Shape

Description automatically generated with low confidence

**QUALITATIVE ANALYSIS OF LEARNER RESPONSES AND EVALUATION OF QUESTION PAPERS: NSC 2021**

|  |
| --- |
| **REPORT 1: EVALUATION OF THE QUESTION PAPER AND MARKING GUIDELINE** |

|  |  |
| --- | --- |
| **SUBJECT** | **PHYSICAL SCIENCES** |
| **PAPER** | **1** |
| **DURATION OF PAPER:** | **3 HOURS** |

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

|  |
| --- |
| The learner performance is instituted based on the comparative performance of experimented 100 scripts tabled and graphed below (see table 1 and figure 1). An overall performance of 53% was achieved from the sample, which showed a 1% drop compared to 2020 which was 54%. The graph and table below indicate that the average learner performance ranges between 32 % and 74% from question 1 to question 10. The overall percentage depicts a drastic drop relative to 2020 performance which ranged between 47% and 64%, however this is not a so good performance as it still ranges in the 50s. |
|  |
| |  |  |  |  | | --- | --- | --- | --- | | |  | | --- | |  | |  |  | |  |  |  | |  |  |  | |  |  |  | |  |  |  | |  |  |  | |  |  |  | |  |  |  | |  |  |  | |  |  |  | |  |  |  | |  |  |  | |  |  |  | |  |  |  | |  |  |  | |  |  |  | |  |  |  | |  |  |  |  |  |  |  | | --- | --- | --- | | **FIGURE 1:** |  |  | |  |  |  | | **TABLE 1** |  |  | | **Question** | **Topic** | **Ave. performance %** | | 1 | All Topics | 61% | | 2 | Newton’s Laws of Motion | 58% | | 3 | Projectile Motion | 32% | | 4 | Momentum and Energy Principles | 53% | | 5 | Work, Energy and Power and Momentum | 50% | | 6 | Waves, Sound and Light | 74% | | 7 | Electrostatics | 57% | | 8 | Electric Circuits and Ohm’s Law | 41% | | 9 | Electrodynamics | 61% | | 10 | Photoelectric Effect | 54% | | **Total** |  | **53%** | |
|  |
| Referring to the data, we can conclude that Projectile motion is the most poorly performed question at 32% followed by Electric Circuits at 41%. Question 2, 4, 5, 7 and 10 are also poorly performed at 50% to 58%. Question 1, 6 and 9 were the only fairly answered questions. We can conclude to say this paper was Generally poorly answered. Learners were not exposed to these types and styles of questioning as their source of trends of the questions was minimal in the paper. |

**SECTION 2: Comment on candidates’ performance in individual questions**

**(It is expected that a comment will be provided for each question on a separate sheet).**

|  |  |  |
| --- | --- | --- |
|  |  |  |
| |  | | --- | |  | |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
| **FIGURE 2** |  |  |

The average performance in the Paper is depicted in Figure 2 above from Question 1-10.

|  |
| --- |
| **QUESTION 1: 61%** |
| (a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered? |
| This was amongst fairly answered questions in the paper at 61% an increase of 14% compared to 47% in 2020. It shows that learners were exposed to the process and procedure to be followed when dealing with MCQ distractors. |
| * Candidates performed very well in 1.1 (83%), 1.6 (87%), 1.8 (70%) & 1.9 (64%). |
| * Candidates performed poorly in 1.4.(33%) and 1.7. (47%) |

|  |
| --- |
| 1. Why the question was poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions. |
| |  |  |  | | --- | --- | --- | | **Sub-question** | **Topic** | **Ave. performance %** | | 1.1 | Forces: Newton’s Laws | 83% | | 1.2 | Projectile motion | 57% | | 1.3 | Momentum | 54% | | 1.4 | Mechanical Energy | 33% | | 1.5 | Waves, sound and light | 59% | | 1.6 | Electrostatics | 87% | | 1.7 | Electrostatics | 47% | | 1.8 | Electric Circuits | 70% | | 1.9 | Electrodynamics | 64% | | 1.10 | Matter and Materials | 58% |   In sub-question 1.4. learners were expected to identify a graph which explains the total Mechanical Energy which is constant i.e. Graph B. The error made was to relate Mechanical Energy with the motion of the bouncing ball. |
| In sub-question 1.7 most learners did not interpret Coulomb’s Law correctly and focused on the magnitude of the charges in relation to the Electrostatic Force and confused the proportionality of the force to the charges, irrespective of their magnitude and charge. |

|  |
| --- |
| 1. Provide suggestions for improvement in relation to Teaching and Learning |
| * Classroom activities i.e. class works, home works and class tests should include a variety of MCQ questions. * Educators should train learners on how to eliminate distractors and the structure and style of creating MCQ, this will assist a lot in the identification process. * Use of past papers to deal with MCQ for each section of the work. i.e. exposure to similar types of MCQ from various resources. |
| * Development of question banks for each topic using other provinces’ Preparatory examination Papers. |
|  |
| **QUESTION 2 (58%)** |
| (a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered? |
| |  |  |  | | --- | --- | --- | | **Sub-question** | **Topic** | **Ave. performance %** | | 2.1 | State Newton First Law | 67% | | 2.2 | Free body diagram | 87% | | 2.3 | Calculation: Applied Force | 65% | | 2.4 | Analysis for the Net force | 26% | | 2.5 | Application of motion | 33% |   This question was fairly answered as it is at least above 50%. 2.1-2.3. were well answered as 2.1.(67%), 2.2.(87%) & 2.3.(65%) |
| *Question 2.4. and 2.5. were poorly answered at 2.4.(26%) & 2.5.(33%)* |

|  |
| --- |
| 1. Why the question was poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions. |
| Mixing of motion with Newton’s Laws created a confusion to most learners. Wrong interpretation of Fnet in 2.4. worth 2 marks contributed to poor performance in 2.5. which is 4 marks. This was a higher order question as it required learners to synthesize the answer in order to be able to do 2.5. |
|  |
| 1. Provide suggestions for improvement in relation to Teaching and Learning |
| Learners be trained in the new trends of questioning by making use of the Paper as a point of Reference. Learners be exposed to the different scenarios of integrating motion with Newton’s laws. Making use of other provinces June & Preparatory examinations to create a question bank that can be integrated in teaching and learning for improved conceptualisation of these topics. |

|  |
| --- |
| (d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc. |
| Most Learners were unable to identify the application of Newton 1st Law concluding statement that talks about the net force, i.e. unbalanced/non-zero resultant force in dealing with 2.4 and 2.5. |
| * There is a need for educators, subject advisors and teacher development to look at the progression of Newton’s laws of motion and try to establish the correlation in their teaching and activities that will assist the understanding of the learners. |

|  |
| --- |
| **QUESTION 3 (32%)** |
| (a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered? |
| |  |  |  | | --- | --- | --- | | **Sub-question** | **Topic** | **Ave. performance %** | | 3.1 | Testing knowledge on Projectile motion | 51% | | 3.2 | Calculation: Analysis of 3 objects motion | 33% | | 3.3 | Calculation: Application of 3.2 for Distance of balloon | 19% | |
|  |
| Generally, the performance of the learners dropped drastically from 52% average in 2020 to 32% in 2021. This question was poorly answered overall. The fairly answered sub-question 3.1.(51%) and poorly answered sub-question 3.3. (19%) |

|  |
| --- |
| 1. Why the question was poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions. |
| The question on projectile involved 3 objects in motion. i.e. Hot-air balloon moving upwards at constant velocity, stone **A** is dropped and **B** is dropped 5 seconds later. This created a lot of confusion to the learners as they are used to 2 objects in this question. They struggled to analyse the problem and were disadvantaged with the calculations of the problem. Learners were also challenged to relate the motion between the hot air balloon and stone **A** and also between the hot air balloon and Stone **B**. The problem was even difficult for most of the level 7 learners because of Mathematical manipulations. The confusion between the times of stone **A** and stone **B** difference of 5 seconds was also missed.This type of question was not appearing in the previous question papers driven by CAPS as they were used by the learners for revision. |

|  |
| --- |
| Sub-questions 3.2.2 and 3.2.3 were expected to be level 3 but were skewed towards level 4. |
| Sub-question 3.3. extended also to level 4 that is evaluation and creating. |

|  |
| --- |
| 1. Provide suggestions for improvement in relation to Teaching and Learning |
| There is a need for teachers, subject advisors and teacher development to draw attention to the new format of assessing the learners in the topic Projectile motion. The approach will be to utilise activities that will reflect motion of 3 objects. The orientation will be for one object moving up and two objects moving down with different times. The other scenario will focus on two objects moving up at different times and the third object moving downwards. These activities must be appearing in classwork, homework and class tests. |

|  |
| --- |
| (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 unable to deal with the problem and were just selecting equations of  motion from the datasheet which in most cases were irrelevant. |
| * Subject Advisors will have to design common controlled tests in their various districts focusing on this new approach of assessing Projectile motion. |
| * Teacher development will have to develop training material to train educators in assessment in the new context of the national panel of examiners for the new trends. |

|  |
| --- |
| **QUESTION 4 (53%)** |
| (a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered? |
| |  |  |  | | --- | --- | --- | | **Sub-question** | **Topic** | **Ave. performance %** | | 4.1 | Definition of Elastic Collision | 36% | | 4.2 | Integration of Energy principles and Momentum principle | 58% | | 4.3 | Impulse and Momentum | 55% | |
|  |
| The question was poorly answered with a drop of 11% average compared to 64% in 2020. The fairly answered sub-question is 4.2.(58%) and worst answered sub-question is 4.1.(36%) |

|  |
| --- |
| 1. Why the question was poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions. |
| * Sub-question 4.1 deals with elastic collision and learners were expecting to do a calculation when solving a problem to establish whether a collision is elastic or inelastic. Most learners were unable to explain the meaning of Elastic collision fully. |
| * Sub-question 4.2 learners struggled to integrate Energy principles and Conservation of momentum and most obtaining 2 marks out of 5 marks. |
| * Sub-question 4.3 also integrated Newton’s laws of motion with momentum. i.e. the concept of impulse. |

|  |
| --- |
| 1. Provide suggestions for improvement in relation to Teaching and Learning |
| Teachers should teach grade 12 concepts starting from the basics in grade 10. Start each topic by giving a baseline assessment of the concepts taught in grade 10 and 11. The baseline assessment will inform the teacher of the concepts that were understood to build on the concepts that are not understood. Revision on the aspects of the concept that are taught in grade 10 and 11 should be done before proceeding to new concepts. Find time to revise grades 10 and 11 work. |

|  |
| --- |
| (d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc. |
| Sub-question 4.3. most learners failed to consider the vector nature of momentum. In teaching emphasise the vector nature of momentum and impulse. |

|  |
| --- |
| **QUESTION 5 (50%)** |
| (a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered? |
| |  |  |  | | --- | --- | --- | | **Sub-question** | **Topic** | **Ave. performance %** | | 5.1 | Stating the Principle of Mechanical Energy | 75% | | 5.2 | Application of the Principle in 5.1 | 62% | | 5.3 | Application of Energy principle | 53% | | 5.4 | Integration of Momentum and Energy principles | 30% | |
|  |
| Generally, the question was poorly answered overall with an average of 50% a drop of 6% from the average of 6% in 2020. The best answered sub-question is 5.1. at (75%) and the worst answered sub-question is 5.4. at (30%) |
| 1. Why the question was poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions. |
| Question 5.3 Learners were struggling to do correct analysis of the work done by the frictional force and its relationship to work-energy theorem and other related energy principles.  Question 5.4, Learners were expected again to integrate momentum with energy principles which pose a challenge to learners. They were also confused whether they are assessed the same concepts as in sub-question 4.3 which lead to poor performance. |
| 1. Provide suggestions for improvement in relation to Teaching and Learning |
| Teachers should emphasise that a change always deals with the final quantity minus the initial quantity. i.e. ∆p = pf – pi, this was a challenge when learners were dealing with work for none conservative forces. They must teach to differentiate conservative and non-conservative forces. |

|  |
| --- |
| (d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc. |
| Learners do not understand that the skill of drawing force diagrams does assist in dealing with energy problems as it is easy to identify the forces doing work. Educators to train learners to be able to differentiate between work done by non-conservative and conservative forces. |
| Subject advisors to work closely with the Teacher Development Section to develop material that will address the integration of momentum and energy principle as a new trend of assessing these concepts. |

|  |
| --- |
| **QUESTION 6 (74%)** |
| (a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered? |
| |  |  |  | | --- | --- | --- | | **Sub-question** | **Topic** | **Ave. performance %** | | 6.1 | Basic Calculation of wavelength | 84% | | 6.2 | Stating Doppler Effect | 78% | | 6.3 | Application of Doppler effect | 84% | | 6.4 | Calculation based on Doppler effect | 63% | |
|  |
| This is the most well performed question in the 2021 Paper with an average increase of 18%. |
| The most highly performed sub-questions being 6.1. & 6.3. at (84%) followed by 6.2. (78%), 6.4.(63%) |

|  |
| --- |
| 1. Why the question was poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions. |
| **N/A** |
| 1. Provide suggestions for improvement in relation to Teaching and Learning |
| There is a need to continue with practicing of past Question Papers as it shows an indication of attainment of 80% and above. There is an improvement in the understanding of the applications of the Doppler effect. |
| Structured classroom activities in a variety of questions from various provinces will also assist in the overall improvement of learner performance. |

|  |
| --- |
| (d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc. |
| Material development that focuses on the approaches of teaching waves, sound and light be established. Subject advisors to select lead educators that will develop common assessment tasks for SBA purposes and assessment activities in collaboration with teacher development. |

|  |
| --- |
| **QUESTION 7 57%** |
| (a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered? |
| |  |  |  | | --- | --- | --- | | **Sub-question** | **Topic** | **Ave. performance %** | | 7.1 | Basic principles of Electrostatics  Definition of Electric field at a point  Calculation of Magnitude of Electric Field | 67% | | 7.2 | Application of Coulomb’s law | 39% | |
|  |
| This question was poorly performed as 60% was expected from the learners. |
| Sub-question 7.1. was well performed at (67%)  Sub-question 7.2. was the most poorly performed at (39%) |

|  |
| --- |
| 1. Why the question was poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions. |
| Electrostatics is a topic that is taught in grade 11 and it expected that by the end of grade 12 learners should have a mastering over the concepts. Candidates could not answer this question well. This can be the evidence that they did not get enough time after the Preparatory Examinations to revise adequately. |
| Learners were not able to establish superposition of Electrostatic forces when there is a net force. Also there was wrong interpretation of Coulomb’s law. |
| 1. Provide suggestions for improvement in relation to Teaching and Learning |
| Teachers should provide enough revision material for learners and assist them with their revision of classroom activities in preparation for common controlled tests and Provincial examinations. |
| Educators to provide a design of activities in line with the revised ATPs and examination guidelines. It is expected that educators are able to deal with learners’ activities and clarify misconceptions and errors. |

|  |
| --- |
| (d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc. |
| **Sub-question 7.2**, learners substituted the net force as the force between the two charges but each charge contributes to Coulomb’s law equation. Learners were unable to relate the net Electrostatic force to superposition of electrostatic forces. i.e. application of Newton’s laws in the new context. Subject advisors needs to communicate with teacher development to discuss the new trends in the assessment of the topics. |
| It will be the responsibility of the Institute and subject advisors to develop worksheets for districts in their provincial material. |

|  |
| --- |
| **QUESTION 8 41%** |
| (a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered? |
| |  |  |  | | --- | --- | --- | | **Sub-question** | **Topic** | **Ave. performance %** | | 8.1 | Basic analysis of electric circuits. | 61% | | 8.2 | Definition of Power | 80% | | 8.3 | Calculations: Circuit Analysis | 73% | | 8.4 | Application of the Circuit analysis in 8.3 | 30% | | 8.5 | Drawing of conclusions using Ohm’s law | 17% | | 8.6 | Interpretation of the Voltmeter readings | 25% | |
|  |
| This is the second most poorly performed question in the paper with an average of 41% a drop of 11% from 2020. The most poorly performed sub-questions being 8.5 (17%), 8.6. (25%) and 8.4. (30%). The well answered sub-questions 8.2. (80%), 8.3. (73%) & 8.1. (61%) |

|  |
| --- |
| 1. Why was the question poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions. |
| The circuit diagram was a challenge as it confused the learners in identifying the parallel connection of resistors in the loop. Misinterpretation of series resistors with the parallel connection did cost the learners negatively. The orientation as a new trend of questioning disadvantaged the learners of 12 marks. |

|  |
| --- |
| 1. Provide suggestions for improvement in relation to Teaching and Learning |
| Teachers must teach with practical demonstration. Connect a simple circuit and show the difference in the reading on the voltmeter when the switch is open and when it is closed. They must also design worksheets that will look at different orientations of resistors in the circuit like the one in the Paper. More exercises be given to learners for practice purposes. |

|  |
| --- |
| (d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc. |
| Learners’ inability to explain basic concepts in electric circuit could be due to lack of time to cover the syllabus and do thorough revision. Analysis of circuits will need an approach by the Subject advisors and educators in the development of worksheets that will integrate assessment in teaching. |

|  |
| --- |
| **QUESTION 9 (61%)** |
| (a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered? |
| |  |  |  | | --- | --- | --- | | **Sub-question** | **Topic** | **Ave. performance %** | | 9.1 | Recall of components of AC generator | 90% | | 9.2 | Application of Faraday’s law Grade 10 concept | 74% | | 9.3 | Root Mean Square definition | 35% | | 9.4 | Calculation: Data interpretation | 66% | | 9.5 | Calculation: Analysis of results | 76% | | 9.6 | Application of Data in the new context, Synthesis. | 38% | |
|  |
| Generally, the question was fairly well answered with an average of 61% an increase of 2% compared to 59% of 2020. The most performed sub-questions 9.1. (90%), 9.5. (76%), 9.2. (74%) & 9.4. (66%) |
| Sub-questions that were poorly performed were 9.3. (35%) and 9.6. (38%) |

|  |
| --- |
| 1. Why was the question poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions. |
| Learners struggled to define root Mean Square in 9.3. and also to interpret the data for Graphical representation in 9.6. missing the meaning of the term doubled for Vmax. The calculations were moderate but application of the concepts of Electrodynamics threatened the learners. |

|  |
| --- |
| 1. Provide suggestions for improvement in relation to Teaching and Learning |
| Grade 12 teachers should create time outside of the normal school tuition hours to assist learners to cover the syllabus and get ample time for revision as well as informal assessment of these problematic concepts. Also use of Phet simulations in most of the concepts in electrodynamics followed by worksheets. |

|  |
| --- |
| (d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc. |
| Learners did not understand that the voltage of a power source is the rms voltage. They would use the source voltage to calculate the rms voltage as if it was the peak or maximum voltage. |
| There will be a need to treat this topic with respect it deserves. Subject advisors take a leadership role in dealing with learner camps with a focus on these challenging topics. Use of material developed by the institutes during these camps. |

|  |
| --- |
| **QUESTION 10 (54%)** |
| (a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered? |
| |  |  |  | | --- | --- | --- | | **Sub-question** | **Topic** | **Ave. performance %** | | 10.1 | Definition Threshold Frequency | 73% | | 10.2 | Graphical Interpretation | 52% | | 10.3 | Application of Photoelectric equation from the graph | 45% | | 10.4 | Role of intensity in photoelectric effect | 56% | |
|  |
| Generally, the Question was poorly performed even though it shows an average increase of 7% from an average of 47% in 2020. |
| Sub-questions that are well performed is 10.1. (73%) most poorly performed subsection is 10.3. (45%). |

|  |
| --- |
| 1. Why the question was poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions. |
| There was a clear evidence that this topic was not taught thoroughly due to lack of time. Many learners did not understand exactly what they were required to do in each question. Reading values from a graph also posed a challenge to some learners. |

|  |
| --- |
| 1. Provide suggestions for improvement in relation to Teaching and Learning |
| Revise grade 10 electromagnetic radiations with learners as it is the bases for the calculations in Photoelectric effect.  Teachers should relate the graphs under Photoelectric effect to the straight-line graph so that learners can be able the interpret the meaning of the intercepts and the gradient. |

|  |
| --- |
| (d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc. |
| Some learners after reading the value from the horizontal axis, they forget to multiply by 1014.  10.3 some learners omitted the word threshold from their explanation and that cost them to lose marks. |
| Learner to be trained by educators and Subject Advisors through the material developed by the Institute. Sample classroom activities that will mainly focus on graphical interpretations will be prioritised for the benefits of the learners. |