

4.19 POWER MECHANICS (447)

4.19.1 Power Mechanics Paper 1 (447/1)

SECTION A

1. (a) A 'machine' is a device used to make work easier. (1) 1 mark
- (b) Two reasons for a first aid box in a vehicle (2 marks)
- (i) To enable the occupants attend to emergency treatment like dressing a patient.
 - (ii) To Avail emergency drugs for common diseases and reduce.
 - pain
 - effect of injury
 - (iii) Legal requirement in a country. (any 2 x 1 = 2 marks)
2. (a) Three functional characteristics of a road wheel:
- (i) be strong to withstand weight of vehicle
 - (ii) be able to absorb road shocks/make the ride comfortable
 - (iii) be able to maintain grip on road surface
 - (iv) be light in weight
 - (v) be easy to remove and clean (any 3 x 1 = 3 marks)
- (b) (i) a business plan is a document that shows a road map to owning and operating a business.
- or
- a document that describes the goals and objectives of a business and clearly shows how and when they will be achieved. (1 mark)
- (ii) Four components of a business plan
- Title
 - Executive summary
 - Business description
 - Marketing plan
 - Organization and management plan
 - Production/operation plan
 - Financial plan (any 4 × $\frac{1}{2}$ = 2 marks)
3. (a) (i) hotter than cylinder (2 marks)
- gap reduces thus ...
- (b) (i) A - diameter
B - pitch
C - threads
D - head (any 4 × $\frac{1}{2}$ = 2 marks)

4. (a) (i) Reamer is used to enlarge or shape holes (1 mark)
 (ii) Tap is used for cutting internal threads (1 mark)
- (b) (i) Strength/torque to be used on task
 (ii) Size of bolt/nut to be removed
 (iii) Location of bolt/nut to be removed
 (iv) Material of spanner
 (v) Possibility of combination of the spanner

(Any 2 x 1 = 2 marks)

5. (a) Four applications of a photo voltaic cell

- (i) in light meters
 (ii) in space craft power supplies
 (iii) in automatic operated switches
 (iv) in burglar alarms

(4 x $\frac{1}{2}$ = 2 marks)

- (b) Four types of lighting circuits

- | | |
|-------------------|------------------------|
| (i) parking | (vii) panel instrument |
| (ii) tail | (viii) headlight |
| (iii) braking | (ix) courtesy |
| (iv) directional | (x) beef and bonnet |
| (v) back-up | (xi) spotlights |
| (vi) number plate | |

(any 4 x $\frac{1}{2}$ = 2 marks)

6. (a) Functions of a final drive:

- (i) To change direction of the drive through 90°
 (ii) To increase the torque of the drive by reducing the speed

(2 x 1 = 2 marks)

- (b) (i) square



- (ii) countersunk



(2 x 1 = 2 marks)

7. Three properties of soldering flux

- (i) should be fluid at soldering temperatures
- (ii) should remove any oxide filing from surfaces
- (iii) should prevent re-oxidation during soldering
- (iv) should be easily displaced by molten solder
- (v) should form a non-corrosive residue when the soldering process is complete

(any 3 x 1 = 3 marks)

8. (a) Four types of manual steering gear boxes

- (i) worm and sector
- (ii) rack and pinion
- (iii) recirculating balls
- (iv) worm and wheel

(any 4 x $\frac{1}{2}$ = 2 marks)

(b) Four types of springs used in vehicle suspension system

- (i) leaf
- (ii) coil
- (iii) torsional bal
- (iv) air
- (v) stabilizer bar
- (vi) rubber

(any 4 x $\frac{1}{2}$ = 2 marks)

9 Four purposes of lubricating oil additives:

- (i) to prevent carbon formation
- (ii) to prevent oxidation
- (iii) to suppress foam
- (iv) to prevent corrosion
- (v) to prevent rusting
- (vi) to prevent acid formation
- (vii) to prevent wear
- (viii) antifreeze

(any 4 x 1 = 4 marks)

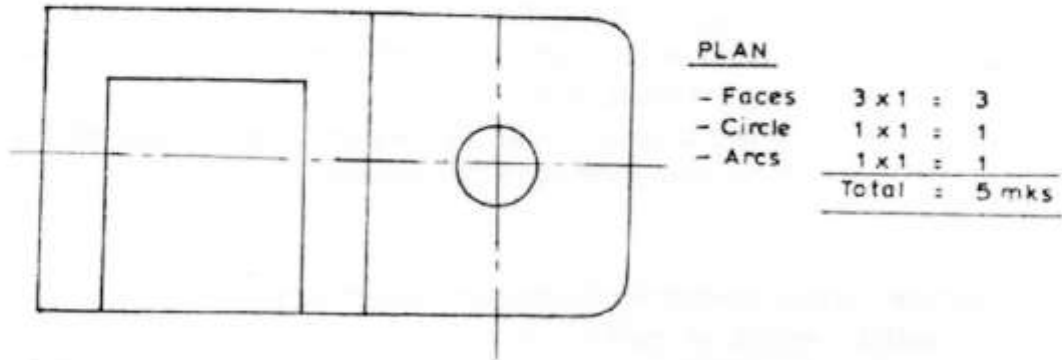
10. Eight cooling system components

- (i) radiator cap
- (ii) radiator
- (iii) hoses
- (iv) water pump
- (v) fan
- (vi) thermostat
- (vii) water jackets
- (viii) temperature gauge
- (ix) overflow tank
- (x) sensor

(any 8 x $\frac{1}{2}$ = 4 marks)

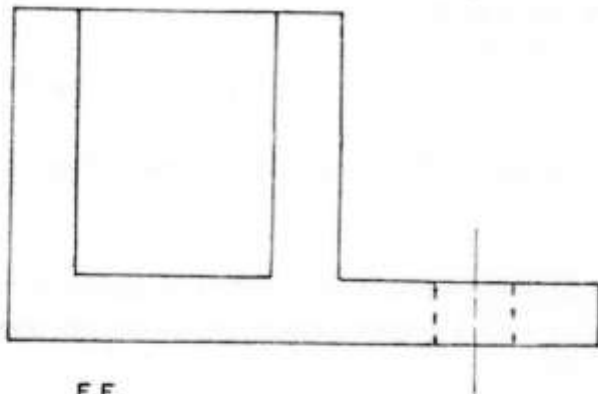
SECTION B

11.



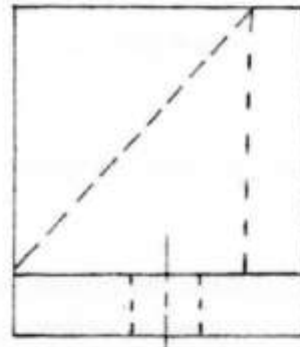
PLAN

- Faces	$3 \times 1 = 3$
- Circle	$1 \times 1 = 1$
- Arcs	$1 \times 1 = 1$
<hr/>	
Total	<u>$= 5 \text{ mks}$</u>



FE

Faces	$2 \times 1 = 2$
Hidden details	$2 \times \frac{1}{2} = 1$
<hr/>	
	<u>$= 3 \text{ mks}$</u>



EE

Faces	$2 \times 1 = 2$
Hidden details	$2 \times \frac{1}{2} = 1$
Slant	$1 \times 1 = 1$
<hr/>	
	<u>$= 4 \text{ mks}$</u>

3 rd Angle projection	$= 2$
Neatness	$= 1$
<hr/>	
	<u>$= 3 \text{ mks}$</u>

Total = 15 mks

12. (a)
- | | | |
|---|---|------------|
| A | - | disc |
| B | - | piston |
| C | - | inlet pipe |
| D | - | caliper |
| E | - | pad |
| F | - | seal |

$(6 \times \frac{1}{2} \text{ marks} = 3 \text{ marks})$

(b) Operation

(i) Brakes applied

(5 marks)

- | | | |
|---|---|---|
| 1 | - | Driver applies the brake pedal |
| 1 | - | Brake fluid forces the piston to move towards the disc |
| 1 | - | On driver applying further pressure leads to distortion of the seal |
| 1 | - | The piston is used to push the brake pads to make contact with the disc |
| 1 | - | This slows/stop the vehicle |

(ii) Brakes off

(7 marks)

- 1 - The driver releases the brake pedal
- 1 - The seal regains its original shape
- 1 - The piston is withdrawn from disc
- 2 - Maintaining a light contact between the pad and disc due to static head of brake fluid
- 2 - When wear occurs the piston moves slightly through the seal and takes new position in the cylinder

(7 marks)

13. (a) - To clear exhaust gases from the engine to the atmosphere
- To muffle or reduce exhaust noises
- To remove a lot of heat from the engine
- To convert poisonous gases to less harmful gases

(any 3 x 1 mark = 3 marks)

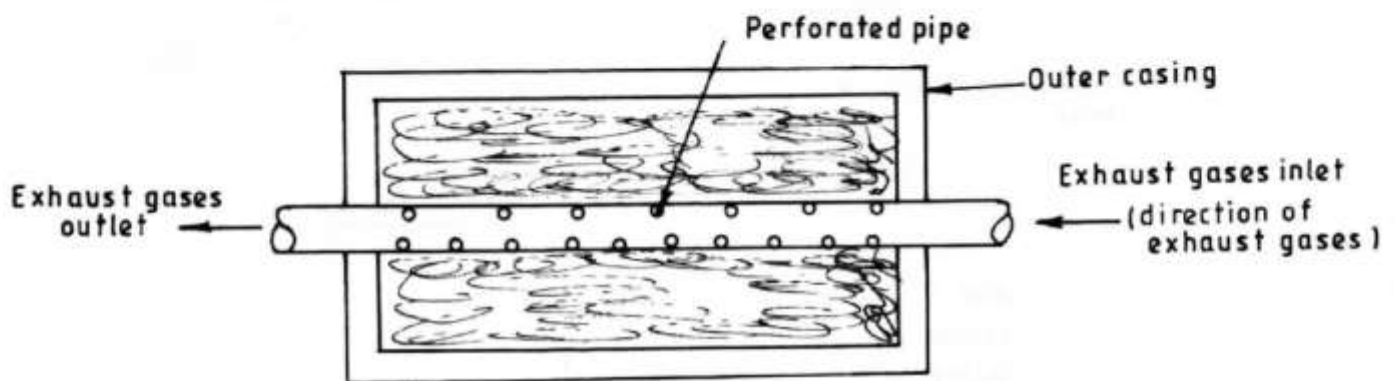
- (b) (i) back pressure is caused by restriction of the free flow of exhaust gases

(1 mark)

- (ii) Excessive restriction causes high back pressure resulting in incomplete scavenging of exhaust gases (1). This in turn causes loss of engine power and increased fuel consumption (1)

(2 marks)

(c)



Sketch - 2 marks
Labelling - $4 \times \frac{1}{2}$ marks
Direction of exhaust - 1 mark
5 marks

- Silencer consists of a perforated inner pipe (1)

- Enclosed in and welded on a cylindrical casing (1)
- Which is about 3 times larger in diameter (1)
- The casing is filled with absorbent material like wool, asbestos fibre or (1) glass

(4 marks)

14. (a) - Petrol intake stroke takes in air fuel mixture while diesel takes in air
 - Petrol engine compresses air-fuel mixture while diesel compresses air alone
 - Diesel engine fuel is used to ignite hot compressed air while in diesel engine a spark ignited the compressed air fuel mixture
- (3 x 1 = 3 marks)

(b)

	Petrol	Diesel Engine
(i) Weight	lighter	heavier
(ii) Running cost	expensive	cheaper
(iii) Emissions	less pollutant	more pollutant
(iv) Thermal efficiency	less	higher
(v) Compression ratio	lower	higher
(vi) Operating temperature	lower	higher
	6 x 1 mark	6 x 1 mark

(12 marks)

15. (a) - oil lubricates the engine
 - oil cools the engine
 - oil cleans the engine
 - oil seals the engine
- (4 x 1 mark = 4 marks)

(b) (i) **Splash feeds**

- It consists of either an oil dipper or oil slinger
- It is commonly used in single cylinder engines with the dipper fastened to the connecting rod to ensure adequate splash lubrication
- The rotating crankshaft splashes oil on the bearing surfaces as it rotates in the bath of oil in the crank case
- In case of a slinger, it is driven by the cam gear situated in the oil bath and sling the oil to lubricate the required areas

(5 marks)

(ii) **Pressure feed**

- The oil pump delivers oil under pressure into the gallery pipe which extends the full length of the crank case
- Each main bearing is connected to this gallery by holes drilled through the crankcase webs and similar drilled holes are used to connect the crankshaft bearings to the gallery
- All these drilled holes enable oil under pressure to lubricate all these parts at the same time
- Connections are made from the gallery to the oil pressure gauge or warning lamp switch, and to the rocker shaft of the overhead valve gear.

(6 marks)