

## 5.5 POWER MECHANICS (447)

### 5.5.1 Power Mechanics Paper 1 (447/1)

1. (a) Define power mechanics  
It is the study about machines that exert mechanical force. (1 mark)
- (b) List **four** types of body cuts  
- incised;  
- lacerated or torn;  
- bruised;  
- stab. (4 x □) = 2 marks
2. (a) State **one** advantage of tubeless tyres over tubed tyres.  
- they are lighter in weight;  
- they run at lower temperatures;  
- they hold pressure for a longer time. any( 1 x 1) = (1 mark)
- (b) State **three** reasons for writing a business plan.  
- to enable a business obtain finances from banks and other financial institutions.  
- to provide guidelines for opening a new business or expanding an existing one.  
- to communicate to outsiders about the goals, objectives and activities of the business.  
- to serve as a tool for managing every aspect of the operation of business. Any 3 x 1 = 3 marks
3. (a) The nominal size of a Gudgeon pin is 50mm. If the tolerance is 0.0825mm, determine its limits.  
- Upper limit =  $50 + 0.0825 = 50.0825$  (1 mark)  
- Lower limit =  $50 - 0.0825 = 49.9175$  (1 mark)
- (b) Explain the functions of a multimeter and state how it is connected in each case.  
- A multimeter is an electrical instrument consisting of an ammeter, ohmmeter and voltmeter all combined to form one instrument. (1 mark)  
- When used as an ammeter the instrument is connected in series with a circuit to measure current.  
- When used as voltmeter it is connected in parallel with a circuit to measure voltage with a circuit to measure voltage.  
- When used as an ohmmeter it is connected in series to measure the resistance of a circuit. (2 marks)
4. (a) State the function of each of the following devices in a motor vehicle:  
(i) Split pin - it is used together with either a slotted or castellated nut to prevent it working loose during an operation. (1 mark)  
(ii) Internal snap ring - used in housings to keep shafts on other parts in position. (1 mark)

- (b) Explain two reasons for alloying materials:
- to lower the melting point of the metal.
  - to achieve additional strength and hardness.
  - To increase resistance to corrosion.
  - To alter the colour appearance.
  - To secure cleaner and sharper castings.

Any 2 x 1 = 2 marks

5. (a) State **two** operational differences between an alternator and a generation.
- An alternator delivers alternating current while DC generation delivers direct current
  - In the DC generator the amature spins inside a field while in the alternator the field spins inside the startor.

2 x 1 = 2 marks

- (b) State **two** disadvantages of external combustion engine over internal combustion engine.
- External combustion engines are too large for general application.
  - They are not as efficient as the internal combustion engines.

2 x 1 = 2 marks

6. (a) Name **four** parts of an automatic transmission system.

- Torque converter.
- Planetary gearcets.
- Brake bands.
- Multiple disc clutches.
- Hydraulic servers and pistons
- Numerous valves.
- Cooling means.
- Manual control systems.

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

- (b) Draw a labelled circuit diagram of the courtesy light circuit.

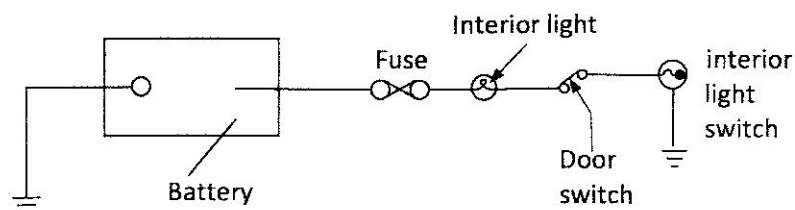


Figure 1

Components correctly drawn and labelled =  $5 \times \frac{1}{2} = 2 \frac{1}{2}$  marks  
 Circuit neatly drawn =  $\frac{1}{2}$  marks

Total = 3 marks

7. (a) State **two** types of each of the following:

- (i) Welding rods:
- Steel /metal filler rods .
  - Cast iron filler rods.

- Aluminium filler rods.

Any 2 x  $\frac{1}{2}$  = 1 mark

(ii) Brazing rods

- Brass filler rods.  
- Bronze filler rods

Any 2 x  $\frac{1}{2}$  = 1 mark

(iii) Fluxes

- Borax  
- Killed spirits.  
- Zinc chloride.  
- Salamonic tellow resin  
- Dilute hydrochloric acid.  
- Olive oil.  
- Phosphoric acid.

Any 2 x  $\frac{1}{2}$  = 1 mark

8. (a) With the aid of a sketch explain the terms negative caster angle.

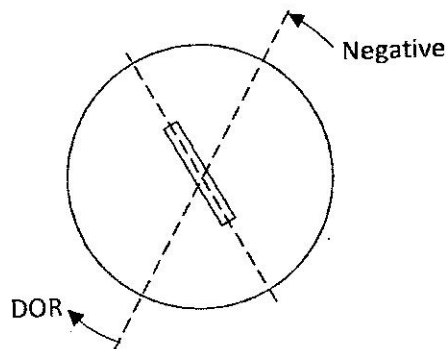


Figure 2

This is the angle formed by the forward or tilting of the steering axis when viewed from the side of the wheel.

Sketch 1 mark  
Explanation 1 mark  
2 marks

(b) Explain how a stabilizer bar works when the body of the vehicle attempts to lean onto one side, as in rounding a curve, one end of the bar bends downwards, producing a torsional effect in the bar that resists the role-tipping effect/action and helps keep the body level. 2 marks

9. (a) List **four** main components driven by the crankshaft in a multi-cylinder engine:

- Crankshaft;  
- Fan;  
- Oil pump.  
- Water pump  
- Alternator  
- Flywheel.

Any 4 x  $\frac{1}{2}$  = 2 marks

- (b) State **two** precautions to be observed when fitting a new cylinder head gasket:
- Ensure the head and block surfaces are clean and flat.
  - Handle the gasket carefully to avoid creasing the metal and breaking the asbestos filing.
  - use either gasket varnish or smear a thin layer of grease over the whole surface.
  - Fit the gasket properly without blocking any of the holes.
  - Tighten the cylinder-head nuts to the right torque and sequence.
- any 2 x 1 = 2 marks

10. Name the parts labelled A, B, C and D and state the function of each part.
- A - Choke lever reduces the amount of air supplied during engine cold starting.
- B - Float bowl Acts as a storage for petrol and operating needle valve to regulate the petrol flow into the float bowl.
- C- Throttle valve regulates the amount of air-fuel mixture entering the cylinder.
- D- Idle mixture adjustment screw- it regulates the mixture for idling cct screw.
- 4 x 1 = 4 marks

11.

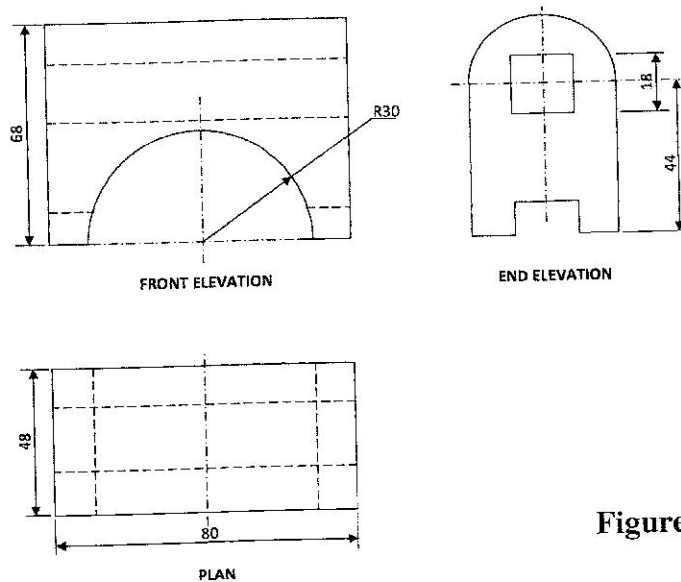


Figure 4

$$\begin{aligned}
 \text{FE} = \text{HD} &= 3 \times \frac{1}{2} = 1\frac{1}{2} \\
 \text{Semicircle} &= 1 \\
 \text{Face} &= 1 \\
 \hline
 &= 3\frac{1}{2} \text{ marks}
 \end{aligned}$$

$$\begin{aligned}
 \text{E.E} = \text{Face} &- 2 \\
 \text{Engrare} &- \frac{1}{2} \\
 \hline
 \text{HD} &- 1\frac{1}{2} \text{ marks}
 \end{aligned}$$

$$\begin{aligned}
 \text{PLAN} = \text{HD} &= 4 \times \frac{1}{2} = 2 \\
 \text{Face} &= 1 \\
 &= 3 \text{ marks}
 \end{aligned}$$

$$\text{Dimensions} \quad 6 \times \frac{1}{2} = 3 \text{ marks}$$

$$\text{Correct position of} \quad - 1 \text{ mark}$$

$$\begin{aligned}
 \text{Correct angle of projection} &- 1 \text{ mark} \\
 \text{Total} &= 15 \text{ marks}
 \end{aligned}$$

Components to be disconnected before removing an engine from a vehicle:-

12. (a)

- Battery cables and the battery.
- Air cleaner.
- Radiator hoses from the engine and water pump. (Drain Radiator)
- Heater hoses.
- Fan and radiator.
- Oil pressure cables.
- Fuel pump hoses.
- Alternator.
- Primary wire from ignition coil.
- Exhaust pipe from exhaust manifolds.
- Starter motor and its cables.
- Intake manifold hoses.
- Engine mounts from frame brackets.
- Clutch or automatic transmission.

any 10 x  $\frac{1}{2}$  = 5 marks

(b)

- Start the engine and leave it idling.
- Using insulated pliers, disconnect each spark plug at a time and note if there is change in engine speed.
- No change in speed means the cylinder is missing even before the cable was disconnected.
- Check a missing cylinder further by holding the spark plug lead clip close to the engine block while the engine is running.
- No spark implies a high voltage leak, hence the cylinder misfires.

Possible causes of misfiring.

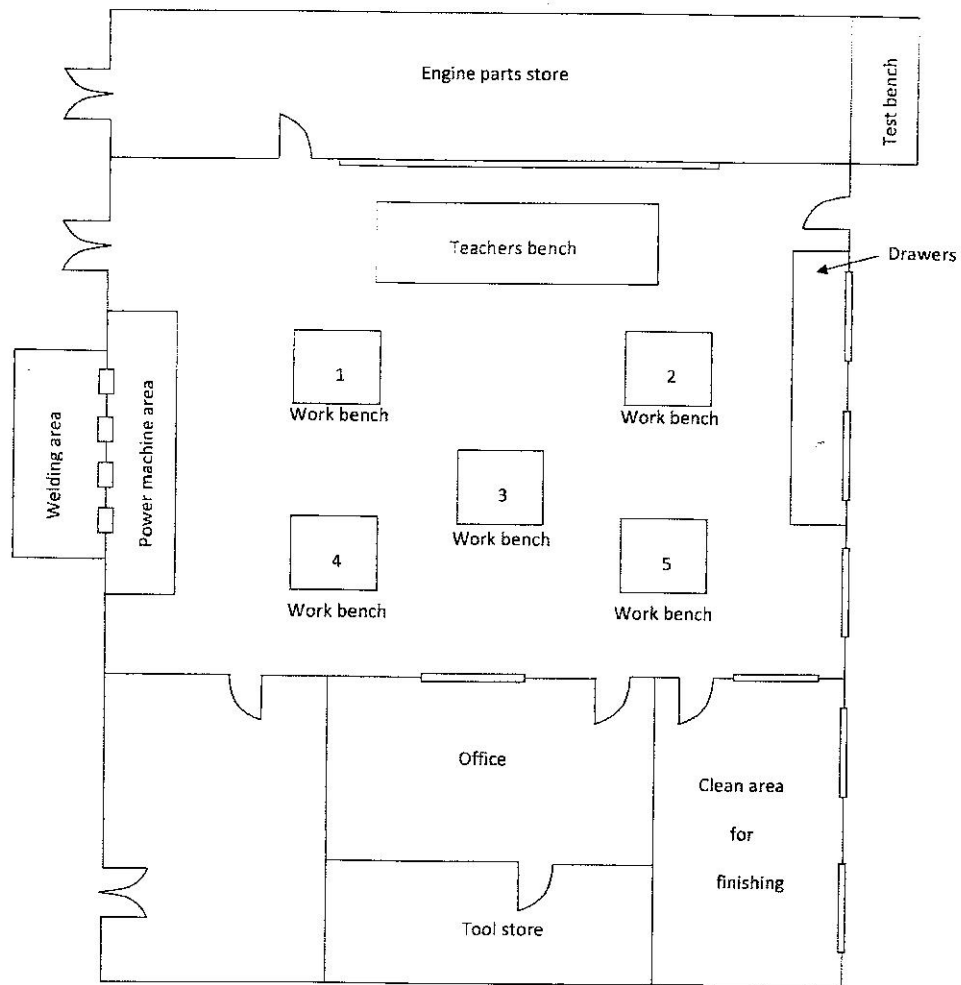
- Defective spark plug or its cable.
- Defective distributor cap.
- Defective valve action.
- Worm pistons and rings.
- Overheated engine.
- Defective head gasket
- Compression leakage.
- Intake manifold leakage.
- Cross-firing plugs wires.
- Defective coil, condenser.
- Large gap c.b. among others.

any 5 x 1 = 5 marks

13. (a) State **three** provisions required when designing a power mechanics workshop.
- doors
  - spaces
  - passage ways
  - washing place
  - provision of light
  - ventilation
  - fire points
  - emergency points.

any 3 x 1 = 3 marks

(b)



**Figure 5**

Layout		- 1 mark
Locations		- 2 marks
Labelling		- 3 marks
Relationship between areas for workflow		- 2 marks
Windows	4 x $\frac{1}{2}$	= - 2 marks
Doors	4 x $\frac{1}{2}$	= - 2 marks
		<u>12 marks</u>

14. (a) Solution: Care practices that enhance tyre lifespan.

- Regular inspection of tyres for nails, stones e.t.c. They should be removed and small cuts should be repaired by vulcanising.
- Maintaining inflation pressures at the recommended values.
- Keeping toe-in and toe-out within specified limits.
- Avoiding violent usage of clutch and brakes (e.g. sudden braking and sudden release clutching).
- Frequent checking of suspension and steering system which can cause misalignment.
- Wheel rotation after every 5000 km or so, incorporating the spare wheel.
- Avoiding contact with oil, grease or paint.
- Avoiding continuous exposure to ultra-violet light from strong sunshine.

any 5 x 1 = 5 marks

(b) Procedure for changing a wheel:

- parking vehicle on a flat surface.
- chocking the appropriate wheel.
- loosening nuts diagonally, remove nuts.
- Jacking up the vehicle.
- putting support stands (or equivalent) under the vehicles
- removal of the flat wheel.
- fitting the inflated wheel to replace the flat wheel.
- replacing wheel nuts and tightening them slightly.
- unjacking the wheel and removal of the jack.
- final tightening of the wheel diagonally and to the correct torque. Unchoke.

10 x 1 = 10 marks

15. The parts labelled A to F.

- A - Rear reservoir.
- B - Push rod.
- C - Primary piston.
- D - Vented cap
- E - Outer port.
- F - Front by-pass port.

6 x  $\frac{1}{2}$  = 3 marks

(b) Explain the operation of the unit under the following conditions.

(i) Normal operation.

The brake pedal is depressed ( $\frac{1}{2}$ ), it pushes the push ( $\frac{1}{2}$ ) rod to move forward once by front pass ( $\frac{1}{2}$ ) port. It is passed by primary piston which pushes the secondary ( $\frac{1}{2}$ ) piston. In both areas brakes are applied at the front areas brakes are applied at the front and rear ( $\frac{1}{2}$ ) axles. Any excess ( $\frac{1}{2}$ ) movement is controlled by top secondary piston. (3 marks)

On release of ( $\frac{1}{2}$ ) pedal the push rod releases (1) the spring that releases the piston ( $\frac{1}{2}$ ) and brake fluid is ( $\frac{1}{2}$ ) released to the reservoir thus releasing ( $\frac{1}{2}$ ) brake application. (3 marks)

(ii) Front brake failure.

On application of the pedal the primary piston gets no resistance (1) until it comes into contact with secondary, (1) it is then pushed to apply rear brakes. (1) (3 marks)

Rear brakes failure/leakage.

(3 marks)

The pedal is depressed, the secondary (1) piston does not get any resistance its pushed to end of cylinder (1), on further application the front wheel brakes (1) are applied.