

## EXAMINATIONS AND ASSESSMENT CHIEF DIRECTORATE

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# 2019 NSC CHIEF MARKER'S REPORT

SUBJECT:	PHYSICAL SCIENCES
PAPER:	1
DURATION OF PAPER:	3 HOURS
DATES OF MARKING:	30 NOV 2019 – 1 DEC 2019

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

The question paper was of a good standard that tested the ability of all the levels of competency of learners. The standard of questions was compliant with the Examination guidelines and were also CAPS compliant.

Some of the questions were set in a slightly different way. This also shows that candidates need to understand the work. Teachers and candidates must not only rely on working through previous papers during the teaching process. If they only use previous papers without understanding the work, they will not be able to answer questions which are set in a different way, as in this paper.

The distribution of marks was good. However, the response of markers was the following:

Question 2.3: Too many marks allocated (6 or 7 instead of 8)

Question 4.2.2: Too many marks allocated (4 instead of 5)

Question 6.4: Too many marks allocated (5 instead of 6)

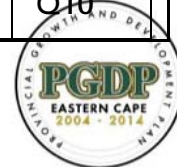
Question 7.1.2: Too few marks allocated (4 instead of 3)

Question 9.2.2: Too few marks allocated (6 instead of 5)

The following is a rating of the performance of learners in each question in the question paper, according to an analysis of 100 scripts that was done during marking:

From the best performing to the worst performing:

1	2	3	4	5	6	7	8	9	10
Q4	Q2	Q5	Q3	Q8	Q7	Q9	Q1	Q6	Q10



## 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).

<b>QUESTION 1 (Performance: 8<sup>th</sup> out of 10)</b>
<b>(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?</b>
<p>The performance of the learners in Question 1 was poor. This question was the question that ranked 8<sup>th</sup> in performance. The levels of the questions were generally of a standard where one expected the candidates to do better.</p> <p>The three questions where the candidates performed best were Questions 1.9, 1.8 and 1.6.</p> <p>The two questions where the candidates performed worst were Questions 1.2 and 1.5.</p> <p>Question 1.2: High level question. Worst performance in analysis. Some candidates did not realize that the distance from the centre of the planet had changed to 3R.</p> <p>Question 1.5: Second worst performance in Question 1. A complicated calculation was needed to find the answer and the candidates could not do it.</p>
<b>(b) Why the question was poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.</b>
<p>Question Multiple Choice-type Questions (MCQ) should be included in as many tests as possible. The skill of eliminating possible wrong choices must be taught to the learners. All previous exam papers can be used to improve this skill. Nevertheless, the better the learners understand the content of the work, the better they will do in this section.</p>
<b>(c) Provide suggestions for improvement in relation to Teaching and Learning</b>
<p>Teachers need to test the learners knowledge by making use of 20-point Multiple Choice-type Questions (10 questions x 2 marks per question). These can be done often and marked quickly during class and the results discussed with learners.</p> <p>Teachers need to set up Multiple Choice-type Questions themselves and then share it with their colleagues so that you create a MCQ-bank of questions</p>
<b>(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.</b>
<p>Since tests that consist only of Multiple Choice-type Questions are easy to mark, these</p>

types of tests can easily be done in a class. Teachers will need to spend some time preparing these tests, but it will be to the advantage of the candidates when answering Question 1 of this paper.

This will teach candidates how to eliminate options that are not relevant and then finally come to the correct answer.

The better the candidates understand the content of the work, the higher the level of Multiple Choice-type Questions they would be able to answer.

<b>QUESTION 2 (Performance: 2<sup>nd</sup> out of 10)</b>
<b>(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?</b>
<p>This was the question which the candidates found the second easiest. Nevertheless, candidates still made some unnecessary mistakes.</p> <p>There was nothing new regarding what was being tested in this question. The candidates found this question challenging because 3 different aspects were tested in the same question:</p> <ul style="list-style-type: none"><li>(1) Inclined plane</li><li>(2) Rough and smooth surfaces</li><li>(3) Applied force at an angle to the inclined plane.</li></ul>
<b>(b) Why the question was poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.</b>
<p>The candidates are not used to answering questions where all three aspects mentioned in (a) are combined. Identifying the forces acting on objects remains a challenge to many learners.</p> <p>The learners did not perform well because:</p> <p>Question 2.1: Candidates do not know their definitions,</p> <p>Question 2.2: Candidates could not identify all the forces acting on each object. This caused problems when they tried to do the rest of the question.</p> <p>Question 2.3: It was obvious in this section that the candidates were making basic mathematic errors while attempting this question.</p>
<b>(c) Provide suggestions for improvement in relation to Teaching and Learning</b>
<p>Identification of forces acting on an object needs to be well taught in Grade 11. Many candidates did not use the correct or adequate subscripts to identify the different forces.</p>
<b>(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.</b>
<p>The identification of the correct forces when drawing free-body diagrams remains a problem for many learners.</p> <p>The use of appropriate subscripts needs to be emphasized when drawing force- and free-body diagrams. Candidates lose unnecessary marks by using the wrong labels to represent the forces (<math>F_g</math>, <math>F_{//}</math>, <math>F_{\perp}</math>, <math>f_s</math>, <math>f_k</math>, <math>F_{App}</math>). Candidates also struggled to understand the difference between <math>F_{//}</math> and <math>F_H</math> as well as <math>F_{\perp}</math> and <math>F_v</math>.</p> <p>Candidates are exposed to this section in Grade 11. Teachers need to revise this topic quite often in Grade 12.</p>

<b>QUESTION 3 (Performance: 4<sup>th</sup> out of 10)</b>
<b>(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?</b>
From the performance of the learners, this question was answered fairly well. It was noted that too many learners could not define free-fall.

<b>(b) Why the question was poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.</b>
Questions 3.1, 3.2 and 3.3 are regularity questions that should be answered with a proper understanding of equations of motion and vertical projectile motion. Most study aids and many past questions provide questions of this level. In Question 3.2, the HEIGHT ABOVE THE GROUND was written in bold letters but the learners only calculated the height from the top of the building. Question 3.4 is a higher-level question designed to test the ability of the top candidates and is a good question as such. Question 3.5 was a new type of question and tests the candidate's ability to understand graphs. This sub-section was relatively well answered.

<b>(c) Provide suggestions for improvement in relation to Teaching and Learning</b>
Learners need to understand what is required from them in the question. After calculating the height which the stone travelled from its starting point (2 marks), they failed to add the height of the building (40 m) to obtain the final answer (2 marks). They therefore lost half of the marks due to not reading properly. Question 3.4 required a higher level of thinking but learners could still get 3 or 4 marks (out of 6) if they had applied the equations of motion correctly.

<b>(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.</b>
Learners still have challenges regarding rounding off to 2 decimal figures, using the correct mathematics to change the subject of the formula and using the calculator correctly.

<b>QUESTION 4 (Performance 1<sup>st</sup> out of 10)</b>
<b>(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?</b>
This question was the best answered question in the paper.

<b>(b) Why the question was poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.</b>
<p>The explanation of <i>isolated system</i> was a challenge for many of the learners.</p> <p>Question 4.2.1 was well answered.</p> <p>Question 4.2.2: Candidates made unnecessary mistakes in this question because they could not differentiate between initial and final momentum (<math>p_i</math>, <math>p_f</math>) and initial and final velocity (<math>v_i</math> and <math>v_f</math>).</p>

<b>(c) Provide suggestions for improvement in relation to Teaching and Learning</b>
<p>The correct use of subscripts needs to be taught from Grade 10.</p> <p>It is also important that the teachers teach the candidates how to use the signs for vector directions correctly.</p>

<b>(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.</b>
<p>Learners seem to have different sources of definitions and explanations which are not aligned to the exam guidelines. Since many learners write down wrong formulae that are on the Data Sheets, they need to have the Data Sheets available to them so that they are familiar with all the formulae and constants. The department needs to make it compulsory that every candidate has access to the exam guidelines, including the Data Sheets at the start of their Grade 12 year.</p>

<b>QUESTION 5 (3<sup>rd</sup> out of 10)</b>
<b>(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?</b>
This question was the 3 <sup>rd</sup> best answered question in the question paper.

<b>(b) Why the question was poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.</b>
<p>Question 5.1: Learners lose unnecessary marks because they do not know their definitions.</p> <p>Question 5.2: Well-answered.</p> <p>Question 5.3: Explaining why mechanical energy is not conserved was challenging to most of the learners.</p> <p>Question 5.4: Well-answered.</p> <p>Question 5.5: Learners struggle to differentiate between the following formulae and what values to substitute into the formula. Identifying the difference between <math>v_f</math> and <math>v_i</math>, <math>h_f</math> and <math>h_i</math> remains a problem. Learners also struggle with the differentiation between the different types of work done – <math>W_{\text{nett}}</math>, <math>W_f</math>, <math>W_g</math>, <math>W_{//}</math>, etc.</p>

<b>(c) Provide suggestions for improvement in relation to Teaching and Learning</b>
Clear explanations of the use of formula when using, for example $\Delta U = mgh_f - mgh_i$ or any other energy related formula. Learners have problems here because they do not understand the concepts well enough.

<b>(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.</b>
Teaching the concepts correctly so that the learners understand them, would mean that these misconceptions are eliminated.

<b>QUESTION 6 (Performance: 9<sup>th</sup> out of 10)</b>
<b>(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?</b>
This question was poorly answered. Except for Question 6.1, all the other sub-sections were poorly answered.
<b>(b) Why the question was poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.</b>
<p>The use of the word “air pressure” as a label for the y-axis was unfamiliar for the learners. Very few text books use this label. The use of time (<math>\times 10^{-4}</math> s) caused the learners to start off with a wrong value.</p> <p>The fact that sound detectors were placed in both the car and the outside source confused the candidates.</p>
<b>(c) Provide suggestions for improvement in relation to Teaching and Learning</b>
<p>Many of the candidates were trying to compare frequency with distance instead of wavelength. They also struggled to identify the relationship between frequency and period for a wave. (Grade 10 work). Candidates were not able to use the Period (T) from graphs A and B and correctly including <math>\times 10^{-4}</math> s in the calculation of frequencies. These concepts are taught in Grade 10 and the candidates should revise and understand these terms in Grade 12. The use of the Doppler formula was a challenge since the candidates did not know where to substitute the appropriate values,</p>
<b>(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.</b>
<p>All wave concepts should be revised in grade 12.</p> <p>The proper understanding of the Doppler effect would improve the performance of candidates in this section.</p> <p>The teachers must also make sure that learners know how to interpret graphs correctly.</p>



<b>QUESTION 7 (Performance: 6<sup>th</sup> out of 10)</b>
<b>(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?</b>
This question was not well answered. The fact that was the 6 <sup>th</sup> most difficult question is surprising since these types of questions are asked in every exam and the work was done in Grade 11.
<b>(b) Why the question was poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.</b>
Candidates failed to differentiate between Electric Field strength ( $E_{\text{nett}}$ ) and Electrostatic force ( $F_{\text{nett}}$ ). This caused candidates to lose many marks in this question.
<b>(c) Provide suggestions for improvement in relation to Teaching and Learning</b>
It is important that teachers pay attention to teach the candidates the difference between Electric Field strength ( $E_{\text{nett}}$ ) and electrostatic force ( $F_{\text{nett}}$ ). Candidates also need to be able to identify the directions of the forces acting on a charge and thereby getting the direction of the answer correct.
<b>(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.</b>
Candidates commonly use the terms used by the teacher in the class when writing definitions and terms. The teachers must use the correct terms as given on the Exam Guidelines to make sure that the definitions are written correctly.

<b>QUESTION 8 (Performance: 5<sup>th</sup> out of 10)</b>
<b>(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?</b>
The question was not very well answered.

<b>(b) Why the question was poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.</b>
<p>Question 8.1: The candidates were not able to explain what is meant by the term <i>emf of a battery</i>.</p> <p>Question 8.2: The candidates showed an inability to read graphs.</p> <p>Question 8.3: Candidates should be able to do this question well since it is Grade 11 work and is done again in Grade 12 when doing the section on internal resistance.</p> <p>Question 8.4: The candidates identified that they had to use the formula <math>E = I(R + r)</math> but then got confused with the substitution and also how to use the answer they had calculated.</p>

<b>(c) Provide suggestions for improvement in relation to Teaching and Learning</b>
Basic application of mathematics was a challenge to many of the candidates. After selecting the correct formula and substituting correctly, the candidates struggled to change the subject of the formula correctly.

<b>(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.</b>
It needs to be explained to the candidates by the teachers that $\mathcal{E}_{\text{mf}}$ and $r_{\text{int}}$ remains constant. If the candidates understand this concept, they will be able to explain any changes that take place better.

<b>QUESTION 9 (Performance: 7<sup>th</sup> out of 10)</b>
<b>(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?</b>
This question was poorly answered and performed 7 <sup>th</sup> out of 10 in the analysis.

<b>(b) Why the question was poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.</b>
The learners struggled to do the explanations and draw the appropriate graph. In Question 9.1.2, the candidates failed to use the term “change in magnetic flux”. Question 9.2.1: There is still confusion concerning the difference between AC and DC. Question 9.2.2: Some of the candidates were not sure whether to use Work or Power in the calculation of $V_{rms}$ . They substituted W into the Power formula and P into the Work formula.

<b>(c) Provide suggestions for improvement in relation to Teaching and Learning</b>
Definitions, graphs and explanations need to be taught in a way that candidates can improve in these aspects. Too many candidates lose marks by not understanding the concepts properly.

<b>(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.</b>
Demonstrations, videos and practicals should be used when presenting the topic on electromagnetic induction, electric motors and generators.

<b>QUESTION 10 (Performance: 10<sup>th</sup> out of 10)</b>
<b>(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?</b>
This was the question in which the learners fared the worst in.

<b>(b) Why the question was poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.</b>
<p>It was evident that the learners do not understand the concepts of Work Function (<math>W_o</math>), threshold frequency (<math>f_o</math>) and Maximum Kinetic Energy (<math>E_{k(max)}</math>) and how each forms part of the formula <math>E = W_o + E_{k(max)}</math>.</p> <p>Question 10.2: Reading the value from the graph and giving the answer as <math>7,48 \times 10^{-19} \text{ J}</math> was challenging for the candidates. Justifying the answer was difficult for many candidates. Their understanding of <math>W_o</math> and <math>E_{k(max)}</math> was tested here.</p> <p>Question 10.3: Very badly answered. Learners struggle to read and understand graphs.</p> <p>Question 10.4: Candidates had problems with this question because they struggle to calculate the gradient of the graph and/or of use the Photo Electric Effect formula. They have challenges in both these two techniques to solve the problem.</p>

<b>(c) Provide suggestions for improvement in relation to Teaching and Learning</b>
<p>The teachers need to show the candidates how the Photo Electric Effect applies to everyday life by making use of videos and other study aids. If candidates see the visual effect of the Photo Electric Effect, they will understand the relative terms related to this concept.</p> <p>It is also evident that the candidates cannot apply their mathematic knowledge in the science class.</p>

<b>(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.</b>
<p>It is worrying that candidates confuse Work in energy principles (<math>W_{nett} = F_{nett} \cdot \Delta x \cdot \cos \theta</math>) with the Work Function in the Photo Electric Effect (<math>E = W_o + E_{k(max)}</math>).</p> <p>The cause of this is that the teachers do not explain the Photo Electric Effect correctly to the candidates and do not do enough examples and problems for them to fully understand this concept.</p>

**GENERAL REMARKS:**

The candidates make many careless mistakes due to not doing the basics correct. Teachers need to guide them in the following:

- Reading and analyzing the question asked and determine exactly what is required to be answered.
- Choosing the correct formula by making use of the Data Sheet.
- Using the directions correctly when working with vectors.
- Using the correct subscripts.
- Using the calculator correctly – especially scientific notation.
- Using the correct SI units.

The candidates do a lot of memorizing without understanding the concepts. This causes them to not understand how to solve the problems where the application of the concept is required.

Teachers must refrain from using exam papers and memorandums for teaching purposes only. These must be used as study aids and for revision purposes.

Note to teachers: Please make sure the candidates **DO NOT** write in pencil. The question paper must be written in pen.