22.0 ELECTRICITY (448)

In the year 2010, Electricity was tested in two papers 1(448/1) and paper 2 (448/2) Paper 1 and paper 2 Paper 1 was a theory paper while Paper 2 was a practical paper which followed the usual setting format as of the previous years.

21.1 GENERAL CANDIDATES PERFORMANCE

The candidate's performance statistics in the KCSE electricity 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**	**48**	60 40 **100**	26.67 21.83 **48.58**	10.78 6.64 **15.29**
2009	1 2 **overall**	**219**	60 40 **100**	35.47 24.08 **59.55**	9.65 5.66 **13.75**
2010	1 2 **overall**	**161**	60 40 **100**	32.96 28.56 **61.52**	9.53 4.33 **12.56**

From the table it can be observed that:

22.1.1 The candidature reduced to 161 in the year 2010 from 219 in the year 2009.
22.1.2 There was a drop in the performance paper 1 from 35.47 in 2009 to 32.96 in 2010.
22.1.3 Paper 2 registered the best mean in the past three years.
22.1.4 There overall performance of electricity improved from 59.55 to 61.52.

The following is a discussion of some of the questions that were poorly done in the two papers.

22.2 PAPER 1 (448/1)

Poor performance in paper 1 was observed in the following questions.

Question 6

(a) A meter movement system is designed to have a full scale deflection of 50 μA. If it is used as an ohmmeter using 1.5v battery, calculate the value of resistance to give full scale deflection.

(1½ marks)

(b) State **three** advantages of digital measuring instruments over analogue measuring instruments.

(1½ marks)

(c) Describe the **two** methods of identifying faults in electrical equipment.

(4 marks)

The question was testing on meter movement calculations, differentiation between digital and analogue instruments as well as electrical faults identification.

Weaknesses

There was general confusion on using the formula for establishing resistance, and conversion of units.

Expected response

(a) $R_T = \frac{V}{If.s.d} = \frac{1.5}{50 \times 10^{-6}} = 0.03xX106 = 31\Omega$

(b) Advantage of digital measuring instrument
High sensitivity
Easy to read
More lagged and robust (withstands rough handling)
No effect from stray magnetism

(c) Identifying Faults
Physical inspection by looking at the circuit components to determine any change in colour, shape, e.t.c.

Circuit analysis – by taking measurements and comparing with what is in the service manual.

Advice to teachers

- Emphasize on the standardization of units for uniformity in computation.
- Remind learners of items like visual inspection of fault finding as a methodology

Question 9

(a) Explain the term "Zener voltage". (2 marks)

(b) Sketch a schematic circuit diagram of a biased PNP transistor connected in the common-emitter mode. (3 marks)

The question called for the knowledge of the term Zener, as well as analysis of a p-n-p transistor circuit in a given configuration mode.

Weaknesses

- Candidates lacked articulation in the explanation of Zener voltage.
- Many confused the transistor configuration mode.

Expected response

(a) Zener voltage
This is the point at which the zener diode breaks down when connected in reverse bias.
The voltage remains almost constant as the load current varies

(b) PNP Transistor

Advice to teachers

There is need to cover the syllabus fully with emphasis on all terms.

Question 11

Figure 4 shows the isometric view of a towing hook.
Draw, FULL size, in first angle projection:

(a) front elevation in the direction of arrow A;

(b) end elevation in the direction of arrow B. (12 marks)

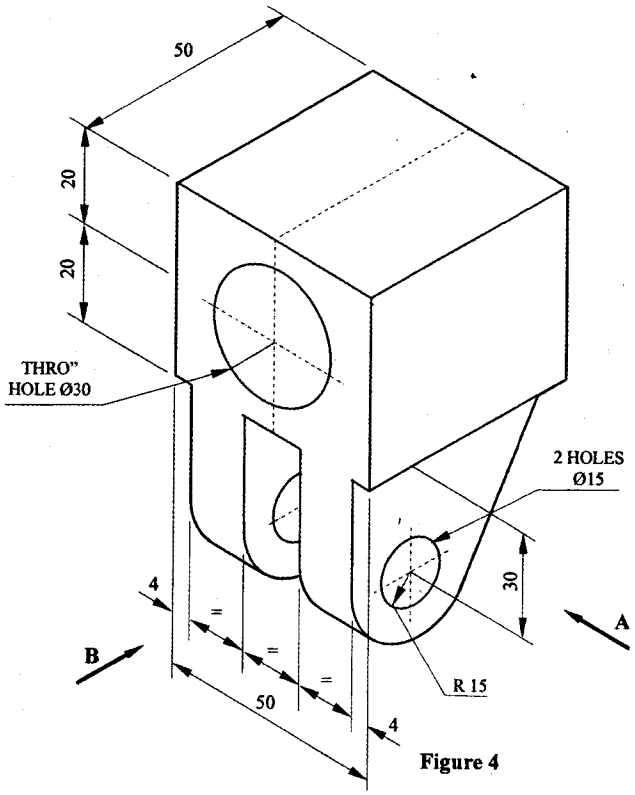
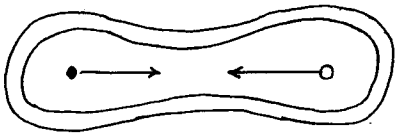


Figure 4

The question called for real interpretation of the isometric drawing, and analysis to get the front elevation and end elevation. Inclusion of all features including hidden details was necessary.
There was need to place the views in conformity with the 1st angle projection.

Weaknesses
Candidates confused basic terms like proper placement of views in the 1st angle projection.
Many omitted the hidden details due to lack of proper tuition.

Expected response



Advice to teachers
There is need to cover the syllabus fully with emphasis on all angles of projection

Question 12

(a) State **two** differences in construction between power transistor and general purpose transistor. (2 marks)

(b) Explain the meaning of each of the following transistor ratios;

(i) dc alpha;

(ii) ac beta. (4 marks)

(c) Figure 5 shows an amplifier circuit whose current gain is 100.

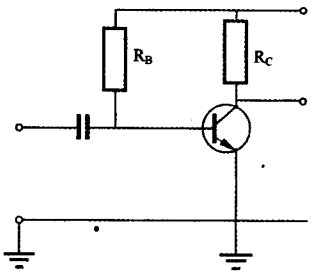


Figure 5

If VCE is 10v, VBE is 0.7v and IC is 10mA, calculate the value of:

(i) R_B;
(ii) R_C. (6 marks)

Weaknesses

Candidates confused dc-alpha and ac-beta. Most were unable to calculate the required values. Many were unable to apply the concepts.

Expected response

(a) Transistor
Power transistors are larger in size and usually have a heat sinks.

(b) Transistor ratio
DC ALPHA is the ratio of the emitter current to the collector current in a dc circuit.

AC BETA is the ac current gained in a common emitter amplifier. It is the ratio of the change in the output (collector) current to the change in the input (base) current.

(c)

$$\beta = \frac{IC}{IB} \Rightarrow 100 = \frac{10mA}{IB}$$

$$\therefore IB = \frac{10mA}{100} = 0.0001mA \text{ or } 100\mu A$$

From the diagram:
$V_{CC} = I_B R_B + V_{BE}$ $20V = I_B R_B + 0.7V$
$I_B R_B = (20 - 0.7) = 19.3V$

$$RB = \frac{19.3}{IB} = \frac{19.3}{100\mu A} = 193k\Omega$$

$$I_c R_c = V_{cc} - V_{CE}$$

$$RC = \frac{V_{CC} - V_{CE}}{I}$$

$$= \left(\frac{20 - 10}{0.01A}\right) = \frac{10}{0.01} = 1K\Omega$$

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Advice to teachers

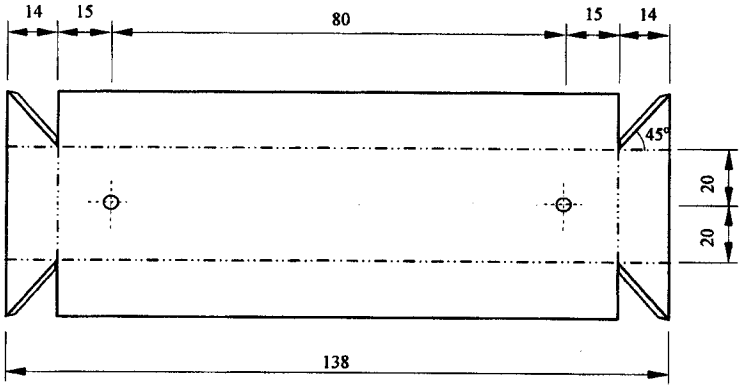
There is need to cover transistors' fully on operational concepts as required by the syllabus.

22.3 PAPER 2 (448/2)

Question 2

Using the materials, tools and equipment provided, make the model of a fluorescent lamp rain guard as shown in figure 2.

(20 marks)



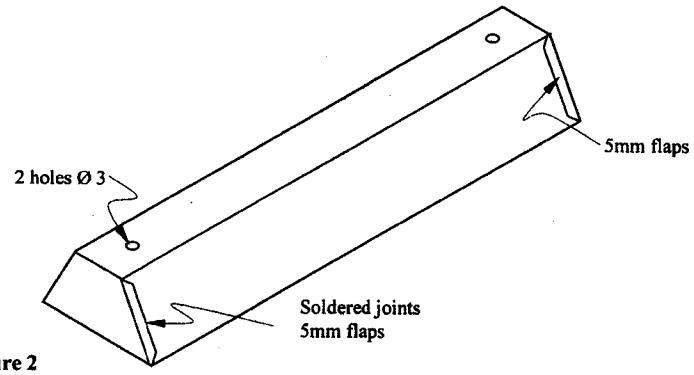


Figure 2

The question tested fabrication of metalwork, a component of electricity in the syllabus to help candidates make electrical undertakings.

The skills tested in the project were to enable the candidates to come up with the rain guard for a fluorescent tube.

Weaknesses

Most candidates were not able to make the complete rain guard.

Expected response

Candicates were expected to perform the following operations:

- Marking
- Cutting
- Folding/bending
- Locating holes
- Driling holes
- Creating flaps
- Soldering
- Deburring

All these skills done on the project were to enable the candidates to come up with a finished product of the rain guard for a flourescent tube.

Advice to teachers

There is need to improve on the teaching of metal fabrication as they form part of electrical undertaking. Candidates should be guided on the time requirements of the project work.

Question 5

Figure 5 shows the layout of a power final circuit. Using PVC sheathed wiring system, install the circuit such that the sockets are connected in radial. (20 marks)

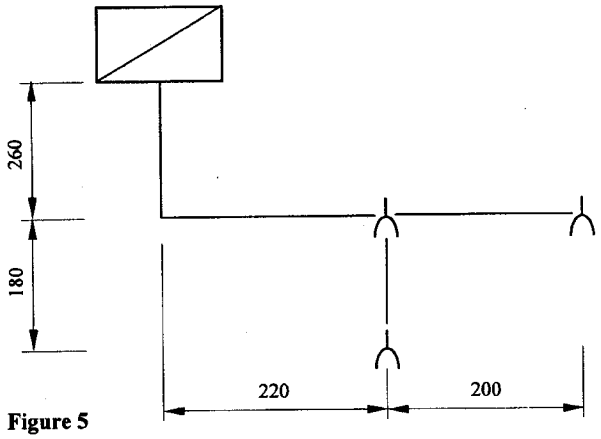


Figure 5

Weaknesses

Candidates were too slow though they knew the tasks.

Expected response

- Measuring and marking points to locate components
- Fixing components firm and level
- Fixing the sheathed cable (horizontal and vertical)
- Firm fixing of cables using appropriate clips
- Terminating wires appropriately (firm and correct colour coding)
- Testing of the wiring system functionality.

Advice to teachers

Teachers should let learners develop speed in their practical work.
The use of unfamiliar tools and equipment during examinations should be avoided. Learners should be exposed to the tools in good time.