

20.0 POWER MECHANICS (447)



The KCSE examination for Power Mechanics as in the previous years, comprised a theory paper marked out of 100 but scaled down to 60% and a practical paper constituting 40% of the overall marks.

20.1 CANDIDATES' GENERAL PERFORMANCE

The table below shows the candidates' performance in Power Mechanics. The statistics for 2005 and 2008 have also been given for comparison.

Table 25: Candidates' Overall Performance in Power Mechanics for the Last Three Years

Year	Paper	Candidature	Maximum Score	Mean Score	Standard Deviation
2005	1		60	34.31	8.48
	2		40	27.60	4.57
	Overall	213	100	61.79	11.00
2008	1		60	24.28	9.32
	2		40	25.49	6.88
	Overall	57	100	49.77	14.67
2009	1		60	28.88	9.27
	2		40	27.05	4.15
	Overall	136	100	56.74	12.37

From the table above, the following observations can be made:

- 20.1.1 The candidature increased from 57 in 2008 to 136 in 2009;
- 20.1.2 In Paper 1, the mean score improved by 4.6 marks from 24.28 in 2008 to 28.88 in 2009.
- 20.1.3 There was also an improvement in Paper 2 and the overall mean score rose remarkably from 49.77 to 56.74.

The following part of this report will address the questions which were poorly done in both Paper 1 and 2.

10.2 PAPER 1 (447/1)

Question 4

- (a) Calculate the compression ratio of a single cylinder engine having a swept volume of 1600cc and clearance volume of 40cc.
- (b) Outline the procedure of starting a single cylinder petrol engine.

The candidates were required to calculate the compression ratio of an engine and also outline the procedure of starting an engine.

Part (a) of this question was quite well done but the majority of the candidates could only list two steps of starting a single cylinder engine out of the six steps involved in this procedure.

Expected responses

(a) CR = $\frac{\text{Total Volume}}{\text{Clearance volume}}$ where TV = swept volume + clearance volume
$$= \frac{160 + 40}{40} = 5:1$$

(b) Starting a Single Cylinder Engine

- Check the oil level
- Close the choke valve
- Open the fuel tap

Switch on the ignition system
Crank the engine
Open the choke valve once the engine starts.

Question 5

- (a) State **two** types of bearing loads and for each state an area of application in a motor vehicle.
- (b) State **two** reasons for using a muffler in vehicle.

This was a straight forward question calling for knowledge on bearing loads and the function of a muffler in an engine.

Most of the candidates were not conversant with bearing loads and their areas of application. However, part (b), of this question was well done.

Expected responses

- (a) **Bearing Loads** - Radial load which is commonly applicable in the main bearing of a crankshaft.
- Thrust load bearing which is mainly applicable in transmission systems.
- (b) Mufflers are required in engines to reduce the level of exhaust noises and carry away exhaust gases and heat.

Question 8

- (a) Name two types of rims used in each of the following vehicle:
- (i) car;
- (ii) heavy commercial vehicles.
- (b) State the function of each of the following parts of the steering system:
- (i) gear box;
- (ii) track rod;
- (iii) ball joint.

This question required the candidates to name the types of rims used in heavy commercial vehicles. In part (b), the candidates were required to state the function of the main parts of a steering system.

The main weakness displayed by the candidates was failure to distinguish between the rims used in a car and those used in heavy commercial vehicles.

Expected responses

- (a) Rims for cars include pressed steel disc, light alloys and disc centre lock wire while those for commercial vehicles include flat base two-piece rim, flat base three-piece rim, semi-drop centre rim and flat base divided rim.
- (b) In a steering system:
- gearbox converts turning motion to side to side motion
 - track rod transfers pitman arm motion to the tie rods
 - ball joint provides the necessary flexibility to tie rods.

Question 12

Figure 4 shows the layout of a vehicle electrical system.

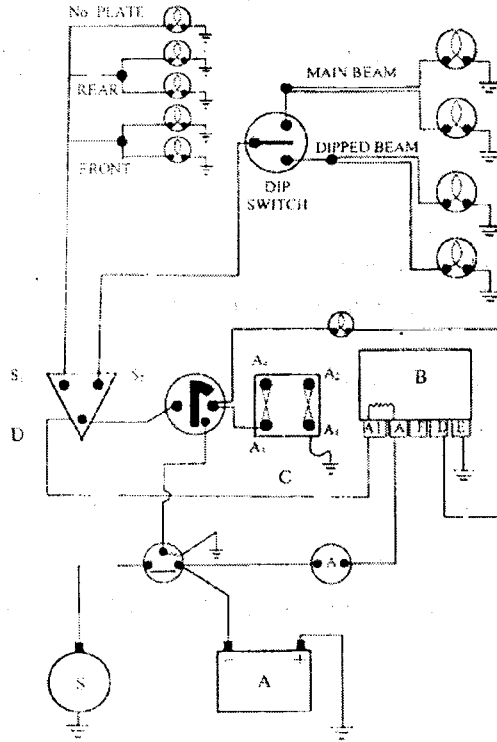


Figure 4 - Lighting Circuits

- Name the parts labeled A, B, C and D.
- State the functions of the parts labeled B and C.
- Explain the operation of the lighting circuit.

The candidates were required to identify some parts of a lighting system, state their function and explain the operation of the lighting system.

Most of the candidates failed to take time to study the diagram and understand that this was a lighting system but not an ignition system. A large number of candidates mistook the diagram for an ignition system and gave a completely wrong answer.

Expected response

- The parts to be named A, B, C and D were battery, control unit, fuse box and lighting switch respectively.
- Control unit regulates current to different electrical circuit while the fuse box houses fuses which protect the circuits from overload.
- When S_1 is switched on, current flows from the battery to the ammeter, terminal A of the control unit and out to the lighting switch D. S_1 controls rear and front lights, number plate and back to earth.

When S_2 is switched on, current flows to the light switch and back to earth. When the lighting switch is not on, at either S_1 or S_2 position, no lighting can take place.

Question 14

Outline the procedure of carrying out each of the following activities and name the tools used in each case:

- checking multicylinder engine cylinder head for warpage;
- measuring cylinder bore taper;
- static timing of the distributor in a spark ignition engine.

This question required the candidates to outline three different procedures on how to check cylinder head warpage, measure cylinder bore and set static timing of a distributor.

Part (a) and (b) were quite well done but most of the candidates were not conversant with static timing of the distributor in a spark ignition engine.

Expected response

(c) Static Timing of Distributor

- Turn the crankshaft until piston 1 is at TDC compression stroke.
- Check to ensure that timing marks on the pulley and the chain cover are aligned.
- Insert the distributor and rotate so that its rotor points to the terminal of cylinder number 1 at the distributor cap.
- Adjust the distributor until the contact breaker points are about to open.
- Tighten the breaker points screws to ensure that the points are securely mounted.
- Tighten the distributor locking device.

20.3 PAPER 2 (447/2)

This was a practical paper in which candidates were required to carry out ten equally weighted exercises. The following activities were included in the exercises:

- Sketching a mechanical drum brake assembly
- Fabricating a bracket which involved cutting, filing, bending and riveting
- Identifying fluids and fastening devices.
- Measuring and determining accuracy of tools
- Performing spark plug and compression tests
- Connecting a lighting circuit
- Replacing a cylinder head gasket
- Taking carburetor float measurements
- Identifying parts and their defects
- Servicing multicylinder engine parts

The chief examiner's report showed that all the exercises except station 4, were well done. This observation was confirmed by the statistics on candidates performance where the overall mean score rose by 6.97 marks from 49.77 in 2008 to 56.74 in 2009. The good performance was attributed mainly to improved tuition.

In exercise 4, the candidates were required to take specific measurements using micrometer, vernier calipers and feeler gauge. Most of the candidates were not able to get the accuracy of vernier calipers and the outside micrometer despite the fact that the information is inscribed on the tool.