THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL

CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

093 MOTOR VEHICLE MECHANICS

Time: 3 Hours **ANSWERS** **Year: 2017**

Instructions

1. This paper consists of section A, B and C.
2. Answer all questions in section A and B and three questions from section C.

1. (i) The cylinder leakage tester applies air pressure to the cylinder with the piston at
A TDC and with both valves closed
B BDC and with both valves open
C TDC and with both valves open
D BDC and with both valves closed
E Starting the compression stroke

Answer: A – Cylinder leakage is tested at Top Dead Centre (TDC) with both valves closed to detect leakage past rings, valves, or head gasket.

(ii) What happens when the piston is just about the top of the exhaust stroke?
A The exhaust valve closes while inlet valve opens.
B The exhaust valve closes while inlet valve still opened.
C The inlet valve opens while exhaust valve still opened.
D The inlet valve closes while exhaust valve still opened.
E The inlet valve closes while exhaust valve still opened.

Answer: C – At the end of exhaust stroke, the inlet valve begins to open while exhaust valve is still closing, known as valve overlap.

(iii) The air gap between the central electrode and ground (or side) electrode of a spark plug is
A 0.2 mm
B 0.5 mm
C 1.5 mm
D 2 mm
E 1 mm
Answer: B – Standard spark plug gap is approximately 0.5 mm to ensure proper spark generation.

(iv) Which of the following is the most commonly used supplementary restraint system (SRS) component?
A Seat belt
B Airbag
C Brake
D Steering
E Side mirror

Answer: B – Airbags are the primary component of SRS, providing passive safety during collisions.

(v) The crescent-shaped cavity on the piston head top surface is known as
A Piston hole
B Snap ring
C Valve clearance
D Valve recess
E E-opening

Answer: D – Valve recess or cavity on the piston head allows valve clearance during overlapping strokes.

(vi) Two advantages of using helical gears rather than spur gears in transmission system are
A Low noise level and high strength
B Less initial cost and high maintenance
C High strength and low noise
D High strength and high maintenance
E Less initial cost and high strength

Answer: C – Helical gears operate more quietly and can transmit more load due to gradual tooth engagement.

(vii) The three basic cylinder arrangements for automotive engines are
A Flat, radial and V
B In a row, inline and opposed
C Inline, V and opposed
D V, inline and flat
E V, double row and opposed

Answer: C – Inline, V-type and opposed (flat) are the common cylinder arrangements in automotive engines.

(viii) The valve overlap in four stroke petrol engine is approximately equal to
A 120°
B 30°
C 90°
D 60°
E 72°

Answer: B – Valve overlap typically ranges between 20°–30° in most petrol engines.

(ix) Which of the following symptom is caused by a result of brake disc run out?
A Rapid wearing of the brake pad
B Localized wearing of the brake pad
C Ineffectiveness of the brake
D Judder during braking
E Ineffectiveness of the hand brake

Answer: D – Disc run out causes vibrations or judder during braking due to uneven disc thickness or warping.

(x) The names of the three diagrams in Figure 1 noting from left are
A Flywheel, clutch fork and clutch plate
B Friction disc, flywheel and clutch plate

C Flywheel, clutch fork and friction disc
D Friction disc, cover disc and clutch plate
E Friction disc, clutch plate and clutch fork

Answer: A – The diagrams show a flywheel, clutch fork, and clutch plate, respectively.

2. (a) Mention two main types of jack which are commonly used.
– Mechanical jack
– Hydraulic jack

(b) Briefly state the connections of a vehicle hand brake.
The handbrake lever connects to rear brake system via cables, often actuating drum brakes or calipers mechanically.
3. (a) What is a motor car's chassis?
It is the vehicle's structural framework supporting the engine, transmission, suspension, and body.

(b) Briefly explain the main effect of tread pattern on tyre.
Tread pattern provides grip, disperses water, improves traction, and reduces skidding.

4. What are the three main frame 'section-forms' of a motor car?
– Channel section
– Box section
– Tubular section

5. (a) How many revolutions of the crank shaft are required to complete the four stroke cycle?
Two revolutions

(b) What are the main uses of stabilizer bars?
– Minimize body roll during turns
– Improve vehicle stability and handling

6. (a) What are the three common classes of fit?
– Clearance fit
– Transition fit
– Interference fit

7. Why mechanics are not allowed to work under a vehicle which is only supported by a jack?
Because a jack can slip or fail, risking serious injury. Proper jack stands must be used for safety.
8. (a) What is the common firing order for a four cylinder petrol engine?
1-3-4-2

(b) What is the main function of fuel in carburettor?

To mix with air in proper ratio and supply fuel-air mixture to engine cylinders.

9. (a) Why hard water is not recommended for cooling system? Briefly explain.
Hard water causes scale formation, which blocks coolant passages and reduces cooling efficiency.

10. (a) What are the basic constituent of a brake-lining materials?
– Asbestos (older type) or synthetic fibers
– Resins and binders
– Friction modifiers

(b) What type of construction is used for most vehicles today?
Integral or monocoque construction

11. Mention three types of lock washers.
– Spring washer
– Tab washer
– Star washer

12 (a) (i) What is meant by a term gear train?

A gear train refers to a system of gears working together to transmit torque and motion from one shaft to another, often used to alter speed, direction, or force in power transmission.

(b) (i) Why are universal joints needed in motor vehicles?

Universal joints allow angular movement between drive shafts. They accommodate movement caused by suspension and chassis flexing while maintaining torque transmission from gearbox to the wheels.

(ii) Briefly describe the sliding or slip joint on the propeller shaft.

A slip joint allows the propeller shaft length to adjust during suspension movement. It slides in and out to compensate for distance changes between gearbox and differential.

(c) (i) Distinguish flywheel from drive plate.

A flywheel stores rotational energy and provides smooth engine operation. It is heavy and mounted on the crankshaft.
A drive plate connects the engine to the transmission and transfers engine torque via clutch system.

(ii) Explain four functions of the drive plate and flywheel.

Flywheel stores rotational energy and maintains engine momentum.
Flywheel provides a mounting surface for the clutch system.

Flywheel helps in engine starting by engaging the starter motor.
Drive plate transmits engine torque to transmission via clutch friction.

13 (a) (i) What is viscosity?

Viscosity is the measure of a fluid's resistance to flow. It describes how thick or thin a liquid is.

(ii) How is oil viscosity determined?

Oil viscosity is determined using standardized tests like the Saybolt or kinematic viscosity methods at specific temperatures.

(iii) In what way does temperature influence oil viscosity?

Higher temperature lowers oil viscosity, making it thinner. Lower temperature increases viscosity, making oil thicker.

(b) With the aid of sketch, briefly explain the functions of a wheel cross spanner and reflecting triangle as employed in motor vehicle mechanics.

A wheel cross spanner is used to loosen or tighten wheel nuts.
A reflecting triangle is placed behind a broken-down vehicle to warn approaching drivers and enhance road safety.

(c) (i) Study the diagrams in Figure 2 (a) and (b) and identify their names as employed in motor car.

Figure 2 (a): Damper (Shock absorber)
Figure 2 (b): Starter motor

(ii) Name the parts of the engine component in Figure 2 (b) indicated by numbers 1, 2, and 3:

1 – Starter motor casing
2 – Pinion gear
3 – Armature

(iii) Briefly explain the functions of the components in Figure 2 (a) and (b) as employed in a motor car.

Damper absorbs shocks and vibrations from road surface, improving ride comfort and stability.
Starter motor rotates the engine flywheel during engine start-up.

14 (a) (i) Write the distinction between a bolt and a screw.

A bolt is used with a nut and has uniform threads, whereas a screw is inserted directly into a tapped hole or material and creates its own thread.

(ii) Briefly explain how a stud is used.

A stud is a threaded rod inserted into a component with nuts on both ends. It provides strong fastening and is used in situations where frequent disassembly is required.

(b) (i) What is the purpose of the cotter pin?

A cotter pin secures other fasteners like castle nuts and prevents them from loosening.

(ii) How is the cotter pin replaced?

The cotter pin is straightened and removed from its hole, and a new one is inserted and bent to lock it.

(c) (i) What is a rivet?

A rivet is a mechanical fastener with a head on one end and is used to join two or more components permanently.

(ii) State three applications of the rivet on automotive.

Securing body panels
Attaching chassis brackets
Fixing brake linings

(iii) How can two parts be fixed by using a rivet?

Insert the rivet through aligned holes in the parts and hammer or press the tail to form a second head, securing the parts.

(iv) State the common way of removing the rivet in a place.

Rivets are removed by drilling through their center or cutting off their head with appropriate tools.

15 (a) Briefly explain three things a car manufacturer's service manual covers.

Maintenance schedules, specifications of components, and service procedures.

(b) Describe four steps to be followed in motor vehicle service.

Inspect vehicle components
Replace worn-out parts
Lubricate moving parts
Test drive for functionality

(c) Define and briefly explain the cause of the following S.I system effects:

(i) Pre-ignition – Fuel-air mixture ignites before spark due to hot carbon deposits or incorrect spark plug heat rating.

(ii) Misfiring – Incomplete combustion caused by weak spark, faulty ignition system, or incorrect fuel-air ratio.

16 (a) (i) Name three basic requirements of any suspension system.

Shock absorption, load support, and maintaining tire contact with road.

(ii) Why swinging shackle is important in leaf springs?

It allows elongation of the spring during compression, preventing breakage and ensuring flexibility.

(b) (i) Give four characteristics of a good brake fluid.

High boiling point, low compressibility, corrosion resistance, and chemical stability.

(ii) Elaborate four main advantages which favors high speed vehicle manufacturers to use disk brakes.

Better heat dissipation, more consistent performance, quick response, and self-cleaning nature due to open design.