basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

MECHANICAL TECHNOLOGY (AUTOMOTIVE)

GUIDELINES FOR PRACTICAL ASSESSMENT TASKS

GRADE 12

2024

These guidelines consist of 48 pages.

TABLE OF CONTENTS

1. INTRODUCTION

The 18 Curriculum and Assessment Policy Statement subjects which contain a practical component all include a practical assessment task (PAT). These subjects are:

- AGRICULTURE: Agricultural Management Practices, Agricultural Technology
- ARTS: Dance Studies, Design, Dramatic Arts, Music, Visual Arts
- SCIENCES: Computer Applications Technology, Information Technology, Technical Sciences, Technical Mathematics
- SERVICES: Consumer Studies, Hospitality Studies, Tourism
- TECHNOLOGY: Mechanical Technology, Civil Technology, Electrical Technology, and Engineering Graphics and Design

A practical assessment task (PAT) mark is a compulsory component of the final promotion mark for all candidates offering subjects that have a practical component and counts 25% (100 marks) of the end-of-year examination mark. The PAT is implemented across the first three terms of the school year. This is broken down into different tasks or a series of smaller activities that make up the PAT. The PAT allows for candidate to be assessed on a regular basis during the school year and it also allows for the assessment of skills that cannot be assessed in a written format, e.g. test or examination. It is therefore important that schools ensure that all candidates complete the practical assessment tasks within the stipulated period to ensure that candidate are resulted at the end of the school year. The planning and execution of the PAT differs from subject to subject.

The PAT allows the teacher to observe applied competence directly and systematically. The PAT comprises the application/performance of the knowledge, skills and values particular to that subject and counts 25% of the total promotion/certification mark out of 400 for the subject.

Any profession requires of its members a thorough grounding in both theory and practice, and MECHANICAL TECHNOLOGY is no exception. It is emphasised that the goal of the practical assessment task is to produce a skilled candidate in each specialisation field. A nation's true wealth is in its manpower and education that should aim to develop the talents of a candidate so that he/she can contribute to the well-being of the society by using and developing scientific and technological resources.

To prepare a candidate in the MECHANICAL TECHNOLOGY'S specialisation fields, one must focus on the following:

- An attitude where the candidate can selectively use ideas, gather evidence and facts and draw logical conclusions to put them to good use creatively and with imagination;
- A capability to express ideas and information clearly by speech, writing, drawing and manufacturing; and
- A willingness and capability to accept and exercise responsibility, to make decisions, and to learn by experience.

Attributes such as these cannot all be achieved in a classroom. A sound knowledge of engineering sciences is essential to equip the MECHANICAL TECHNOLOGY candidate with the necessary practical capabilities for the required processes. Practical training is the application of acquiring essential skills to bridge between trade theory and practice.

Practical application in the workshop must therefore be made an interesting and challenging experience to develop the candidates physically and mentally. The candidates must show their initiative, curiosity and persistence in learning. In order to stimulate and develop self-confidence, the granting of some degree of responsibility during the practical application is very important.

2. TEACHER GUIDELINES

2.1 Administration of the PAT

Teachers are requested to make copies of the different specialisation PAT documents. These documents need to be handed out to the candidates at the beginning of the year. The practical assessment task for Grade 12 is externally set, internally assessed and externally moderated.

Teachers must attach due dates for the different facets of the PAT. (Refer to the CAPS document.) In this manner, candidates can easily assess their progress. It is the responsibility of the teacher to administer formal assessment.

The PAT should be completed within the first three terms. The PAT should be completed under controlled conditions. (Refer to Mechanical Technology SPECIALISATION: CAPS Grade 10–12.)

Teachers MUST compile the manufacturer's specifications of the engines and vehicles available in their workshops before the tasks can commence. See ANNEXURE A as an example of a specification sheet. Candidates must have access to these specification sheets during the tasks. Teachers must perform all the tasks prior to assessing candidates so that the teacher can identify possible challenges and the final results. It provides the teacher with insight into possible challenges regarding equipment or tools and what possible procedures he/she needs to follow in the workshop in order to complete the PAT.

NOTE: The candidate must complete the **procedures** practically. The teacher must record reasons, readings, specifications, etc. provided by the candidate onto the worksheet.
TASK 9: The candidate must be provided with WORKSHEET 9.2 during the assessment, as the candidate has to record his/her own measurements and perform the necessary calculations.

2.2 Assessment of the PAT

Frequent and developmental feedback is needed to ensure the necessary guidance and support to the candidates.

Both formal and informal assessment should be conducted to ensure that the embedded skills are developed. Informal assessments must be conducted to monitor the progress of the candidates.

All mark sheets in the candidate's portfolio of evidence must be signed by the teacher, departmental head and moderator (if the candidate was moderated). The formal assessment mark must be recorded on the composite mark sheet. The composite mark sheets MUST be signed by the teacher, departmental head and the principal before external moderation commences.

On completion of each task in each term, the marks for the completed task need to be recorded on the South African School Administration and Management System (SASAMS). Candidates must sign and date the mark sheet on completion of every task.

2.3 Moderation of the PAT

Internal moderation by the departmental head of the school MUST be conducted for each completed task. Evidence of moderation reports must be available in the teacher file and be available as proof for provincial and external moderation. The internal moderator must use the same mark sheets as are available in the candidate's portfolio of evidence whereby the candidate has conducted self-assessment, with formal assessment by the teacher.

Marks must be recorded in the space provided for internal moderation. The marks on the school administration system, captured by the school, must be verified by the moderator against the composite mark sheet. The tasks, assessment criteria and the mark sheets must be presented to the moderator during moderation of the PAT.

The moderator should be able to call on a candidate to explain and demonstrate the functions, principles and skills during the moderation process.

On completion, the moderator will, if necessary, adjust the marks of the group upwards or downwards should he/she deem it necessary.

All tasks must be clearly marked with the correct date, initials, surname and signature of the candidate.

2.4 Consequences of absence/non-submission of tasks

If a candidate's practical assessment task is incomplete or unavailable with a valid reason, the candidate may be given three weeks before the commencement of the final end-of-year examination to submit the outstanding task. Should the candidate fail to fulfil the outstanding PAT requirement, such a candidate will be awarded a zero mark for that PAT component.

A candidate's results are regarded as incomplete if the he/she did not attempt any one of the PAT tasks. Based on the decision of the head of the assessment body, the he/she will be given another opportunity. Should the candidate fail to fulfil the outstanding PAT requirement, the marks for the task(s) will be omitted and the final mark for Mechanical Technology will be adjusted for promotion purposes in terms of the completed tasks. If any tasks are still outstanding, the candidate runs the risk of not being resulted at the end of the year.

2.5 Declaration of Authenticity

NAME OF THE SCHOOL:

_____

NAME OF CANDIDATE:

_____
(FULL NAME(S) AND SURNAME)

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

SCHOOL STAMP

3. CANDIDATE GUIDELINES

Instructions to the candidate

- The PAT consists of a compulsory task in **Automotive**. The compulsory task could be completed during any of the three terms, as set out in this document. (Also see CAPS document.)
- All tasks must be completed according to the timeframes as set out in this document.
- Candidates are requested to actively engage in all practical assessment tasks.
- Candidates who are uncooperative will receive demerits or a zero mark for that particular section of the work.
- Candidates who act unsafely in the workshop and place other candidates in danger will be given additional corrective measures to improve their safety awareness.
- Your tasks must be completed fully by the end of August 2024 in order to be ready for provincial and/or national moderation.
- Your worksheets need to be **clearly marked** with your name, surname, signature and date of assessment.
- At least one task must be completed each term. The additional compulsory task must be completed during Term 1, Term 2 or Term 3.
- The candidate must be present and available to explain and demonstrate the functions, principles and skills during the moderation.
- Candidates MUST complete the **Declaration of Authenticity** to declare that the tasks they presented for formal assessment are their own work.
- Each term must have a completed task/phase in order to enter the mark on the working mark sheet and the South African School Administration and Management System (SASAMS).

4. SPECIALISATION: AUTOMOTIVE (SPECIFIC)

Term: 1 to 3
Starting date: January 2024
Completion date: August 2024

INTRODUCTION

This section comprises NINE practical tasks.

Choose any THREE tasks from the EIGHT tasks given (TASKS 1–8), namely:

TASK 1: Compression test
TASK 2: Cylinder leakage tests
TASK 3: Exhaust gas analysis
TASK 4: Wheel balancing
TASK 5: Fuel system test
TASK 6: Wheel alignment
TASK 7: Charging system
TASK 8: Computerised diagnostic scanner

The following task is a **COMPULSORY TASK:**

TASK 9: Engine components measurement and calculations

NOTE: TASK 9 IS COMPULSORY.

CONDUCT ANY THREE OF THE EIGHT TASKS GIVEN (TASKS 1–8).

NOTE: The total number of tasks to be completed = 4 (3 choices + 1 compulsory).

The teacher must explain and demonstrate the knowledge and skills that will be assessed during these tasks. Due dates for the completion of the tasks should also be communicated to the candidates.

Activity outcome:

- Candidates apply theoretical knowledge in practice with regard to:
  - Safety, tools, maintenance and systems and control
  - Correct use of tools and equipment
  - Use equipment to diagnose faults in the engine
- These tasks must be done under the supervision of the teacher and the candidates should be assessed while performing these tasks.
- The candidates should answer questions, inform the teacher of the findings and give reasons for certain actions while they are performing these tasks.
- The teacher must record the findings on the worksheet provided.

TASK 1: COMPRESSION TEST

- WORKSHEET 1 – Compression Test – Procedure
    - Perform the tasks as on WORKSHEET 1.
    - Record the compression readings and reasons on WORKSHEET 1.
    - Use the specification manual or ANNEXURE A to obtain specifications for the engine that you are using to conduct the compression test.
    - Perform a dry and a wet compression test on a four-cylinder, four-stroke petrol engine.

TASK 2: CYLINDER LEAKAGE TEST

- WORKSHEET 2.1 – Cylinder Leakage Test – Questions
    - Answer the questions on WORKSHEET 2.1 under examination-controlled conditions.

- WORKSHEET 2.2 – Cylinder Leakage Test – Procedure
    - Perform a cylinder leakage test on a four-cylinder, four-stroke petrol engine.
    - Record the causes and reasons on WORKSHEET 2.2.

TASK 3: EXHAUST GAS ANALYSIS

- WORKSHEET 3.1 – Exhaust Gas Analysis – Questions
    - Answer the questions on WORKSHEET 3.1 under examination-controlled conditions.

- WORKSHEET 3.2 – Exhaust Gas Analysis – Procedure
    - Use the specification manual or ANNEXURE A to obtain readings for the engine that you are using to conduct the Exhaust Gas Analysis task.
    - Perform the tasks as on WORKSHEET 3.2.

TASK 4: WHEEL BALANCING

- WORKSHEET 4.1 – Wheel Balancing – Questions
    - Answer the questions on WORKSHEET 4.1 under examination-controlled conditions.

- WORKSHEET 4.2 – Wheel Balancing – Procedure
    - Perform the tasks as on WORKSHEET 4.2.
    - Use a wheel-balancing machine to balance a wheel.

TASK 5: FUEL SYSTEM TEST

- WORKSHEET 5.1 – Fuel System Test – Questions
    - Answer the questions on WORKSHEET 5.1 under examination-controlled conditions.

- WORKSHEET 5.2 – Fuel System Test – Procedure
    - Perform the fuel system test procedures on a fuel system.
    - Record the findings on WORKSHEET 5.2.

TASK 6: WHEEL ALIGNMENT

- WORKSHEET 6.1 – Wheel Alignment – Questions
  - Answer the questions on WORKSHEET 6.1 under examination-controlled conditions.

- WORKSHEET 6.2 – Wheel Alignment – Procedure
  - Perform the wheel alignment procedures on a vehicle.
  - Record the findings on WORKSHEET 6.2.

TASK 7: CHARGING SYSTEM

- WORKSHEET 7 – Charging System – Procedure
  - Identify components of the alternator.
  - Perform the charging system test procedures on an engine vehicle.
  - Test alternator components as on WORKSHEET 7.

TASK 8: COMPUTERISED DIAGNOSTIC SCANNER

- WORKSHEET 8.1 – Computerised Diagnostic Scanner – Questions
  - Answer the questions on WORKSHEET 8.1 under examination-controlled conditions.

- WORKSHEET 8.2 – Computerised Diagnostic Scanner – Procedure
  - Perform the computerised diagnostic scanning procedures on a vehicle and record the findings on WORKSHEET 8.2.

COMPULSORY TASK

TASK 9: ENGINE COMPONENTS MEASUREMENT AND CALCULATIONS

- WORKSHEET 9.1 – Engine Components Measurement and Calculations – Questions
  - Answer the questions on WORKSHEET 9.1 under examination-controlled conditions.

- WORKSHEET 9.2 – Engine Components Measurement and Calculations – Procedure
  - Perform the engine components measurement and calculations procedures on an engine.
  - Record the findings on WORKSHEET 9.2.

TASK 1: COMPRESSION TEST

WORKSHEET 1.1 – PROCEDURE

CANDIDATE'S NAME AND SURNAME: _____

DRY COMPRESSION TEST				
1.1.	Conduct a dry compression test.			
	PROCEDURE		**MARK**	**TOTAL**
1.1.1	Obtain the compression pressure specification.		1	
1.1.2	Test the battery voltage.	REASON:	2	
1.1.3	Start the engine.		1	
1.1.4	Check if engine is at operating temperature.	REASON:	2	
1.1.5	Switch off the engine.		1	
1.1.6	Number the spark plug (HT) leads according to the cylinder.		1	
1.1.7	Remove the spark plug (HT) leads.		1	
1.1.8	Clean around the spark plugs before removing them.	REASON:	2	
1.1.9	Remove the spark plugs.		4	
1.1.10	Remove the air filter.	REASON:	2	
1.1.11	Disable the ignition system; if not, remove HT lead from coil.		1	
1.1.12	Disconnect the fuel supply.		1	
1.1.13	Fit the compression tester in the spark plug hole.		4	
1.1.14	Fully open the throttle valve.		4	
1.1.15	Crank the engine to perform tests for each cylinder.		4	
1.1.16	Record the readings.	1. 2. 3. 4.	4	
1.1.17	Compare the readings.	REASON:	2	
	TOTAL – Dry Compression Test – Procedure		**37**	

WET COMPRESSION TEST				
1.2	Conduct a wet compression test on the cylinder/cylinders with the lowest reading(s).			
	PROCEDURE		**MARK**	**TOTAL**
1.2.1	Squirt oil into cylinder onto piston.		1	
1.2.2	Fit compression tester.		1	
1.2.3	Open throttle valve fully.		1	
1.2.4	Crank engine 4 to 10 times.		1	
1.2.5	Record the reading.		1	
1.2.6	Conclusions after the wet compression test.	REASON:	2	
1.2.7	Replace all the spark plugs (initially turn plugs in by hand).		2	
1.2.8	Reconnect the electrical connections and fit air filter.		2	
1.2.9	Reconnect the fuel supply.		1	
1.2.10	Ensure the engine starts.		1	
	TOTAL – Wet Compression Test – Procedure		**13**	

TOTAL – Dry Compression Test – Procedure	37	
TOTAL – Wet Compression Test – Procedure	13	
GRAND TOTAL:	**50**	

SIGNATURES			
Candidate	Date	Teacher	Date
Internal moderator	Date	External moderator	Date

Declaration by the teacher:

I, _____,declare that the Compression Test's marks are
Initial & Surname (Teacher)
captured on the school database.

_____ _____
Signature Date

TASK 2: CYLINDER LEAKAGE TEST

WORKSHEET 2.1 – QUESTIONS

CANDIDATE'S NAME AND SURNAME: _____

QUESTIONS		MARK
2.1.1 Describe THREE safety precautions and the reason for the precautions that must be adhered to when conducting the cylinder leakage test.		6
PRECAUTION:	REASON:	
2.1.2 State THREE faults that can develop due to cylinder leakages on an engine.		3
TOTAL – Cylinder Leakage Test – Questions	**9**	

TASK 2: CYLINDER LEAKAGE TEST

WORKSHEET 2.2 – PROCEDURE

CANDIDATE'S NAME AND SURNAME: _____

CYLINDER LEAKAGE TEST				
2.2	Perform the cylinder leakage test on one cylinder.			
	PROCEDURE		**MARK**	**TOTAL**
2.2.1	Start the engine.		1	
2.2.2	Check if the engine is at operating temperature.	REASON:	2	
2.2.3	Switch off the engine.		1	
2.2.4	Number the HT spark plug leads according to the cylinders.		1	
2.2.5	Remove the HT spark plug leads.		1	
2.2.6	Clean around the spark plugs before removing them.	REASON:	2	
2.2.7	Remove the spark plugs.		4	
2.2.8	Remove the air filter.	REASON:	2	
2.2.9	Turn the engine clockwise at the front pulley.		1	
2.2.10	Turn engine until piston is on compression stroke.	REASON:	2	
2.2.11	Turn piston to TDC.		1	
2.2.12	Lock the crankshaft.		1	
2.2.13	Screw the spark plug hose adapter into the spark plug hole.		1	
2.2.14	Ensure compressor pressure is sufficient.		1	
2.2.15	Connect the leakage tester to the compressor.		1	
2.2.16	Calibrate the leakage tester.	REASON:	2	
2.2.17	Connect leakage tester to spark plug hole adapter.		1	
2.2.18	Read the percentage leakage.	REASON:	2	

2.2.19 Check for causes of leakage(s) (irrespective of the engine condition).		8	
2.2.20 Replace spark plugs (initially turn spark plugs in by hand).		4	
2.2.21 Reconnect electrical connections, air filter and fuel supply.		2	
TOTAL – Cylinder Leakage Test – Procedure		**41**	

TOTAL – Cylinder Leakage Test – Questions	9	
TOTAL – Cylinder Leakage Test – Procedure	41	
GRAND TOTAL:	**50**	

SIGNATURES			
Candidate	Date	Teacher	Date
Internal moderator	Date	External moderator	Date

Declaration by the teacher:

I, _____,declare that the Cylinder Leakage Test's marks are
Initial & Surname (Teacher)
captured on the school database.

_____ _____
Signature Date

TASK 3: EXHAUST GAS ANALYSIS

WORKSHEET 2.1 – QUESTIONS

CANDIDATE'S NAME AND SURNAME: _____

QUESTIONS	MARK
3.1.1 What is the purpose of using a gas analyser on an internal combustion engine?	2
3.1.2 State TWO faults that would prompt you to analyse the exhaust gases of an internal combustion engine.	2
3.1.3 Name FIVE gases that can be analysed by the exhaust gas analyser.	5
3.1.4 State FOUR safety precautions that must be adhered to when conducting the exhaust gas analysis.	4
3.1.5 State FOUR causes of improper and/or incomplete combustion.	4
3.1.6 What is the ideal air-fuel ratio for a spark ignition engine?	1
TOTAL – Exhaust Gas Analysis – Questions **18**	

TASK 3: EXHAUST GAS ANALYSIS

WORKSHEET 3.2 – PROCEDURE

CANDIDATE'S NAME AND SURNAME: _____

EXHAUST GAS ANALYSIS			
3.2 Conduct an exhaust gas analysis on an internal combustion engine, following the correct sequence. Analyse any TWO of the following gases: oxygen (O_2), carbon monoxide (CO) and carbon dioxide (CO_2).			
PROCEDURE		**MARK**	**TOTAL**
3.2.1 Obtain the following manufacturers' exhaust gas specifications of the engine to be tested:		3	
• Oxygen (O_2)			
• Carbon monoxide (CO)			
• Carbon dioxide (CO_2)			
3.2.2 Ensure proper ventilation when conducting test.	REASON:	2	
3.2.3 Bring engine to operating temperature.	REASON:	2	
3.2.4 Ensure the filters on analyser are clean.		2	
3.2.5 Check for any exhaust leaks.	EFFECTS OF EXHAUST LEAKS:	4	
3.2.6 Check for any vacuum leaks.	EFFECTS OF VACUUM LEAKS:	3	
3.2.7 Switch on the gas analyser.		1	
3.2.8 Calibrate the gas analyser.		2	
3.2.9 Ensure that the inlet hose is not restricted.		1	
3.2.10 Insert probe into exhaust pipe.		1	

3.2.11 Take the readings of the exhaust gases. (**Choose ANY TWO** of the following three gases: CO, O_2 and CO_2)			
Obtain CO% results.			
Compare CO% reading with specifications.	CONCLUSION:	4	
Obtain O_2% results.			
Compare O_2 reading with specifications.	CONCLUSION:	4	
Obtain CO_2% results.			
Compare CO_2 reading with specifications.	CONCLUSION:	4	
3.2.12 Switch off the analyser.		1	
3.2.13 Remove the probe from the exhaust pipe.		1	
3.2.14 Remove condensate from pipes.		1	
TOTAL – Exhaust Gas Analysis – Procedure		**32**	

TOTAL – Exhaust Gas Analysis – Questions	18	
TOTAL – Exhaust Gas Analysis – Procedure	32	
GRAND TOTAL:	**50**	

SIGNATURES			
Candidate	Date	Teacher	Date
Internal moderator	Date	External moderator	Date

Declaration by the teacher:

I, _____,declare that the Exhaust Gas Analysis's marks are
Initial & Surname (Teacher)
captured on the school database.

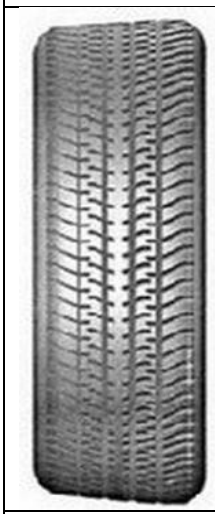
_____ _____
Signature Date

TASK 4: WHEEL BALANCING

WORKSHEET 4.1 – QUESTIONS

CANDIDATE'S NAME AND SURNAME: _____

QUESTIONS	MARK
4.1.1 State FOUR advantages of having the motor vehicle's wheels balanced.	4
4.1.2 Why is it necessary for the wheel balancing machine to be correctly calibrated?	1
4.1.3 State THREE functions of the wheel-weight hammer.	3
4.1.4 Define *static balance* of a wheel and tyre assembly.	2
4.1.5 Define *dynamic balance* of a wheel and tyre assembly.	2

4.1.6	FIGURE 4.1.6 shows different tyre conditions. State the cause of EACH condition (A–C).	**A**	**B**	**C**	3
					
		FIGURE 4.1.6			
		A –			
		B –			
		C –			
4.1.7	State FOUR safety measures that should be observed when performing wheel balancing.				4
		TOTAL – Wheel Balancing – Questions		**19**	

TASK 4: WHEEL BALANCING

WORKSHEET 4.2 – PROCEDURE

CANDIDATE'S NAME AND SURNAME: _____

WHEEL BALANCING			
4.2 Balance a wheel and tyre assembly using the correct procedure.			
PROCEDURE		**MARK**	**TOTAL**
4.2.1	Choose the correct rim adapter to mount the wheel for the rim size.	1	
4.2.2	Fit the wheel to the wheel balancer correctly.	1	
4.2.3	Check the tyre for uneven wear.	1	
4.2.4	Check the tyre for bruises, cracks and damaged side walls.	1	
4.2.5	Check tyre wear level at the tyre wear indicators (TWI).	1	
4.2.6	Remove foreign matter from the rim and tyre.	1	
4.2.7	Check the wheel rim for damaged beads.	1	
4.2.8	Obtain the wheel rim diameter from the tyre.	1	
4.2.9	Enter the wheel rim diameter into the wheel balancer.	1	
4.2.10	Obtain tyre pressure specification.	1	
4.2.11	Check tyre pressure.	1	
4.2.12	Use the calliper to determine the rim width.	1	
4.2.13	Enter wheel rim width into the wheel balancer	1	
4.2.14	Use the off-set arm to measure the distance to the wheel.	1	
4.2.15	Enter the off-set measurement into the wheel balancer.	1	
4.2.16	Close the safety cover.	1	
4.2.17	Start the wheel balancer and allow the wheel to spin.	1	
4.2.18	Obtain the imbalance readings on the outer and inner part of the rim. Inner reading: _____ Outer reading: _____	REASON:	3	

4.2.19 Remove the wheel weights.	1	
4.2.20 Close the safety cover.	1	
4.2.21 Start the balancer and allow wheel to spin.	1	
4.2.22 Obtain the imbalance readings and its locations on the rim. Inner reading: _____ Outer reading: _____	2	
4.2.23 Choose the correct weights.	2	
4.2.24 Fit the weights correctly.	2	
4.2.25 Re-check the balancing.	1	
4.2.26 Remove the wheel if balanced.	1	
TOTAL – Wheel Balancing – Procedure	**31**	

TOTAL – Wheel Balancing – Questions	19	
TOTAL – Wheel Balancing – Procedure	31	
GRAND TOTAL	**50**	

SIGNATURES			
Candidate	Date	Teacher	Date
Internal moderator	Date	External moderator	Date

Declaration by the teacher:

I, _____,declare that the Wheel Balancing's marks are
Initial & Surname (Teacher)
captured on the school database.

_____ _____
Signature Date

TASK 5: FUEL SYSTEM TEST

WORKSHEET 5.1 – QUESTIONS

CANDIDATE'S NAME AND SURNAME: _____

QUESTIONS			MARK
5.1.1 State the function of the fuel system tester.			2
5.1.2 Name TWO methods by which fuel pumps are driven on an internal combustion engine.			2
5.1.3 State the function of a fuel filter.			1
5.1.4 State TWO functions of a check valve in the fuel system.			2
5.1.5 State THREE possible faults and their corrective measures for low fuel pressure.			6
FAULT	**CORRECTIVE MEASURE**		
TOTAL – Fuel System Test – Questions		**13**	

TASK 5: FUEL SYSTEM TEST

WORKSHEET 5.2 – PROCEDURE

CANDIDATE'S NAME AND SURNAME: _____

5.2 Conduct the Fuel System Test in the correct sequence.							
PROCEDURE						**MARK**	**TOTAL**
5.2.1	Obtain the fuel pressure specifications:					3	
5.2.2	Work in a well-ventilated area.					1	
5.2.3	Ensure there is a fire extinguisher nearby.					1	
5.2.4	Obtain the correct adaptor in accordance with the hose size.					1	
5.2.5	Ensure that the tester can read the pressure of the fuel system.					1	
5.2.6	Ensure that the rubber hose on the tester is not perished.					1	
5.2.7	Ensure that the tester's pressure relieve valve is working properly.					1	
5.2.8	Fit fuel pressure tester to fuel line between the pump and engine.					3	
5.2.9	Switch ignition on until maximum fuel pressure is reached.					1	
5.2.10	Switch ignition off after the full pressure is reached.					1	
5.2.11	Check fuel pressure on gauge.					3	
5.2.12	Release pressure and connect to fuel hose on engine side as well.					2	
5.2.13	Switching ignition on and off after the full pressure is reached.					2	
5.2.14	Check fuel pressure on gauge.					2	
5.2.15	Check regulator vacuum hose for wetness.					2	
5.2.16	Check for leaking injectors.	1.	2.	3.	4.	4	
TOTAL – Fuel System Pressure Test – Procedure						**29**	

5.3 Check the fuel delivery rate.			
	FUEL DELIVERY RATE – PROCEDURE	**MARK**	**TOTAL**
5.3.1	Obtain the delivery rate (fuel flow rate) specifications.	1	
5.3.2	Release fuel pressure from fuel system.	2	
5.3.3	Disconnect fuel hose.	1	
5.3.4	Insert fuel hose into measuring beaker.	1	
5.3.5	Switch ignition on.	1	
5.3.6	Measure the fuel delivery volume after ONE minute.	2	
	TOTAL – Fuel Delivery Rate – Procedure	**8**	

TOTAL – Fuel System Test – Questions	13	
TOTAL – Fuel System Pressure Test – Procedure	29	
TOTAL – Fuel Delivery Rate – Procedure	8	
GRAND TOTAL:	**50**	

SIGNATURES			
Candidate	Date	Teacher	Date
Internal moderator	Date	External moderator	Date

Declaration by the teacher:

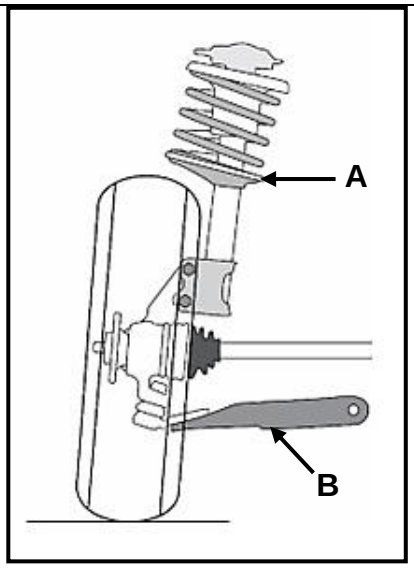
I, _____,declare that the Fuel System Test's marks are
Initial & Surname (Teacher)
captured on the school database.

_____ _____
Signature Date

TASK 6: WHEEL ALIGNMENT

WORKSHEET 6.1 – QUESTIONS

CANDIDATE'S NAME AND SURNAME: _____

QUESTIONS	MARK
6.1.1 What is the purpose of toe-out on turns?	2
6.1.2 Draw a neat, labelled sketch of toe-in on a vehicle.	3
6.1.3 Which tool is used to measure the toe angles on a vehicle?	1
6.1.4 Label **A** to **B** in FIGURE 6.1.4 of the front suspension below.	2
 **FIGURE 6.1.4**	
A.	
B.	
TOTAL – Wheel Alignment – Questions **8**	

TASK 6: WHEEL ALIGNMENT

WORKSHEET 6.2 – PROCEDURE

CANDIDATE'S NAME AND SURNAME: _____

6.2 Conduct the wheel alignment procedure using the bubble gauge in the correct sequence.			
PROCEDURE		**MARK**	**TOTAL**
6.2.1 Do ANY SEVEN of the pre-checks on the vehicle.		7	
6.2.2 Obtain wheel alignment specifications.	(a) Caster …… (b) Camber …… (c) KPI ……	3	
6.2.3 Place vehicle on turntables.		5	
6.2.4 Taking the wheel alignment CAMBER reading.		3	

6.2.5 State if the camber reading is within specifications or not.		1	
6.2.6 Advise on how to correct the camber.		1	
6.2.7 Reading the wheel alignment CASTER and KPI angles on the LEFT wheel.	CASTER _____ KPI _____	11	
6.2.8 Reading the wheel alignment CASTER and KPI angles on the RIGHT wheel.	CASTER _____ KPI _____	11	
TOTAL – Wheel Alignment – Procedure		**42**	

TOTAL – Wheel Alignment – Questions	8	
TOTAL – Wheel Alignment – Procedure	42	
GRAND TOTAL:	**50**	

SIGNATURES			
Candidate	Date	Teacher	Date
Internal moderator	Date	External moderator	Date

Declaration by the teacher:

I, _____,declare that the Wheel Alignment's marks are
Initial & Surname (Teacher)
captured on the school database.

_____ _____
Signature Date

TASK 7: CHARGING SYSTEM

WORKSHEET 7 – PROCEDURE

CANDIDATE'S NAME AND SURNAME: _____

7. Perform the following tasks regarding the charging system.

CHARGING SYSTEM (ALTERNATOR)	**MARK**	**TOTAL**
7.1 Identify any SEVEN components (A to I) of the alternator in FIGURE 7.1.	7	

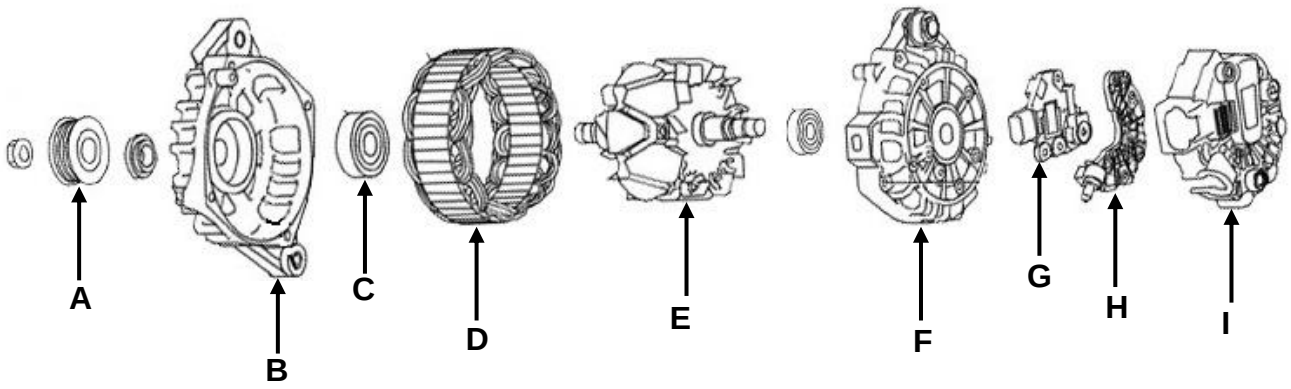


FIGURE 7.1

A -	F -
B -	G -
C -	H -
D -	I -
E -	

7.2 Test the charging system on a vehicle.

	PROCEDURE	**MARK**	**TOTAL**
7.2.1	Select DC voltage on the multimeter.	1	
7.2.2	Obtain the manufacturer's specifications for the vehicle's charging system.	2	
7.2.3	Check for loose electrical connections.	1	
7.2.4	Check the fan belt.	2	
7.2.5	Use the multimeter to measure the battery voltage at idling speed without load.	2	
7.2.6	Use the multimeter to measure the battery voltage at idling speed with load.	2	
7.2.7	Report on voltage drop between readings at idling speed, with and without load.	2	
	TOTAL – Charging System – Procedure	**19**	

7.3 Test the following components of a dismantled alternator.			
ALTERNATOR TESTING – PROCEDURE		**MARK**	**TOTAL**
7.3.1 Select continuity (buzzer) on the multimeter.		1	
Check the six diodes on the rectifier.			
7.3.2 Connect the multimeter to both sides of the diodes.		6	
7.3.3 Report on condition of diodes.		6	
Check stator for continuity.			
7.3.4 Connect the multimeter to a different pair of each of the three winding ends respectively.		3	
7.3.5 Report on continuity of stator windings.		3	
Check stator for earth leakage.			
7.3.6 Connect the multimeter to the stator framework and the other end to any of the three windings ends.		1	
7.3.7 Report on earth leakage of stator windings.		1	
Check rotor for continuity.			
7.3.8 Connect multimeter to both slip rings.		1	
7.3.9 Report on continuity of rotor windings.		1	
7.3.10 Check if slip rings are connected properly to rotor windings.		2	
7.3.11 Check slip rings for wear.		1	
Check rotor for earth leakage.			
7.3.12 Connect multimeter to rotor winding and rotor framework (poles).		1	
7.3.13 Report on earth leakage of rotor windings.		1	
7.3.14 End bracket/Cover for wear.		1	
7.3.15 Check front bearing and rear bearing.		2	
TOTAL – Alternator Testing – Procedure		**31**	

TOTAL – Charging System – Procedure	19	
TOTAL – Alternator Testing – Procedure	31	
GRAND TOTAL	**50**	

SIGNATURES			
Candidate	Date	Teacher	Date
Internal moderator	Date	External moderator	Date

Declaration by the teacher:

I, _____,declare that the Charging System's marks are
Initial & Surname (Teacher)
captured on the school database.

_____ _____
Signature Date

TASK 8: COMPUTERISED DIAGNOSTIC SCANNER

WORKSHEET 8.1 – QUESTIONS

CANDIDATE'S NAME AND SURNAME: _____

QUESTIONS		MARK
8.1.1	What do the following abbreviations stand for?	
	(a) OBD	1
	(b) ECU	1
	(c) TCU	1
	(d) MAF	1
	(e) TPS	1
8.1.2	Interpret the following fault code: P0171	
	(a) P	1
	(b) 0	1
	(c) 1	1
	(d) 71	1
8.1.3	State TWO manufacturer's specifications required to set up an OBD scanner.	2

8.1.4 State the FOUR basic functions of an OBD scanner.		4
8.1.5 Name FIVE systems that the OBD scanner can detect.		5
TOTAL – Computerised Diagnostic Scanner – Questions	**20**	

TASK 8: COMPUTERISED DIAGNOSTIC SCANNER

WORKSHEET 8.2 – PROCEDURE

CANDIDATE'S NAME AND SURNAME: _____

COMPUTERISED DIAGNOSTIC SCANNER			
8.2 Conduct a Computerised Diagnostic Test on a vehicle using the OBD-II scanner.			
PROCEDURE		**MARK**	**TOTAL**
8.2.1 Check for any of the SIX obvious problems listed:		6	
8.2.2 Obtain the VIN of the vehicle.		1	
8.2.3 Obtain the make and model of the vehicle.		1	
8.2.4 Locate the car's OBD-II port.		1	
8.2.5 Gain access to the car's OBD-II port.		1	
8.2.6 Plug the diagnostic tool into the OBD-II port.		2	
8.2.7 Access the diagnostic scanner.		2	
8.2.8 Enter the vehicle's details into the scanner.		2	
8.2.9 Turn on the vehicle's ignition.		2	
8.2.10 Select the system to be scanned.		2	
8.2.11 Perform a diagnostic scan.		2	
8.2.12 Record any diagnostic trouble codes.		2	
8.2.13 Clear the trouble codes and restart the diagnostic scan.		2	
8.2.14 Read the trouble codes.		1	
8.2.15 Interpret the trouble codes.		1	
8.2.16 Make a diagnosis.		2	
TOTAL – Computerised Diagnostic Scanner – Procedure		**30**	

TOTAL – Computerised Diagnostic Scanner – Questions	20	
TOTAL – Computerised Diagnostic Scanner – Procedure	30	
GRAND TOTAL	**50**	

SIGNATURES			
Candidate	Date	Teacher	Date
Internal moderator	Date	External moderator	Date

Declaration by the teacher:

I, _____,declare that the Computerised Diagnostic Scanner's marks
Initial & Surname (Teacher)
are captured on the school database.

_____ _____
Signature Date

TASK 9: ENGINE COMPONENTS MEASUREMENTS AND CALCULATIONS (COMPULSORY)

WORKSHEET 9.1 – QUESTIONS

CANDIDATE'S NAME AND SURNAME: _____

QUESTIONS	MARK
9.1.1 Explain what is meant by *swept volume*.	2
9.1.2 Define *clearance volume*.	2
9.1.3 What do you understand by the term *compression ratio*?	2
9.1.4 Describe THREE methods to raise the compression ratio in an engine.	3
9.1.5 Describe THREE methods to lower the compression ratio in an engine.	3

9.1.6	Obtain the stroke length and bore diameter for a given engine from the specification sheet to calculate the compression ratio. Stroke length = _____ mm Bore diameter = _____ mm Clearance volume = 35 cm^3	8

9.1.7	The following data was recorded during a test carried out on a four-cylinder four-stroke petrol engine: Crankshaft revolutions: 2 000 r/min Mean effective pressure: 900 kPa Cylinder bore diameter: 84 mm Stroke length: 86 mm Determine the following by means of calculations: (a) Indicated power in kW (8) (b) Mechanical efficiency if the brake power is 22 kW (2)	10

9.1.8	What equipment is used to measure the mean effective pressure developed during the power stroke?	1
9.1.9	Name TWO types of dynamometers used to measure brake power.	2
	TOTAL – Engine Components Measurement and Calculations – Questions **33**	

TASK 9: ENGINE COMPONENTS MEASUREMENT – PROCEDURE

WORKSHEET 9.2 – ENGINE COMPONENTS MEASUREMENT

CANDIDATE'S NAME AND SURNAME: _____

ENGINE COMPONENTS MEASUREMENT
9.2 Measure the cylinder bore and crankshaft journal of an internal combustion engine. Answer the questions that follow.
PROCEDURE

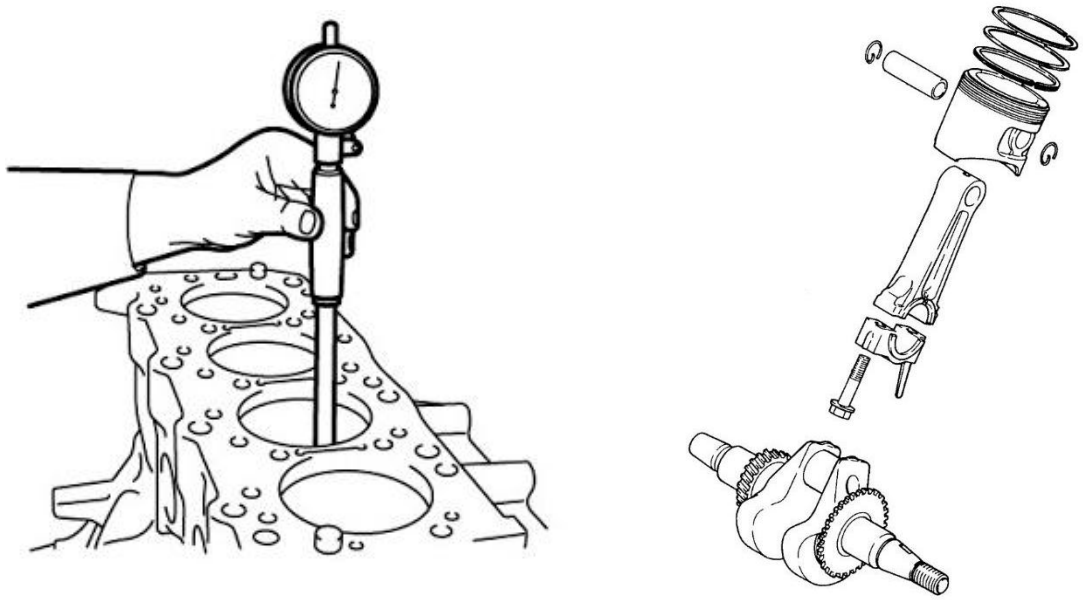



FIGURE 9.2: ENGINE BLOCK, CRANKSHAFT AND CONROD ASSEMBLY

9.2.1 Obtain specifications with correct SI units for the following.

COMPONENT	SPECIFICATION	MARK	TOTAL
Big-end journal		1	
Main journal		1	
Cylinder bore diameter		1	
Stroke length		1	
Big-end bearing clearance		1	
Mains bearing clearance		1	
	TOTAL – Engine Specifications	**6**	

9.2.2 Measure the main journal.

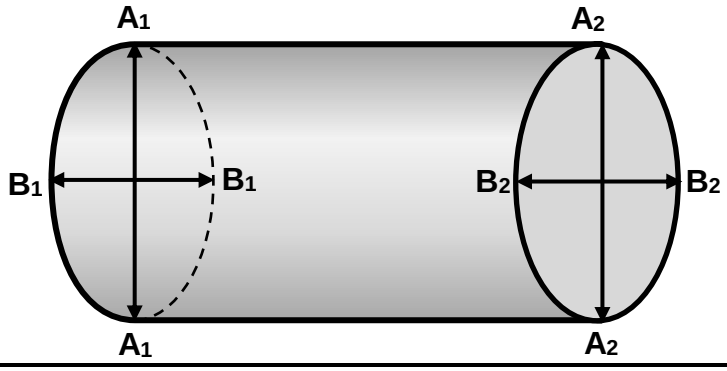


FIGURE 9.2.2: MAIN JOURNAL

DIMENSION	MEASUREMENT	MARK	TOTAL
A_1		5	
A_2		5	
B_1		5	
B_2		5	

9.2.3 Calculate the ovality.

$A_1 – B_1 =$		2	
$A_2 – B_2 =$		2	

9.2.4 Calculate the taper.

$A_1 – A_2 =$		2	
$B_1 – B_2 =$		2	
TOTAL – Engine Main Journal Measurement and Calculations		**28**	

9.2.5 Measure the cylinder bore.

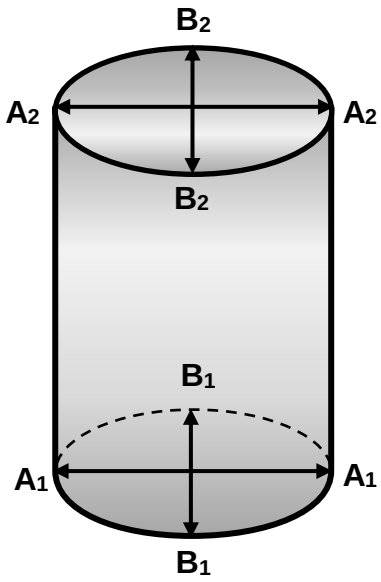


FIGURE 9.2.5: CYLINDER BORE

DIMENSION	MEASUREMENT	MARK	TOTAL
A_1		5	
A_2		5	
B_1		5	
B_2		5	
Stroke length		5	

9.2.6 Calculate the ovality.

$A_1 – B_1 =$		2	
$A_2 – B_2 =$		2	

9.2.7 Calculate the taper.

$A_1 – A_2 =$		2	
$B_1 – B_2 =$		2	
TOTAL – Engine Cylinder Measurement and Calculations		**33**	

TOTAL – Engine Components Measurements and Calculations – Questions	33	
TOTAL – Engine Specifications	6	
TOTAL – Engine Main Journal Measurements and Calculations	28	
TOTAL – Engine Cylinder Measurements and Calculations	33	
GRAND TOTAL	**100**	

SIGNATURES			
Candidate	Date	Teacher	Date
Internal moderator	Date	External moderator	Date

Declaration by the teacher:

I, _____,declare that the Engine Components Measurements and
Initial & Surname (Teacher)
Calculations' marks are captured on the school database.

_____ _____
Signature Date

5. COMPOSITE MARK SHEET – TOTALS

MECHANICAL TECHNOLOGY											
AUTOMOTIVE											
COMPOSITE MARK SHEET – TOTALS											
GRADE		12		DATE							
		CANDIDATES									
PHASES	MARKS										
		1	2	3	4	5	6	7	8	9	10
TASK: _____	50										
TASK: _____	50										
TASK: _____	50										
TASK 9 COMPULSORY	100										
TOTAL:	250										
TOTAL PAT MARK:	100										

NAME AND SIGNATURE OF TEACHER		
NAME AND SIGNATURE OF TECHNICAL DEPARTMENTAL HEAD		
NAME AND SIGNATURE OF PRINCIPAL		
NAME AND SIGNATURE OF INTERNAL MODERATOR		
NAME AND SIGNATURE OF EXTERNAL MODERATOR		

SCHOOL STAMP

6. ANNEXURE A – SPECIFICATIONS SHEET

ENGINE:	
Type	
Bore	
Stroke	
Idling speed	
Power max.	
Torque max.	
Compression ratio	
Oil pressure	
Firing order	
Radiator cap pressure	
Thermostat opening pressure	

TRANSMISSION:	
Clutch type and diameter	
Gearbox	
Rear axle type	
Final drive type and ratio	
Speed in top gear per 1 000 r/min	

CAPACITIES:	
Sump without oil filter	
Gearbox	
Final drive	
Cooling system	
Fuel tank	

FUEL:	
Fuel system	
Aspiration	
Consumption	
CO emissions	
CO_2 emissions	
O_2 emissions	
Fuel type	

PISTONS AND RINGS:	
Piston clearance in bore	
Over-sizes	
Number of rings	
Groove gap	
Ring gap in bore	

VALVES:	
Working clearance	
Inlet	
Exhaust	
Timing	
Inlet opens	
Inlet closes	
Timing	
Exhaust opens	
Exhaust closes	
Valve spring free length	
Valve spring rate	
Valve seat angle	
Valve lift	
Cam height	

IGNITION AND ELECTRICAL:	
Distributor type	
Stroboscopic setting	
Position of timing marks	
Spark plugs	
Spark plugs gaps	
Battery	
Alternator	
Charging rate	
Regulator type	

CRANKSHAFT:	
Main bearings	
Under-sizes	
Clearance	
Big end	
Under-sizes	
Clearance	
Small end bushes	

TORQUE SETTINGS:	
Flywheel	
Cylinder head	
Big ends bearings	
Main bearings	
OHC bearing caps	

7. CONCLUSION

On completion of the practical assessment task candidates should be able to demonstrate their understanding of the industry, enhance their knowledge, skills, values and reasoning abilities as well as establish connections to life outside the classroom and address real-world challenges. The PAT furthermore develops the candidate's life skills and provides opportunities for candidates to engage in their own learning.