

Date : October 11, 2025
Total Marks : 100
Writing Time : 150 minutes (2.5 hours)
Reading Time : 15 Minutes (prior to writing time)

1. Write your Registration Number clearly and correctly on the Answer Booklet.
2. The first 15 minutes is to check the number of pages of Question Paper, printing errors, clarify doubts and to read the instructions. You are NOT permitted to write during this time.
3. This paper consists of **TWO SECTIONS**, namely SECTION A & SECTION B:
 - **SECTION A** has two parts:
 - Part I - 30 Multiple Choice Questions
 - Part II - 4 Short Answer QuestionsAll questions under SECTION A are **COMPULSORY**.
 - **SECTION B** consists of two Case Studies. Choose only **ONE** case study and answer the questions of your choice.
4. All answers should be written on the Answer Booklet provided to you. Candidates are not allowed to write anything on the question paper. If required, ask for additional Answer Booklet.
5. All answers should be written with correct numbering of Section, Part and Question Number in the Answer Booklet provided to you. Note that any answer written without indicating the Section, Part and Question Number will NOT be evaluated and no marks will be awarded.
6. Begin each Section and Part in a fresh page of the Answer Booklet.
7. You are not permitted to tear off any sheet(s) of the Answer Booklet as well as the Question Paper.
8. Use of any other paper including paper for rough work is not permitted.
9. **You must hand over the Answer Booklet to the Invigilator before leaving the examination hall.**
10. This paper has **11 printed pages**, including this instruction page.

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SECTION A

PART I: Multiple Choice Questions [30 marks]

Choose the correct answer and write down the letter of your chosen answer in the Answer Booklet against the question number e.g. 31 (d). Each question carries ONE mark. Any double writing, smudgy answers or writing more than one choice shall not be evaluated.

1. According to Heinrich's Law, which of the following number combinations best completes the statement below?
"Heinrich's Law states that for every major or fatal accident, there are approximately (A) minor accidents and (B) near-miss incidents caused by the same underlying hazards."
 - a) (A)19, (B)300
 - b) (A)19, (B)400
 - c) (A)29, (B)300
 - d) (A)29, (B)400
2. Which of the following safety-related statements is **inappropriate** in an automotive workshop setting?
 - a) When drilling holes in parts with an electric drill, always wear gloves to prevent injury to your hands from the drill.
 - b) When moving a chain block or electric hoist, do so from a position away from the lifted object.
 - c) When jacking up a car with a garage jack, use wheel chocks appropriately, and do not move the jack while the car is jacked up.
 - d) When charging lead-acid batteries, hydrogen and oxygen gases are produced, so keep them away from open flames.
3. A technician accidentally spills sulfuric acid from a lead-acid battery onto their skin. What is the most appropriate immediate action to take?
 - a) Wipe the acid off with a dry cloth
 - b) Apply hand sanitizer to neutralize the acid
 - c) Rinse the affected area with plenty of water and seek medical attention if needed
 - d) Continue working and check for irritation later
4. A workshop manager is preparing a risk assessment for welding tasks conducted near flammable materials. According to standard safety protocols, which of the following actions should be taken before starting the work?
 - a) Ensure the welder is wearing PPE and proceed without further action
 - b) Assign a fire extinguisher to the area and start work immediately
 - c) Remove or shield all flammable materials, implement a hot work permit system, and ensure fire watch procedures are in place
 - d) Inform employees to be cautious and proceed with normal operations

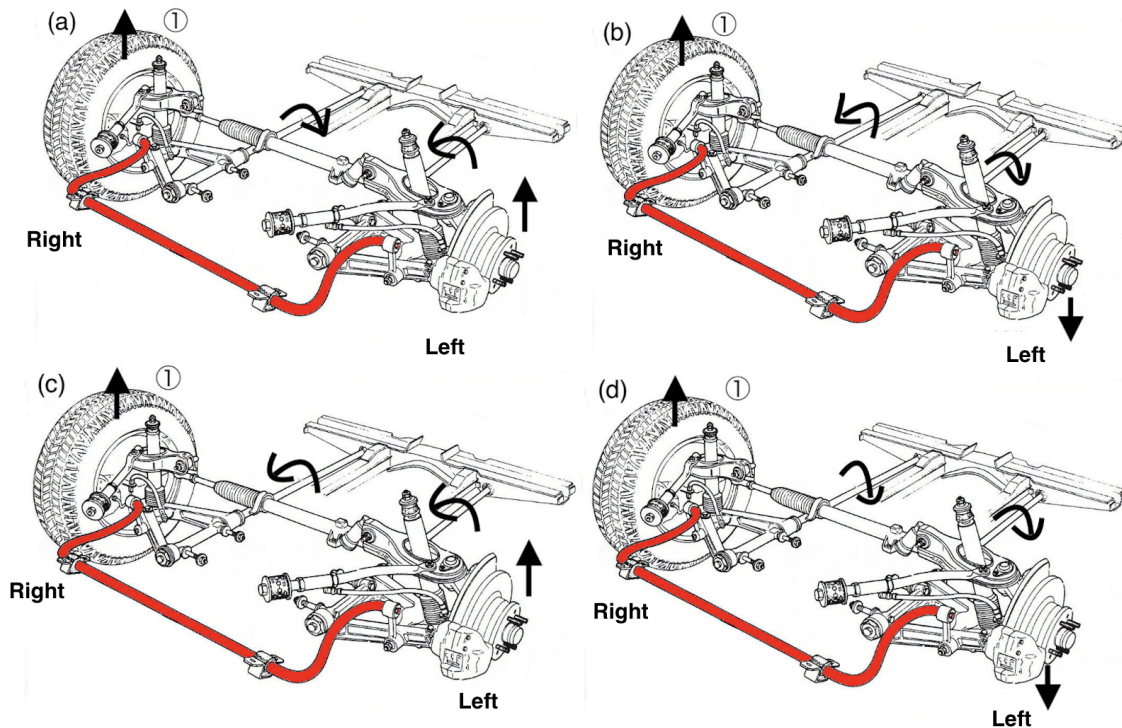
5. Which physical law forms the basic principle behind the operation of hydraulic brake systems?
 - a) Pascal's law
 - b) Newton's law
 - c) Law of conservation of energy
 - d) Law of conservation of momentum

6. What is the consequence of excessive moisture absorption in brake fluid?
 - a) Increased brake pad wear
 - b) Decreased brake fluid pressure
 - c) Lower boiling point of the fluid
 - d) Lower freezing point of the fluid

7. A vehicle pulls to the right while driving. Technician A claims the cause could be more positive camber on the right side than on the left. Technician B suggests it could be due to more toe-in on the left side than the right. Who is correct?
 - a) A only
 - b) B only
 - c) Both A and B
 - d) Neither A nor B

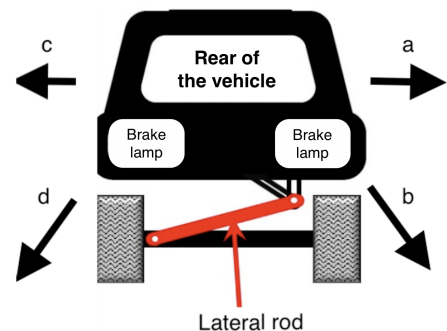
8. A car needs 3 revolutions of the steering wheel to turn the wheel from the most right to the full left position. What is the steering ratio, if the front wheel has been turned 72° ?
 - a) 12:1
 - b) 13:1
 - c) 14:1
 - d) 15:1

9. When the right-side tire moves in the direction indicated by arrow ①, how do the stabilizer and torsion bars behave?



- a) Left tire moves upward, both torsion bars twist inward
 b) Left tire moves downward, both torsion bars twist outward
 c) Left tire moves upward, both torsion bars twist to the right
 d) Left tire moves downward, both torsion bars twist to the left
10. In the diagram of a rear rigid axle suspension system, if the suspension shortens (the lateral rod length remains constant), which direction does the vehicle body move?

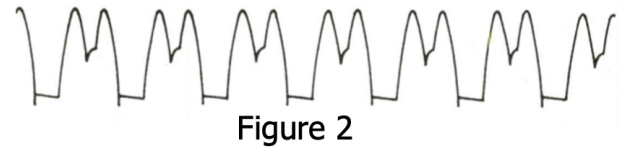
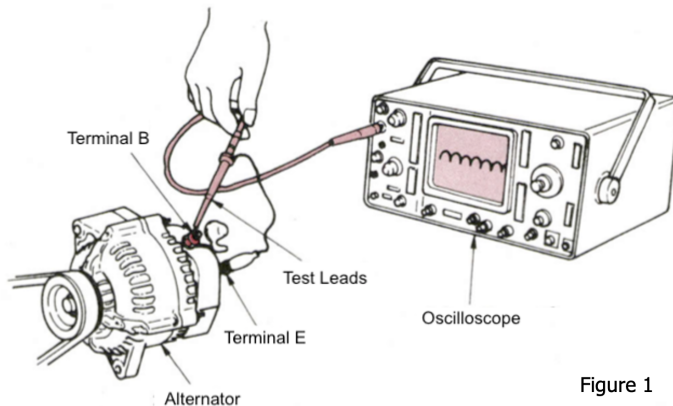
- a) Direction a (Right)
 b) Direction b (Bottom right)
 c) Direction c (Left)
 d) Direction d (Bottom left)



11. What component in modern manual transmissions eliminates the need for double-clutching?
- a) Equalizers
 b) Motivators
 c) Elite motor oil
 d) Synchronizers

12. If the propeller shaft is out of balance, engine speed is 3000 rpm, and the transmission gear ratio is 3.0, what is the resulting vibration frequency?
- a) 7.7 Hz
 - b) 12.4 Hz
 - c) 16.6 Hz
 - d) 22.2 Hz
13. The clutch release bearing is positioned between:
- a) Flywheel and pressure plate
 - b) Clutch disc and pressure plate
 - c) Pressure plate and release fork
 - d) Clutch master cylinder
14. Which of the following is the most probable cause of a diaphragm spring clutch failing to disengage?
- a) Worn or broken damper spring in the clutch disc
 - b) Excessive clutch disc runout
 - c) Hardened or worn clutch disc friction material
 - d) Deteriorated clutch spring
15. What problem may result from excessive bearing preload in a differential assembly?
- a) Failure of Oil seal
 - b) Loose gear engagement
 - c) Noisy differential operation
 - d) Excessive heat and bearing failure
16. Why is checking the gear mesh pattern important during differential setup?
- a) To set pinion bearing clearance
 - b) To measure differential oil thickness
 - c) To align the axle shafts
 - d) To ensure optimal gear contact for smooth operation
17. How is the alternator's output voltage regulated?
- a) By cutting current to the rotor coil
 - b) By cutting current to the stator coil
 - c) By using a neutral diode
 - d) By shifting stator coil phases by 120°

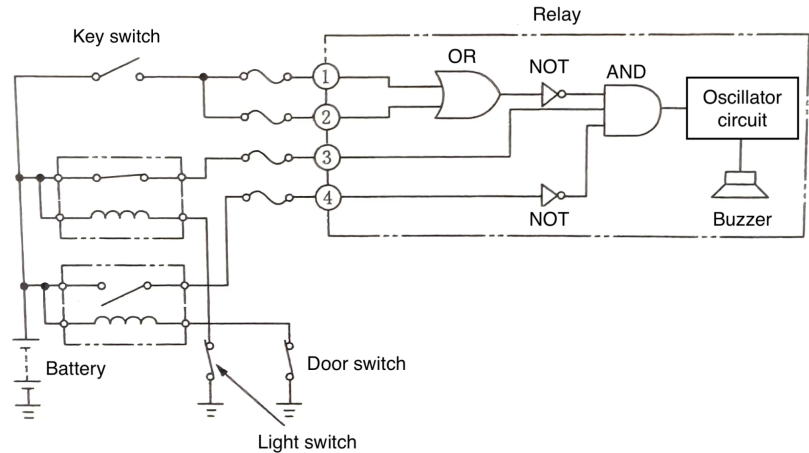
18. When a probe is connected between the alternator's B and E terminals and the waveform shown in Figure 2 is observed, what is the most likely fault?



- a) One diode is open
b) One diode is shorted
c) One phase of the stator coil is open
d) One phase of the stator coil is open
19. In a reduction-type starter motor, which part quickly disengages the pinion from the ring gear after the engine starts?
- a) Magnetic switch
b) Overrunning clutch
c) Planetary gear
d) Pinion shaft thread spline
20. Which statement about the starter motor's output characteristics is incorrect?
- a) Current in the armature coil is highest when the pinion speed is zero
b) Drive torque increases with pinion speed
c) Drive torque is proportional to armature current
d) As speed increases, back EMF rises and armature current decreases
21. What does a car alarm system typically detect?
- a) Engine oil level
b) Tire pressure
c) Unauthorized access or impact
d) Coolant temperature
22. Which statement about vehicles with immobilizers is incorrect?
- a) Immobilizer verifies key code via transmitter and receiver
b) Unregistered key prevents engine start by disabling ignition signal
c) Lost keys can be replaced by registering new keys in the system
d) Replacing the ECU require key re-registration

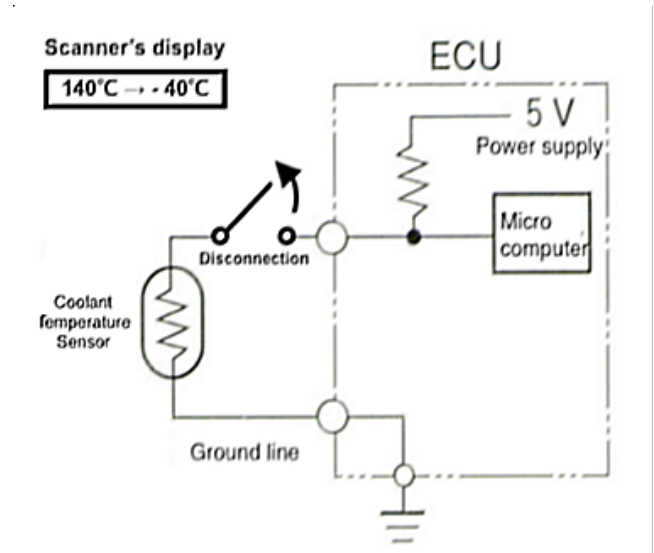
23. According to the light-off alarm circuit diagram, which switch positions will cause the buzzer to sound? "The buzzer sounds when the light switch is ON, the key switch is (A), and the door switch is (B)."

- a) (A) OFF, (B) ON
- b) (A) OFF, (B) OFF
- c) (A) ON, (B) OFF
- d) (A) ON, (B) ON



24. A customer reports that the right headlight is not working (halogen bulb), while the left side is functional. The right headlight connector shows 12V, but the bulb does not light. What is the most likely cause?
- a) Blown fuse for the headlight circuit
 - b) Open ground connection on right headlight
 - c) Faulty headlight switch
 - d) Failed alternator
25. Which component converts electrical signals into sound in a car audio system?
- a) Amplifier
 - b) Antenna
 - c) Speaker
 - d) Headlight relay
26. After installing a new head unit, the radio works but loses saved settings when the ignition is turned off. What is the most likely cause?
- a) Improper antenna grounding
 - b) Battery power (constant) wire not connected properly
 - c) Shorted speaker wires
 - d) Faulty ignition switch
27. What is a correct description of the variable valve timing mechanism?
- a) Inlet valve closes earlier to improve high-speed volumetric efficiency.
 - b) Inlet valve closes later to improve high-speed volumetric efficiency
 - c) Exhaust valve closes later to stabilize idle
 - d) Inlet valve opens earlier to stabilize idle

28. A scan tool shows the coolant temperature sensor reads 140°C when the actual coolant temperature is 20°C. When the coolant temperature input line to the ECU was disconnected, the coolant temperature changed to -40°C. What is the most probable cause?
- a) Faulty coolant temperature sensor
 - b) Signal wire disconnected
 - c) Faulty engine ECU
 - d) Ground line wire disconnected



29. The Exhaust Gas Recirculation (EGR) system helps reduce:
- a) CO₂ emissions
 - b) CO emissions
 - c) NO_x emissions
 - d) Particulate matters
30. Which statement best describes a common rail high-pressure fuel injection system?
- a) Storing pressurized fuel in the common rail ensures a fuel injection pressure that is appropriate for the engine's condition, improving engine performance.
 - b) Precise injection timing improves combustion temperature and reduces black smoke and nitrogen oxide emissions.
 - c) Pilot injection in the intake stroke before main injection reduces noise and vibration
 - d) Atomized fuel spray reduces surface area of fuel and improves combustion

PART II – Short Answer Questions [20 marks]

This part has 4 Short Answer Questions. Answer ALL the questions. Each question carries 5 marks. Mark for each sub-question is indicated in the brackets.

1. A customer reports that a warning light has illuminated on their diesel vehicle dashboard, as shown in the figure.



- a. What actions should be taken to resolve this issue? **(2.5 marks)**
- b. What precautions or guidelines should be followed when taking action? **(2.5marks)**

2. A customer owns a turbocharged diesel-engine vehicle that complies with BS6 (Bharat Stage 6) emission standards.

- a. Which type of engine oil would you recommend for this vehicle? **(2.5 marks)**
- b. What are the reasons for your recommendation? **(2.5 marks)**

3. Describe the basic function of the ignition system in a petrol engine. In your answer, include the following:

- a. What is the main purpose of the ignition system? **(2 marks)**
- b. Name three main components of a conventional ignition system (distributor type) and describe their roles. **(3 marks)**

4. A customer who drives a passenger car reports that their car frequently overheats. Write at least five actions to be taken to resolve this issue? **(5 marks)**

SECTION B: Case Study [50 marks]

Choose either CASE I OR CASE II from this section. Each case study carries 50 marks.

CASE I

Prepare a 500-word case study that critically examines the significance of maintaining clean and organized work environments in automotive workshops. Your case study should begin by identifying three specific risks commonly associated with poor housekeeping and explain how each risk affects worker safety, equipment durability, and operational efficiency. Structure your case study in a coherent and professional format, balancing technical insight with clarity and engagement.

You are expected to cover the following aspects:

1. Risk Factors and Consequences (25 marks)

- a. Identify three risks commonly caused by poor housekeeping in an automotive workshop.
- b. Explain how each risk affects worker safety, equipment durability, or workflow efficiency.

2. 5S Method Application (10 marks)

- a. Describe the 5S method (Sort, Set in order, Shine, Standardize, Sustain) and explain how it can be applied specifically in a vehicle repair environment to reduce hazards and improve operational quality.

3. Sustainability and Environmental Impact (15 marks)

- a. Explain how proper housekeeping contributes to environmental sustainability in a garage.
- b. Include examples such as waste segregation, fluid management, and spill prevention.

CASE II

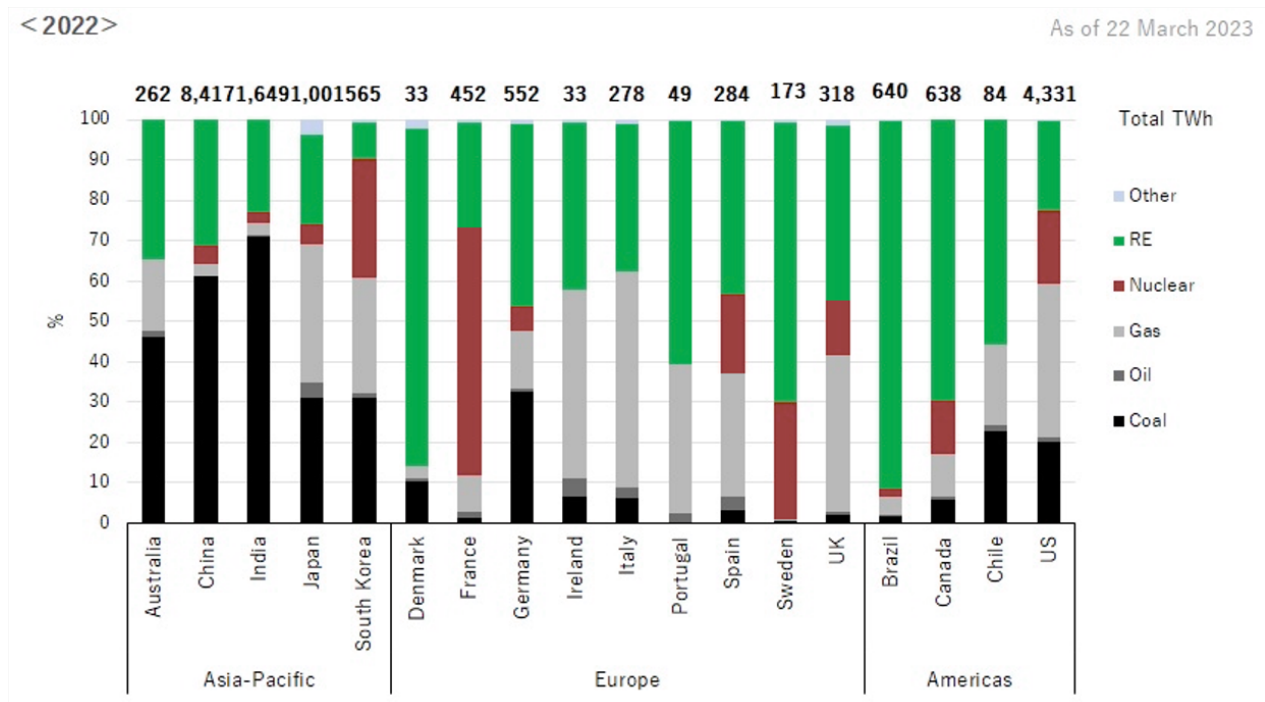
Write a 500-word case study that critically evaluates the suitability of green technology vehicles (such as electric vehicles) versus conventional internal combustion engine vehicles including hybrids and plug-in hybrids for achieving a sustainable society. Consider the environmental implications throughout the entire vehicle life cycle, including resource extraction, manufacturing processes, energy consumption, emissions during use, maintenance, and end-of-life disposal. Present balanced arguments, supported by evidence or examples, that compare the strengths and limitations of both vehicle types in terms of sustainability. Conclude with a reasoned perspective on which category better supports long-

term environmental goals, taking into account technological trends, infrastructure readiness, and real-world viability. Ensure your case study maintains clarity, objectivity, and depth of analysis.

You are expected to cover the following aspects:

1. Choose one country from a number of countries and explain whether electric vehicles or internal combustion engine vehicles are more suitable for that country based on the types and proportions of power plants used there. **(10 marks)**

You may or may not refer to the following chart from Global Electricity Trends.



2. Automobile Life Cycle Assessment (LCA) **(20 marks)**
 - a. Describe environmental Impact of Automobile Manufacturing impact, Automobile Operational impact, Automobile Disposal impact.
3. Reusing electric vehicle batteries **(20 marks)**
 - a. Describe ideas for reusing discarded electric vehicle batteries and safety measures.

TASHI DELEK