THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL

CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

031/2B **MOTOR VEHICLE MECHANICS**

(For Both School and Private Candidates)

Time : 3 Hours **ANSWERS** **Year : 2021**

Instructions

1. This paper consists of sections A, B and C.
2. Non-programmable calculators may be used.
3. Communication devices and any unauthorised materials are **not** allowed in the examination room.
4. Write your **Examination Number** on every page of your answer booklet(s).

1. (i) What are the advantages of using helical gears compared to spur gears in a transmission system?

A. Strength is high and less cost

B. Strength is high and less end thrust

C. Noise level is low and its strength is high

D. Noise level is low and its economy in fuel

E. Noise level is high and its strength is high

Correct Answer: C. Noise level is low and its strength is high

Reason: Helical gears provide smoother engagement and higher load capacity than spur gears, with reduced noise during operation.

(ii) Which of the following is an example of a chassis component?

A. Gearbox

B. Propeller shaft

C. Rear axle

D. Steering system

E. Differential

Correct Answer: D. Steering system

Reason: The chassis includes systems such as steering, suspension, and brakes, while components like gearbox and differential belong to the transmission system.

(iii) Why is it necessary to maintain correct air pressure in tyres?

A. To avoid engine knocking and reduce noise

B. To maintain stability and reduce tyre wear

C. To reduce brake fade and increase speed

D. To save fuel and reduce end thrust

E. To maintain lubrication and reduce slip

Correct Answer: B. To maintain stability and reduce tyre wear

Reason: Correct tyre pressure ensures better road grip, stability, even tread wear, and longer tyre life.

(iv) The main function of piston rings in an internal combustion engine is to

A. Transfer heat from piston to cylinder wall

B. Prevent knock and pre-ignition

C. Increase compression and fuel ratio

D. Cool down the connecting rod

E. Regulate oil circulation in the crankshaft

Correct Answer: A. Transfer heat from piston to cylinder wall

Reason: Piston rings also seal combustion gases and control oil, but their key role is to transfer heat away from the piston to the cylinder wall for cooling.

(v) What is the main purpose of the differential in a motor vehicle?

A. To change the direction of power by 90°

B. To allow wheels to rotate at different speeds when cornering

C. To reduce noise during power transmission

D. To increase torque equally in all wheels

E. To connect the gearbox to the propeller shaft

Correct Answer: B. To allow wheels to rotate at different speeds when cornering

Reason: The differential ensures the outer wheel turns faster than the inner wheel during cornering, preventing tyre skidding and reducing strain.

(vi) Which of the following instruments is used to measure specific gravity of electrolyte in a battery?

A. Hydrometer

B. Ammeter

C. Voltmeter

D. Multimeter

E. Thermometer

Correct Answer: A. Hydrometer

Reason: A hydrometer measures the density (specific gravity) of battery electrolyte, indicating the state of charge.

(vii) What is the function of the silencer in the exhaust system of a motor vehicle?

A. To increase exhaust gas velocity

B. To cool exhaust gases

C. To reduce exhaust noise

D. To filter out unburnt fuel

E. To prevent oil leakage

Correct Answer: C. To reduce exhaust noise

Reason: The silencer muffles engine exhaust sounds by dissipating the noise energy.

(viii) Why are aluminium alloys commonly used in the manufacture of engine components?

A. They are hard and brittle

B. They are light and conduct heat well

C. They are cheap and reduce noise

D. They are elastic and resist corrosion

E. They are strong and reduce wear

Correct Answer: B. They are light and conduct heat well

Reason: Aluminium alloys reduce engine weight and dissipate heat efficiently, making them ideal for engine blocks and pistons.

(ix) The main purpose of a thermostat in a cooling system is to

A. Regulate the flow of fuel to the carburetor

B. Regulate the flow of coolant to maintain engine temperature

C. Reduce knocking and overheating in the cylinders

D. Open and close radiator cap automatically

E. Pump coolant through water jackets

Correct Answer: B. Regulate the flow of coolant to maintain engine temperature

Reason: A thermostat ensures the engine warms up quickly and maintains an optimal operating temperature by controlling coolant circulation.

(x) Which of the following is a function of the carburetor in a petrol engine?

A. To regulate the ignition timing

B. To mix air and fuel in the correct proportion

C. To supply only air into the cylinder

D. To measure exhaust gases

E. To cool the combustion chamber

Correct Answer: B. To mix air and fuel in the correct proportion

Reason: The carburetor's primary function is to atomize fuel and mix it with the right amount of air before it enters the combustion chamber.

2. Explain five effects of hazardous materials to be observed when working in motor vehicle workshop.

1. Hazardous materials can cause respiratory complications when inhaled, such as coughing, asthma, or long-term lung diseases.

2. They may cause skin damage including burns, rashes, or irritation when they come into direct contact with the skin.

3. Toxic chemicals may affect the eyes, leading to irritation, temporary blindness, or long-term vision problems.

4. Flammable hazardous materials increase the risk of fire and explosion, endangering both people and property.

5. Oil, grease, and chemical spills create slippery floors which may cause accidents like falls and serious injuries.

3. (a) Mention five stationary parts of an engine.

Cylinder block, Cylinder head, Crankcase, Valve seats, and Main bearing saddles.

(b) State the importance of each part in (a).

- Cylinder block provides the main structure that houses cylinders and supports other components.

- Cylinder head covers the cylinders, holds valves, and forms the combustion chamber.

- Crankcase encloses and supports the crankshaft and provides lubrication oil storage.
- Valve seats provide surfaces for inlet and exhaust valves to seal properly.
- Main bearing saddles support crankshaft bearings to ensure smooth rotation.

4. Briefly explain five important engine components which facilitate the flow of the lubricating oil in an engine.

1. Oil pump – circulates oil under pressure throughout the lubrication system.
2. Oil filter – cleans the oil by removing dirt, metal particles, and impurities.
3. Oil galleries – passages that direct the flow of lubricating oil to various moving parts.
4. Oil sump – stores lubricating oil before circulation.
5. Pressure relief valve – regulates oil pressure to prevent damage to engine components.

5. Explain two functions of the valves available in a radiator cap.

1. The pressure valve maintains pressure in the cooling system, raising the boiling point of coolant and preventing overheating.
2. The vacuum valve allows coolant to flow back into the radiator from the reservoir when the system cools down, preventing collapse of hoses.

6. (a) Describe in brief three main parts of the tyre.

- Tread: the outer surface that makes contact with the road and provides grip.

- Sidewall: the vertical section that provides flexibility and protects the carcass.
- Bead: the reinforced edge that secures the tyre onto the rim.

(b) Explain in brief two characteristics of a steering system that must be realized in motor vehicle.

- Stability: the steering system must keep the vehicle in a straight line with minimal driver effort.
- Responsiveness: the system must respond quickly and smoothly to steering input for safe control.

7. Briefly explain the procedures of removing a broken stud or nut by using extractor.

1. Drill a hole at the center of the broken stud or nut.
2. Insert the correct size extractor into the drilled hole.
3. Turn the extractor anticlockwise using a wrench or handle.
4. The tapered threads of the extractor grip tightly into the stud.
5. Continue turning until the broken stud or nut is fully removed.

8. Enumerate five major components of hydraulic operated brakes and their application.

1. Master cylinder – generates hydraulic pressure when the brake pedal is pressed.
2. Brake lines and hoses – carry brake fluid under pressure to wheel cylinders or calipers.
3. Wheel cylinder – converts hydraulic pressure into mechanical force to push brake shoes.
4. Brake caliper – squeezes brake pads against the disc in disc brake systems.

5. Brake fluid reservoir – stores brake fluid and supplies it to the hydraulic system.

9. Explain five ways of solving the problem of the client's car engine which emits a lot of gases.

1. Check and replace worn-out piston rings which may allow oil burning.
2. Clean or replace clogged air filters to ensure complete combustion.
3. Adjust or replace faulty fuel injectors or carburetors causing excessive fuel supply.
4. Inspect and repair worn-out valve seals that allow oil into combustion chamber.
5. Service the exhaust system, including replacing damaged catalytic converters.

10. Identify five safety precautions to be considered when removing airbags from the vehicle.

1. Disconnect the vehicle's battery to cut power supply to the airbag system.
2. Wait for a few minutes to allow stored energy in the system to discharge.
3. Handle the airbag module carefully and keep it facing upwards.
4. Store the airbag in a cool, dry, and safe place away from heat or electricity.
5. Avoid using electronic devices or exposing the airbag to static electricity during removal.