20.0 POWER MECHANICS (447)

There was no KCSE examination for Power Mechanics in the years ***2006*** and ***2007.*** When the examination resumed in the year ***2008,*** the format for both ***Paper I (447/1)*** and ***Paper 2 (447/2)*** was still the same as in the previous years.

20.1 CANDIDATES' GENERAL PERFORMANCE

The table below shows the candidates' performance of candidates in both papers for the year 2008. Statistics for the years ***2003, 2004*** and ***2005*** have also been provided for comparison.

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

Year	Paper	Candidature	Maximum Score	Mean Score	Standard Deviation
2003	1	**311**	60	30.42	8.43
	2		40	23.64	4.96
	Overall		**100**	**54.18**	**11.44**
2004	1	**286**	60	33.65	8.08
	2		40	27.57	3.86
	Overall		**100**	**61.22**	**10.00**
2005	1	**213**	60	34.31	8.48
	2		40	27.60	4.57
	Overall		**100**	**61.79**	**11.00**
2008	1	**57**	60	24.28	9.32
	2		40	25.49	6.88
	Overall		**100**	**49.77**	**14.67**

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

20.1.1 The candidature dropped drastically from ***213*** in the year ***2005*** to ***57*** in the year 2008.

20.1.2 The mean score for ***paper 1 (447/1)*** dropped significantly from ***34.31*** in the year ***2005*** to ***24.28*** in the year ***2008***.

20.1.3 There was also a drop in the mean score for ***paper 2 (447/2)*** from ***27.60*** in the year 2005 to ***25.49*** in the year 2008.

20.1.4 The overall mean score for the subject declined by ***12.02*** marks from ***61.79*** in the year ***2005*** to ***49.77*** in the year 2008.

The two year break had a very adverse effect in both enrollment and performance for this subject. It is hoped that in the future performance and enrollment in the subject will improve.

20.2 PAPER 1 (447/1)

The questions which were noted to have been poorly done by candidates in ***paper 1 (447/1)*** will be briefly discussed below. These include ***questions 4, 5, 7, 9, 13*** and ***15***.

Question 4

(a) State **four** characteristics of a good flux.

(b) Give **two** examples of dry lubricant.

Weaknesses

Most of the candidates did not have the background information on what a flux was and its function in joining metals. Similarly, the candidates needed to know what dry lubricants are in order to get the expected responses.

Expected Responses

(a)

- To clean the joint.
- Should form a non-corossive residue.
- Should be fluid at soldering temperature.
- Should easily be displaced by the molten solder.

(b)

- Graphite, Silicon and Molytidenum disulphide.

Question 5

(a) Name parts (a),(b), (c) and (d) of the camlobe shown in figure 2.

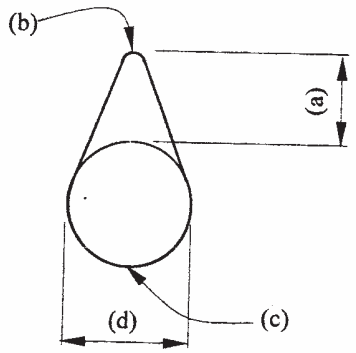

Figure 2

(b) Give **three** advantages of a pressurized water cooling system over thermo-syphon cooling system.

Candidates were required to identify the main parts of a camlobe and also give the advantages of pressurized water cooled system.

Weaknesses

About **60%** of the candidates displayed limited knowledge in camlobe construction and also the operation of a pressurized water cooled system.

Expected Responses

(a) ***Camlobe***
A: Cam Lift.
B: Nose tip apex.
C: Heel.
D: Base diameter.

(b) ***Cooling Systems***

- Positive circulation is faster.

- Less mass of water needed.
- Smaller and lighter radiator required.
- Small bore water pipes used.
- Water level not critical.
- Engine operating temperature more accurate.

Question 7

(a) Give **two** reasons for inclining the kingpin of a vehicle steering system.

(b) State **three** advantages of a rear engine rear wheel drive vehicle over a front engine rear wheel drive vehicle.

Candidates were expected to identify kingpin indination as one of the angles in the steering geometry and explain why it is necessary in the steering system. In part (b) of the question candidates were expected to state the advantages of having an engine at the back of a vehicle.

Weaknesses

About **90%** of the candidates failed to give satisfactory responses to the questions mainly due to lack of adequate knowledge.

Expected Responses

(a) ***Inclining Kingpin***
- Reduces wheel scrub.
- Eases steering effort.
- Reduces road shock.
- Reduces type wear.
- Compliments caster angle.

(b) ***Advantages***
- Excellent traction especially in hill climbing.
- Compact and accessible power transmission assembly.
- Large passenger space.

Question 9

(a) State the operational difference between a single-acting damper and a double-acting damper.

(b) State **three** factors that determine the friction of a surface.

The candidates were required to compare single and double acting dampers and give the operational differences between the two types of dampers. Part (b) of the question was a basic question calling for factors that determine the friction of a surface.

Weaknesses

Although dampers is a simple sub-topic in suspension systems, most candidates did not seem familiar with dampening and how it is achieved.

Expected Responses

(a) ***Single acting dampers*** act in one direction while ***double acting dampers*** are constructed in such a way that they will react to both bump and rebound.

(b)

- Load on the surface.
- Finish of a surface.
- Material of a surface.
- Speed between the surfaces in contact.

Question 13

(a) State **two** advantages and **two** disadvantages of brazing over fusion welding.

(b) Explain **four** possible causes of a bad brazed joint.

(c) Outline the procedure of brazing a joint.

Candidates were required to compare brazing with welding and state the advantages and disadvantages of the former over the latter. More details were required regarding defects in brazing and the actual procedure of brazing.

Weaknesses

The majority of the candidates confused these two distinct operations and presented them as one operation.

Expected Responses

(a) ***Advantages***

- Requires less heat then fusion welding.
- Produces less distorted joint.
- Joints are easier to machine.
- Faster process.

Disadvantages

- Ferrous metals produced a different colour from that of base metal when brazed.
- Strength of joints deteriorates at temperatures above 250° C.

(b)

- Inadequate cleaning of the joint.
- Using wrong or insufficient flux.
- Using wrong welding rod.
- Incorrect welding temperature.

(c)

- Obtain and set the welding equipment, clean the two parts to be joined by removing oxide and dirt.
- Place the two parts on a table. Hold them in position, select the correct filler rod and flux.
- Preheat the two pieces evenly, applying more heat for thicker pieces.
- Heat the metal at weld start, play the torch over this part in a circular motion.
- When metal is red hot, heat rod slightly and stock it into the flux.
- Hold the end of the fluxed rod just ahead of the torch. Apply more heat to the metal until the flux and rod start to flow.
- Machine the finished joint if necessary.

Question 15

Figure 6 shows a cross-section of a fuel injector of a diesel engine.

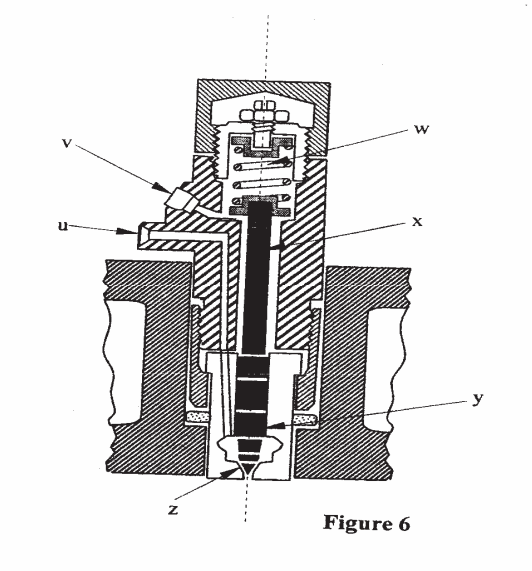

Figure 6

This was a precise question addressing the main parts of a typical fuel injector and how it works.

Weaknesses

Very few candidates attempted this question and those who attempted it performed very poorly. Apparently, the teaching or coverage of this syllabus sub-topic was totally ignored. Teachers should ensure that all the syllabus topics are covered adequately.

Expected Responses

(a)
U: Fuel inlet.
V: Leak of return.
W: Spring.
X: Spindle.
Y: Nozzle.
Z: Seat.

(b)

- When the standing pressure in the delivery pipe and the injector is exceeded by the pressure built up in the chamber of the injection pump, the delivery valve of the pump is forced away from its seat. This higher pressure acts immediately. In the Annular space of the injector, and by acting on the face of the needle value, produces a force which tends to lift the value away from the seat. When this force exceeds that applied to the valve by the spring, the valve moves away from its seat, and atomized fuel is sprayed into the combustion chamber.
- Continued movement of the pump plunger results in uncovering of its spill port and the pressure in the pump chamber collapses. The injector needle returns to it seat by its spring, and the closing of the pump delivery valve by its spring ensures that fuel under pressure just less than that required for injection is trapped in the pipeline and injector body.

20.3 PAPER 2 (447/2)

This practical paper, as in the previous years, was composed of ten (10) equally weighted exercises which were compulsory. The paper test various aspects including the following:

- Related drawing.
- Metal fabrication.
- Precision measurements.
- Changing engine parts.

- Disassembling and assembling components.
- Connecting electric circuits.
- Operating gas welding equipment.
- Simple calculations.

All the exercises were quite well done despite the slight drop in the mean score compared to the previous years. The candidates' performance in a few areas particularly in the use of measuring tools and setting of various gas welding flames require a lot of improvement.