EXAMINATIONS AND ASSESSMENT CHIEF DIRECTORATE
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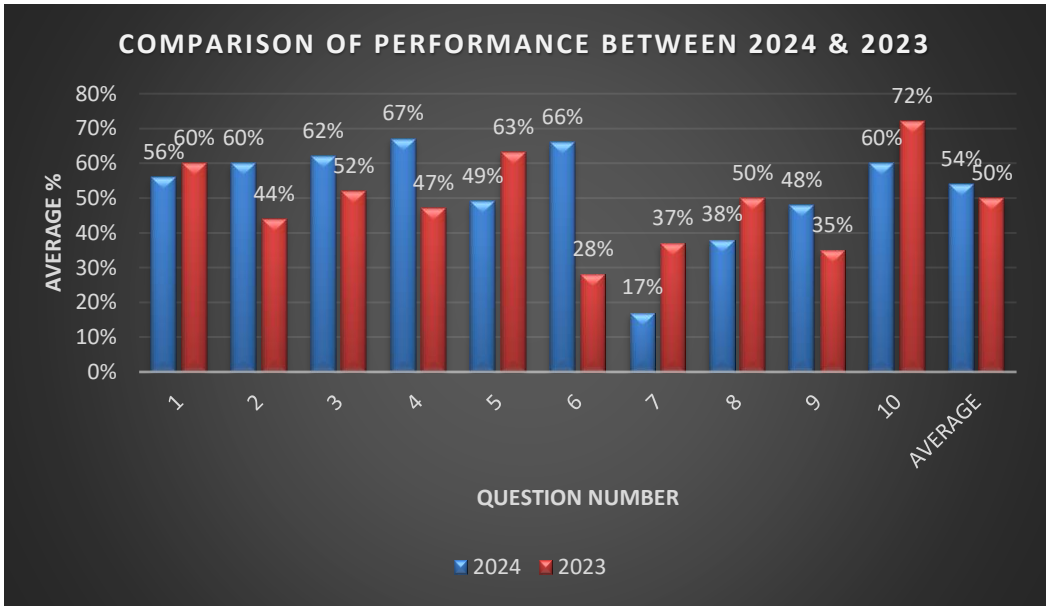
2024 NSC CHIEF MARKER'S REPORT

SUBJECT	**TECHNICAL SCIENCES**		
QUESTION PAPER	**1**		
DURATION OF QUESTION PAPER	**3 HOURS**		
PROVINCE	**EASTERN CAPE**		
NAME OF THE INTERNAL MODERATOR	**RICHARD MWELWA**		
NAME OF THE CHIEF MARKER	**NONTOMBI NGXABATYE**		
DATES OF MARKING	**27/11.2024 – 12/12/2024**		
HEAD OF EXAMINATION:	**MR E MABONA**		

SECTION 1: (General overview of Learners Performance in the question paper as a whole)

The graph below, show the comparison of 2023 and 2024 performance of candidates from the sampled hundred (100) scripts. The sample show a very poor performance in waves sound and light. The most poorly performed in 2024 being question 7,8,9 and 5. Most candidates seem not to have enough information to answer the stated questions.



However, the average performance for 2024 is at 54% better than the 2023 which was at 50%. It is worrying to note that the same topic (**Waves, Sound and Light**) has been

underperformed in the past three consecutive NSC examinations.

SECTION 2: Comment on candidates' performance in individual questions

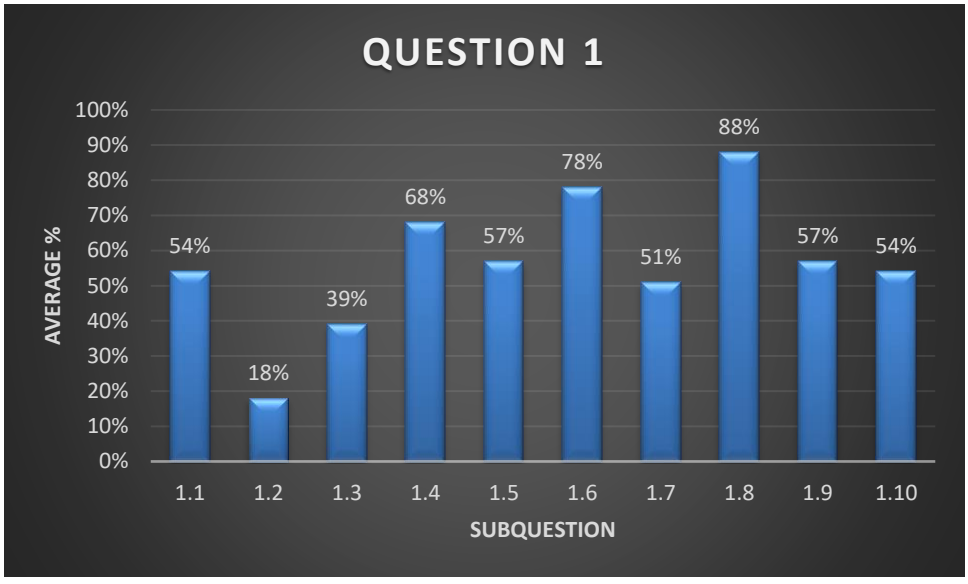
QUESTION 1 (Multiple Choice Questions) 56%

(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?

The question was not well answered given to the nature of the format in this question. The performance is slightly above. Sub question 1.2 and 1.3 were the worst performed below 50%. The table and graph below represent the performance in this question.

Sub-question	Topic	Ave. performance %
1.1	Resultant of forces	54%
1.2	Forces	18%
1.3	Net force	39%
1.4	Work done	68%
1.5	Viscosity	57%
1.6	Elasticity	78%
1.7	Dispersion of white light	51%
1.8	Transformer	88%
1.9	SI units	57%
1.10	AC generator	54%
TOTAL		**56%**

The best performed sub-question is 1.8



(b) Why was the question poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.

Candidates were picking either option A or B in question 1.2. This means that they do not understand that when a constant force is applied on an object it produces a constant acceleration. In 1.3 many candidates answered option C indicating that they do not know the relationship between the net force and the mass.

(c)Provide suggestions for improvement in relation to Teaching and Learning

Educators must train learners on how to answer multiple choice questions. When teaching Newton's second law of motion, they should explain clearly the proportionality relationship of F_{net} and acceleration and F_{net} and the mass. Addition and subtraction of forces must be done thoroughly. Educators and subject advisors are therefore advised to regularly assess learners on answering multiple-choice questions. Short topic tests that are multiple choice questions may be introduced.

(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.

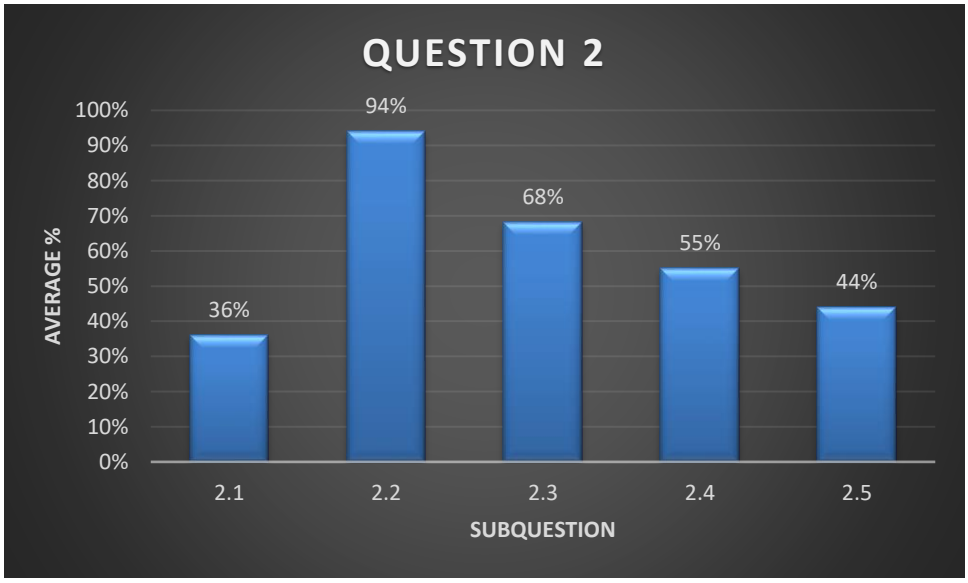
Learners must be trained to avoid guessing the answers, instead they must try to eliminate those answers that are completely not close to the expected answer.

QUESTION 2 (Newton's laws of motion) 60%

(a) General comment on the performance of Candidates in the specific question. Was the question well answered or poorly answered?

The question was fairly answered performed at 60%. The table and graph below represent the performance in this question.

Sub-question	Topic	Ave. performance %
2.1	Newton's third law	36%
2.2	Free body diagram	94%
2.3	Frictional force	68%
2.4	Tension	55%
2.5	Frictional force, inertia and acceleration	44%
TOTAL		**60%**



(b) Why was the question poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.

In 2.1 candidates were referring to the name of the law as Third Law omitting "Newton" while others were not stating it law in full. They were either omitting the terms simultaneously/ equal/ oppositely directed. In question 2.2 those candidates who managed to identify and correctly label the five forces acting on the bakkie were still losing 1mark for not putting the dot on the diagram. Some of the candidates could not correctly identify the correct direction of the tension acting on the bakkie. Some of the candidates were unable to write the correct definition of friction at all and others were writing an incomplete definition of friction in 2.3. Others were defining friction as "the force that opposes the applied force". This is a misconception as friction opposes the motion but does not always directly oppose the applied. Most candidates started by calculating the acceleration in 2.4 even though the statement indicated that the bakkie and car were moving at a CONSTANT VELOCITY which showed that they did not know or understand what the statement meant.

In 2.5.1 they were unable to explain what will happen to the car after the tow bar has been detached.

(c) Provide suggestions for improvement in relation to Teaching and Learning.

Teachers must emphasise the correct names of every law when teaching and give informal exercises where learners will have to identify and write the names of the laws. Learners must be given as many exercises as possible where they will be asked to draw free-body diagrams. Educators must emphasize that when drawing free-body diagrams forces must:

- Be represented by arrows
- Start from a dot and move away from the dot to their respective directions.
- All touch the dot
- Be correctly labelled using ***correct*** labels.

The concept of different kinds of forces must be thoroughly taught in grade 10 and 11 and extensively revised in grade 12. Examination Guidelines must be used for correct definitions and laws. Meaning and explanations for key phrases in definitions and laws must be given to learners. Applications of Newton's First Law in real life situations must be explained to the learners. Different examples of calculations involving Newton's laws must be done in class

(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.

The use of Examination Guidelines and CAPS document will ensure that learners

can state and write correct definitions and laws without omitting important keys phrases.

More exercises and examples maybe extracted from previous exam question papers to expose learners on questions relating to forces and Newton's laws. Calculations based on the laws must be taught and learners must be exposed

to various contexts.

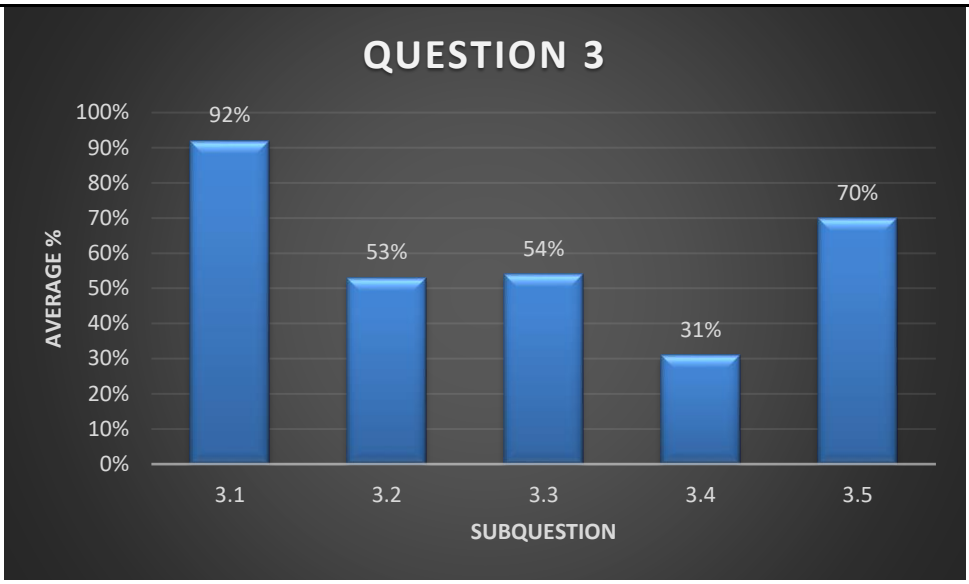
QUESTION 3 (Momentum and Impulse) 62%

(a) General comment on the performance of candidates in the specific question. Was the question well answered or poorly answered?

The question was fairly answered and performed at 62%. The table and graph below represent the

Sub-question	Topic	Ave. performance %
3.1	Principle of conservation of linear momentum	92%
3.2	Calculation of velocity	53%
3.3	Inelastic collision	54%
3.4	Explanation of change in velocity	31%
3.5	Momentum and impulse	70%
TOTAL		**62%**

performance in this question. Sub question 3.4 poorly answered.



(b) Why was the question poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.

Omission of the term "total" when stating the principle of conservation of linear momentum led candidates to only scoring 1 mark in question 3.1. In question 3.2 most candidates were not writing the subscripts in the formula to differentiate between the total momentum before collision and the total momentum after the collision and therefore lost 1mark for an incomplete formula. Those who managed to write the correct formula were losing marks due to the incorrect conversion of mass of the bullet from grams "g" to kilograms "kg". Most candidates managed to choose the correct type of collision "inelastic" in 3.3 but could not explain without a calculation why the collision was inelastic. This might mean that the candidates were guessing the answer and, they cannot differentiate between these two types of collisions. This also indicates that they were unable to analyse the given scenario by looking at the changes of the initial velocities and final velocities. In 3.4 candidates could not explain why the change in velocity of the gun-trolley system was less than that of a bullet which means they did not know that an object with a greater mass will have a smaller acceleration and therefore a smaller change in velocity. In 3.5.1 Some candidates were using an incorrect formula $p = mv$ instead of $\Delta p = mv_f - mv_i$ to calculate the change in momentum. Most candidates were also losing marks for either writing incorrect direction or no direction in the final answer in 3.2 and 3.5.1. Some of the candidates were writing "sec" instead of "s" as an SI unit for time in question 3.5.2.

(c) Provide suggestions for improvement in relation to Teaching and Learning

Thoroughly revise the conversion between units as it is a topic taught in grade 10 and give more informal exercises where the learners will be required to convert before doing a calculation. Each learner must be provided with a copy of formula sheet by their teacher to paste on their classwork book and use it even on classwork and homework. Learners must be trained to write definitions and principles/laws as they appear on the Examination Guidelines. The SI units must be thoroughly taught in grade 10 and revised throughout grade 11 and 12. Learners must be exposed to various context of calculations, and they must always be reminded about vector nature of velocity and force when dealing

with the topic of momentum and impulse.

(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.

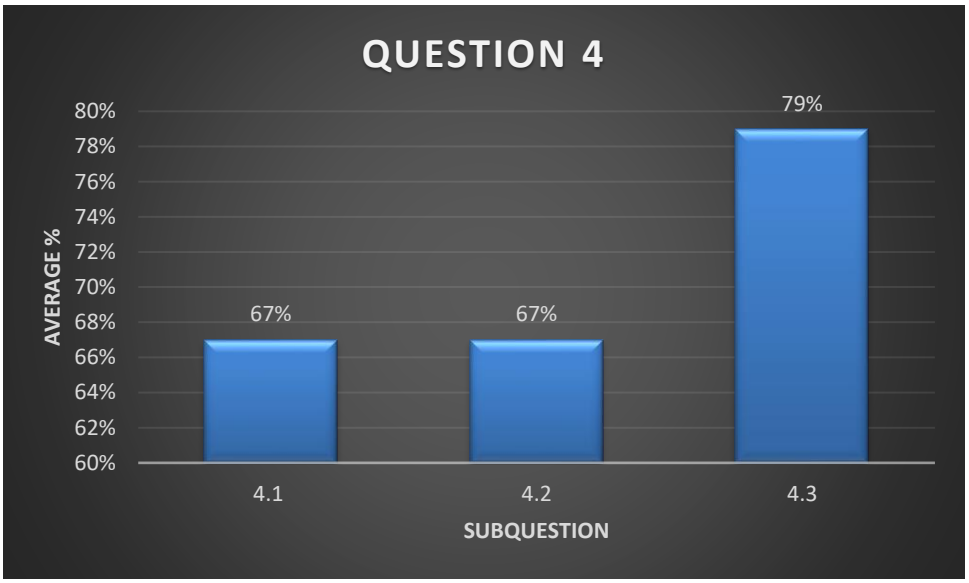
The use of Examination Guidelines in everyday teaching is extremely important. Conversion between units in general and SI units seem to be a huge challenge and therefore when preparing informal district class tests the conversion of units must be included. Subject advisors must moderate the district class tests to ensure the conversion between units and correct SI units is getting enough attention.

QUESTION 4 (Work Energy and Power 67%)

(a) General comment on the performance of candidates in the specific question. Was the question well answered or poorly answered?

The question was fairly answered, the performance is 67%. The table and graph below represent the performance in this question.

Sub-question	Topic	Ave. performance %
4.1	Free body diagram and work done by applied force	67%
4.2	Energy and Power	67%
4.3	Mechanical energy	79%
TOTAL		**67%**



(b) Why was the question poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.

Candidates were drawing all the forces in 4.1.1 even though the question only required horizontal forces. Some candidates did not resolve the applied force into the horizontal component. Most candidates calculated the correct answer in question 4.1.2 but a few were using wrong units and incomplete formula.

Some candidates could not differentiate between energy and power. Many candidates also left out key words in the definition of conservation of mechanical energy while some added the term "linear" which made the definition to be incorrect. Many candidates were using kinetic energy formula in 4.2.4 trying to calculate the energy of the egg when the egg was half the distance to the ground.

Candidates did not use the correct formula for conservation of mechanical energy hence they lost a mark. Many candidates did not make correct conversions of units of mass and height.

(c) Provide suggestions for improvement in relation to Teaching and Learning.

Educators must teach learners to read and understand the question before answering. Not always that all forces acting on an object are asked to be drawn. Learners must practice on how to draw free body diagrams correctly. The correct formula for conservation of mechanical energy is $\mathbf{M_E = E_k + E_P}$. Revision of grade 10 topic for units and measurements must be an ongoing exercise so that learners do not make errors

(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.

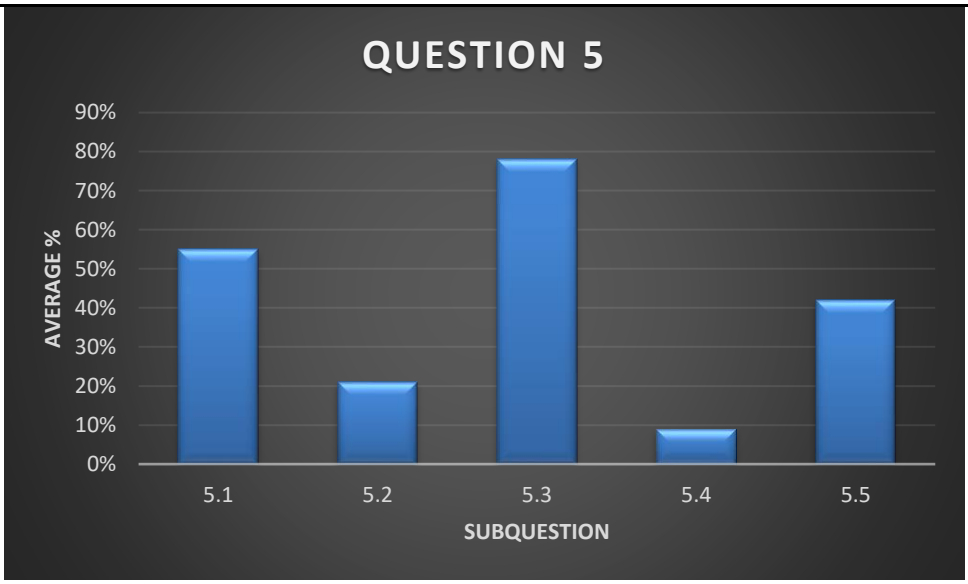
When teaching this topic teachers must refrain from using incomplete formular as this may mislead learners. Learners must be shown how they could lose marks should they omit certain information on calculations during teaching and revision periods.

QUESTION 5 (Elasticity 49%)

(a) General comment on the performance of candidates in the specific question. Was the question well answered or poorly answered?

This question is the This question is the third worst performed topic below 50%. The worst performed sub question is 5.5. The table and graph below represent the performance in this question.

Sub-question	Topic	Ave. performance %
5.1	Define elasticity	55%
5.2	Young's modulus of elasticity	21%
5.3	Calculation of young's modulus from the graphs	78%
5.4	Elasticity	9%
5.5	Comparisons of elasticity of materials from the graphs	42%
TOTAL		**49%**



(b) Why was the question poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.

There is a misconception on the definition of elasticity and a perfectly elastic body. Most candidates were defining a perfectly elastic body instead. Candidates could not state the importance of understanding Young's modulus of elasticity in industry. Some candidates could not put correct units on the calculations while others did not put any units at all. Candidates could not explain the difference in the values of elasticity of the two materials represented in the graphs. Candidates could not identify the elastic region from the graph, they were identifying the elastic limit instead. In 5.3 most candidates could not write the correct formula for the calculation of Young's modulus.

(c) Provide suggestions for improvement in relation to Teaching and Learning

Educators must spend time on explaining what the definitions mean so that learners do not only memorize them but understand what they mean. When teaching calculations educators must always remember to emphasize the use of data and formula sheets and correct units. Educators must use graphs in their daily assessment tasks. Learners should be taught how to analyse graphs. Learners must be taught to use the formula sheet at all times in order to choose the correct formula for calculations.

(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.

Learners were leaving out the words "property of a body" in the definition of elasticity hence ending up defining perfectly elastic body.

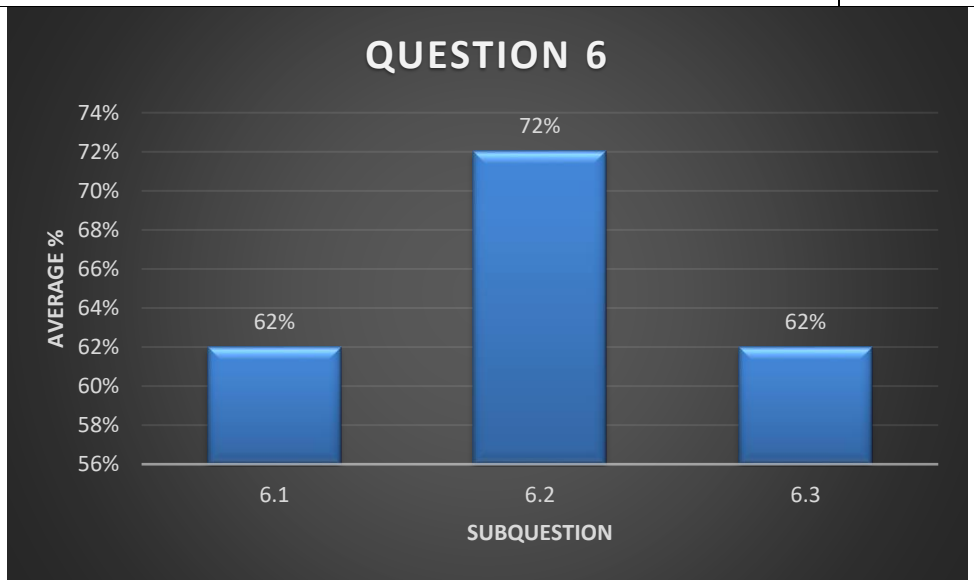
Some candidates were using wrong formulae and symbols

QUESTION 6 (Hydraulics- 66%)

(a) General comment on the performance of candidates in the specific question. Was the question well answered or poorly answered?

This question is the second best performed question in the whole paper at 66%. The table and graph below represent the performance in this question.

Sub-question	Topic	Ave. performance %
6.1	Pascal's law	62%
6.2	Calculation of the force	72%
6.3	Pressure of a liquid	62%
TOTAL		**66%**



(b) Why was the question poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.

Common errors committed by candidates:

Candidates left out keys words in defining Pascal's law in question 6.1

Candidates were rounding off given values from the statement, hence getting the wrong answer.

Wrong conversion of the area from cm^2 to m^2.

Some candidates substituted correctly in the formular but could not get the correct answer. Some candidates did not write the correct SI unit in the final answer for the calculation in 6.3. those who manged to remember it were using the correct symbol for **Pa** instead were writing **pa.**

(c) Provide suggestions for improvement in relation to Teaching and Learning

Educators should provide examination guidelines to learners at the beginning of the year. They should encourage learners to study and understand the key words in the definitions, laws and concepts. Learners should be advised not to round off figures until the final answer to the minimum of two decimal places. Grade 10 units and measurements topic must be revised throughout the year. Candidates must be trained thoroughly on how to use calculators.

(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.

Candidates were omitting the word 'equally and liquid'. The use of examination guidelines is advised for learners to grasp the definitions. Correct SI units on final answers must be emphasized. Learners must be reminded at all times that unit conversion is extremely important for this topic and a subject as a whole

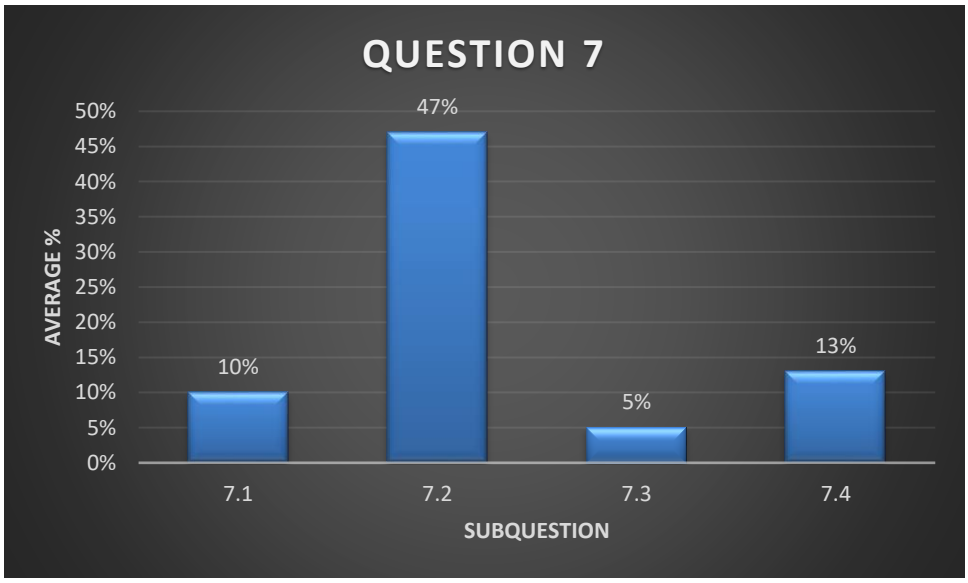
.

QUESTION 7 (Light) 17%)

(a) General comment on the performance of candidates in the specific question. Was the question well answered or poorly answered?

This is the worst performed question at 17%. The table and graph below represent the performance in this question.

Sub-question	Topic	Ave. performance %
7.1	Total internal reflection	10%
7.2	Law of reflection	47%
7.3	Critical angle	5%
7.4	Refraction	13%
TOTAL		**17%**



(b) Why was the question poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.

In 7.1 candidates were making a common error of referring to dispersion instead of total internal reflection. A misconception could have arisen because of confusing the diagram of a diamond to a prism hence giving the response as dispersion. In 7.2 Most candidates did not understand the question, they were defining the law instead of explaining why the angle of incidence is equal to angle of reflection. In 7.3 candidates were again supposed to explain critical angle using an actual angle of 24.4^0, but many of them could not realise that the given value was the incident angle. In 7.4 candidates could not explain what happens to the light as it exits the diamond medium.

(c) Provide suggestions for improvement in relation to Teaching and Learning

Educators must teach this topic using practical experiments such as demonstration of total internal reflection using different optical materials of different shapes. Expose learners to more applications of total internal reflection and discuss conditions for total internal reflection. Educators must provide examination guidelines to learners at the beginning of the year.

Educators must show learners how a law, principle and or definition can be explained.

Educators must also demonstrate refraction using different optical objects such as prisms, rectangular glass blocks etc.

(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.

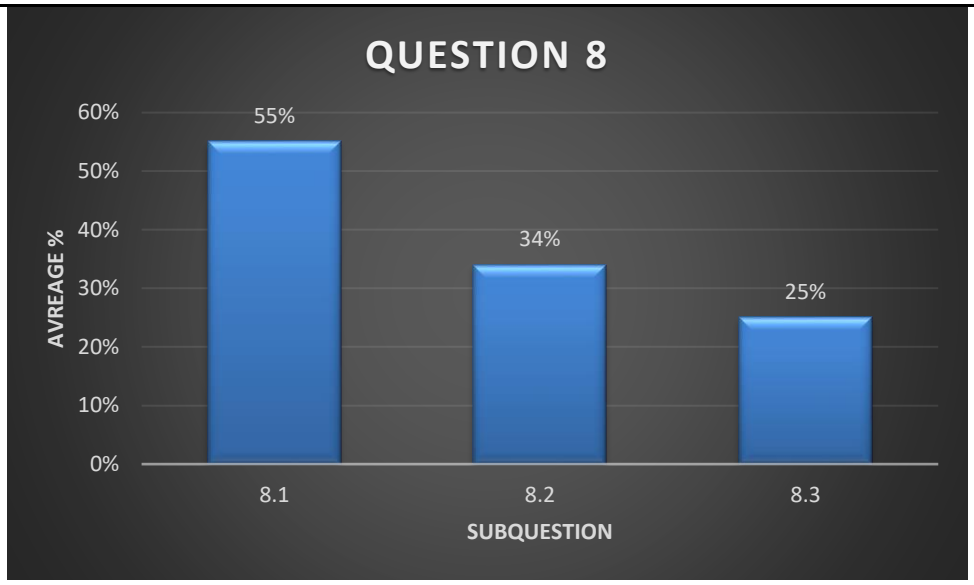
Learners seem to have problems with narrative answers. They either gave wrong answers due to language limitations or lack of deep understanding of concepts. Educators and subject advisors must guide and encourage learners to read on their own.

QUESTION 8 (Electromagnetic radiation and Lenses) 38%

(a) General comment on the performance of candidates in the specific question. Was the question well answered or poorly answered?

This is the second poorly answered question at 38%. Sub questions 8.2 and 8.3 being the worst performed in this question. The table and graph below represent the performance in this question.

Sub-question	Topic	Ave. performance %
8.1	Electromagnetic waves	55%
8.2	Lenses	34%
8.3	Ray diagrams	25%
TOTAL		**38%**



(b) Why was the question poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.

In 8.1.1 candidates were writing the answer as “Radio” instead of “Radio waves”. In 8.1.2 Candidates could not correctly convert units from MHz to Hz. They do not know the conversion factor. In 8.2.1 candidates could not label parts on the ray diagram. They were writing incomplete answers like, “Axis, length, centre, focal, straight line etc.

In 8.2.2 candidates could not identify the type of lens in the ray diagram.

In 8.3 candidates did not know where the object will be formed and mention its properties

(c) Provide suggestions for improvement in relation to Teaching and Learning

This topic must be taught in a practical way, where learners practice how to draw ray diagrams using different types of lenses and describe the images formed. Ray diagrams must be drawn to scale so that learners will confidently answer any questions regarding ray diagrams.

Calculations in this topic must include revising grade 10 units and measurements and scientific notation.

(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.

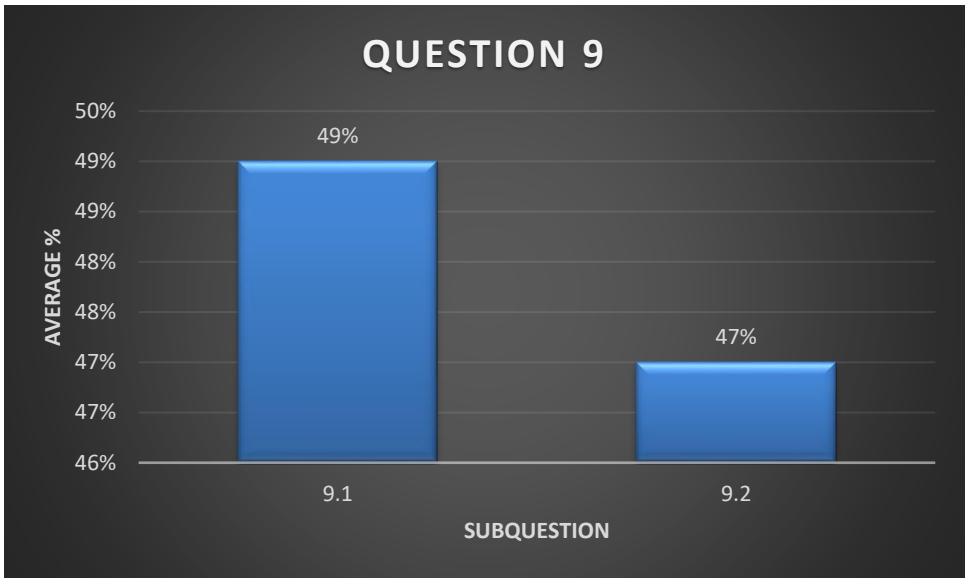
Candidates were guessing when describing the image formed, because they would randomly use all the properties for example, some candidates would describe the image as inverted and upright, or real and virtual. Educators need to explain the meaning of these words and not just write them.

QUESTION 9 (Capacitors and Capacitance, Electric circuits) 48%

(a) General comment on the performance of candidates in the specific question. Was the question well answered or poorly answered?

The performance in this question was just below 50%. The question was not well answered in both sub questions. The table and graph below represent the performance in this question.

Sub-question	Topic	Ave. performance %
9.1	Capacitors and Capacitance	49%
9.2	Electric circuits	47%
TOTAL		**48**



(b) Why was the question poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.

Candidates could not mention the factors affecting capacitance correctly in 9.1.1 In 9.1.2 candidates were substituting charge in place of capacitance. Candidates had a challenge to convert 60pF to Farads (F) in 9.1.2 Candidates could not clearly explain why appliances with large capacitors need to be fully discharged before they are serviced.

Candidates left out the key word when defining current in 9.2.1

(c) Provide suggestions for improvement in relation to Teaching and Learning

Educators should spend enough time on teaching capacitors and capacitance for the learners to grasp the concepts. Educators must expose learners to conversion of different units and measurements as taught in grade 10. Educators need to explain the functions of capacitors in appliances and then explain why they should be fully discharged before servicing them. Examination guidelines must be provided to learners at

the beginning of every year. Educators must assess learners on definitions and concepts in Technical Sciences throughout the year.

(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.

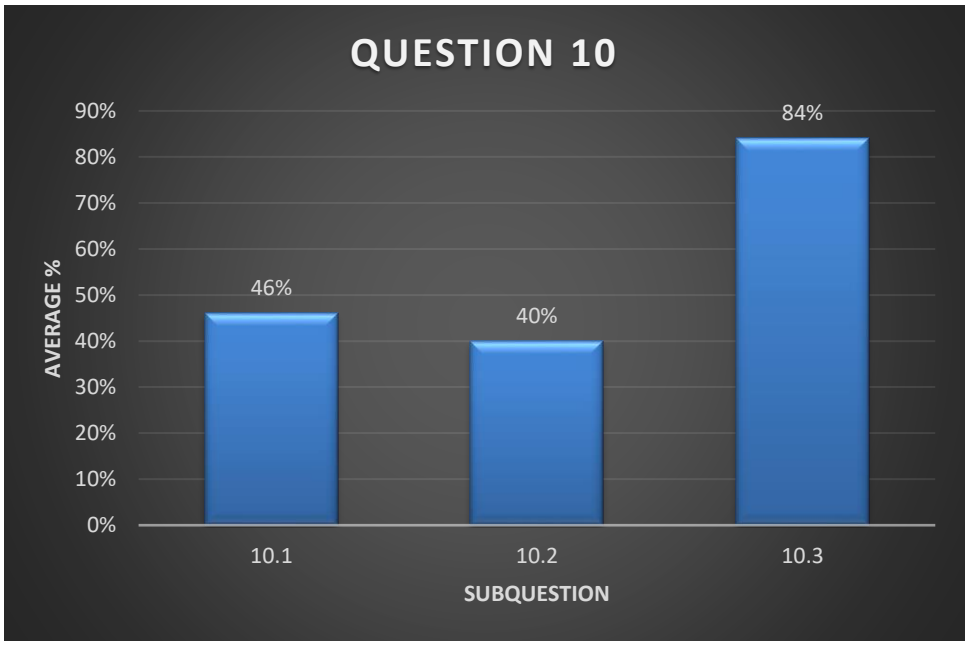
In 9.1.1 candidates were writing; Distance instead of distance between the plates; and Area instead of area of the plates. Learners were leaving out the key word "rate" in defining current. Educators must teach learners to study all the key words in definitions and laws. Subject advisors and teacher development can assist by developing material that can be used by teachers and learners.

QUESTION 10 (Electromagnetism- 60%)

(a) General comment on the performance of candidates in the specific question. Was the question well answered or poorly answered?

The overall question was fairly performed at 60%. However, sub questions 10.1.1 – 10.1.4 and 10.2 were not well answered. The table and graph below show the performance in each sub question.

Sub-question	Topic	Ave. performance %
10.1	Motors and Generators	46%
10.2	Lenz's Law	40%
10.3	Transformers	84%
TOTAL		**60%**



(b) Why was the question poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.

Candidates did not perform well in sub questions 10.1 and 10.2. Candidates could not state the principles on which the generator and motor operate. A few candidates were also confusing the energy conversions that take place in the generator and motor.

Candidates could not state Lenz's law correctly, some left out key words such as "**direction and effect**" in the law

(c) Provide suggestions for improvement in relation to Teaching and Learning

Educators must provide Examination Guidelines to learners at the beginning of each year and grade so that learners can grasp the definitions and laws. Educators must emphasize the energy conversions that take place in the two devices and make comparisons between the two devices. Teachers must thoroughly teach the basics of electromagnetic induction for learners. More exercises involving calculations of transformers must be given to learners.

When teaching the topic, teachers must use practical demonstrations to enhance the level of understanding.

(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.

Electromagnetism is one of the topics that can easily boost learner performance. Teachers must teach the topic in conjunction with lots of demonstrations and simulations. Thorough preparation must be done before teaching the topic. Learners must be assessed regularly to measure the extent at which learning had taken place. Teachers must teach all the prescribed content, not only the content that had been assessed in the previous years.