basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

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MARKS: 200

TIME: 3 hours

This question paper consists of 17 pages and a 2-page formula sheet.

INSTRUCTIONS AND INFORMATION

1. Write your centre number and examination number in the spaces provided on the ANSWER BOOK.
2. Read ALL the questions carefully.
3. Answer ALL the questions.
4. Number the answers correctly according to the numbering system used in this question paper.
5. Start EACH question on a NEW page.
6. Show ALL calculations and units. Round off final answers to TWO decimal places.
7. Candidates may use non-programmable scientific calculators and drawing instruments.
8. The value of gravitational acceleration should be taken as 10 m/s^2.
9. All dimensions are in millimetres, unless stated otherwise in the question.
10. Write neatly and legibly.
11. A formula sheet is attached at the end of the question paper.
12. Use the criteria below to assist you in managing your time.

QUESTION	CONTENT	MARKS	TIME IN MINUTES
	GENERIC		
1	Multiple-choice Questions	6	6
2	Safety	10	10
3	Materials	14	14
	SPECIFIC		
4	Multiple-choice Questions	14	10
5	Tools and Equipment	23	20
6	Engines	28	25
7	Forces	32	25
8	Maintenance	23	20
9	Systems and Control (Automatic Gearbox)	18	20
10	Systems and Control (Axles, Steering Geometry and Electronics)	32	30
	TOTAL	**200**	**180**

QUESTION 1: MULTIPLE-CHOICE QUESTIONS (GENERIC)

Various options are provided as possible answers to the following questions. Choose the answer and write only the letter (A–D) next to the question numbers (1.1 to 1.6) in the ANSWER BOOK, e.g. 1.7 E.

1.1 Which ONE of the following is the last stage when applying first aid?

A Examination
B Treatment
C Diagnosis
D Transport (1)

1.2 What is the maximum thickness of sheet metal that a manual guillotine can cut?

A 0,2 mm
B 1,2 mm
C 2,2 mm
D 3,2 mm (1)

1.3 Which part of a hydraulic press is used to safely keep the platform at a desired height?

A Return spring
B Plunger
C Supporting pin
D Base (1)

1.4 Which ONE of the following tests is used to determine resistance to penetration?

A File test
B Machining test
C Hardness test
D Sound test (1)

1.5 Which machine is used to conduct a spark test on carbon steels?

A Bench grinder
B Drilling machine
C Lathe machine
D Milling machine (1)

1.6 Which ONE of the following materials will have a high ringing sound when tapped with a hammer during a sound test?

A Cast iron
B Cast steel
C Mild steel
D Aluminium (1)

[6]

QUESTION 2: SAFETY (GENERIC)

2.1 Name TWO vital functions of an injured person that must be checked when first aid is applied. (2)

2.2 Give a reason why safety goggles must be worn when working with an angle grinder. (1)

2.3 Name TWO types of safety guards that are used when the opening at the guillotine shears is greater than 10 mm. (2)

2.4 State THREE safety precautions that must be adhered to before gas welding is undertaken. (3)

2.5 State TWO disadvantages of the product layout of machines. (2)
[10]

QUESTION 3: MATERIALS (GENERIC)

3.1 State THREE properties that can be obtained from heat-treatment processes. (3)

3.2 Describe the following heat-treatment processes:

3.2.1 Tempering (4)

3.2.2 Hardening (3)

3.3 Give TWO examples of case-hardened products used in the industry. (2)

3.4 Why is steel cooled in still air, away from a draught, during the normalising process? (2)
[14]

QUESTION 4: MULTIPLE-CHOICE QUESTIONS (SPECIFIC)

Various options are provided as possible answers to the following questions. Choose the answer and write only the letter (A–D) next to the question numbers (4.1 to 4.14) in the ANSWER BOOK e.g. 4.15 E.

4.1 Which precaution must be taken before calibrating the emission (exhaust) gas analyser?

A Ensure that the engine is at operating temperature.
B The pick-up hose must be removed from the exhaust pipe.
C Do not step on the pick-up hose or restrict it in any way.
D The pick-up hose connections must be airtight. (1)

4.2 How many degrees are the wheels turned from the straight-ahead position when checking caster and king pin inclination (KPI) with a bubble gauge?

A 20°
B 40°
C 15°
D 30° (1)

4.3 Why are flywheels fitted to the crankshaft flange in one position only?

A To prevent it from loosening
B To maintain its balance
C To ensure that the clutch fits correctly
D To improve engine boost (1)

4.4 What is meant by the term *turbo lag*?

A The delay between pressing the accelerator and the turbo kicking in
B The dirt found in the oil
C The turbo is placed after the catalytic converter
D The time it takes for the turbo to cool down (1)

4.5 7 R U T X H L V G H I L Q H G D V «

A the rotational frequency of a shaft.
B a force causing linear movement.
C the rate at which work is done.
D the twisting force applied to a rotating shaft. (1)

4.6 Which ONE of the following will result in a lower compression ratio?

A Fit piston with suitable higher crowns
B Fit crankshaft with a longer stroke
C Fit a thicker gasket between the cylinder block and the cylinder head
D Increase bore size of cylinders (1)

4.7 Clearance volume is also known as «

A combustion volume.
B compression chamber volume.
C confined volume.
D cylinder volume. (1)

4.8 What type of engine diagnostic test is shown in FIGURE 4.8 below?

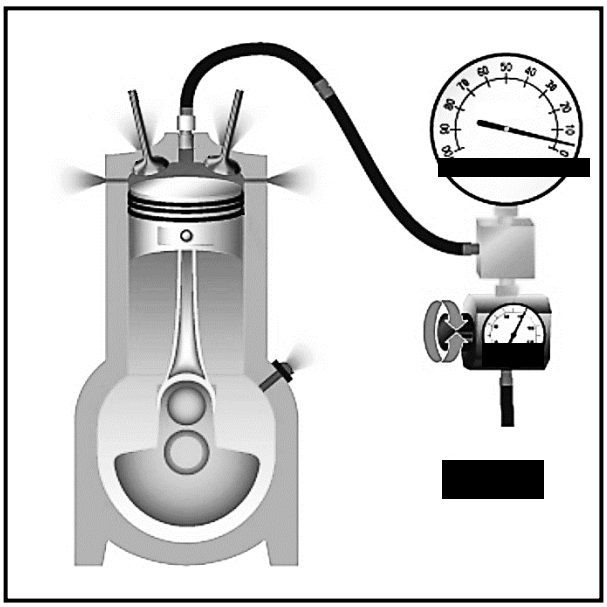

FIGURE 4.8

A Radiator pressure test
B Fuel pressure test
C Cylinder leakage test
D Compression pressure test (1)

4.9 Which ONE of the following setup procedures refer to an oil pressure test?

(Q V X U H W K D W «

A a fire extinguisher is close by.
B both intake and exhaust valves are closed.
C the rubber hose is not damaged.
D the throttle valve is completely open. (1)

4.10 Which ONE of the following is a reduction gear ratio?

A 1 : 3
B 2 : 1
C 1 : 1
D 2 : 3 (1)

4.11 $ Q D G Y D Q W D J H R I X V L Q J D W U D Q V P L V V L R Q F R

A better fuel ignition.
B increased harmful engine emissions.
C that no gearbox is required.
D improved vehicle handling. (1)

4.12 What is the purpose of the Ackermann angle on a vehicle?

It allows for variable … on turns.

A toe-in
B toe-out
C camber
D caster (1)

4.13 What is the function of the coil on a distributorless ignition system?

A It converts battery voltage to high voltage.
B It supplies low voltage to the ignition system.
C It heats the fuel to room temperature.
D It will melt the ceramic monolith of the catalytic converter. (1)

4.14 Which ONE of the following is an advantage of an electric fuel pump?

A Low delivery pressure
B Noisy operation
C Inconsistent discharge pulsation of fuel
D Compact and light design (1)
[14]

QUESTION 5: TOOLS AND EQUIPMENT (SPECIFIC)

5.1 Give TWO reasons why EACH of the following precautions should be observed before a compression test:

5.1.1 The ignition system is disconnected. (2)

5.1.2 All spark plugs are removed. (2)

5.1.3 The air filter is removed. (2)

5.2 Explain in THREE steps how to calibrate a cylinder leakage tester. (3)

5.3 State TWO functions of an exhaust gas analyser. (2)

5.4 State THREE ways in which on-board diagnostic (OBD) scanners can be connected to a laptop or computer. (3)

5.5 Explain the difference between *static* and *dynamic wheel balancing*. (2)

5.6 Which THREE factors are used to locate a wheel's dynamic imbalance? (3)

5.7 How do you obtain a reading for toe-in/toe-out, using the periscope optical alignment gauge, after it has been set up against the wheels? (4)
[23]

QUESTION 6: ENGINES (SPECIFIC)

6.1 Name THREE engine parts that are indirectly driven by the crankshaft. (3)

6.2 Identify the TWO vibration dampers shown in FIGURES 6.2.1 and 6.2.2 below.

6.2.1

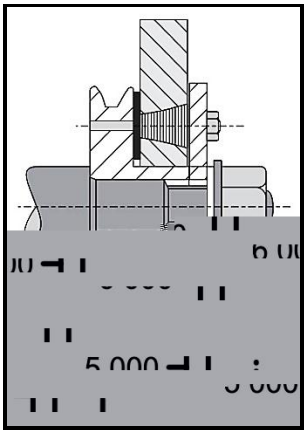

FIGURE 6.2.1 (1)

6.2.2

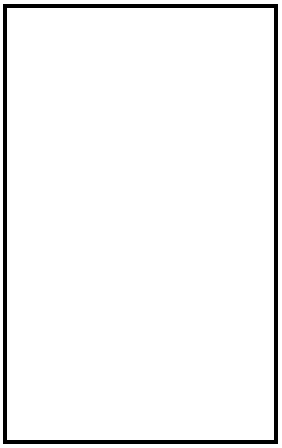

FIGURE 6.2.2 (1)

6.3 State FOUR features, other than vibration dampers, which are built into an engine to improve balance. (4)

6.4 State TWO advantages of using V-type engines compared to in-line (straight) engines in motor vehicles. (2)

6.5 State TWO possible firing orders for a four-cylinder, four-stroke in-line (straight) engine. (2)