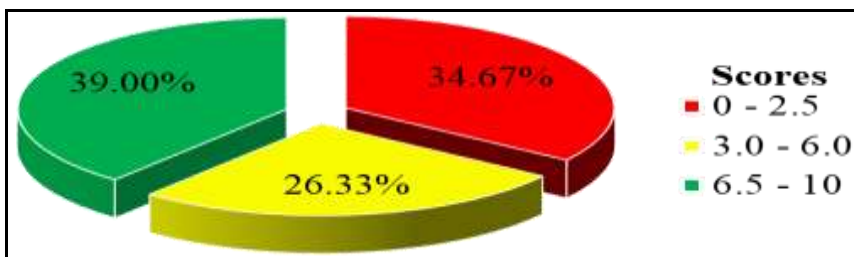


Figure 6: *The Students' Performance in Question 6*

Figure 6 highlights that the overall performance on this question was moderate, with 196 (55.33%) scoring between 3.0 and 10 marks. This suggests that many students lacked sufficient knowledge and practical experience in the assessed area.

However, 39.00 percent of the students achieved good marks (6.5–10), demonstrating a good understanding of the topic. In Part (a), the students who excelled were able to accurately draw and label all six key components of the oxyacetylene welding setup which are: the acetylene cylinder, oxygen cylinder, regulator, rubber hose, mixing chamber, and nozzle (or tip). These students displayed a good understanding of metalwork technology. In contrast, some students provided partial responses, drawing and labelling few

parts, such as the nozzle, regulator, and rubber hose.

In Part (b), students were tasked to list three advantages and disadvantages of oxyacetylene welding in comparison to other processes. The students who scored well were able to respond correctly, list the three advantages and three disadvantages. For example, one student wrote: "No electric current is required, the operator has better control of heat and filler metals, it is portable, and the maintenance cost of the welding equipment is low. However, the rate of heating and cooling of the weld deposit and job is slow, and it is applied to a wide variety of manufacturing." This student demonstrated understanding and proved that he/she had sufficient knowledge of metalwork technology. Extract 6.1 shows the responses of the student who performed well.

(b) What are three advantages and three disadvantages of oxyacetylene welding plant compared with other process?

(i) Advantages:

- It does not require the use of electric arc
- It is used to join dissimilar metal
- It is portable and easy to transport

(ii) Disadvantages:

- It does not weld reactive metals such as aluminium and magnesium
- It causes the enlargement of a work piece due to the high temperature
- Acetylene gas is flammable as it can react and explode

Extract 6.1: A sample of good responses to Question 6

In Extract 6.1, the student provided correct responses to all parts of the question. In Part (a), he/she accurately drew and labelled the main components of the oxyacetylene plant, and in Part (b), he/she correctly listed the advantages and disadvantages of the oxyacetylene welding process. This student demonstrated a good level of knowledge, skills, and experience in the assessed competency.

On the other hand, 26.33 percent of students scored average marks (3.0–6.0) on this question. They failed to draw and label the six main components of the oxyacetylene welding plant. Most students in this category were unable to provide correct responses, and some mixed up the parts, resulting in average

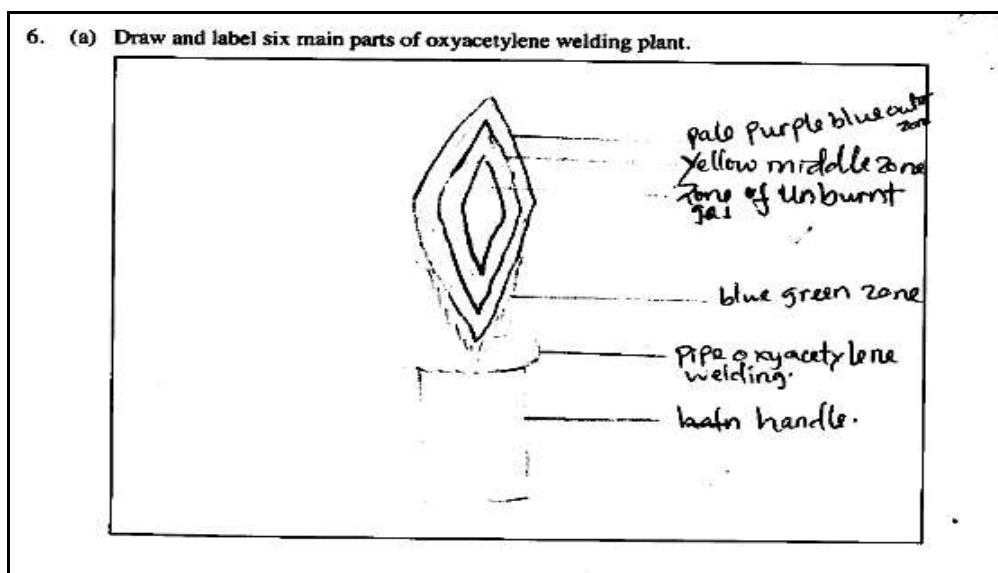
scores.

Additionally, other students submitted irrelevant drawings that were outside the scope of the question. This suggests that the students had only partial understanding of the topic.

Furthermore, the students who scored average marks were able to provide some, but not all, advantages or disadvantages of oxyacetylene welding in Part (b). These responses were partial, and as a result, the students scored average marks for their knowledge and understanding. On other hands, 34.70 percent of students managed to score poor marks (0–2.0) in this question.

In part (a), some students were unable to draw and label the six main components of an oxyacetylene welding plant. For example, one drew a luminous flame instead of the oxyacetylene welding plant.

Additionally, these students did not correctly provide the advantages and disadvantages of oxyacetylene as required. Some students in this group misunderstood the context of the question which led to inaccuracies in their responses. This indicates that the students' understanding on the topic was not fully developed. Extract 6.2 presents an example of a poor responses from a student script.



(b) What are three advantages and three disadvantages of oxyacetylene welding plant compared with other process?

(i) Advantages:

- Facilitates the production of decoration things or objects example chains through joining metal parts.
- Facilitates the production of drills through joining the metal parts.
- Facilitates the production of defence objects like Gate through joining the metal parts.

(ii) Disadvantages:

- It requires the use of electricity.
- It requires enough skills and procedures in order to use it well.
- It requires knowledgeable people.

Extract 6.2: A sample of poor responses to Question 6

Extract 6.2 shows that student failed to accurately provide the advantages and disadvantages of oxyacetylene as expected. Some students in this group misinterpreted the question, resulting in incorrect responses.

2.2.5 Question 7: Metal Work Technology

This question had four parts; (a), (b), (c) and (d). In this question, the students were given a figure of an oxyacetylene cutting blowpipe and were required to study it, and then answer the questions that followed. The question was:

The given figure below shows an oxyacetylene cutting blowpipe. Study the figure and answer the questions that follows:

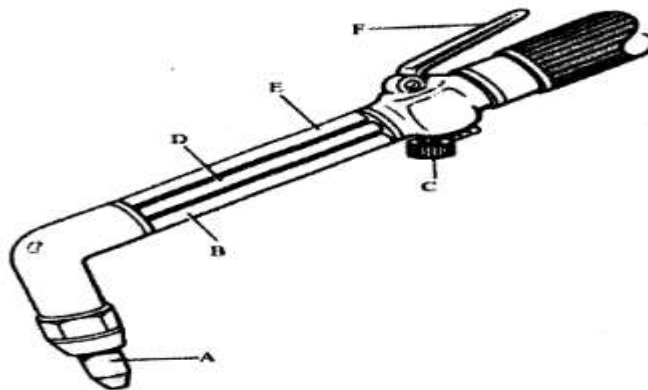


Figure 1

(a) Name the parts marked A-F.

- (b) *What is the main function of the part marked 'C'?*
- (c) *What will happen to the output flame if the part named 'C' will be removed?*
- (d) *Give five procedures of lighting and adjusting the cutting blowpipe*

The question was attempted by 300 (100%) students who sat for this assessment. Data analysis shows that, 136 (45.30%) students scored from 0 to 2.5 marks, 100 (33.30%) scored from 3.0 to 6.5 marks, and 64 (21.30%) scored from 6.5 to 10 marks. This performance is summarized in Figure 7.

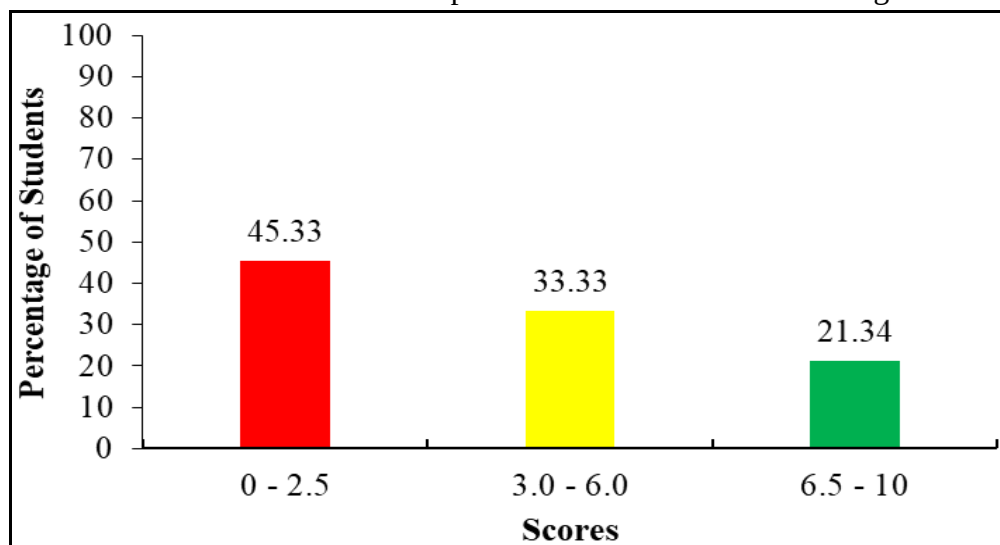


Figure 7: *The Students' Performance in Question 7*

Figure 7 shows that the general performance in this question was average because 54.66 percent of the students scored average or above.

The data show that only 21.30 percent of the students achieved high marks (ranging from 6.5 to 10) on this question. In part (a), these students accurately identified the labelled parts A, B, C, D, E, and F of a blowpipe and explained the function of the part (b). They identified part A as the cutting nozzle or tip, part B as the preheating acetylene tube, part C as the cutting head oxygen valve, part D as the preheating oxygen tube, and part F as the cutting oxygen lever or trigger switch. They also accurately identified that part C is responsible for regulating the flow of oxygen. This demonstrates that these students had a good understanding, particularly parts of a blowpipe used in gas welding.

Despite their good performance in part (b), these students also demonstrated good performance in part (c). They successfully explained the impact of

removing part C from the blowpipe by stating that if part C is removed, the oxygen flow would exceed the acetylene flow. As a result, the flame would become an oxidizing flame making it unsuitable for cutting operations.

In part (d), the students successfully outlined five procedures required for lighting and adjusting a cutting blowpipe, which are opening the acetylene and oxygen cylinder valves, opening the acetylene regulator, opening the oxygen regulator valve and setting the working pressure, pressing down the cutting oxygen lever, and opening the blowpipe acetylene valve. Students' responses reflect a good understanding of the topic of Metalwork Technology, particularly in gas welding. Extract 7.1 is a sample of the good responses to this question.

- (a) Name the parts marked A-F.
- A Tip
 - B Acetylene Pipe
 - C Regulating valve
 - D oxygen pipe
 - E Oxygen Pipe
 - F on and off valve knob
- (b) What is the main function of the part marked 'C'?
- The function of part marked C is to regulate or allow equal amount of gas to pass and to mix up equally.
- (c) What will happen to the output flame if the part named "C" will be removed?
- There will be no equal mixup of gases that will lead to an equal mixup of gases.
- (d) Give five procedures of lighting and adjusting the cutting blowpipe.
- (i) connecting the pipes to the gas cylinders correctly without any mistake
 - (ii) connect the blow pipes to the blow pipe or welding torch oxygen gas and acetylene gas.
 - (iii) Allowing the gas to blow from the cylinders gas tanks to the welding torch pipe.
 - (iv) set up the pressure regulator and the pressure gauges to allow equal distribution of gas.
 - (v) Then press up the blow pipe switch to allow the burning gas to produce a flame - or oxyacetylene flame.

Extract 7.1: A sample of good responses to Question 7

Extract 7.1 shows that the students' responses to both parts are relevant.

However, 33.33 percent of the students scored average marks (3.0–6.0) on this question. In part (a), these students were able to name some of the required parts of the blowpipe.

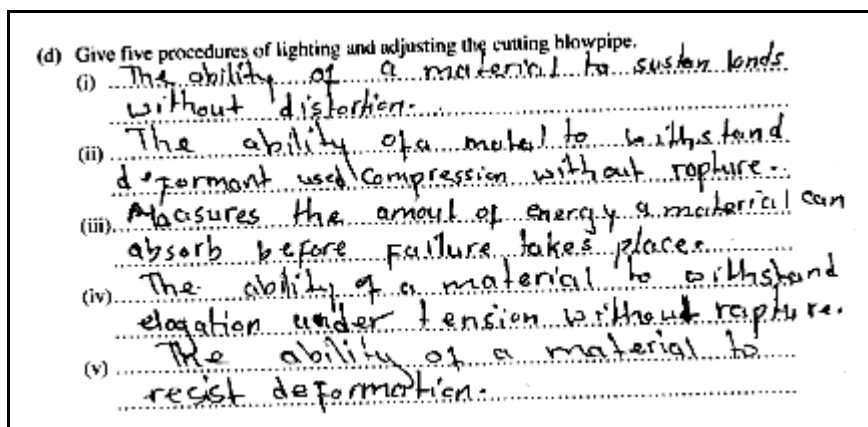
Additionally, most of them failed to correctly address the impact or effect of removing part C from the blowpipe. Their limited understanding in part (b)

contributed to their poor performance in part (c) as well.

In part (d), only a few students correctly described the procedures for lighting and adjusting the cutting blowpipe. Most of them were able to list the first three steps of opening the acetylene and oxygen cylinder valves, and the acetylene and oxygen regulator valves but failed to detail the remaining steps. This indicates a basic understanding of the question, but lack of sufficient knowledge and skills in gas welding prevented them from providing complete responses.

On the other hand, 45.33 percent of students performed poorly by scoring from 0 to 2.5 marks on this question. In part (a), most of them failed to name the labelled parts of the blowpipe, with some failing to respond to the sketch. Their lack of engagement and incorrect answers indicated a deficiency in both knowledge and competence. Most of them did not write anything in both parts (a), (b) and part (c) showing a failure to understand the question's context, insufficient knowledge and skills in the topic of metal work technology.

In part (d), the students were unable to list the five procedures required for lighting and adjusting the cutting blowpipe. Most provided incorrect and irrelevant responses, such as "open the gas valve, open trigger switches, and increase oxygen gas." These answers indicate a poor understanding of both the tested topic and the question. Extract 7.2 is a sample of the poor responses to this question.



Extract 7.2: A sample of poor responses to Question 7

Extract 7.2 shows the responses of a student who did not managed to respond correctly to all parts of the question. This extract shows that; the

student was not comprehended to the topic, which contributed to low scores.

2.2.6 Question 8: Engineering Materials

This question had five parts; (a), (b), (c), (d) and (e). The students were required to use their knowledge of Engineering Material to give a correct response to the subject matter. The question was:

You are provided with the following non-ferrous metals. Give two physical properties, which differentiate it from others and two applications of each.

- (a) *Aluminium Physical properties and applications*
- (b) *Copper Physical properties and applications*
- (c) *Lead Physical properties and applications*
- (d) *Silver Physical properties and applications*
- (e) *Zinc Physical properties and applications*

The question was attempted by 300 (100%) students. Among them, 94 (31.33%) scored from 0 to 2.5 marks, 163 (54.33%) scored from 3.0 to 6.0 marks and 43 (14.34%) scored from 6.5 to 10 marks. Figure 8 summarizes this performance.

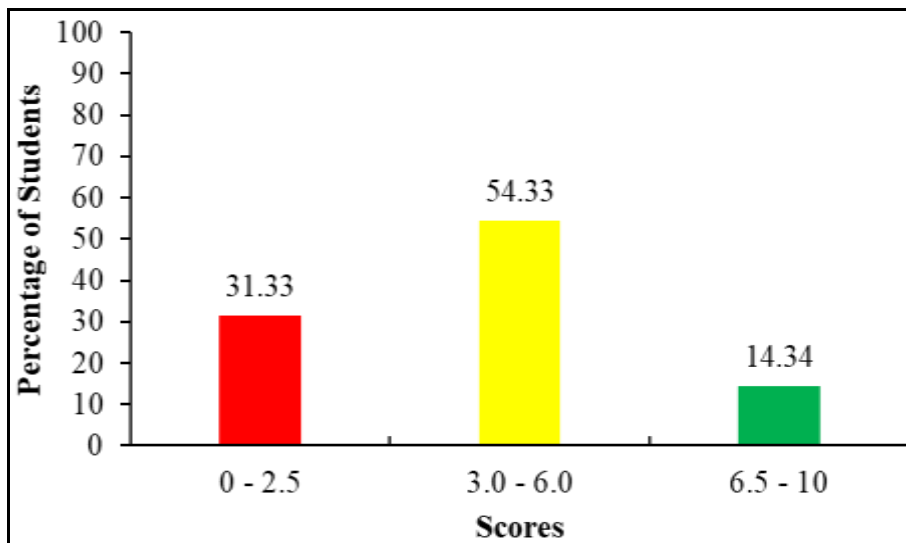


Figure 8: *The Students' Performance in Question 8*

Figure 8 shows that, the general performance in this question was good since 206 (68.67%) students scored from 3.0 to 10 marks. This signifies that the students had adequate knowledge on Metal Work Technology.

The students, who scored well 14.34% on this question, correctly identified

the physical properties and applications of various non-ferrous metals. For example, aluminium is lightweight, corrosion-resistant, and conductive, used in cooking utensils, frames, and alloys. Copper is soft, ductile, and corrosion-resistant, found in electrical conductors, pipes, and brass alloys. Lead is soft, corrosion-resistant, and used in solder and cable sheaths. Silver is known for its conductivity, is used in electronic circuits and decoration. Zinc, with high corrosion resistance, is used in galvanization and brass alloys. Extract 8.1 is a sample of good responses from the script of one of the students.

8. You are provided with the following non-ferrous metals. Give two physical properties which differentiate it from others and two applications of each.

(a) Aluminium

Physical properties

(i) low-weight

(ii) non-magnetic property.

Applications:

(i) Making aircrafts.

(ii) Making electrical cables.

(b) Copper

Physical properties

(i) low-weight

(ii) high conductivity.

Applications

(i) Making household.

(ii) Making electrical cables.

(c) Lead

Physical properties

(i) low-weight

(ii) Non-magnetic property.

Applications

(i) Making batteries.

(ii) Making electrical appliances.

(d) Silver

Physical properties

(i) low-weight

(ii) Resistant to corrosion.

Applications

(i) Making electrical appliances.

(ii) Making jewellery.

(e) Zinc

Physical properties

(i) low-weight

(i) high conductivity.

Applications

(i) Galvanization.

(ii) Making paints.

Extract 8.1: A sample of good responses to Question 8

Extract 8.1 shows a student's responses in which he/she successfully provided the physical properties and their uses for all parts of the question. This indicates that he/she had adequate knowledge and skills in Material Engineering.

On the other hand, 54.33 percent of the students scored average marks (3.0–6.0) on this question. These students accurately provided the physical properties and applications of aluminium and copper but failed to provide the application of lead, silver, and zinc. Some students provided incomplete responses regarding the applications of these metals.

However, 31.33% of the students scored poor marks (0 - 2.5) on this question. Students in this category failed to provide the physical properties and applications of the non-ferrous metals which are aluminium, copper, lead, silver, and zinc. The analysis shows that many students provided incorrect answers, while others did not respond about lead, silver, or zinc. Some of the students misinterpreted physical properties as applications, reflecting a lack

of understanding of the topic of Engineering Materials. Extract 8.2 is a sample of the poor responses of a student in this question.

(a) Aluminium

Physical properties

(i) It help to container non-metal

(ii) It help to the container carbon

Applications:

(i) It used to design tool and clothes

(ii) It used to the design the machine

(b) Copper

Physical properties

(i) it help to container metal

(ii) It used to the design machine and other material

Applications

(i) It used to cutting tool

(ii) It used to design clothes or equipment

(c) Lead

Physical properties

(i) It used to container non-metal

(ii) It used to the used chemical material

(d) Silver

Physical properties

(i) It is container metal

(ii) It container non-metal

Applications

(i) It used to the design clothes

(ii) It used to the furniture of the domestic

(e) Zinc

Physical properties

(i) It the help of the design or machine

(i) It the help of the design tool of chemical

Applications

(i) It used to the labo chemistry laboratory

(ii) It used to the design chemical of the kill of the plant and animals

Extract 8.2: A sample of poor responses to Question 8

In Extract 8.2, the student provided unmatched responses compared to the competence tested in this part. This student lacked knowledge, skills and experience on Engineering Material.

2.2.7 Question 9: Workshop Management and Safety Rules

The question primarily assessed students' knowledge by requiring them to explain concepts such as mechanical hazards and identify specific details, including types of hazards and precautionary measures. However, it also assessed their ability to apply t knowledge in the context of industrial safety. The question was:

Some of the production activities in the industry include working with rotating, sliding, reciprocating and sharp edge machine and equipment. Therefore, a worker is mostly exposed to mechanical and physical hazard.

(a) *What does the term 'mechanical hazard' mean as used in industry*

activities?

- (b) *What are the four hazards which are considered as mechanical hazard?*
- (c) *What are the four precautions measures should be taken by a worker who is working in the industry?*

The question was attempted by 300 (100%) students. Among them, 49 (16.33%) scored from 0 to 2.0 marks, 148 (49.33%) scored from 3.0 to 6.0 marks and 103 (34.34%) scored from 7 to 10 marks. Figure 9 represents the performance of the students in question 9.

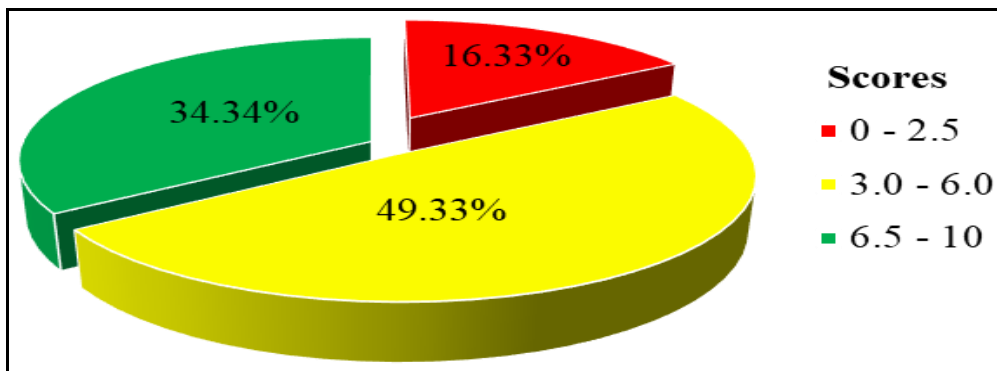


Figure 9: *The Students' Performance in Question 9*

Figure 9 shows that the overall performance on this question was good, with 251(83.67%) students scoring marks from average and above. This indicates that the majority of students had a good understanding of the topic of Workshop Management and Safety Rules.

Furthermore, 34.34 percent of the students achieved good marks (6.5–10) on this question. In part (a), these students correctly defined 'mechanical hazard' as the risk of physical injury caused by moving objects or flying debris from malfunctioning machines or equipment.

In part (b), most students accurately identified four types of mechanical hazards, such as design flaws in mechanical components, poor assembly, inadequate maintenance, insufficient safeguards, misuse of personal protective equipment, and lack of worker knowledge or skills.

Similarly, in part (c), they gave correct precautions for workers in the industry including: daily inspection of safety devices or guards, prohibition of tampering with or removal of guards, regular repairs and maintenance, easy

access to control mechanisms, and the use of personal protective equipment. Students who answered correctly displayed a good understanding of industrial safety protocols, highlighting both their theoretical knowledge and practical application skills. Extract 9.1 provides an example of well-constructed responses to this question.

9. Some of the production activities in the industry include working with rotating, sliding, reciprocating and sharp edge machine and equipment. Therefore a worker is mostly exposed to mechanical and physical hazard.

(a) What does the term 'mechanical hazard' mean as used in industry activities?

Mechanical hazard is a situation that can be caused by process such as sliding, rotating and reciprocating which put our safety into danger / harmful situation which is caused by doing mechanical work such as milling and drilling.

(b) What are the four types of hazards which are considered as mechanical hazard?

- Cuts on the hand by the ~~new~~ hacksaw or other machine tool caused by not wearing safety devices
- Burns caused by friction of machine parts due to lack of safety devices
- Improper use and handling of machine tools can lead to mechanical hazard
- Working/operating machine without understand its control can lead to mechanical hazard

(c) What are the four precaution measures should be taken by a worker who is working in the industry?

- Follow rules and regulations in the industry during working.
- Wear personal protective equipment such as p. gloves and overall.
- Do not operating the machine without understand Understand its controls.
- put the surrounding floor area clean all the time to avoid accidents.

Extract 9.1: A sample of good responses to Question 9

In Extract 9.1, the student accurately explained the concept of mechanical hazards, identified the types of hazards involved, and provided relevant safety precautions for workers in industrial environments.

Additionally, 49.33 percent of the students scored average marks (3.0–6.0) on this question. In part (a), these students failed to provide a clear definition of 'mechanical hazard,' omitting key terms, which resulted in incomplete or incorrect answers. Lack of clarity in explaining the term suggests a gap in

their knowledge on the topic being assessed.

In part (b), they were unable to identify all four types of mechanical hazards, often providing incomplete or partial responses. Similarly, in part (c), these students provided only a few precautionary measures that should be taken by workers in industrial settings.

On the other hand, 49 (16.33%) of the students scored from 0 to 2.5 marks on this question. Most of them performed poorly in part (a) because they failed to provide the correct meaning of 'mechanical hazard' in industrial activities. In part (a) they were not familiar with the question's requirements thus their responses indicated that, they lacked knowledge on safety measure in industry context. In part (b), some students scored low marks as they failed to mention all four types of mechanical hazards. Their responses were either incomplete or incorrect, indicating deficiencies in both theoretical knowledge and practical understanding of mechanical hazards. Similarly, in part (c), students failed to outline the four precautionary measures that workers should adopt in industrial settings. Most students were unable to list any of the required measures, indicating insufficient knowledge of the topic and a failure to comprehend the question. Extract 9.2 offers an example of poor responses from student.

9. Some of the production activities in the industry include working with rotating, sliding, reciprocating and sharp edge machine and equipment. Therefore a worker is mostly exposed to mechanical and physical hazard.
- (a) What does the term 'mechanical hazard' mean as used in industry activities?
 because mechanical hazard it used to contain activities in the industry.
- (b) What are the four types of hazards which are considered as mechanical hazard?
- (i) melting hazard Smollic hazard
 boiling hazz
- (ii) boiling hazard metallic hazard
- (iii) carbon hazard carbon hazard
- (iv) strenght hazard safety hazard
- (c) What are the four precaution measures should be taken by a worker who is working in the industry?
- (i) It used to control people of in workshop
- (ii) It used to appured material in workshop
- (iii) It used to welding material in workshop
- (iv) it used to cutting material in workshop

Extract 9.2: A sample of poor responses to Question 9

In Extract 9.2, the student faced difficulty with all aspects. He/she failed to correctly explain the concept of mechanical hazards as applied in industrial activities as well as not correctly identify the four types of hazards associated with mechanical hazards.

2.3 SECTION C: STRUCTURED QUESTION

This section had one structured essay question composed from the topic of *Metalwork Technology*. The question had 15 marks.

2.3.1 Question 10: Metal Work Technology

The question assessed students' ability to analyse, make decisions, and effectively communicate technical information. The question was:

- (a) *Suppose you have found out of that most of your fellow students are confused on choosing the proper type of grinding wheels capable for cutting various materials. Briefly explain three criteria to consider on deciding the type of grinding wheel to use.*
- (b) *What are the two-grinding wheel defects? Indicate a remedy for each?*
Defect 1 and Remedy.
Defect 2 and Remedy.
- (c) *Briefly explain the term abrasive materials or grit as used in grinding wheel.*
- (d) *Give two examples of abrasive materials and their uses.*

A total of 300 (100%) students attempted the question and analysis indicates that, 226 (75.33%) scored from 0 to 4.0 marks, 59 (19.67%) scored from 4.5 to 9.5 marks and 15 (5.00%) scored from 10 to 15 marks. These scores are presented in Figure 10.

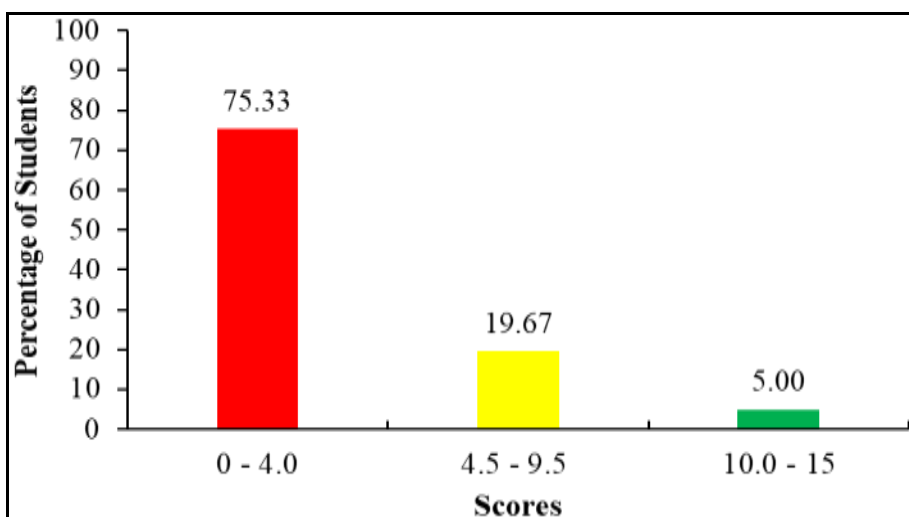


Figure 10: *The Students' Performance in Question 10*

Figure 10 shows that, the students' general performance in this question was weak since 226 (75.33%) students scored from 0 to 4.0 marks.

This is the most poorly performed question since 75.33 percent of students scored low marks from 0 to 4.0. In part (a), some students failed to identify the criteria for selecting a good grinding wheel. For instance, one student wrote that the grinding wheel must have *hole, thickness, and cutting ability*; this response was wrong because he/she did not relate the answer and the question. Similarly, in part (b), many students failed to address the defects and remedies of grinding wheels. Others provided irrelevant answers, like *heat generated, low power, put grease or oil*, which were incorrect.

In part (c), the students did not clearly define abrasive material or grit as used in a grinding wheel. Some incorrectly stated that *abrasive material or grit is the outer coating of the grinding wheel that protects it from damage and enhances its durability, preventing the wheel from wearing out quickly*. Additionally, some students provided incorrect examples of abrasive materials. One student mentioned *sand, gravel, wood, and rubber* as examples of abrasive materials. This misunderstanding suggested that the students had insufficient knowledge of the topic. Extract 10.1 presents a sample of a student's poor responses.

10. (a) Suppose you have found out that most of your fellow students are confused on choosing the proper type of grinding wheels capable for cutting various materials. Briefly explain three criteria to consider on deciding the type of grinding wheel to use.

(i) Material made from.

(ii) Quality and uses of the wheel.

(iii) ISO qualification code number.

(b) What are the two grinding wheel defects? Indicate a remedy for each?

(i) Defect 1: Abrasive

Remedy: ~~Grind~~ Produce the wheel

(ii) Defect 2: Grit

Remedy: Produce the wheel.

(c) Briefly explain the term abrasive materials or grit as used in grinding wheel.

Abrasive is the material that made up graphite or sand that used to produce grinding wheel.

(d) Gives two examples of abrasive materials and their uses.

- Grinding wheel - Grinding tools.
- lather machine - cutting metal.

Extract 10.1: A sample of poor responses to Question 10

In Extract 10.1, the student provided irrelevant answers to all parts of the question.

On the other hand, 19.67 percent of the students scored average marks (4.5–9.0) on this question. Some were able to provide the criteria and explanations for selecting a grinding wheel in part (a) but lacked a clear understanding of how to choose the appropriate wheel for cutting operations. Their responses were partial, indicating a limited grasp of the topic.

Similarly, in part (b), they identified defects and remedies but provided only a few, which resulted in average marks. This suggests insufficient knowledge and failure to meet the requirements of the question.

In part (c), they failed to give a complete definition while in part (d), some students scored average marks by giving only one example of an abrasive material and its use. For example, only one student mentioned aluminium oxide, which is used for grinding high-tensile materials such as tool steels.

Additionally, only 5.00 percent of students achieved good marks (10–13) on this question. They were able in part (a) to identify and make good explanation on each criterion on the three key criteria for selection of a grinding wheel which are: shape, arbour hole size, and abrasive materials or grit. In part (b), (c) and (d) students provided partial responses thus scored high but less than 15 marks. For example, they partially identified defects in grinding wheels and suggested remedies for each in part (b). Some wrote correct defects of Loading or clogging the grinding wheel such as; *Cracks, Chattering and Wheel rapid wear*, but did not provide the remedy for each defect. In part (c), they partially recognized term *abrasive materials* that abrasives and were able to emphasize that, abrasive are particles within the wheel, instead of; *sharp particles of the abrasive beyond the face of the bond producing a series of cutting edge*. In part (d), most of these students only provided examples of abrasive materials without giving their applications. For example, some wrote only *aluminium oxide and silicon carbide* without proving their uses, such as *for example 1: Aluminium oxide, is used for grinding high tensile materials such as tools steels and example 2: Silicon carbide is used for grinding low tensile and non-ferrous metals*. Extract 10.2 illustrates a good response from one of the students to question 10 (a).

10. (a) Suppose you have found out that most of your fellow students are confused on choosing the proper type of grinding wheels capable for cutting various materials. Briefly explain three criteria to consider on deciding the type of grinding wheel to use.

- (i) The grinding wheel should have proper Abrasive material like: Diamond, Aluminium oxide, Silicon carbide.
- (ii) The grinding wheel should have proper ~~grit~~ grain size eg. high (A, B, C, D, E, F, G, H, J, K, L, M, N, P, Q, R, S, T, U, V, W, X, Y, Z).
- (iii) The grinding wheel should have proper - ~~grit~~ binder, structural and bond type.

Extract 10.2: A sample of good responses to Question 10

In Extract 10.2 (a), the student successfully explained the criteria for selecting the type of grinding wheel in part (a).

3.0 ANALYSIS OF STUDENTS' PERFORMANCE IN EACH TOPIC

The Form Two National Assessment in Mechanical Engineering subject had four topics. These topics are: *Metalwork Technology*, *Workshop Tools and Equipment*, *Workshop Management* and *Safety Rules*, and *Engineering Materials*.

Based on the analysis of the students' performance, good performance (84.75%%) was observed in questions 3, 4 and 9 which were both drawn from the topics of *Workshop Management and Safety Rules* and in question 1 which were extracted from the topics of *Workshop Tools and Equipment*, *Engineering Materials*, *Metalwork Technology*, *Workshop Management and Safety Rules*. Students who performed well demonstrated a clear understanding of question requirements and effectively applied their knowledge and skills to the tested topics.

The average performance was observed in question 6, 7 and 10 from the topics of *Metal Working Technology* and in question 2, 5 and 8 from the topic of *Engineering Materials*. Analysis reveals that, the students had adequate knowledge and ability to apply the knowledge and skills in the topics assessed by identifying operational sequences to perform activities, providing explanation on different technique in welding and producing well labelled drawings on gas welding. A summary of the students' performance on each topic is presented in Appendix.

4.0 CONCLUSION AND RECOMMENDATIONS

This section presents concluding remarks and recommendations. The recommendations provided focus the students and teachers for forthcoming improvement.

4.1 Conclusion

The overall performance in Form Two National Assessment (FTNA) for Mechanical Engineering subject was good. This report reveals that, students had good performance in the topic of *Workshop Management and Safety*

Rules in questions 3, 4 and 9. However, the students had poor performance in topics such as Engineering Materials in question 2 and 5, as well as Metalwork Technology particularly in questions 7 and 10.

The performance analysis shows that, the factors that contributed to the average performance of the students are partial understanding to the requirement of the questions, inadequate knowledge and skill on some tested subject matters. Students' good performance was attributed to their ability to identify the requirements of each question, adequate subject knowledge. This report provides detailed justifications for both poor and good performance through illustrative extracts. In other words, extracts of both well-answered and poorly answered questions are included in the report for reference.

4.2 Recommendations

In order to advance the performance of students in Mechanical Engineering subject, the following are recommended:

4.2.1 Recommendations to the Students

- (a) Students should perform practical activities to relate between the theory and practical for hands on skills. This will help students recognize hand tools and understand their applications as outlined in Workshop Tools and Equipment topic.
- (b) Students should be guided to participate in Mechanical Engineering subject clubs. This will encourage them to develop interest to the subject.
- (c) Students should be supported in improving their English language skills by encouraging active participation in speaking and writing activities. This can be achieved by allowing them to participate in debates, group discussions and presentation of various assignments.
- (d) Students should combine the drawing skills and knowledge acquired from other subject like Engineering Drawing I and II. This will help them to acquire appropriate skills of drawing neatly and correctly label diagrams.

4.2.2 Recommendations to the Teachers

- (a) Teachers should guide students in developing the habit of carefully reading questions before attempting. This will help the students to comprehend with the requirements of the questions during assessment.
- (b) Teachers should prepare the supportive environment to students in order to gain and expand their knowledge and understand the requirements of the question and subject matter during teaching and learning process.
- (c) Teachers should organize practical sessions and guide students in hands-on activities for topics or sub-topics related to Engineering Materials.

APPENDIX**A Summary of Students' Performance (Question-Wise) in Mechanical Engineering, 2024**

S/N	Topics	Question Number	Percentage of students who scored 30% or above	Remarks
1	Workshop Management and Safety Rules	3, 4 and 9	84.75%	Good
2	Workshop Tools and Equipment, Engineering Materials, Metalwork Technology, Workshop Management and Safety Rules	1	78.00%	Good
3	Metal Work Technology	6,7 and 10	48.20%	Average
4	Engineering Materials	2,5 and 8	48.08%	Average

