

4.20 POWER MECHANICS (447)

4.20.1 Power Mechanics Paper 1 (447/1)

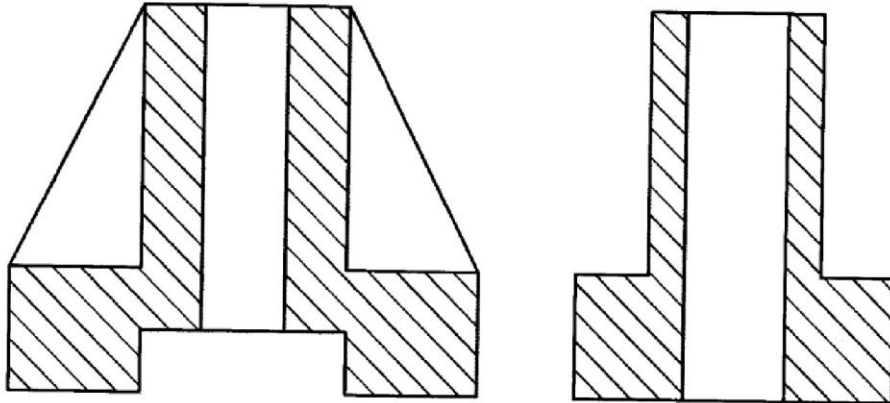
1. (a)	Integrity – steadfast adherence to a strict moral or ethical code or pureness or uprightness	(1 mark)
(b)	<ul style="list-style-type: none"> ❑ Very aggressive ❑ Take calculated risks ❑ Adventurous ❑ Persistent ❑ Future focus ❑ Action oriented ❑ Working extra harder ❑ Optimistic ❑ High profit orientation ❑ High drive for achievement e.t.c. <p>(Any 6 x <input type="checkbox"/> mark)</p>	(3 marks)
2. (a)	<ul style="list-style-type: none"> ❑ Ensure the plug is properly and safely connected to the tool. ❑ Ensure all wires are insulated. ❑ Never use electrical tools when standing on a damp floor. ❑ Ensure the tools are properly earthed. ❑ Never use tools with naked and loose wire joints. <p>(Any 2 x 1 mark)</p>	(2 marks)
(b)	Scale length = Representative fraction x Maximum reading	(1 mark)
	$= \frac{1}{5} \times 800 = 160mm$ $\frac{1}{5} \times 800 = 160mm$	(1 mark)
3. (a)	<p>Cleaning tools</p> <ul style="list-style-type: none"> ❑ Wire brush ❑ Power wire wheel ❑ Buffing wheel ❑ Bristle brush ❑ Scraper ❑ Sanding block <p>(Any 4 x <input type="checkbox"/> mark)</p>	(2 marks)
(b)	i. Grub screw Often used with keys to prevent a pulley from moving along a shaft.	(1 mark)
	ii. Pal nut Is a single threaded nut used lock another nut to prevent it from working loose.	(1 mark)
4. (a)	i. Tungsten – increases hardness	(1 mark)
	ii. Chromium – increases strength and hardness	(1 mark)

(b)	<ul style="list-style-type: none"> ❑ Starting system - (Starter motor) ❑ Wipers - (Motor) ❑ Charging system – (Alternator) ❑ Odometer – (Generator) ❑ Gauges e.g. ❑ Tachometer – (Ac generator) <p>(Any 4 x ❑ mark)</p>	(2 marks)
5. (a)	<p>Undersquare engine Is one where the bore is smaller than the stroke. Therefore the piston travels longer distance per minute to cover a stroke, and thus travels at a higher speed to cover a given RPM.</p> <p>Oversquare engine Is one where the bore is larger than the stroke. Therefore, the piston travels a shorter distance per minute to cover a stroke, and thus travels at a lower speed to cover a given RPM.</p>	(1 mark) (1 mark)
(b)	<p>Causes of cylinder wall wear</p> <ul style="list-style-type: none"> ❑ The piston, especially the thrust side. ❑ Piston rings. ❑ Abrasive material from lubricating oil. ❑ Poor quality oil ❑ Engine overheating <p>(Any 4 x ❑ mark)</p>	(2 marks)
6. (a)	<ul style="list-style-type: none"> ❑ Battery ❑ Radiator ❑ Air cleaner ❑ Start motor ❑ Bell housing <p>(Any 4 x ❑ mark)</p>	(2 marks)
(b)	<ul style="list-style-type: none"> ❑ Levers and cables ❑ Belts and pulleys ❑ Wheels and pulleys ❑ Chairs and sprockets ❑ Gears ❑ Clutches <p>(Any 4 x ❑ mark)</p>	(2 marks)
7. (a)	<p>1. Inlet valve lead This early opening gives as long as possible time for the intake of fresh charge into the cylinder.</p> <p>2. Exhaust valve lag Gives adequate time for the exhaust gases to be cleared from the cylinder.</p>	(1 mark) (1 mark)
(b)	<ul style="list-style-type: none"> ❑ It has a high specific heat capacity ❑ It is readily available ❑ It is not costly ❑ Absorbs mechanical noise <p>(Any 2 x 1 mark)</p>	(2 marks)

8. (a)	<ul style="list-style-type: none"> ❑ The filament do not burn easily because of chemical interaction with the gas. ❑ It operates at higher temperature without blackening. ❑ It emits more brightness <p>(Any 2 x 1 mark)</p>	(2 marks)
(b)	<p>i. Castor angle Is the tilt of the spindle pivot towards the front or the rear of the vehicle from the vertical axis.</p> <p>ii. It plays an important role in self-centering of the wheels after cornering.</p>	(1 mark) (1 mark)
9. (a)	<ul style="list-style-type: none"> ❑ Flat base – two piece rim. ❑ Flat base divided rim. ❑ Flat base – three piece rim. ❑ Semi-drop center rim <p>(Any 2 x 1 mark)</p>	(1 mark)
(b)	<p>i. Backfiring during welding procedures refers to when the flame goes out, producing a loud snapping or popping noise at the nozzle.</p> <p>ii. Causes of backfiring include:-</p> <ul style="list-style-type: none"> ❑ If the torch touched the hot metal ❑ If there is a piece of hot metal blocking the nozzle orifice ❑ When the torch tip is loose ❑ When the torch nozzle is overheated. <p>(Any 2 x 1 mark)</p>	(2 marks)
10. (a)	<ul style="list-style-type: none"> ❑ Should be light in weight ❑ Should have adequate strength ❑ Should be able to rapidly absorb and dissipate heat <p>(Any 2 x 1 mark)</p>	(2 marks)
(b)	<ul style="list-style-type: none"> ❑ Twisting or tension when one wheel is deflected ❑ Bending due to the load and weight of the vehicle ❑ Driving and braking thrust transferring the axle motion to the chassis ❑ The driving and braking torques reaction forces due to the resistance of the axle to rotate. <p>(Any 2 x 1 mark)</p>	(2 marks)

11.

(15 marks)



M.S.

3rd Angle projection = 1

F.E. 5 faces 5 x 1 = 5

Sectioning 2 x 1 = 2

EE: 4 faces 4 x 1 = 4

Sectioning 2 x 1 = 2

Neatness = 1

Total= 15 Marks

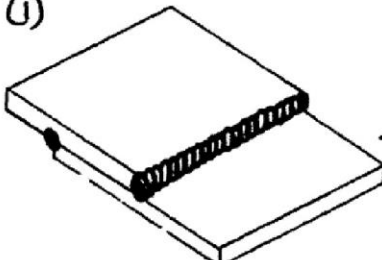
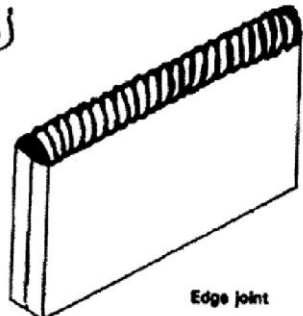
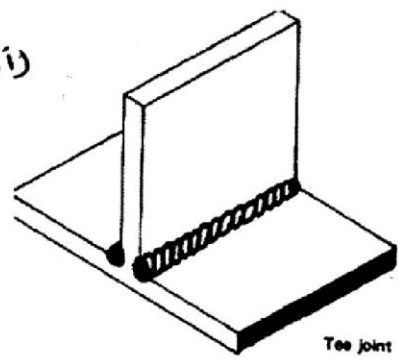
12. (a)

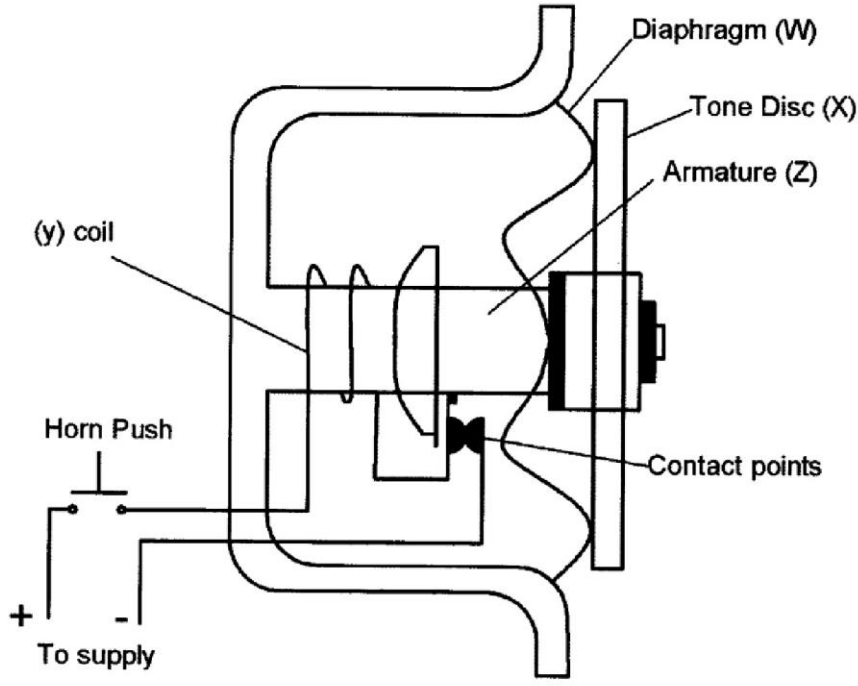
- A – Radiator
 - B – Filler cap
 - C – Water pump/cylinder wall
 - D – Fan
 - E – Thermostat
 - F – Temperature gauge
 - G – Upper water gallery
 - H – Water jacket
- (Any 8 x mark)

(4 marks)

(b)	<p>Operation</p> <p>When the car starts, the engine is cold and the thermostat shuts off the flow of water to the radiator⁽¹⁾. Since the water is confined to flow within the engine, it heats quickly as the engine runs hot. When water reaches a pre-determined temperature, the thermostat opens, allowing free flow of coolant.⁽¹⁾</p> <p>The hot water leaves the engine through the upper hose to the radiator⁽¹⁾. In the radiator, it passes through the radiator core tubes, which are surrounded by cooling fins,⁽¹⁾through which air is drawn inwards by the low pressure vacuum⁽¹⁾ created by the revolving fan⁽¹⁾. This air cools the hot water as it passes down the radiator core⁽¹⁾. The cooled water is then drawn into the engine by the water pump⁽¹⁾ through the radiator return pipe⁽¹⁾ into the water jackets surrounding⁽¹⁾ the cylinders to cool the engine block.</p> <p>When there is excessive pressure build up in the system, the radiator cup equalizes the internal system pressure with the atmospheric pressure.⁽¹⁾</p>	(11 marks)
13. (a)	<ul style="list-style-type: none"> ❑ Number of cylinders e.g. 1, 2, 4, 6, 8, 12 e.t.c. ❑ Arrangement of the valves e.g. I, L, F, T and H. ❑ Arrangement of the cylinder e.g. Inline vertical, Inline horizontal, Inclined inline, radial, V-arrangement, horizontal opposed. ❑ Type of fuel e.g. petrol (gasoline), diesel, ethanol, industrial alcohol e.t.c. ❑ Type of cooling system e.g. air-cooled, coolant or water cooled e.t.c. ❑ Type of cycle e.g. two strokes cycle or four stroke cycle <p>(Any 3 x 1 mark)</p>	(3 marks)
(b)	<p>Operational differences between 2 – stroke and 4 stroke cycle engines</p> <p style="text-align: center;">2 Stroke 4 Stroke</p>	

	<ul style="list-style-type: none"> ❑ Piston performs two tasks <ul style="list-style-type: none"> ❑ Acts as a valve ❑ Is the compressor in primary and secondary compressions ❑ Mixture comprises of petrol, air and lubricating oil. ❑ Engine has two compressions Primary compression which takes place in the crank case and secondary compression which takes place in the cylinder head. ❑ For every revolution of the crankshaft (i.e. 360°), the engine has a power stroke ❑ Not all exhaust gases are cleared out of the combustion chamber, hence this prevents a huge amount of fresh charge from entering the cylinder. ❑ Has smoother running because it has only one dead stroke per cycle ❑ Runs at higher temperatures and is difficult to time because strokes are too short. ❑ Engine records higher fuel consumption because of high scavenging (Explain any 6 x 2 marks) 	<ul style="list-style-type: none"> ❑ Piston only acts as the compressor since the engine has valves ❑ Mixture comprises of fuel and air only. ❑ Engine has only one compression which takes place in combustion chamber. ❑ For every 2 revolutions of the crankshaft (i.e. 720°), the engine has a power stroke. ❑ Nearly all burnt gases are cleared from combustion chamber allowing more fresh charge to enter. ❑ Has rough running because it has three dead strokes per cycle. ❑ Runs at lower temperatures, and is easier to time. ❑ Engine is more economical in fuel consumption because there is little scavenging. 	<p>(12 marks)</p>
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<p>14. (a)</p>	<p>Non fusion welding rod</p> <ul style="list-style-type: none"> ❑ Nickel bronze rods ❑ Silicon bronze rods ❑ Manganese bronze rods ❑ White brazing rods ❑ Silver soldering rods <p>(Any 5 x ❑ mark)=2❑ marks</p>	<p>Where used to weld</p> <ul style="list-style-type: none"> ❑ Used on steel and mal-leable irons ❑ On brass, copper tubes, G I sheets ❑ Cast iron and building gear teeth ❑ Steel and Nickel ❑ Used for low and high melting points copper, brass and steel <p>(Any 5 x ❑ mark)= 2❑ marks</p>	<p>(5 marks)</p>
<p>(b)</p>	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>(i)</p>  <p>Lap joint (2 marks)</p> </div> <div style="text-align: center;"> <p>(ii)</p>  <p>Edge joint (2 marks)</p> </div> <div style="text-align: center;"> <p>(iii)</p>  <p>Tee joint (2 marks)</p> </div> </div>	<p>(2 marks)</p>	
<p>(c)</p>	<p>Difficulties in welding cast iron</p> <ul style="list-style-type: none"> ❑ Cast iron never attains fluidity the same way as steel; penetration is more difficult and promotes oxidation in the weld. For this reason, a flux is necessary when welding cast iron. ❑ Cast iron is a brittle material. The uneven expansion and contraction caused by local heating often makes it to crack. This fault is due to the fact that most cast irons are normally in cast forms. 	<p>(2 marks)</p> <p>(2 marks)</p>	
<p>15. (a)</p>	<p>i. Engine stalls after idling or slow speed driving</p> <ul style="list-style-type: none"> ❑ Defective fuel pump ❑ Overheating ❑ High carburetor float level ❑ Idling adjustment incorrect ❑ Malfunction PCV valve <p>(Any 4 x 1 mark)</p>	<p>(4marks)</p>	

	<p>i. Engine backfires</p> <ul style="list-style-type: none"> ❑ Idle stop or solenoid adjustment not correct ❑ Engine overheating ❑ Hotspots in cylinders due to carbon ❑ Excessively lean or rich mixture ❑ Cracked distributor cap ❑ Valves hot or sticking <p>(Any 4 x 1 mark)</p>	(4 marks)
(b)	 <p>(4 x ½ mark)</p>	(2 marks)
	<p>Operation of the horn circuit. When the push button is pressed, current flows through the contact points to the electromagnetic coil. The coil gets energized⁽¹⁾ and attracts the armature,⁽¹⁾ which moves together with the diaphragm⁽¹⁾ which is attached to it. When the armature is attracted, the contact points open,⁽¹⁾ breaking the flow of current. The coil is the de-energized, thus making armature to be released.⁽¹⁾ And to move back closing the points to start the procedure again.</p>	(5 marks)