21.0 ELECTRICITY (448)

As in the previous years, the 2009 KCSE examination in Electricity comprised two papers namely theory and practical papers.

21.1 CANDIDATES' OVERALL PERFORMANCE

The performance of the candidates in Electricity is shown in the table below. The candidates' performance in **2005** and **2008** is also given for comparison.

Table 26: Candidates' Overall Performance in Electricity for the Years, 2009, 2008 and 2005

Year	Paper	Candidature	Max. Score	Mean Score	Standard Deviation
	1		60	36.77	9.76
	2		40	25.43	4.37
2005	**Overall**	**443**	**100**	**62.20**	**12.00**
	1		60	26.67	10.78
	2		40	21.83	6.64
2008	**Overall**	**48**	**100**	**48.53**	**15.29**
	1		60	35.47	9.65
	2	**219**	40	24.08	5.66
2009	**Overall**		**100**	**59.55**	**13.75**

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

21.1.1 The candidature rose remarkably from **48 in 2008** to **219** in **2009**.

21.1.2 There was an improvement in the mean score for both papers resulting in the overall mean score rising from **48.53** in **2008** to **59.55** in **2009**.

21.1.3 The standard deviation however, went down slightly in both papers.

Despite the general improvement in **2009**, poor performance was observed in questions **3, 4, 11, 13 and 15** in **Paper 1** and exercises **1, 2** and **5** in **paper 2** as highlighted below.

21.2 PAPER 1 (448/1)

Question 3

(a) Name four types of capacitors

(b) Two capacitors having capacitance of 6 μ and 4 μ are connected in series across a 200V dc supply.

Calculate the:

(i) voltage across each capacitor;

(ii) charge on each capacitor.

This question called for knowledge in capacitors and their manipulations in circuit design. Most of the candidates failed to see the significance of connecting the capacitors in series and take that into consideration when doing the calculations required. However, in part (a) of the question, the candidates were able to list various types of capacitors.

Expected response

(a) Types of Capacitors

- Air capacitor
- Paper

- Mica
- Electrolytic
- Tantalum

(b) (i) $V_1 = 200 \times \frac{4}{4+6} = 80V$

$V_2 = 200 - 80 = 120V$

(ii) Charge is the same on each capacitor

$Q = CV = 6 \times 10^{-6} \times 80 = 0.00048C$

Question 4

(a) Name two types of secondary cells.

(b) Six cells each of emf 1.5V and internal resistance of 1.2Ω are connected In parallel to supply a load of 10 Ω. Calculate the current through the load.

The candidates were required to do calculations involving the dry cells in part (b) and in (a) they were expected to name types of secondary cells.

The main weakness displayed by most candidates who attempted this question was failure to include the internal resistance in their calculations. They should have realized that in order to get the total circuit resistance the total internal resistance had to be worked out.

Expected Response

The total emf = 1.5V

Total internal resistance $= \frac{V}{R} = \frac{1.2}{6} = 0.2\Omega$

∴Totalcircuit resistance = R+r =10+0.2=10.2 Ω

Question 11

(a) With the aid of a labelled diagram, explain the operation of a single Phase transformer.

(b) 1 200 KVA, 11000v/240v 5Hz single phase transformer has 600 turns on the primary side. Calculate:

(i) the primary and secondary currents;

(ii) the number of secondary turns.

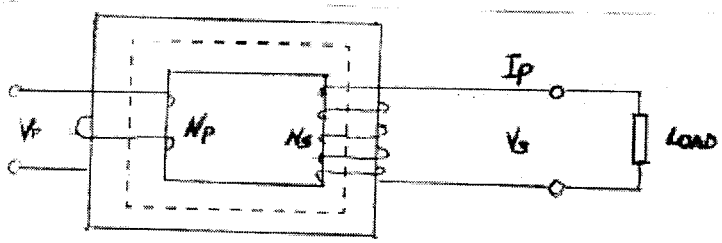
This question tested the candidates' knowledge on operation of a single phase transformer and the ability to do calculations related to the transformer.

Most of the sketches presented in part (a) did not show distinctly the difference in number of turns between the primary and secondary windings. Correct labelling of the sketch was also lacking in most of the answers presented. The explanation for operation of the transformer should have been systematic and complete.

In part (b) of the question, some candidates could not come up with the required calculations mainly because of poor tuition.

Expected Response

11. (a)



Vs & Vp = primary and secondary voltages.
Np & Ns = primary and secondary windings
The supply voltage will circulate on alternating magnetic flux in the core.
This flux will link with secondary winding to induce emf.
The induced emf will depend on the number of turns in the secondary windings as well as rate of change of magnetic flux.

The winding turns (N) and terminal voltage can be expressed as $\frac{Vp}{Vs} = \frac{Np}{Ns}$

(b) (i) $200000 = Vplp = Vsls$

$Ip = \frac{200000}{11000} = 18.18A$

(ii) $\frac{Vp}{Vs} = \frac{Np}{Ns}$. $Ns = \frac{Np \times Vp}{Vp} = \frac{600 \times 240}{11000} = 13$ turns

Question 13

(a) List **three** metal parts that are exempted from earthing in a domestic installation.
(b) Give **three** reasons why a verification of polarity test is carried out in a completed Domestic installation.
(c) Draw a line diagram of a national grid system showing typical voltages at each stage

This question on domestic installation required the candidates to explain why verification of polarity test is necessary, state the parts that are exempted from earthing and draw a typical national grid system.

The listing of parts that are exempted from earthing in a domestic installation was very well done. However, most of the candidates failed to give three reasons why verification of polarity test is required in a newly completed domestic installation. The required diagram in part (c) of this question also lacked accuracy and completeness.

(a) Parts Not Earthed

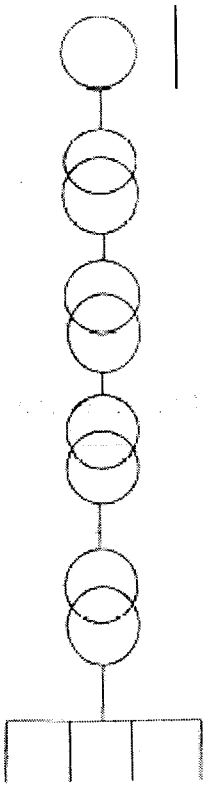
Metal clips
Metal caps for lamps
Metal chains for suspending fittings
Catenary wire

(b) Polarity Test

Done to establish that

(i) All fuses and switches are connected to live conductors only.
(ii) Socket outlets have the live conductor connected to the terminals marked L Neutral to N and earth to E.
(iii) The centre contact of bayonet and Edison screw lamp holder have their outer contacts connected to earth conductors.

(c)



11KV generation

66KV secondary transmission

66KV secondary transmission

33KV h.v. distribution

11KV

415v / 240v *utilization*

Question 15

(a) Draw a labelled circuit diagram of a PNP transistor amplifier in Common base configurations.

(b) Table 1 below shows a bill of materials used to construct a stabilized dc supply.

No	Description of material	Quantity
1	Double pole switch	1
2	Double wound transformer	1
3	Rectifier diodes	4
4	Electrolytic capacitor	1
5	Carbon resistors	1
6	Zener diode	1
7	Connecting wires	several

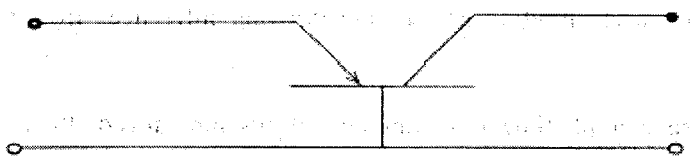
Draw a circuit diagram of the power supply.

A circuit diagram of a PNP transistor was required in part (a) while in part (b) of this question, the candidates were required to come up with a circuit from a given bill of materials.

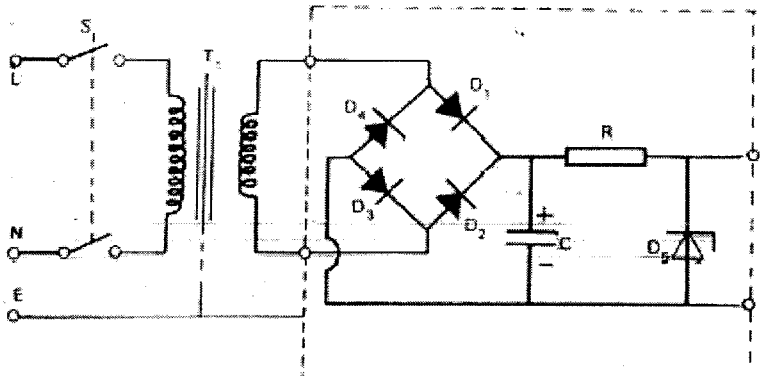
In part (a), most of the candidates had difficulties in identifying correctly the PNP and giving the correct common configuration. In part (b), majority of the candidates could not draw a complete circuit diagram with all the components included in the circuit. A few candidates also used the wrong symbols for various components.

Expected Responses

(a) PNP TRANSISTOR AMPLIFIER



(b)



21.3 PAPER 2 (448/2)

Some very good performance in this paper was reported by the chief examiner attributing it to improved tuition. However, relative poor performance was reported particularly in question **1, 2** and **5** where the following skills were tested.

- Connecting various components to complete a circuit
- Measuring current in a circuit with various resistors
- Determining the relationship between total circuit current and the branch current
- Fabricating a sheet metal object from a given drawing.
- Installing a circuit using common house wiring components.

Weaknesses

The following were noted as the main weaknesses displayed by the candidates in this practical paper:

- Inability to fabricate a sheet metal article using basic metalwork tools.
- Failure to connect various components to complete a given circuit and take the necessary measurements.
- Inability to read various measuring instruments accurately.
- Lack of the required speed and accuracy in completing house wiring exercise.

ADVICE TO TEACHERS AND STUDENTS

- Teachers are advised to ensure that the entire syllabus is covered adequately and that the students should be exposed to all the practical activities in the syllabus.

- Students should take time to read and understand the instructions given in each exercise before they start carrying out the activities.
- Students should be accurate when taking measurements using instruments such as voltmeter onmmeter, micrometer etc. Accuracy is also required when plotting graphs and drawing inferences from the data obtained.
- Teachers should ensure that their students have ample time to manipulate various apparatus on their own.
- Teachers should also ensure that related topics like drawing and metal fabrication are covered adequately.