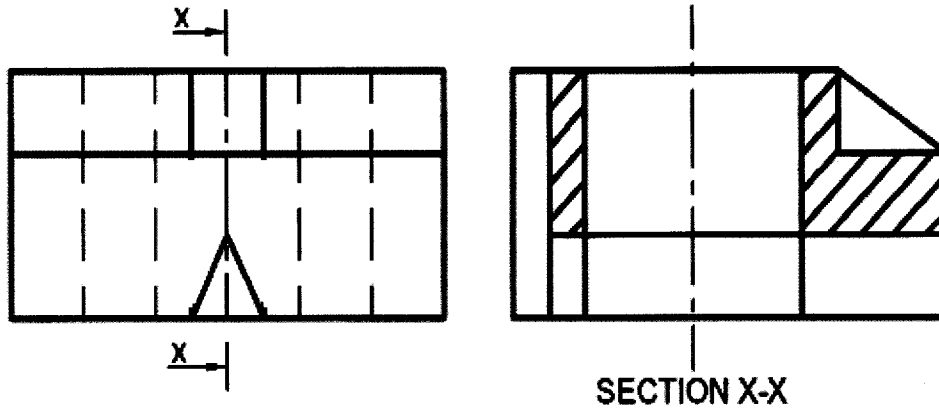


(b)	An external circlip fits into a groove on the outside of a shaft and is so made that it tends to contract in diameter. An internal circlip fits into a groove on the inside of a hole and is so made that it tends to expand and increase its diameter.	(1 mark) (1 mark)
4. (a)	<ul style="list-style-type: none"> - Chemical energy enters the engine in form of fuel. - The fuel is burnt to produce heat energy. - The heat energy exerts pressure to move the piston downwards (mechanical energy) - The mechanical energy is turned to vehicle motion to drive a vehicle. <p style="text-align: right;">4 x ½ mark = (2 marks)</p>	
(b)	Volumetric efficiency is a measure of an engine's ability to draw fuel mixture into the cylinders. It is determined by the ratio between what is actually drawn in and what could be drawn in if all the cylinders were completely filled up. Its formulae $\text{Volumetric efficiency} = \frac{\text{Total volume of the charge}}{\text{Total cylinders' volume (displacement)}}$	(1 mark) (1 mark)
5. (a)	It can lead to engine knocking or detonation, whereby secondary explosion occurs after the spark plug has fired, causing excessive rapid burning of mixture and a pinging or knocking noise. This can damage the engine/con rod cylinder.	(2 marks)
(b)	<ul style="list-style-type: none"> - High electrical conductivity. - Easily soldered. - Resistant to corrosion. - Quite ductile (i.e. cannot break easily) <p style="text-align: right;">Any 2 x 1 = (2 marks)</p>	
6. (a)	Seals <ul style="list-style-type: none"> - Prevent oil or grease leaking from where it is needed. - Prevent entry of dirt, dust or grit into the sealed area. - Improves engine breathing. <p style="text-align: right;">Any 2 x 1 mark = (2 marks)</p>	
(b)	<ul style="list-style-type: none"> - To attain maximum power output. - To achieve fuel consumption economy. - To avoid pre-ignition. - Smooth operation <p style="text-align: right;">Any 2 x 1 (2 marks)</p>	
7. (a)	(i) Induced current will be low and therefore produced spark will be weak. -Advance weak sparks leading into power loss (ii) May lead to inadequate opening of the points being unable to interrupt current flow in the primary circuit and this may lead to misfiring. -Retarded/delayed strong sparks leading to engine overheating	(1 mark) (1 mark)
(b)	<ul style="list-style-type: none"> - Making the crankshaft heavier. - Using more support bearings. <p style="text-align: right;">Any 2 x 1= (2 marks)</p>	

8. (a)	<ul style="list-style-type: none"> - Prolonged discharging. - Local chemical action in the cell due to dirt particles. - Insufficient or infrequent charging. - Frequent low electrolyte level. - Low specific gravity of electrolyte. 	Any 2 x 1 = (2 marks)
(b)	<ul style="list-style-type: none"> - Brazing is much faster. - Brazing requires less heat. - Braze welded joints are easier to machine. - Brazing produces less distorted joints. 	
9. (a)	<ul style="list-style-type: none"> (i) Brake fade – refers to loss of frictional properties of the brake lining due to overheating. (ii) Primary shoe: refers to the forward or leading brake shoe that moves in the direction of rotation of the drum. 	(1 mark) (1 mark)
(b)	Its purpose is to prevent the tyres from moving into the drop center of the rim when the tyre blows and thus coming off the wheel.	(1 mark)
10. (a)	<ul style="list-style-type: none"> - Leaf springs - Air springs - Coil springs – Torsional bar - Rubber - Stabilizer bar 	(2 marks) Any 4 x ½ mark
(b)	<ul style="list-style-type: none"> - To maintain directional stability and control. - To reduce steering effort. - To increase steering return ability. - Reduce tyre wear 	Any 2 x 1 = (2 marks)

11.

**Marks distribution***Front elevation*

4 faces x ½	= 2
Trough	= 1
4 hidden details	= <u>2</u>
Sub-total	= <u>5</u>

End elevation

6 faces x ½	= 3
2 selected faces 2 x 1	= 2
Quality of hatching	= 1
Web (not sectional)	= 1
Cutting plane xx	= <u>1</u>
Subtotal	8

First angle	= 1
Scale (double size)	= <u>1</u>
Subtotal	= <u>2</u>
Gross Total	<u>15</u>

12.

(a) (i) Straight through muffler

(1 mark)

(ii)

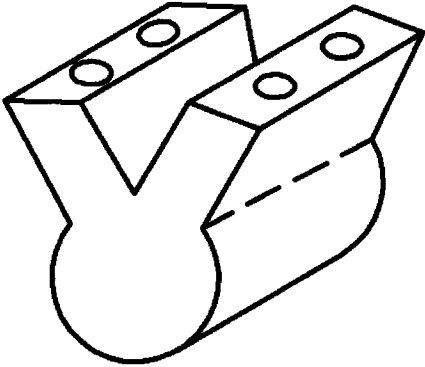
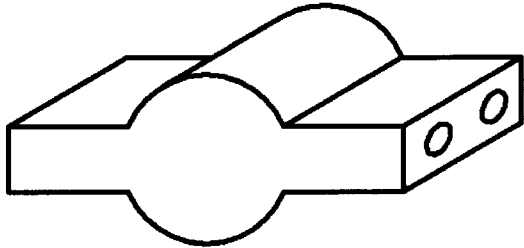
- A - inlet
- B - shell (body)
- C - perforated pipe
- D - fibre glass

(2 marks)

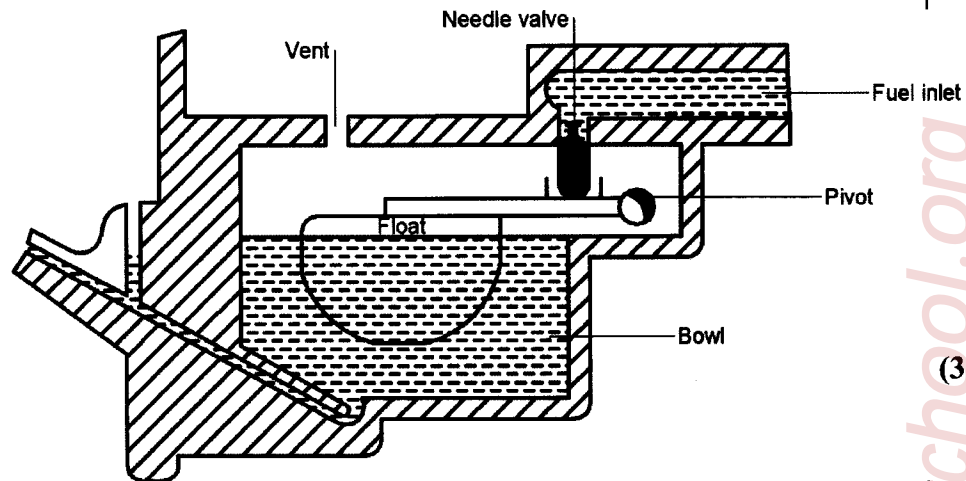
(iii)

- Hot exhaust gases enter through the inlet into the silencer.
- As they pass through the packed fibre glass material, their noise is muffled or reduced and the flow is such that back pressure is impeded.
- The gas go out through the outlet.

(½ mark)**(2 marks)****(½ mark)**

(b)	<table border="1"> <thead> <tr> <th data-bbox="362 259 505 338">Type of smoke</th> <th data-bbox="505 259 745 338">Meaning</th> <th data-bbox="745 259 1263 338">Possible causes</th> </tr> </thead> <tbody> <tr> <td data-bbox="362 338 505 607">Blue</td> <td data-bbox="505 338 745 607">Water in the system <i>(1 mark)</i></td> <td data-bbox="745 338 1263 607"> <ul style="list-style-type: none"> - Worn piston - Bad valve seal - Damaged glow plug - Stuck PVC valve - Worn Engine - Blown turbo <p style="text-align: right;"><i>(Any 2 x 1) =</i></p> </td> </tr> <tr> <td data-bbox="362 607 505 797">Black</td> <td data-bbox="505 607 745 797">Mixture is too rich <i>(1 mark)</i></td> <td data-bbox="745 607 1263 797"> <ul style="list-style-type: none"> - High speed driving - Fuel pump leakage/faulty - Clogged air cleaner - Stuck jets/fuel needle <p style="text-align: right;"><i>(Any 2 x 1) =</i></p> </td> </tr> <tr> <td data-bbox="362 797 505 954">White</td> <td data-bbox="505 797 745 954">There is steam in exhaust <i>(1 mark)</i></td> <td data-bbox="745 797 1263 954"> <ul style="list-style-type: none"> - coolant leaking into exhaust - worn cylinder head gasket - loose cylinder head bolts <p style="text-align: right;"><i>(Any 2 x 1) =</i></p> </td> </tr> </tbody> </table>	Type of smoke	Meaning	Possible causes	Blue	Water in the system <i>(1 mark)</i>	<ul style="list-style-type: none"> - Worn piston - Bad valve seal - Damaged glow plug - Stuck PVC valve - Worn Engine - Blown turbo <p style="text-align: right;"><i>(Any 2 x 1) =</i></p>	Black	Mixture is too rich <i>(1 mark)</i>	<ul style="list-style-type: none"> - High speed driving - Fuel pump leakage/faulty - Clogged air cleaner - Stuck jets/fuel needle <p style="text-align: right;"><i>(Any 2 x 1) =</i></p>	White	There is steam in exhaust <i>(1 mark)</i>	<ul style="list-style-type: none"> - coolant leaking into exhaust - worn cylinder head gasket - loose cylinder head bolts <p style="text-align: right;"><i>(Any 2 x 1) =</i></p>	<p style="text-align: right;"><i>(2 marks)</i></p> <p style="text-align: right;"><i>(2 marks)</i></p> <p style="text-align: right;"><i>(2 marks)</i></p>
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13. (a)	<ul style="list-style-type: none"> - To vaporize easily. - To enable engine to warm up quickly. - To facilitate easy starting of a cold engine. - To facilitate smooth acceleration. <p style="text-align: right;"><i>(Any 3 x 1) =</i></p>	<p style="text-align: right;"><i>(3 marks)</i></p>												
(b)	<p>i)</p>  <p>ii)</p> 	<p style="text-align: right;"><i>(2 marks)</i></p> <p style="text-align: right;"><i>(2 marks)</i></p>												

(c)



(3 marks)

(6 parts x 1) =

Operation

This circuit consists of a float bowl, float and a needle assembly. If the fuel enters the bowl faster than it leaves, the fuel level rises. (1) The rise causes the float to move up and push up the needle valve into a valve seat, closing the fuel inlet to the float bowl. (1) When the fuel level drops, the float moves down and releases the needle valve so that fuel inlet opens for fuel to enter the bowl (1) and compensate for the drop. During the engine operation, the float tends to keep the needle valve partly closed so that the fuel flow from (1) the bowl is the same as the fuel flow into the bowl, and therefore a constant level is maintained (1).

(5 points x 1) = (5 marks)

14. (a)

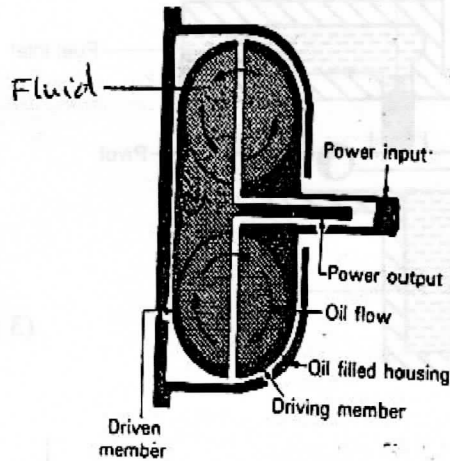
Crown wheel and pinion assembly is used to:

- Change the direction of drive through a right angle.
- Increase the available torque by reducing the speed.

(Power = torque x speed)

(Any 2 x 1) = (2 marks)

(b) (i)



marks

Drawing = 4

Labelling any 6 x 1/2) = 3 marks
7 marks

(ii) (a) **Idling** – When the engine is idling, there is insufficient centrifugal force for the oil to turn the turbine and so to move the car.

(2 marks)

(b) **Low to medium speed** – As the engine speeds up, centrifugal force pushes into the turbine and some turning effort is transmitted. But there is still a large degree of ‘slip’ in the unit; the output shaft is therefore rotating more slowly than the input shaft.

(2 marks)

(c) **Medium to high speed** – Once the engine reaches preset high speed, the force of the oil is sufficient to transmit full power. This gives in effect a direct drive with the output shaft rotating at about 98% of the speed of the output shaft.

(2 marks)

15. (a)

(i) Metering valve

- Prevents brake fluid movement to the discs until a specified **psi** has built up in the system. (72 – 125 lbs)

(1 mark)

(ii) Proportionating valve – limits the amount of pressure to the rear drum brakes to prevent rear wheel lock-up during rapid stops.

(1 mark)

