21.0 POWER MECHANICS (447)

In the year 2010, power mechanics was tested in two papers 1(447/1) and paper 2 (447/2) Paper 1 and paper 2 were both theory papers which followed the usual setting format as of the previous years.

21.1 GENERAL CANDIDATES PERFORMANCE

The candidate's performance statistics in the KCSE power mechanics examination since the year 2008 when the syllabus was revised are as shown in the table below.

Table 27: candidates overall performance in the years 2008 to 2010.

Year	Paper	Candidature	Maximum score	Mean score	Standard deviation
2008	1 2 **overall**	**57**	60 40 **100**	24.38 25.49 **49.77**	9.32 6.88 **14.67**
2009	1 2 **overall**	**136**	60 40 **100**	28.88 27.05 **56.74**	9.27 4.15 **12.37**
2010	1 2 **overall**	**159**	60 40 **100**	26.49 26.34 **52.66**	8.67 5.24 **12.81**

From the table it can be observed that:

21.1.1 The candidature increased from 136 in the year 2009 to 159 in the year 2010.
21.1.2 There was a drop in the performance paper 1 from 28.88 in 2009 to 26.49 in 2010.
21.1.3 There was also a drop in the performance paper 2 from 27.05 in 2009 to 26.34 in 2010.
21.1.4 There overall performance of power mechanics dropped significantly from 56.74 to 52.66 in 2010.
The enrollment has continued to increase after the two year break in 2006 and 2007.
The following is a discussion of some of the questions that were poorly done in the two papers.

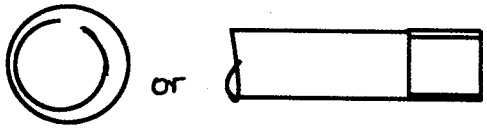
21.2 paper 1 (447/1)

Although Q 10 was poorly done most of the poorly done questions in paper 1were from section B and include 11, 12, 14 and 15.

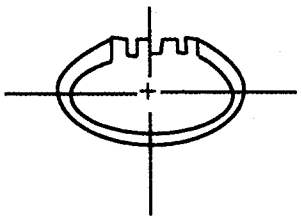
Question 10
Draw the symbols used to represent each of the following machine parts in assembly drawing:
(a) external screw thread;
(b) splined shaft;
(c) cylindrical tension spring.

Candidates were required to draw the symbols used to represent machine parts.
Weakness
Students were unable to draw the symbols properly probably because they did not have background information on the basics of assembly drawing.

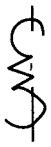
Expected response
(a)



(b)



(c)



Question 11

Figure 1 shows two orthographic views of an object drawn in third angle projection.

On the drawing paper provided, draw an oblique view of the object taking XX as the front face. Indicate **three** leading dimensions. (15 marks)

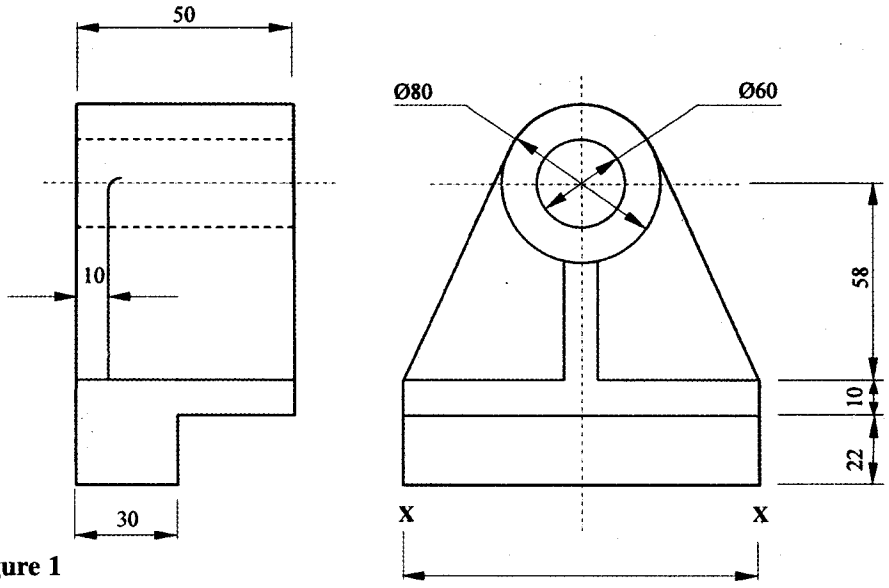


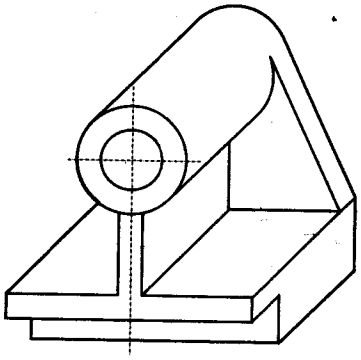
Figure 1

Candidates were required to draw the oblique view give the orthographic views.

Weakness

Most candidates draw the figure in isometric instead of oblique. This is probably due to overemphasis on isometric at the expense of other views such as oblique, pictorial and assembly. This id caused by lack of knowledge on different inclination angles between oblique and isometric.

Expected response



Question 12

(a) State **four** service checks performed on engine valves.

(b) Explain how a radiator is tested for leakage using water.

(c) Outline the procedure of detecting and correcting misfiring spark plug on a running multicylinder engine.

Candidates were required to draw state service checks, explain how a radiator is tested for leakage using water and outline the procedure for correcting misfiring of a sparkplug.

Weakness

Most students did not know the procedures for testing a radiator for leakage and correcting misfiring. This may be caused by limited practical exercises on operational multi-cylinder engines.

Expected response

(a) **SERVICE CHECKS**

Burnt faces
Face wastage
Face pitting
Stem bending
Scoring

Any 4 x ½

(b) **TESTING RADIATOR FOR LEAKS**

Mount radiator in upright position.
Close the lower end
Fill it with water and pressure
Identify and mark leakage points. 4 x1

(c) **DETECTING AND CORRECTING MISFIRING S. PLUG**

- Start the engine and leave it running at idle speed.
- Remove spark plug lead for cylinder number one spark plug and listen to the idling.
- The idling should slow down and get noticeably rougher if that cylinder is firing.
- Repeat the above procedure for each of the three spark plugs.
  The plug that does not five any noticeable change is misfiring.
- Stop the engine and remove this plug.
- Replace the plug with a good one.

- With the engine at idle speed again, remove the plug cable for this new plug and see if there will be a difference in idling. If it is there, then it was the plug that was the cause.

- If the misfiring persists, replace the plug cable with a good one and try to notice the difference.

Question 14

(a) State **three** qualities of effective steering system of a motor vehicle. (3 marks)

(b) Outline **four** preliminary checks carried out before vehicle wheel alignment. (4 marks)

(c) With the aid of a labelled sketch, explain the construction and operation of the rack and pinion steering box. (8 marks)

Candidates were required to express their understanding on the steering system of a motor vehicle and the knowledge of the wheel alignment.

Weakness

Most candidates did not know the preliminary checks on wheel alignment.

Expected response

(a) **EFFECTIVE STEERING SYSTEM**

Being self- centering

Should enable accurate control along the path taken by the vehicle at all times.

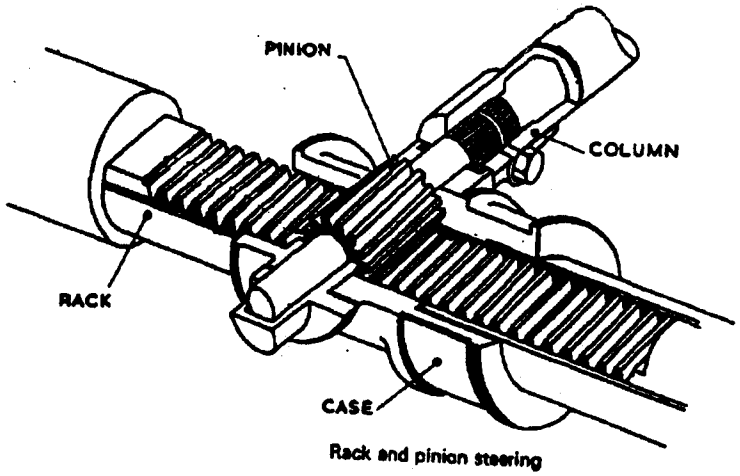
Shouldn't be affected by the action of suspension and braking systems.

(b) **PRELIMINARY CHECKS**

- Kingpins and bushes for excessive wear and lift.
- Ball joints for locking, excessive war and rod lifting.
- Hub bearing for free play and correct adjustment.
- Swivel points of suspension for free movement.
- Steering gear box for excessive wear and being secured.
- Shackles pins and bushes for excessive war and side movement.

Any 4 x 1

(c)



Rack and pinion steering

The rack consists of a cylindrical steel bar which has gear teeth machined on one side.
The steel pinion, which is attached to the lower end of the steering column, is meshed with the teeth of the rack. When the steering wheel is rotated, it causes the rack to move to and fro along its axis.
The ends of the rack are connected to the steering track arms by the short balt jointed tie rod ends. Therefore, its movement causes the wheels to turn through this mechanism.

Question 15

(a) List **three** operational requirements of a propeller shaft. (3 marks)

(b) Outline the procedure of removing, servicing and assembling a propeller shaft of a vehicle. (12 marks)

Candidates were required to list operational requirements of a propeller, outline the procedure of removing, servicing and assembling the propeller shaft of a vehicle.

Weakness
Most candidates could not bring out the operational requirements of the propeller shaft. Many of them missed some steps in the procedure for servicing the propeller shaft.

Expected response

(a) **OPERATIONAL REQUIREMENT FOR PROPELLER SHAFT**
High resistance to misalignment
Torsional stress of hollow shaft
Shouldn't exceed prescribed maximum length
Low resistance to any change in rotational speed.

(b) **REMOVING SERVICING AND INSTALLING PROPELLER SHAFT (PS)**
(i) Carryout visual inspection to identify the problem;
(ii) Place vehicle on stands to access underneath;
(i) Remove PS with universal joints from vehicle;
(ii) Mark matching flange for accurate reinstallation;
(iii) Remove universal joint from the propeller;
(iv) Check the propeller shaft for defects e.g dents and cracks;
(v) Disassemble the universal joints;
(vi) Inspect the bearing cups and rollers for wear;
(vii) Replace worn out parts;
(viii) Assemble the universal joint;
(ix) Reassemble the unity to the vehicle aligning the flange and pinion shaft;
(x) Test for free movement in all directions;
(xi) Remove vehicle from stands.

21.3 paper 2(447/2)

The paper had 10 equally weighted compulsory exercises. It tested competencies in the following areas:
- Related drawing
- Metal fabrication skills.
- Disassembly and assembly of components.
- Servicing procedures
- Parts identification and visual checks.
- Connecting electrical circuits.
- Basic measurements and calculations.
- Static ignition timing.

- Wheel changing.

All the exercises were fairly done despite a slight drop in the mean score. A general weakness was noted in the reading and interpreting of measuring instruments, specifically the vernier caliper and micrometer screw gauge. A number of candidates were quite tense when drilling and require more practice prior to taking examination.