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PRACTICE PAPER - ANSWER BANK

Assessors Note:

This answer bank should be used as the primary resource when marking students work. However, responses to some questions may be subjective and tutors are advised to exercise their professional judgement when making assessment decisions.

ELEMENT ONE

Demonstrate knowledge of diesel oil as an automotive fuel.

1. **What is meant by the term “self-ignition temperature” when referring to diesel fuels?**

Temperature when the fuel will ignite without the aid of an external ignition source.

2. **What is meant by the term “viscosity” when referring to diesel fuels?**

Viscosity is the fuels ability to flow, this is important because of the fine discharge holes required in the injectors to allow the fuel to be fully atomises as it enters the cylinder.

3. **What is meant by the term “flash point” when referring to diesel fuels?**

The temperature when the fuel will give off combustible fumes.

4. **Match up the diesel oil properties with their descriptions. For example:**

A	Cloud point	A3	1	Is the material that is left behind in the combustion chamber after burning
B	Sulphur content	B5	2	Is a measure of the heat produced from the fuel during burning
C	Resistance to contamination	C6	3	Temperature at which diesel starts to wax and become thicker
D	Energy content	D2	4	Time between fuel injection and the start of combustion
E	Oxidation and water	E7	5	Is a property of diesel that when combined with water produces an acid which corrodes engine components
F	Carbon residue	F1	6	Measures how effective the diesel fuel is at limiting the growth of harmful bacteria in the fuel tank.
G	Ignition lag	G4	7	This makes the diesel appear cloudy and is a major problem

5. **Which grade of fuel (summer or winter) has a greater quantity of kerosene content?**

Winter grade

Why is the kerosene added and what effect does this have on the fuel?

In warmer ambient conditions the kerosene additive to thin out the fuel, this reduces the lubrication qualities (which may cause damage to the injection system).

ELEMENT TWO

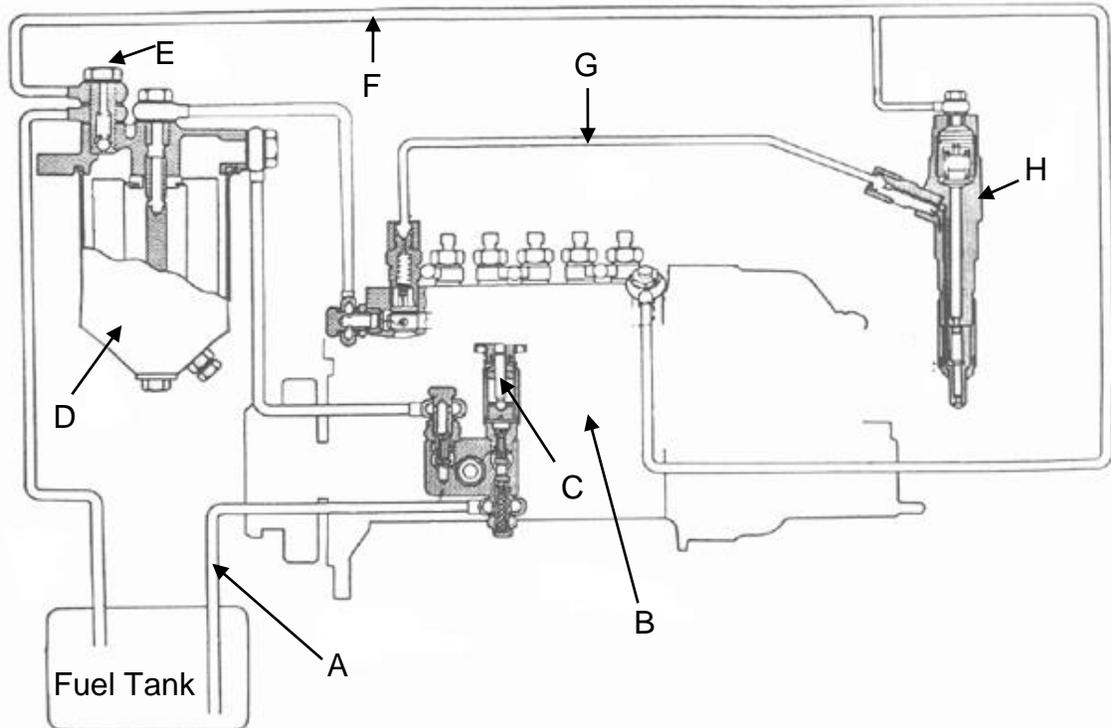
Demonstrate knowledge of a diesel fuel system.

1. From the list provided identify the fuel injection components A-H shown in the following diagram.

Injector pump	Air bleeder screw
Fuel return pipe	Injector
Manual primer/lift pump	Fuel filter
High pressure delivery pipe	Low pressure fuel pick up pipe

A	Low pressure fuel pick up pipe	E	Air bleeder screw
B	Injector pump	F	Fuel return pipe
C	Manual primer/pump	G	High pressure delivery pipe
D	Fuel filter	H	Injector

- 1b. Draw a line with arrows to trace the fuel flow path



2. Match up the diesel fuel system components with the most appropriate clue. For example:

A – Fuel tank = 4 – Designed to hold the diesel fuel safely

A	Fuel tank	A4	1	Located in the injector pump assembly and controls engine speed using spinning weights to control the fuel delivery plunger.
B	Air system	B6	2	Has a longer life, is light weight with a smaller volume than traditional injector types
C	Hole type injector	C7	3	Located in the injector pump assembly and is part of the throttle delay mechanism. Used to assist with delaying fuel supply to the injectors
D	Injector pump	D8	4	Designed to hold the diesel fuel safely
E	Mechanical governor	E1	5	Located in the injector pump assembly and advances injection timing at idle and during low speed running. This advance provides more time for fuel to burn which improves performance and prevents soot emissions during start up.
F	Pencil injector	F2	6	Supplies clean air for the air intake system of the engine
G	Start aid mechanism	G5	7	Used on direct injection engines
H	Yield link	H3	8	Designed to meter the exact amount of fuel to each injector at precisely the right time.

3. Match up the diesel fuel system components with the most appropriate clue. For example:

A – Lift pump = 3 – Draws the fuel from the tank and supplies it to the injector pump.

A	Lift pump	A3	1	Must be able to withstand very high pressures particularly between the injector pump and the injectors
B	Fuel line	B1	2	Located in the injector pump assembly and is used to delay full throttle when the engine is accelerated.
C	Glow plugs	C8	3	Draws fuel from the tank and supplies it to the injector pump.
D	Hydraulic governor	D7	4	Injector and pump are combined in one
E	Electronic governor	E6	5	Injector used for pre-combustion chamber engines
F	Pintle nozzle injector	F5	6	Located in the injector pump assembly and uses a magnetic speed sensor to monitor engine rpm and feeds information to the ECU
G	Throttle delay mechanism	G2	7	Located in the injector pump assembly and uses oil pressure to control engine speed.
H	Unit injector	H4	8	Designed to assist starting at low temperatures

4. How many pumping elements are in an in-line four cylinder fuel injection pump?

Four

5. How many pumping elements are in a rotary type four cylinder fuel injection pump?

One

6. Name two common types of diesel fuel filters used in the automotive industry.

Any two of the following:

- Felt Pack
- Metal Disc
- Edge Type
- Pleated Paper
- Canister Type
- Metal or plastic Gauze
- Sediment
- Sintered Metal
- Agglomerator
- Water Trap

7. Describe two safety precautions to be observed when working on vehicles equipped with electronically controlled diesel fuel injection systems.

Any two of the following:

- Only use manufacturer's specified test equipment.
- Ensure that all electrical connections are in good condition and making good contact.
- Ensure battery is fully charged and correctly connected before starting the engine.
- Do not flash a wire or circuit to earth to check continuity exists.
- Do not disconnect or connect the ECU or any plug connection when the engine is running.
- Do not carry out arc or electric welding on the vehicle without disconnecting the ECU.

8. Describe the two main functions of the injectors used in diesel fuel systems

- 1 To atomise the fuel into a fine mist spray during injection.
- 2 To ensure that fuel does not seep or drip into the cylinder during other engine strokes.

9. What are the main types of injectors and in which type of engines are they used?

Hole and Pintle Type

Hole are used for direct injection engines

Pintle are used for pre combustion chamber engines

10. Provide a brief description of the common rail diesel system and outline two advantages the system has over standard diesel engines

The common rail system allows the engine and the injection systems to be matched to each other in the most efficient way.

A high pressure pump generates a pressure of up to 25000psi and stores it in an accumulator (known as a rail), regardless of engine speed or the quantity of fuel being injected. The high pressure fuel is fed through rigid pipes to the injectors, which inject the correct amount of fuel in a fine spray into the combustion chambers.

The Electronic Diesel Control (EDC) unit accurately controls all the injection functions, such as the pressure in the rail, the timing and duration of injection.

By ensuring that extremely high injection pressures are available at all times it allows the common rail system to supply up to five finely atomised injections per cycle.

Advantages include:

- Lower fuel consumption
- Less noise
- Better engine performance
- Lower harmful emissions
- Fuel saving

11. What is the main function of a governor?

Governors are used to control the engine speed by limiting the fuel delivered to the injectors. Governors are required to stop a diesel engine from over revving and causing considerable internal damage.

12. What is the main function of a throttle delay mechanism?

The throttle delay mechanism is located on the injector pump and is used to delay full delivery when the engine is accelerated. The fuel delay allows the air intake system to catch up as a turbo or blower speed is very low at idle. This reduces exhaust smoke and improves fuel economy.

- 13. Describe the function of a governor in a diesel fuel injection system and describe where it is normally located.**

The governor controls engine speed by controlling the amount of fuel being delivered by the injector pump. It is normally located on or in the injector pump.

- 9. Which THREE of the following statements are true? Please tick the appropriate boxes.**

A common rail diesel injection system supplies up to five finely atomised injections per cycle.

A common rail diesel injection system uses Piezo injectors.

In the common rail diesel injection system fuel is stored under high pressure in an accumulator (rail).

- 10. List two advantages that common rail diesel engines have over standard diesel engines.**

Any two of the following