THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL

CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

093 MOTOR VEHICLE MECHANICS

Time: 3 Hours **ANSWERS** **Year: 2006**

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) A torque wrench usually indicates the degree of tightness in the following standard unit.
A Foot pound (FtLb)
B Kilogram (kg)
C Newton (N)
D Newton metre (Nm)
E Poundal

Answer: D – Newton metre (Nm) is the standard SI unit for measuring torque, indicating the force applied per unit distance.

(ii) A motor vehicle workshop should be equipped with this type of fire extinguisher.
A Foam
B Caustic Soda
C Sand
D Water
E Carbon dioxide

Answer: E – Carbon dioxide extinguishers are ideal for electrical and flammable liquid fires common in vehicle workshops, without leaving residue.

(iii) In a two-stroke petrol engine the firing stroke occurs every
A 90°
B 180°
C 270°
D 360°
E 720°

Answer: D – In two-stroke engines, firing occurs every 360° of crankshaft rotation, providing power in every revolution.

(iv) A supercharger is usually driven by
A exhaust gases
B A and C
C belt
D chain
E camshaft

Answer: C – A supercharger is typically belt-driven by the engine crankshaft to force air into the intake manifold and boost power.

(v) One of the compression ignition engine disadvantages is
A high thermal efficiency
B high initial costs

C longer intervals between services
D low speed
E low volumetric efficiency

Answer: B – High initial cost is a disadvantage due to the heavy construction and fuel injection systems in compression ignition engines.

(vi) The range of an oil in which it changes its viscosity with respect to temperature is known as
A flash point
B viscosity index
C power point
D SAE number
E multigrade

Answer: B – Viscosity index indicates the rate of change in oil's viscosity with temperature. A higher index means less variation.

(vii) The angle formed between road wheels axes and the vehicle frame direction when cornering is called
A castor angle
B camber angle
C king pin inclination
D slip angle
E toe out or turns

Answer: D – Slip angle is the angle between the direction in which a wheel is pointing and the actual path the wheel is taking, crucial in vehicle dynamics.

(viii) The disadvantage of the disc brakes is that they are
A not self adjusting
B not self energizing
C liable to brake fade
D not applicable to rear brakes
E adjusted automatically

Answer: C – Disc brakes are susceptible to brake fade under heavy or continuous use due to heat build-up reducing braking efficiency.

(ix) The petrol engine ignition system secondary circuit has
A low current
B high current
C no voltage
D high voltage
E no spark plugs

Answer: D – The secondary circuit of an ignition system carries high voltage from the ignition coil to the spark plug to produce spark.

(x) A castellated nut will usually be locked by
A flat washer
B spring washer
C split pin
D king pin
E double nut

Answer: C – Castellated nuts are secured with a split pin through the nut and a hole in the bolt or shaft to prevent loosening.

2. Name three (3) materials suitable for bushes.
– Bronze
– Nylon
– Phosphor bronze
3. Which are the three (3) types of governors used in compression ignition engines?
– Centrifugal governor
– Pneumatic governor
– Hydraulic governor

4. In general, ignition timing marks can be found on either the _____ or the _____ of an engine.
– Flywheel
– Crankshaft pulley

5. Which are the three (3) forms of lubricant?
– Liquid lubricant (engine oil)
– Semi-solid lubricant (grease)
– Solid lubricant (graphite or molybdenum disulfide)

6. Where is the liquid temperature cooling medium control device fitted in an engine?
It is fitted in the thermostat housing or coolant outlet passage to regulate the engine's operating temperature.

7. How much will be the current flow in a circuit of three loads with resistances 1 ohm, 2 ohms and 3 ohms connected in series under a voltage of 12V?

Total resistance = 1 + 2 + 3 = 6 ohms
Current = Voltage / Resistance = 12 / 6 = 2 Amperes

8. What is the importance of a clutch free pedal clearance?
It ensures the release bearing is not constantly engaged, preventing wear and allowing complete clutch engagement when not in use.

9. How can a tyre life be prolonged? Mention three ways only.
– Maintain correct tyre pressure
– Perform regular wheel alignment and balancing
– Rotate tyres regularly

10. What will be the intention, if a leaf spring is fitted transversely?
A transverse leaf spring improves load distribution across the chassis and helps in vehicle stability by controlling lateral forces.

11. List three (3) parts found inside the hydraulic brake wheel cylinders.

The piston is located inside the wheel cylinder and is responsible for transmitting hydraulic pressure to push the brake shoes against the drum surface.

The rubber cup seals prevent brake fluid from leaking out of the cylinder and help maintain consistent hydraulic pressure during braking.

The return spring is used to return the pistons to their original position once the brake pedal is released, ensuring the brake shoes disengage from the drum.

12. Define the following terms as applied to engines:

(a) Valve timing refers to the precise timing of the opening and closing of the engine's intake and exhaust valves in relation to the position of the piston during the four-stroke cycle. Proper valve timing is essential for efficient engine operation and power output.

(b) Ignition timing is the point at which the spark plug ignites the air-fuel mixture in the combustion chamber, typically measured in degrees before the piston reaches top dead center. Correct ignition timing ensures optimal engine performance and fuel efficiency.

(c) Valve timing diagram is a graphical representation showing the exact moments when the intake and exhaust valves open and close relative to the piston movement and crankshaft rotation. It helps understand valve operation across all strokes of the engine.

13. A road wheel has a diameter of 28 cm and evolves at 30 rps.

(a) What will be the distance covered in metres per second?

Circumference = $\pi \times$ diameter = $3.142 \times 0.28 = 0.87976$ m
Distance per second = $0.87976 \times 30 = 26.3928$ m/s

(b) What is the vehicle's speed in kmph?

Speed in kmph = 26.3928 × 3600 ÷ 1000 = 95.014 kmph

14. (a) List tools and their uses in carrying out tappet clearance adjustments.

A feeler gauge is used to measure the gap between the rocker arm and valve stem to ensure it is within manufacturer's specification.

A spanner or wrench is used to loosen or tighten the lock nut on the rocker arm for adjustment.

A screwdriver is used to rotate the adjusting screw on the rocker arm to achieve the correct clearance.

(b) Briefly explain the procedures followed when performing valve clearance adjustment on a four-cylinder engine.

First, remove the cylinder head cover to expose the rocker arms. Then, rotate the crankshaft until the piston of the first cylinder is at top dead center on the compression stroke. Use a feeler gauge to check the valve clearance between the rocker arm and valve stem. If the gap is incorrect, adjust it using a screwdriver and spanner. After setting the clearance, tighten the lock nut without disturbing the adjustment. Repeat the procedure for each cylinder as per the firing order, then refit the cover.

15. (a) Mention two reference materials required when servicing or ordering spare parts of a vehicle.

The vehicle's service manual provides technical specifications, servicing procedures, and parts identification.

The spare parts catalogue contains part numbers, diagrams, and compatibility details necessary for ordering the correct components.

(b) What is the effect of a too large c.b. point gap?

A too large contact breaker point gap delays spark timing, causing weak ignition and poor engine performance. It may also lead to engine misfiring or reduced fuel efficiency.

(c) What is the effect of over inflating a road wheel rubber tyre?

Over inflating a tyre reduces its contact patch with the road, leading to reduced traction, uneven tire wear, and a harsh ride. It also increases the risk of tire blowouts due to excessive internal pressure.

16. (a) What is meant by independent suspension system? (i.f.s.)

An independent suspension system means each wheel on the same axle can move up and down independently without affecting the opposite wheel. It improves ride comfort, handling, and road grip.

(b) Which type of bearing is used in the front steered road wheel hubs?

Tapered roller bearings are commonly used in the front steered road wheel hubs due to their ability to support both radial and axial loads.

(c) Mention three (3) parts of a roller bearing.

The inner race is the ring that fits onto the rotating shaft.

The outer race is the ring that fits into the housing or wheel hub.

The rolling elements (rollers or balls) roll between the inner and outer races, reducing friction and allowing smooth rotation.