



## UNIT V: Emissions, Alternatives, and Vehicle Maintenance

### Multiple Choice Questions (MCQs)

1. Which pollutant emitted by internal combustion engines is a poisonous, odorless gas formed due to incomplete combustion of hydrocarbon fuel?
  - a) Nitrogen Oxides ( $\text{NO}_x$ )
  - b) Carbon Monoxide ( $\text{CO}$ )
  - c) Particulate Matter ( $\text{PM}$ )
  - d) Sulfur Dioxide ( $\text{SO}_2$ )
2. Nitrogen Oxides ( $\text{NO}_x$ ) are primarily formed inside an engine cylinder due to:
  - a) Low combustion temperatures and rich mixtures
  - b) Extremely high combustion temperatures in the presence of excess oxygen
  - c) The presence of lead additives in gasoline
  - d) Rapid evaporation of engine oil from the cylinder walls
3. India's national automotive emission regulation framework, which mirrors Euro emission standards, is known as:
  - a) EPA standards
  - b) Bharat Stage (BS) emission standards
  - c) CARB regulations
  - d) SAE mandates

4. What emission control component uses precious metals like platinum, palladium, and rhodium to reduce  $\text{NO}_x$  into nitrogen and oxidize  $\text{CO}$  and hydrocarbons into  $\text{CO}_2$  and  $\text{H}_2\text{O}$ ?
  - a) Charcoal canister
  - b) Three-way catalytic converter
  - c) Exhaust Gas Recirculation (EGR) valve
  - d) Turbocharger
5. The primary purpose of an Exhaust Gas Recirculation (EGR) system in an engine is to:
  - a) Increase the engine power output during acceleration
  - b) Route a fraction of inert exhaust gas back into the intake manifold to lower peak combustion temperatures and reduce  $\text{NO}_x$
  - c) Dry out water vapor before it leaves the tailpipe
  - d) Evaporate fuel leaks inside the crankcase
6. Which fuel delivery layout uses precise electronic control to meter fuel injection individually for each intake port in an SI engine?
  - a) Single point throttle body injection
  - b) Multipoint Fuel Injection (MPFI)
  - c) Conventional single barrel carburetor
  - d) Mechanical inline direct injection
7. Common Rail Diesel Injection (CRDI) systems reduce particulate emissions primarily by:
  - a) Adding alcohol to the fuel tank automatically
  - b) Utilizing extremely high injection pressures to produce an ultra-fine fuel spray for complete combustion
  - c) Lowering compression ratios to match SI engines
  - d) Eliminating the fuel filter circuit
8. What alternative fuel consists mainly of methane, is stored under high pressures around 200 bar, and produces low carbon emissions?

- a) Liquefied Petroleum Gas (LPG)
  - b) Compressed Natural Gas (CNG)
  - c) Biodiesel
  - d) Gasohol
9. Liquefied Petroleum Gas (LPG) used in motor vehicles is primarily a mixture of which hydrocarbons?
- a) Methane and Ethane
  - b) Propane and Butane
  - c) Hexane and Heptane
  - d) Benzene and Toluene
10. Which alternative energy source utilizes photovoltaic cells mounted on a vehicle to directly convert light energy into electricity?
- a) Solar energy
  - b) Biomass gasification
  - c) Hydrogen fuel cell
  - d) Geothermal power
11. What is a key challenge or demerit of utilizing Hydrogen directly as a combustion fuel inside an Internal Combustion Engine?
- a) It produces high volumes of carbon dioxide ( $\text{CO}_2$ ) emissions
  - b) It has an extremely low energy density by weight
  - c) It has a wide flammability range and high flame speed, which can cause backfiring and pre-ignition
  - d) It requires a carburetor to be twice as large
12. A major environmental benefit of using Biomass-derived fuels like Ethanol is that they:
- a) Completely eliminate  $\text{NO}_x$  emissions without an EGR system
  - b) Are considered carbon-neutral over their lifecycle because feedstock crops absorb  $\text{CO}_2$  while growing

- c) Do not require any storage tanks
  - d) Have a boiling point higher than diesel oil
13. Standard automotive preventive maintenance practices dictate that engine oil should be replaced based on:
- a) Only when the oil pressure light turns on
  - b) Specified intervals of elapsed time or distance driven (whichever comes first)
  - c) The color of the exhaust smoke
  - d) Changes in the vehicle steering alignment angles
14. Tire rotation during scheduled vehicle maintenance is performed primarily to:
- a) Ensure the tire pressure stays identical across all tires
  - b) Promote even tread wear across all four tires and extend their service life
  - c) Balance the weight distribution of the passenger cabin
  - d) Calibrate the electronic speedometer sensor
15. What maintenance procedure corrects an imbalance of mass distribution within a wheel and tire assembly, preventing steering wheel vibration at high speeds?
- a) Wheel alignment
  - b) Wheel balancing
  - c) Honing the rim edges
  - d) Bleeding the tires
16. "Bleeding" a hydraulic brake circuit is a mandatory maintenance practice to:
- a) Drain contaminated brake dust from the drum
  - b) Remove trapped air bubbles from the fluid lines to restore a firm pedal feel
  - c) Increase the volume of the master cylinder reservoir
  - d) Lubricate the contact points of the brake pads
17. Evaporative emissions (\$HC\$) from a vehicle's fuel tank are captured and stored temporarily in a component called a:
- a) Catalytic converter

- b) Charcoal canister
  - c) PCV valve
  - d) Muffler
18. Which system routes blow-by gases from the crankcase back into the intake manifold to be burned during combustion?
- a) Positive Crankcase Ventilation (PCV) system
  - b) Secondary air injection
  - c) Common rail pressure loop
  - d) Diesel particulate filter
19. What does the acronym TDI denote in modern automotive contexts?
- a) Total Delivery Injector
  - b) Turbocharged Direct Injection
  - c) Thermal Dynamic Ignition
  - d) Throttle Distribution Intake
20. During a routine vehicle service, checking the specific gravity of battery electrolyte with a hydrometer evaluates the battery's:
- a) Voltage capacity across terminals
  - b) State of charge and health of the cells
  - c) Total internal resistance in ohms
  - d) Operating surface temperature

### Fill in the Blanks

1. The unburned or partially burned fuel compounds emitted from an engine tailpipe are classified as\_\_\_\_\_.
2. The Euro 6 or \_\_\_\_\_ standard represents the current stringent national emission framework implemented across India.
3. A \_\_\_\_\_ system injects an aqueous urea solution (DEF) into the exhaust stream to break down  $\text{NO}_x$  into harmless nitrogen and water.
4. MPFI systems utilize an electronic engine control unit \_\_\_\_\_ to calculate the exact duration of injector opening based on sensor feedback.
5. In a \_\_\_\_\_ system, fuel is fed from a shared high-pressure line called a common rail to electronically triggered solenoid or piezoelectric injectors.

6. \_\_\_\_\_ consists primarily of methane gas compressed down for storage in heavy steel or composite cylinders.
7. Alcohols such as \_\_\_\_\_ and methanol can be blended with conventional commercial petrol to create alternative biomass fuel blends.
8. A \_\_\_\_\_ vehicle combines hydrogen gas with atmospheric oxygen electrochemically to generate electricity, releasing only water vapor as a byproduct.
9. An alternative gaseous fuel derived from domestic petroleum refining that liquefies under moderate pressure is \_\_\_\_\_.
10. Periodic \_\_\_\_\_ involves checking fluid levels, filters, and belts at regular mileage benchmarks to avoid sudden mechanical breakdowns.
11. To correct vehicle tracking and prevent irregular tire wear, technicians adjust steering angles during a \_\_\_\_\_ service.
12. Small metal clip-on weights are attached to a wheel rim during a \_\_\_\_\_ procedure to eliminate high-speed wheel wobble.
13. \_\_\_\_\_ is the service procedure performed to extract air pockets out of a hydraulic brake line setup.
14. A device used to read diagnostic trouble codes (DTCs) from a vehicle's onboard computer during maintenance is an \_\_\_\_\_.
15. A \_\_\_\_\_ uses an internal honeycomb substrate coated with precious metals to treat tailpipe emissions through chemical reduction and oxidation.
16. The abbreviation GDI stands for \_\_\_\_\_, where fuel is delivered straight inside the spark-ignition combustion pocket.
17. Gaseous alternative fuels generally have higher \_\_\_\_\_ ratings than standard petrol, allowing for higher compression ratios without engine knocking.
18. The accumulation of carbon deposits on intake valves is a common service issue in \_\_\_\_\_ engines because fuel no longer washes over the backs of the valves.
19. The process of safely removing old, worn out, or contaminated oil from an engine block and filling it with fresh oil is called an \_\_\_\_\_.
20. The device that monitors the level of oxygen in the exhaust gases to enable fine tuning of the air-fuel ratio by the ECU is the \_\_\_\_\_.