education

Department:
Education
REPUBLIC OF SOUTH AFRICA

NATIONAL CURRICULUM STATEMENT GRADES 10-12 (GENERAL)

SUBJECT ASSESSMENT GUIDELINES

MECHANICAL TECHNOLOGY

JANUARY 2008

PREFACE TO SUBJECT ASSESSMENT GUIDELINES

The Department of Education has developed and published Subject Assessment Guidelines for all 29 subjects of the National Curriculum Statement (NCS). These Assessment Guidelines should be read in conjunction with the relevant Subject Statements and Learning Programme Guidelines.

Writing Teams established from nominees of the nine provincial education departments and the teacher unions formulated the Subject Assessment Guidelines. The draft copies of the Subject Assessment Guidelines developed by the Writing Teams were sent to a wide range of readers, whose advice and suggestions were considered in refining these Guidelines. In addition, the Department of Education field-tested the Subject Assessment Guidelines in 2006 and asked for the comments and advice of teachers and subject specialists.

The Subject Assessment Guidelines are intended to provide clear guidance on assessment in Grades 10 to 12 from 2008.

The Department of Education wishes you success in the teaching of the National Curriculum Statement.

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1. PURPOSE OF THE SUBJECT ASSESSMENT GUIDELINES

This document provides guidelines for assessment in the National Curriculum Statement Grades 10 - 12 (General). The guidelines must be read in conjunction with *The National Senior Certificate: A Qualification at Level 4 on the National Qualifications Framework (NQF)* and the relevant Subject Statements. The Subject Assessment Guidelines will be applicable for Grades 10 to 12 from 2008.

The Department of Education encourages teachers to use these guidelines as they prepare to teach the National Curriculum Statement. Teachers should also use every available opportunity to hone their assessment skills. These skills relate both to the setting and marking of assessment tasks.

2. ASSESSMENT IN THE NATIONAL CURRICULUM STATEMENT

2.1 Introduction

Assessment in the National Curriculum Statement is an integral part of teaching and learning. For this reason, assessment should be part of every lesson and teachers should plan assessment activities to complement learning activities. In addition, teachers should plan a formal year-long Programme of Assessment. Together the informal daily assessment and the formal Programme of Assessment should be used to monitor learner progress through the school year.

Continuous assessment through informal daily assessment and the formal Programme of Assessment should be used to:

- develop learners' knowledge, skills and values
- assess learners' strengths and weaknesses
- provide additional support to learners
- revisit or revise certain sections of the curriculum and
- motivate and encourage learners.

In Grades 10 and 11 all assessment of the National Curriculum Statement is internal. In Grade 12 the formal Programme of Assessment which counts 25% is internally set and marked and externally moderated. The remaining 75% of the final mark for certification in Grade 12 is externally set, marked and moderated. In Life Orientation however, all assessment is internal and makes up 100% of the final mark for promotion and certification.

2.2 Continuous assessment

Continuous assessment involves assessment activities that are undertaken throughout the year, using various assessment forms, methods and tools. In Grades 10-12 continuous assessment comprises two different but related activities: informal daily assessment and a formal Programme of Assessment.

2.2.1 Daily assessment

The daily assessment tasks are the planned teaching and learning activities that take place in the subject classroom. Learner progress should be monitored during learning activities. This informal daily monitoring of progress can be done through question and answer sessions; short assessment tasks completed during the lesson by individuals, pairs or groups or homework exercises.

Individual learners, groups of learners or teachers can mark these assessment tasks. Self-assessment, peer assessment and group assessment actively involves learners in assessment. This is important as it allows learners to learn from and reflect on their own performance.

The results of the informal daily assessment tasks are not formally recorded unless the teacher wishes to do so. In such instances, a simple checklist may be used to record this assessment. However, teachers may use the learners' performance in these assessment tasks to provide verbal or written feedback to learners, the School Management Team and parents. This is particularly important if barriers to learning or poor levels of participation are encountered.

The results of these assessment tasks are not taken into account for promotion and certification purposes.

2.2.2 Programme of Assessment

In addition to daily assessment, teachers should develop a year-long formal Programme of Assessment for each subject and grade. In Grades 10 and 11 the Programme of Assessment consists of tasks undertaken during the school year and an end-of-year examination. The marks allocated to assessment tasks completed during the school year will be 25%, and the end-of-year examination mark will be 75% of the total mark. This excludes Life Orientation.

In Grade 12, the Programme of Assessment consists of tasks undertaken during the school year and counts 25% of the final Grade 12 mark. The other 75% is made up of externally set assessment tasks. This excludes Life Orientation where the internal assessment component counts 100% of the final assessment mark.

The marks achieved in each assessment task in the formal Programme of Assessment must be recorded and included in formal reports to parents and School Management Teams. These marks will determine if the learners in Grades 10 and 11 are promoted. In Grade 12, these marks will be submitted as the internal continuous assessment mark. Section 3 of this document provides details on the weighting of the tasks for promotion purposes.

2.2.2.1 Number and forms of assessment required for Programmes of Assessment in Grades 10 and 11

The requirements for the formal Programme of Assessment for Grades 10 and 11 are summarised in Table 2.1. The teacher must provide the Programme of Assessment to the subject head and School Management Team before the start of the school year. This will be used to draw up a school assessment plan for each of the subjects in each grade. The proposed school assessment plan should be provided to learners and parents in the first week of the first term.

Table 2.1: Number of assessment tasks which make up the Programme of Assessment by subject in Grades 10 and 11

SUBJECTS		TERM 1	TERM 2	TERM 3	TERM 4	TOTAL
Language 1: Home Language		4	4*	4	4*	16
Language 2: Choice of HL or FAL	HL	4	4*	4	4*	16
	FAL	4	4*	4	4*	16
Life Orientation		1	1*	1	2*	5
Mathematics or Maths Literacy		2	2*	2	2*	8
Subject choice 1**		2	2*	2	1*	7
Subject choice 2**		2	2*	2	1*	7
Subject choice 3		2	2*	2	1*	7

Note:

* One of these tasks must be an examination

** If one or two of the subjects chosen for subject choices 1, 2 or 3 include a Language, the number of tasks indicated for Languages 1 and 2 at Home Language (HL) and First Additional Language (FAL) are still applicable. Learners who opt for a Second Additional Language are required to complete 13 tasks in total: 4 tasks in term 1 and 3 tasks in each of terms 2, 3 and 4.

Two of the assessment tasks for each subject must be examinations. In Grades 10 and 11 these examinations should be administered in mid-year and November. These examinations should take account of the requirements set out in Section 3 of this document. They should be carefully designed and weighted to cover all the Learning Outcomes of the subject.

Two of the assessment tasks for all subjects, excluding Life Orientation, should be tests written under controlled conditions at a specified time. The tests should be written in the first and third terms of the year.

The remainder of the assessment tasks should not be tests or examinations. They should be carefully designed tasks, which give learners opportunities to research and explore the subject in exciting and varied ways. Examples of assessment forms are debates, presentations, projects, simulations, written reports, practical tasks, performances, exhibitions and research projects. The most appropriate forms of assessment for each subject are set out in Section 3. Care should be taken to ensure that learners cover a variety of assessment forms in the three grades.

The weighting of the tasks for each subject is set out in Section 3.

2.2.2.2 Number and forms of assessment required for Programme of Assessment in Grade 12

In Grade 12 all subjects include an internal assessment component, which is 25% of the final assessment mark. The requirements of the internal Programme of Assessment for Grade 12 are summarised in Table 2.2. The teacher must provide the Programme of Assessment to the subject head and School Management Team before the start of the school year. This will be used to draw up a school assessment plan for each of the subjects in each grade. The proposed school assessment plan should be provided to learners and parents in the first week of the first term.

Table 2.2: Number of assessment tasks which make up the Programme of Assessment by subject in Grade 12

SUBJECTS		TERM 1	TERM 2	TERM 3	TERM 4	TOTAL
Language 1: Home Language		5	5*	4*		14
Language 2: Choice of HL or FAL	HL	5	5*	4*		14
	FAL	5	5*	4*		14
Life Orientation		1	2*	2*		5
Mathematics or Maths Literacy		3	2*	2*		7
Subject choice 1**		2	2*	(2*) 3*		(6[#]) 7
Subject choice 2**		2	2*	(2*) 3*		(6[#]) 7
Subject choice 3		2	2*	(2*) 3*		(6[#]) 7

Note:

* One of these tasks in Term 2 and/or Term 3 must be an examination

** If one or two of the subjects chosen for subject choices 1, 2 or 3 include a Language, the number of tasks indicated for Languages 1 and 2 at Home Language (HL) and First Additional Language (FAL) are still applicable. Learners who opt for a Second Additional Language are required to complete 12 tasks in total: 5 tasks in term 1, 4 tasks in term 2 and 3 tasks in term 3.

[#] The number of internal tasks per subject differs from 6 to 7 as specified in Section 3 of this document.

Schools can choose to write one or two internal examinations in Grade 12. Should a school choose to write only one internal examination in Grade 12, a scheduled test should be written at the end of the term to replace the other examination. Internal examinations should conform to the requirements set out in Section 3 of this document. They should be carefully designed and weighted to cover all the Learning Outcomes of the subject.

Two of the assessment tasks for all subjects, excluding Life Orientation, should be tests written under controlled conditions at a specified time.

The remainder of the assessment tasks should not be tests or examinations. They should be carefully designed tasks, which give learners opportunities to research and explore the subject in exciting and focused ways. Examples of assessment forms are debates, presentations, projects, simulations, assignments, case studies, essays, practical tasks, performances, exhibitions and research projects. The most appropriate forms of assessment for each subject are set out in Section 3.

2.3 External assessment in Grade 12

External assessment is only applicable to Grade 12 and applies to the final end-of-year examination. This makes up 75% of the final mark for Grade 12. This excludes Life Orientation which is not externally examined.

The external examinations are set externally, administered at schools under conditions specified in the *National policy on the conduct, administration and management of the assessment of the National Senior Certificate: A qualification at Level 4 on the National Qualifications Framework (NQF)* and marked externally.

In some subjects the external assessment includes practical or performance tasks that are externally set, internally assessed and externally moderated. These performance tasks account for one third of the end-of-year external examination mark in Grade 12 (that is 25% of the final mark). Details of these tasks are provided in Section 3.

Guidelines for the external examinations are provided in Section 3.

2.4 Recording and reporting on the Programme of Assessment

The Programme of Assessment should be recorded in the teacher's portfolio of assessment. The following should be included in the teacher's portfolio:

- a contents page;
- the formal Programme of Assessment;
- the requirements of each of the assessment tasks;
- the tools used for assessment for each task; and
- record sheets for each class.

Teachers must report regularly and timeously to learners and parents on the progress of learners. Schools will determine the reporting mechanism but it could include written reports, parent-teacher interviews and parents' days. Schools are required to provide written reports to parents once per term on the Programme of Assessment using a formal reporting tool. This report must indicate the percentage achieved per subject and include the following seven-point scale.

RATING CODE	RATING	MARKS %
7	Outstanding achievement	80 – 100
6	Meritorious achievement	70 –79
5	Substantial achievement	60 – 69
4	Adequate achievement	50 – 59
3	Moderate achievement	40 – 49
2	Elementary achievement	30 – 39
1	Not achieved	0 – 29

2.5 Moderation of the assessment tasks in the Programme of Assessment

Moderation of the assessment tasks should take place at three levels.

LEVEL	MODERATION REQUIREMENTS
School	The Programme of Assessment should be submitted to the subject head and School Management Team before the start of the academic year for moderation purposes. Each task which is to be used as part of the Programme of Assessment should be submitted to the subject head for moderation before learners attempt the task. Teacher portfolios and evidence of learner performance should be moderated twice a year by the head of the subject or her/his delegate.
Cluster/ district/ region	Teacher portfolios and a sample of evidence of learner performance must be moderated twice during the first three terms.
Provincial/ national	Teacher portfolios and a sample of evidence of learner performance must be moderated once a year.

3. ASSESSMENT OF MECHANICAL TECHNOLOGY IN GRADES 10 – 12

3.1 Introduction

Mechanical Technology focuses on the technological processes used from conceptual design to practical problem solving and the application of scientific principles. The subject provides scope for the improvement and control of different mechanically related processes, services and systems in the production and manufacturing of goods and products which enhance the quality of life of both the individual and society.

The focus of assessment in Mechanical Technology falls on the measurement of learner performance in:

- demonstrating an awareness and understanding of the interrelationship between Mechanical Technology, society and the environment;
- understanding and the applying the technological process;
- demonstrating knowledge and understanding of the principles and concepts used in Mechanical Technology; and
- demonstrating the application of the principles, practice and skills used in Mechanical Technology.

The following table suggests the weighting of the Learning Outcomes for Mechanical Technology:

LEARNING OUTCOME	WEIGHTING
LO1: Technology, society and the environment	10%
LO2: Technological process	10%
LO3: Knowledge and understanding	40%
LO4: Application of knowledge	40%

Mechanical Technology is a practically orientated subject and to fully assess all the knowledge, skills and values of the subject in an authentic manner a Performance Assessment Task is necessary. The Performance Assessment Task should showcase the learners' broad range of knowledge, skills and values acquired during the learning process. It also provides learners the opportunity to express their creativity and innovativeness.

3.2 Daily assessment in Grades 10, 11 and 12

Daily assessment in Mechanical Technology provides learners with multiple opportunities to improve and master the knowledge, skills and values related to the subject.

The following are examples of daily assessment tasks to develop learners' knowledge, skills and values:

- Enabling tasks which develop practical competency and are based on concepts as stipulated by the Assessment Standards of Learning Outcome 4
- Experiments to verify scientific principles
- Demonstrations of skills
- Theoretical tasks aimed at developing conceptual understanding
- Short tests

3.3 Assessment in Grades 10 and 11

3.3.1 Programme of Assessment in Grades 10 and 11

The Programme of Assessment for Mechanical Technology in Grades 10 and 11 comprises seven tasks which are internally assessed. The six tasks which are completed during the school year make up 25% of the total mark for Mechanical Technology. The seventh task is the end-of-year assessment which includes a Practical Assessment Task (PAT) and a written theory paper. Together these two tasks make up the remaining 75%.

<table>
<tr><th colspan="3">PROGRAMME OF ASSESSMENT (400 marks)</th></tr>
<tr><th>ASSESSMENT TASKS</th><th colspan="2">END-OF-YEAR ASSESSMENT</th></tr>
<tr><th>25% (100 marks)</th><th colspan="2">75% (300 marks)</th></tr>
<tr><td rowspan="3">2 tests
1 exam (mid-year)
3 practical tasks</td><th>PAT</th><th>EXAM PAPER</th></tr>
<tr><th>25% (100 marks)</th><th>50% (200 marks)</th></tr>
<tr><td>Design project (main focus LO4)
• Portfolio (25)
• Product/ Artefact (75)</td><td>• Written exam LO1-4
• Main focus LO3</td></tr>
</table>

The Programme of Assessment comprises:

- Two tests (first and third term)
- One midyear examination (written)
- Three practical tasks (one per term in terms 1-3)
- The end-of-year assessment task (which includes a Practical Assessment Task and a written examination)

Example of an annual Programme of Assessment for Grades 10 and 11:

ASSESSMENT TASKS		TERM ONE	TERM TWO	TERM THREE	TERM FOUR	% OF FINAL PROMOTION MARK
Tests		1		1		5
Midyear examination (written)			1			5
Practical tasks: Simulations/ Investigations/ Small projects		1	1	1		15
End-of-year assessment	Written examination				1	50
	Practical Assessment Task				1	25

3.3.2 Examples of assessment tasks in Mechanical Technology

Tests

The tests in Mechanical Technology must be substantive in terms of time and marks. For example, a test should last at least 60 minutes and count a minimum of 50 marks. Tests should include the theory of the technological process, and mechanical principles and concepts and the application thereof in the production of product(s)/ artefact(s).

Practical tasks

The practical tasks should incorporate both the design (planning and development) and the production of a product or artefact. These tasks should be based on simulations, investigations and small projects and should focus on more than one area of specialisation, i.e. maintenance (motor mechanics/ welding), repairs (motor mechanics/ welding) and manufacturing (welding/ fitting and turning) or an integration of two to three of these areas.

In Mechanical Technology a practical task of an investigative nature could involve the intense practical testing and observation of materials that can be used in industry or a technology workshop while simulations could require learners to replicate the actual activities of the technological process without being in the real situation.

See Appendix 1 for an exemplar of a Grade 10 practical investigative task and Appendix 2 for an exemplar of a Grade 10 simulation task.

Practical Assessment Task (100 marks)

The Practical Assessment Task comprises a design project which leads to the design and development of a product or artefact and counts 25% of the total promotion mark in Grades 10 and 11. This task should take on the form of problem solving and realisation (making) and should be completed in the first three terms and handed in at the end of the third term. The learners should know the assessment criteria before they start with the task.

A Practical Assessment Task allows the teacher to directly and systematically observe learner applied competence. The assessment of performance is based on the demonstration of specific technological skills. Practical Assessment Tasks allow the learner to illustrate complex learning where knowledge, skills, and values are integrated in a performance.

The Practical Assessment Task in Grades 10 and 11 is **internally** set, assessed and moderated. The project is completed under controlled conditions and is assessed by means of a rubric.

The Practical Assessment Task counts 100 marks and consists of a design portfolio (25 marks) and a final product or artefact (75 marks). The Practical Assessment Task therefore focuses on the development of the design portfolio as well as the product or artefact itself, including manipulative skills.

The design portfolio should include evidence of how the development of the product was approached, that is:

- The planning process
- The knowledge and skills accumulated in the process
- The technological process followed
- The safety and environmental aspects considered
- The calculations used – if applicable, sketches or diagrams
- The starting time and ending time – how long it took to complete from start to finish
- The investigations or research undertaken, and
- Any other information that is relevant to the project.

The product or artefact developed in the Practical Assessment Task is the culmination of problem solving and development through the technological process expounded in Learning Outcome 2 (Investigate, Design, Make, Evaluate and Communicate). The task should have utilitarian value and must be based on real-life situations, for example seek ways to improve and strengthen the aids used by disabled people; investigate safety measures for the storage of metal in a factory or use space effectively in limited areas.

The Practical Assessment Task for Mechanical Technology will be undertaken in three phases:

Phase 1: Learners produce the relevant information and drawings or sketches and modelling and trial material which will lead to the making of the product or artefact. The evidence of this phase will be located in the design portfolio and this phase will be undertaken during term 1 and the start of term 2.

Phase 2: Learners develop the actual product or artefact at the start of the second term and finalise it by the end of term 3.

Phase 3: Learners submit the product or artefact for assessment by the end of the third term. The accompanying planning done in phase 1 (design portfolio) must also be submitted for assessment at this time.

Examinations

The mid-year and end-of-year examinations for Grades 10 and 11 should consist of one paper of 6 questions and will count 200 marks. The suggested duration of the paper is 3 hours. All the questions are compulsory. The questions should be set in such a way that they cover the knowledge and skills of Learning Outcome 3, the investigative assessment standard of Learning Outcome 2 and the values and attitudes of Learning Outcome 1 of the Mechanical Technology Subject Statement. The questions will not necessarily carry the same marks, as each section of the work has a different weighting.

The format of the written examination paper must be similar to that in Grade 12.

The following table suggests the outline for the written examination paper in Grades 10 and 11:

EXAMINATION GUIDELINES FOR MECHANICAL TECHNOLOGY GRADE 10 AND 11
GENERAL REMARKS
• These guidelines are applicable to Grade 10 and 11 Mechanical Technology. • The Assessment Standards of Learning Outcome 1 and Assessment Standard 1 of Learning Outcome 2 are infused into and used as contexts for formulating questions in the theory paper.

EXAMINATION PAPER
(50% of final mark for Mechanical Technology)

- One paper
  - Duration: 3 hours
  - 6 questions
  - 200 marks
- All the questions must be answered:
  - Question 1: Multiple-choice questions
  - Questions 2-6: Combination of short questions, paragraphs and essay questions
- Sketches must be neat.
- Show all calculations and units.

QUESTION	ASSESSMENT STANDARD(S)	CONCEPTS COVERED IN LEARNING OUTCOME 3	MARKS
1	1 - 9	Cover all content.	20
2	8 and 6	Applied mechanics	50
3	2	Tools and equipment	20
4	3	Materials	20
5	1, 4 and 5	Manufacturing process, construction methods and safety	50
6	7 and 9	Heat engines and maintenance	40
		TOTAL	**200**

3.4 Assessment in Grade 12

In Grade 12, assessment consists of two components: a Programme of Assessment which makes up 25% of the total mark for Mechanical Technology and external assessment which makes up the remaining 75%. The Programme of Assessment for Mechanical Technology comprises six tasks which are internally assessed. The external assessment component comprises two components: a Practical Assessment Task and a written theory paper. Together these two tasks make up the remaining 75%.

PROGRAMME OF ASSESSMENT (100 marks)	**EXTERNAL ASSESSMENT (300 marks)**	
ASSESSMENT TASKS	**EXTERNAL ASSESSMENT TASKS**	
25% (100 marks)	**75% (300 marks)**	
	PAT	**EXAM PAPER**
	25% (100 marks)	**50% (200 marks)**
2 tests 2 exams (mid-year and trial) 2 practical tasks	Design project (main focus LO4) • Portfolio (25) • Product (75)	• Written exam LO1-4 • Main focus LO3

In Grade 12 one of the tasks in Term 2 and/or Term 3 must be an internal examination. In instances where only one of the two internal examinations is written in Grade 12, the other examination should be replaced by a test at the end of the term.

Together the Programme of Assessment and the external assessment component make up the annual assessment plan for Grade 12.

The annual assessment plan comprises:

- Two tests (first and third term)
- Two written examinations (midyear and trial)
- Two practical tasks (one per term in terms 1 and 2)
- The external assessment task (which includes a Practical Assessment Task and a written examination)

Example of an annual assessment plan for Grade 12:

ASSESSMENT TASKS		**TERM ONE**	**TERM TWO**	**TERM THREE**	**TERM FOUR**	**% OF FINAL PROMOTION MARK**
Tests		1		1		5
Examinations (midyear and trial)			1	1		10
Practical tasks: Simulations/ Investigations/ Small projects		1	1			10
External assessment	Written examination				1	50
	Practical Assessment Task			1		25

3.4.1 Programme of Assessment in Grade 12

Tests

The tests in Mechanical Technology must be substantive in terms of time and marks. For example, a test should last at least 60 minutes and count a minimum of 50 marks. Tests should include the theory of the technological process, and mechanical principles and concepts and the application thereof in the production of product(s)/ artefact(s).

Practical tasks

The practical tasks should incorporate both the design (planning and development) and the production of a product or artefact. These tasks should be based on simulations, investigations and small projects and should focus on more than one area of specialisation, i.e. maintenance (motor mechanics/ welding), repairs (motor mechanics/ welding) and manufacturing (welding/ fitting and turning) or an integration of two to three of these areas.

In Mechanical Technology a practical task of an investigative nature could involve the intense practical testing and observation of materials that can be used in industry or a technology workshop while simulations could require learners to replicate the actual activities of the technological process without being in the real situation.

Examinations

The mid-year and trial examinations for Grade 12 should consist of one paper which should contain 6 questions and will count 200 marks. The suggested duration of the paper is 3 hours. All the questions are compulsory. The questions should be set in such a way that they cover the knowledge and skills of Learning Outcome 3, the investigative assessment standard of Learning Outcome 2 and the values and attitudes of Learning Outcome 1 of the Mechanical Technology Subject Statement. The questions will not necessarily carry the same marks, as each section of the work has a different weighting.

The trial examination needs to be closely related to the final examination in terms of time allocation, layout of the paper and subject requirements. See Section 3.4.2.2 for an outline of the Grade 12 examination paper.

3.4.2 External assessment in Grade 12

The external assessment task in Grade 12 consists of an externally written paper (50%) and the Practical Assessment Task (25%).

3.4.2.1 Practical Assessment Task

Schools will be informed of the task at the beginning of the first term of each academic year. Schools will choose one option from given scenarios.

The Practical Assessment Task comprises a design project which leads to the design and development of a product or artefact and counts 25% of the total promotion mark in Grade 12. This task should take on the form of problem

solving and realisation (making) and should be completed in the first three terms and handed in at the end of the third term.

The Practical Assessment Task for Grade 12 is externally set, internally assessed and externally moderated. The project is completed under controlled conditions and is assessed by means of a rubric. See Appendix 3 for an example of a Grade 12 Practical Assessment Task and a rubric.

The Practical Assessment Task counts 100 marks and consists of a design portfolio (25 marks) and a final product or artefact (75 marks). The Practical Assessment Task therefore focuses on the development of the design portfolio as well as the product or artefact itself, including manipulative skills.

The design portfolio should include evidence of how the development of the product was approached, that is:

- The planning process
- The knowledge and skills accumulated in the process
- The technological process followed
- The safety and environmental aspects considered
- The calculations used – if applicable, sketches or diagrams
- The starting time and ending time – how long it took to complete from start to finish
- The investigations or research undertaken, and
- Any other information that is relevant to the project.

The Practical Assessment Task for Mechanical Technology will be undertaken in three phases:

Phase 1: Learners produce the relevant information and drawings or sketches and modelling and trial material which will lead to the making of the product or artefact. The evidence of this phase will be located in the design portfolio and this phase will be undertaken during term 1 and the start of term 2.

Phase 2: Learners develop the actual product or artefact at the start of the second term and finalise it by the end of term 3.

Phase 3: Learners submit the product or artefact for assessment by the end of the third term. The accompanying planning done in phase 1 (design portfolio) must also be submitted for assessment at this time.

See Appendix 3 for an example of a Grade 12 Practical Assessment Task and its accompanying rubrics.

3.4.2.2 External examination

The external examination for Grade 12 will consist of one paper which contains six questions and counts 200 marks. The duration of the paper will be 3 hours. All the questions are compulsory. The questions should cover the knowledge and skills of Learning Outcome 3, the investigative Assessment Standard of Learning Outcome 2 and the values and attitudes of Learning Outcome 1 of Mechanical

Technology. The questions will not necessarily carry the same marks as each section of the work has a different weighting.

The following table provides guidelines for the written examination paper in Grade 12:

EXAMINATION GUIDELINES FOR MECHANICAL TECHNOLOGY GRADE 12
GENERAL REMARKS
• These guidelines are applicable to Grade 12 in Mechanical Technology • The Assessment Standards of Learning Outcome 1 and Assessment Standard 1 of Learning Outcome 2 are infused into and used as contexts for formulating questions in the theory paper.

EXAMINATION PAPER
(50% of final mark for Mechanical Technology)

- One paper
  - Duration: 3 hours
  - 6 questions
  - 200 marks
- All the questions must be answered:
  - Question 1: Multiple-choice questions
  - Questions 2-6: Combination of short questions, paragraphs and essay questions
- Sketches must be neat.
- Show all calculations and units.

QUESTION	ASSESSMENT STANDARD(S)	CONCEPTS COVERED IN LEARNING OUTCOME 3	MARKS
1	1 - 9	Cover all content	20
2	8 and 6	Applied mechanics	50
3	2	Tools and equipment	20
4	3	Materials	20
5	1, 4 and 5	Manufacturing process, construction methods and safety	50
6	7 and 9	Heat engines and maintenance	40
		TOTAL	**200**

3.5 Promotion

For promotion and certification purposes learners should achieve at least a level 2 rating (Elementary achievement: 30-39%) in Mechanical Technology.

3.6 Moderation

All Grade 10 and 11 tasks are internally moderated, while Grade 12 tasks should be externally moderated. The subject head for Mechanical Technology or head of department for the technology subjects at a school will generally manage this process.

APPENDIX 1: EXEMPLAR OF A GRADE 10 PRACTICAL INVESTIGATIVE ASSESSMENT TASK

Investigation task - The effects of carbon on steel

Determine the effect that carbon has on steel by heating steel.

REQUIREMENTS:

File
Gas welding apparatus and lighter
Workbench
Tongs
Piece of mild steel
Pen or pencil
Paper (6 x 1/2) = [3]

TEST:

- Clamp the mild steel in the bench vice and file to determine the hardness of the steel (apply the hardness test).
- Remove the mild steel from the bench vice and heat it with the gas welding apparatus until it is red hot (before critical temperature).
- Take the red-hot mild steel with the tongs and cool it down in cold water.
- When the mild steel has cooled down, repeat step 1.

[9]

CONCLUSION:

Briefly describe in your own words your observation and give possible reasons for your observation.

[3]

NB: The teacher must be present at all times during the experiment and fire prevention precautions must be implemented.

APPENDIX 2: EXEMPLAR OF A GRADE 10 SIMULATION ASSESSMENT TASK

Simulations (applied knowledge)

Simulations put theoretical knowledge to practical use and usually do not require conclusions to be made.

The purpose of applied theory is to display certain competencies and skills, for example the use of tools, instruments and equipment. Therefore, simulations will not include elaborate worksheets and conclusions but rather guidelines and criteria as to what is required.

Simulation Task: Setting up of a square bar in a four jaw chuck

Activity outcomes:

- Learners apply theoretical knowledge in practice.
- Learners familiarise themselves with the use of tools.
- Learners explain and demonstrate how to set up a square bar in a four-jaw chuck.

MEMORANDUM:

Tools:

- Hammer (1)
- Surface gauge (1)
- Spirit level (1)

[3]

Safety checks:

- All automatic feeds are disengaged (1)
- No persons cleaning, oiling or repairing machine (1)

[2]

Method:

- Mark out the largest possible circle on the square face of the bar. (1)
- Grip the bar in the chuck and tighten lightly in the approximate central position. (1)
- Use the surface gauge and set up the scribed circle. (1)
- Work with the opposite jaws when centralising the scribe circle. (1)
- Check the bar for parallelism (level) with a spirit level. (1)
- Tap and adjust the end until the bar is level with the spindle. (1)
- Check the circle again with the surface gauge and tighten the jaws firmly. (1)

[7]

Total: [12]

APPENDIX 3: EXAMPLE OF GRADE 12 MECHANICAL TECHNOLOGY PERFORMANCE ASSESSMENT TASK

Information:

Candidates are expected to produce evidence of applying Learning Outcome 4 in the context of Learning Outcome 2 when responding to this task.

Candidates must identify the problem or need in their chosen scenario, investigate the scenario, generate ideas and arrive at possible design solutions to make or produce and evaluate and communicate the solution to the problem or need.

The Practical Assessment Task covers the following Learning Outcomes and Assessment Standards:

Learning Outcome 1 Assessment Standard 2
Learning Outcome 2 Assessment Standard 1-5
Learning Outcome 3 Assessment Standard 1-8
Learning Outcome 4 Assessment Standard 1, 3, 7, 8

When setting Performance Assessment Tasks it is important to keep the following in mind:

- Time available
- The skills, knowledge, values and attitudes of the National Curriculum Statement for Mechanical Technology
- The degree of difficulty
- The equipment available
- The material available or obtainable

Instructions:

Learners must choose **ONE** of the three given scenarios and complete the project by following the steps:

i. During the first term, produce a project portfolio which contains relevant information, drawings or sketches and modelling as well as trial material which leads to the making of the product or artefact.
ii. Develop the product or artefact from the beginning of the second term and submit the completed product or artefact for assessment by the end of the third term. The project portfolio must also be submitted at this time.
iii. If the solution does not lend itself to a full-scale artefact, a scaled model or a representation can be produced. However, in the latter instance, the learner is expected to provide full-size sections showing construction details including relevant surface finishing. A model or mock must indicate the context in which the product is to be used.
iv. This task must be done under strict supervision of the teacher and candidates should under no circumstances assist one another with their task.
v. A candidate may not be permitted to complete sections of the practical task outside of the classroom unless it is with the consent of the teacher and district officer or curriculum advisor.

SCENARIO 1:

There are many disabled people in South Africa and they find it impossible to perform many necessary day-to-day activities. Speak to a disabled person and identify a particular problem or need experienced by the person in his or her day-to-day living in the house.

Provide evidence that you gathered information to assist you to design and make an aid to address the need of the disabled person. In your investigation show how you used expert advice to determine the nature of the aid so that it addresses the needs of the disabled person. In consultation with the disabled person, design and make an aid that will improve his or her quality of life. **Total [100]**

SCENARIO 2:

You work in a factory and safety is very important because the factory must comply with the Occupational Health and Safety Act. Therefore, stacking must be done in a responsible manner so that workers do not get hurt. A new shipment of metal has been delivered to the factory and has been placed on the floor. Storage hooks have been placed on the walls.

Provide evidence that you gathered information that assisted you to design and make an artefact to safely store the metal out of the way of all the workers. **Total [100]**

SCENARIO 3:

In South Africa some people stay in confined apartments and flats are built on any available piece of land. Because of the high density of occupancy in flats there is no place where people can hang their washing. Speak to people who live in flats and ask them for possible solutions to their problem.

Provide evidence that you gathered information to assist you to design and make an artefact to address the need of the people in the flats. In your investigation show how you used expert advice to determine what the people want. **Total [100]**

Example of the rubrics that can be used to assess the Performance Assessment Task

Name of Candidate: _____
School: _____
Grade: _____
Date: _____

RECORDING SHEET FOR THE PERFORMANCE ASSESSMENT TASK						
NAME OF ASSESSOR	**FITNESS FOR PURPOSE**	**MANUFACTURING PROCESS**	**MANAGEMENT OF PROCESS**	**SURFACE FINISH (where applicable in construction)**	**MODELLING THE PRODUCT**	**TOTAL**
	/15	/30	/15	/15		/75

A. RUBRIC FOR ASSESSMENT OF FINAL PRODUCT/ ARTEFACT

CRITERIA	7	6	5	4	3	2	1
	80 -100%	70 - 79%	60 - 69%	50 - 59%	40 - 49%	30 - 39%	0 - 29%
FITNESS FOR PURPOSE	This product has an outstanding level of functionality. It shows a very high level of innovation that is appropriate to the design brief.	The product demonstrates a high level of functionality. It shows a high level of innovation that is appropriate to the design brief.	The product adequately fulfils the purpose for which it was designed. It shows some innovation that is appropriate to the design brief.	The product satisfactorily fulfils the purpose for which it was designed. It shows limited innovation for the identified need or problem.	The product fulfils its functional requirements. It shows no evidence of innovation in the solution to the identified need or problem.	The product barely fulfils functional requirements but lacks any refinement or innovation.	The project is incomplete and does not address the identified need or problem.
MANUFACTURING COMPETENCY	Demonstrates an outstanding level of skill and competence to correctly and safely use a wide range of materials, tools, equipment and machines with teacher supervision.	Demonstrates a very high level of skill and competence to correctly and safely use a wide range of materials, tools, equipment and machines with teacher supervision.	Demonstrates a high level of skill and competence to correctly and safely use a range of materials, tools, equipment and machines with teacher supervision.	Demonstrates a satisfactory level of skill and competence to correctly and safely use appropriate materials, tools, equipment and machines with teacher supervision.	Demonstrates an acceptable level of skill and competence to correctly and safely use appropriate materials, tools, equipment and machines with teacher supervision.	Demonstrates some regard for accuracy and safety in the use of materials, tools, equipment and machines with teacher supervision.	Demonstrates a lack of skill and competence in the use of appropriate materials, tools, equipment and machines with teacher supervision. Pays little attention to safety.

CRITERIA	7	6	5	4	3	2	1
	80 -100%	70 - 79%	60 - 69%	50 - 59%	40 - 49%	30 - 39%	0 - 29%
MANAGEMENT OF PROCESS	Demonstrates continual review of the making process. Shows outstanding ability to adapt and modify the design when difficulties arise. Adopts procedures to minimise waste and manages time outstandingly well.	Reviews design during the making process. Demonstrates resourcefulness and adaptability in making modifications to ensure a high quality product. Manages waste and time excellently.	Shows ability to adapt and modify the design when difficulties arise. Plan adequately to minimise waste and manages time well.	Applies knowledge of materials and processes to overcome problems in the making process. Demonstrates a good sense of material and time management.	Shows evidence of adopting alternative ways of proceeding when difficulty is experienced. Seeks assistance from teacher to proceed. Demonstrates some sense of material and time management.	Shows little evidence of alternative ways of proceeding when difficulty is experienced. Does not seek assistance from teacher. Proceeds regardless of time and material management.	Makes no attempt to overcome problems. Shows no proper planning resulting in no regard for time and material management.
SURFACE FINISH (where applicable in construction) **OR**	Demonstrates an outstanding degree of skill in the surface finishing. The surface finish is of an exceptional quality.	Demonstrates a very high degree of skill in the surface finishing. The surface finish is blemish free.	Demonstrates a high degree of skill in the surface finishing.	Demonstrates a satisfactory level of skill in the surface finish but some blemishes are evident.	Demonstrates a low level of skill in the surface finishing but blemishes are evident.	Demonstrates a very low level of skill in the surface finishing.	No surface finish is evident.
MODELLING THE PRODUCT (where product is not a construction)	The product is exceptionally modelled to illustrate, realistically the function for which it was developed.	Specialist modelling techniques demonstrate, realistically, the function for which the product was developed.	The product is effectively modelled to illustrate the function for which it was developed.	The product is adequately modelled to illustrate the function for which it was developed.	The product is modelled to illustrate the function for which it was developed.	The product barely illustrates the function for which it was developed.	The modelling shows no clarity as to how the product is to function.

DECLARATION OF AUTHENTICITY

SCHOOL STAMP

NAME OF THE SCHOOL: …….

NAME OF LEARNER: ……...

(FULL NAME(S) AND SURNAME)

EXAMINATION NUMBER: …….

NAME OF TEACHER: ……...

I hereby declare that the project submitted for assessment is my own, original work and has not been previously submitted for moderation.

_____ _____

SIGNATURE OF CANDIDATE **DATE**

As far as I know, the above declaration by the candidate is true and I accept that the work offered is his or her own.

_____ _____

SIGNATURE OF TEACHER **DATE**

B. RUBRIC FOR ASSESSMENT OF DESIGN PORTFOLIO

ASSESSMENT RUBRIC FOR ASSESSING THE DESIGN BRIEF							
CRITERIA	**7**	**6**	**5**	**4**	**3**	**2**	**1**
	80 -100%	**70 - 79%**	**60 - 69%**	**50 - 59%**	**40 - 49%**	**30 - 39%**	**0 - 29%**
Presentation	Exceeds the required information, extremely neat: Name Register class Year 20.. Appropriate cover illustration Appropriate title Index All sections Page numbers	Required information, extremely neat: Name Register class Year 20.. Appropriate cover illustration Appropriate title Index All sections Page numbers	Adequate information from list below, neatly presented: Name Register class Year 20.. Appropriate cover illustration Appropriate title Index All sections Page numbers	Necessary information from list below, neatly presented: Name Register class Year 20.. Appropriate cover illustration Appropriate title Index All sections Page numbers	Limited information from list below, neatly presented: Name Register class Year 20.. Appropriate cover illustration Appropriate title Index All sections Page numbers	Lack of essential information, not neatly presented	Only name and register class, untidily presented
Identifies and develops a design brief	The design brief is extremely well formulated defines the need or opportunity. It lists detailed specifications and constraints.	The design brief is a very well constructed and defines the need or opportunity. It lists detailed specifications and constraints.	The design brief is a well constructed and defines the need or opportunity. It lists detailed specifications and constraints.	The design brief defines the needs or opportunity and provides a list of specifications and constraints.	The design brief defines the needs or opportunity but provides limited specifications.	The simple design brief makes little reference to the need or problem.	The design brief is vague and lists no specifications or constraints.
Investigates and analyses information	Shows evidence of a variety of strategies *(6) of investigation used to obtain all relevant information to assist in developing innovative design ideas.	Shows the use of a wide range*(5) of appropriate information sources to develop innovative design options.	Shows the use of a range of information sources*(4) to understand the problem or need.	Uses adequate sources *(3) to collect relevant information to assist with design ideas.	Uses relevant research *(2) to address the problem or need identified in the design brief.	Uses less than adequate sources* (1) and collects less than adequate information.	Collect very little relevant information *(0).
Generate design ideas	Generates an excellent variety of alternative and	Uses a wide range of communication methods to develop	Uses a range of communication methods to develop	Uses a good variety of alternatives to explore different	Considers some alternatives but lack originality and flair.	Offers some alternatives but tends to be a	Shows little or no exploration of alternatives.

ASSESSMENT RUBRIC FOR ASSESSING THE DESIGN BRIEF							
CRITERIA	**7**	**6**	**5**	**4**	**3**	**2**	**1**
	80 -100%	**70 - 79%**	**60 - 69%**	**50 - 59%**	**40 - 49%**	**30 - 39%**	**0 - 29%**
	innovative ideas and approaches to addressing the problem or need. The preferred option is well justified with clear links to the design brief.	original and creative design options. Choice of final design well substantiated.	original and creative design options including modelling design ideas. Choice of final design well motivated and reasoned.	approaches. Final design option is well reasoned.	The final design choice is indicated.	collection of existing products with limited reasoning of choice. The final choice shows limited links with research done.	
Communicates ideas	A very interesting solution was developed exceptionally well communicated using appropriate techniques and methods. Ideas were modelled to test and explore design thinking.	A very interesting solution was developed and was very well communicated using appropriate techniques and methods.	An interesting solution was developed and effectively communicated using appropriate techniques.	Balanced reasoning for choice of solution was given. Good overall appropriate communication techniques were used.	The solution lacks creativity and limited communication techniques were used.	The solution lacks creativity and inappropriate communication techniques were used.	The solution lacks details, making interpretation difficult. Scant attention was given to communication techniques.
Plans sequence of production steps	Provides clear plan showing detailed sequence of steps in the production process (detailed working drawings including a cost analysis). Indicates how the project is to be completed in the time available. Uses correct terminology throughout.	Provides clear sequential plan with reference to the timeframe in which project is to be completed (detailed working drawings including a cost analysis). Uses correct terminology throughout.	Lays out steps logically, clearly and unambiguously. Supplies appropriate clarification sketches and notes (working drawings including a cost analysis). Uses correct terminology throughout.	Lays out steps logically and clearly. Supplies appropriate clarification sketches and notes (working drawings including a cost analysis). Uses correct terminology throughout.	Lays out steps logically. Supplies clarification sketches and notes (working drawings are incomplete). Uses correct terminology.	Does not lay out the steps logically. Supplies few clarification sketches and notes (working drawings are incomplete). Sometimes uses the correct terminology.	Does not lay out the steps logically. Does not supply clarification sketches and notes. Uses incorrect terminology throughout.

ASSESSMENT RUBRIC FOR ASSESSING THE DESIGN BRIEF							
CRITERIA	**7**	**6**	**5**	**4**	**3**	**2**	**1**
	80 -100%	**70 - 79%**	**60 - 69%**	**50 - 59%**	**40 - 49%**	**30 - 39%**	**0 - 29%**
Evaluation	Comprehensively evaluates the product against the design brief taking account of user and cost-effectiveness. Evaluates procedures, techniques and processes and indicates possible improvements. Evaluates the appropriateness of the materials used.	Evaluates the product against the design brief taking account of user and cost-effectiveness. Evaluates procedures, techniques and processes and indicates possible improvements. Evaluates the appropriateness of the materials used.	Evaluates the product against the design brief. Presents suggestions for improvements on function. Evaluates the appropriateness of the materials used with limited suggestions for improvement.	Evaluates the product against the design brief. Evaluates the appropriateness of the materials used.	Superficially evaluates the product against the design brief. Makes recommendations to improve functionality.	Very superficially evaluates with limited recommendations.	Shows little or no evidence of an evaluation of the project.
References	Detailed account of at least four sources: Title of source Author of source Publisher and date of source Website addresses Interviews with specialist	Detailed account of at least three sources: Title of source Author of source Publisher and date of source Website addresses Interviews with specialist	Reference to at least three sources with at least two of the specifications below: Title of source Author of source Publisher and date of source	Reference to at least two reference sources with at least two of the specifications below: Title of source Author of source Publisher and date of source	Reference to at least two sources with at least one of the specifications below: Title of source Author of source Publisher and date of source	Reference to at least one source with at least one of the specifications below: Title of source Author of source Publisher and date of source.	Little or no reference made to sources used. Reference to: Title of source

* With reference to the Assessment Standard 'Investigate and analyse information' learners must provide evidence that the number of sources indicated in brackets was used.