

3.6 ELECTRICITY (448)

In the year 2019, Electricity examination comprised of two papers; paper 1 (448/1) and paper 2 (448/2). Paper 1 tested theory while paper 2 tested practical skills. The papers constituted 60% and 40% of the final mark respectively. Both papers followed the usual setting format as those of the previous years.

General Candidates Performance

The table below shows candidates' overall performance in the KCSE electricity examination since the year 2014.

Table 13: Candidates' overall performance in the last six years

Year	Paper	Candidature	Maximum Score	Mean Score	Standard Deviation
2014	1		60	41.31	9.05
	2		40	27.98	3.65
	Overall	189	100	69.30	11.5
2015	1		60	38.00	7.55
	2		40	29.24	3.03
	Overall	209	100	67.06	9.85
2016	1		60	38.55	69.62
	2		40	26.6	5.04
	Overall	215	100	65.14	12.87
2017	1		60	32.02	9.89
	2		40	31.52	3.99
	Overall	227	100	63.53	12.31
2018	1		60	37.14	10.91
	2		40	27.32	4.64
	Overall	244	100	64.46	13.93
2019	1		60	36.42	9.98
	2		40	30.77	3.47
	Overall	274	100	67.19	11.85

From the table it is clear that:

- The candidature increased from 244 in the year 2018 to 274 in the year 2019.
- The mean score increased from 64.46% in the year 2018 to 67.19% in the year 2019.
- The standard deviation decreased from 13.93 in 2018 to 11.85 in 2019.

3.6 Electricity Paper 1 (448/1)

The questions which were reported to have been poorly responded to are analyzed with a view to pointing out candidates' weaknesses and propose suggestions on some remedial measures that need to be taken in order to improve performance in future. The questions for discussions include 5, 9, 12, and 13.

Question 5

Make a free hand oblique drawing of a conduit switch box.

(3 marks)

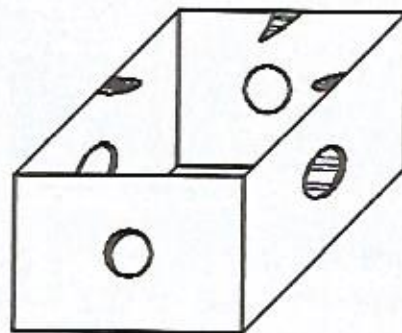
Weaknesses

Drawing in oblique was problematic to most candidates.

Advice to Teachers

Teach related drawing holistically. Let the candidates do enough practise in technical drawing.

Expected response



Correct sketch - 1
 Oblique - 1
 Proportionality - $\frac{1}{3}$

Question 9

- (a) (i) Draw the sketches of magnetic field around two parallel conductors carrying current in the opposite directions. (2 marks)
- (ii) State what happens between the two conductors in a (i) above. (1 mark)

Weaknesses

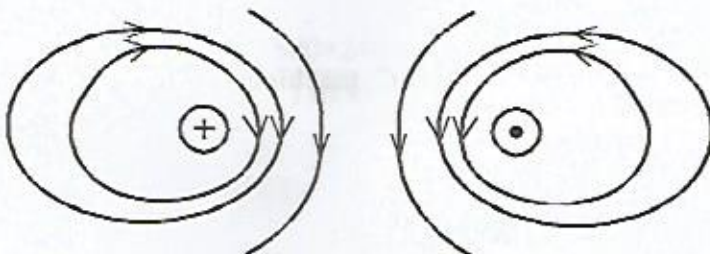
Most candidates had a problem in making the drawing and inferring the behavior.

Advice to Teachers

Teachers to improve tuition.

Expected response

- (i) Field produced by two parallel conductors



Sketches 2 x 1 = 2 x 1 marks
 Explanation - $\frac{1}{3}$ mark
 3 marks

- (ii) Flux lines around the two conductors carrying current in the opposite direction *repel each other*. (1)

Question 12

- (a) List **two** accessories used in PVC conduit installation and in each case state their function. (2 marks)
- (b) State **two** possible causes for a fluorescent lamp **not** to start. (2 marks)
- (c) (i) Outline **four** IEE regulations requirements regarding 13A socket outlets. (4 marks)

Weaknesses

Candidates had a challenge in identifying the accessories, causes for a fluorescent lamp not to start and outlining the IEE regulations.

Advice to Teachers

Teachers are advised to improve tuition on IEE socket regulation.

Expected response

- (a) Coupler: (1/2) - Used to connect two conduits together. (1/2)
Circular boxes (1/2) – enable many outlet way connections to be made. (1/2)
Saddles (1/2) – securing the conduit to surface during installation. (1/2)
Elbow joint bend (1/2) – to enable 90° bend to be made. (1/2)
- (b) **Faulty fluorescent fitting**
Lamp does not light at all
- Faulty starter switch.
 - No power supply.
 - Broken tube electrodes.
 - Broken wires in the circuit.
 - Burn out tube.
- Any 2 x 1 =2
- (c) (i) IEE Regulation
- The rating of fuse or circuit breaker should be 30 A.
 - Maximum floor area should be 100 m².
 - Standard 13 A socket outlets should not be installed inside a bathroom.
 - The total number of spurs on stationery appliances shall not exceed the total number of socket outlets.
- Any 4 x 1 =4

Question 13

- (a) Describe the construction of the following parts of a D.C. machine:
- (i) Yoke
 - (ii) Poles
- (4 marks)

- (b) A 100KVA, 11 KV/240 V single phase transformer has 800 turns on the primary side. Calculate the:
- Primary current
 - Number of secondary turns (6 marks)
- (c) State **three** IEE regulations regarding bell transformers. (3 marks)

Weaknesses

The candidates had a challenge in identifying the DC construction parts. Performing calculations for a single phase transformer with stated parameters was a problem. They had a challenge in identifying IEE regulations relating to bell transformers.

Advice to Teacher

Teachers to teach IEE regulations well. Candidates should be advised to do more practice in identifying parts of machines and related calculations.

Expected response

(a) Parts of a DC machine.

- Yoke
 - Consists of the external frame (1) it forms part of the field magnetic circuit.
 - It is made of mild steel casing (1) or cast steel construction.
- Poles
 - They designed to produce the maximum flux in cores slots; each pole assembly is made up of a pole core circular or (1) rectangular threaded to a field coil.

The core is bolted to the yoke and has an extension consisting of pole shoe. (1).

(b) (i) $kVA = I_1 V_1 = I_2 V_2$
 (1) (1)

$$\frac{100,000}{110,000} = I_1 = 9.09A \quad (1)$$

(ii) $\frac{V_1}{V_2} = \frac{N_1}{N_2}$
 (1) (1)

$$N_2 = \frac{N_1 \times V_2}{V_1} = \frac{800 \times 240}{11000} = 17 \text{ turns} \quad (1)$$

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(c) IEE Regulations

- Transformer must be double wound.
- The core of transformer (metal case at one point of the secondary must be earthed).
- The transformer must be connected to a separate sub-circuit.
- Cables used to supply the transformer must be of suitable grade.

Any 3 x 1 = 3

3.6.2 Electricity Paper 2 (448/2)

The items were all derived from the syllabus. The paper was well balanced in terms of skills being tested, difficult versus easy questions, syllabus coverage, length of questions and adequacy of time allocated for the paper.

The exercises which were reported to have been responded to with a difficulty are analyzed to point out candidates' weaknesses and suggest some remedies that need to be taken in order to improve performance in future. The exercises for discussions include 2 and 5.

EXERCISE 1

- (a) Using the materials and equipment provided, connect the circuit shown in **Figure 1** on a bread board. (3 marks)

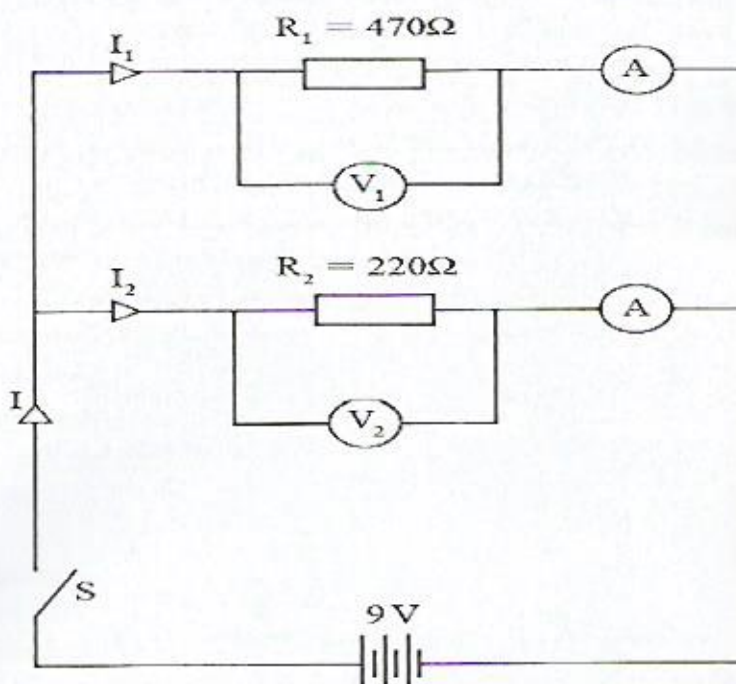


Figure 1

Let the examiner check your work.

Weaknesses

Not all the candidates were able to correctly use the breadboard.

Advice to teachers

Teachers should advise candidates to continually practice use of breadboard to ease connections.

EXERCISE 2

Use the tools and materials provided to fabricate the electronic components tray shown in

Figure 3.

(20 marks)

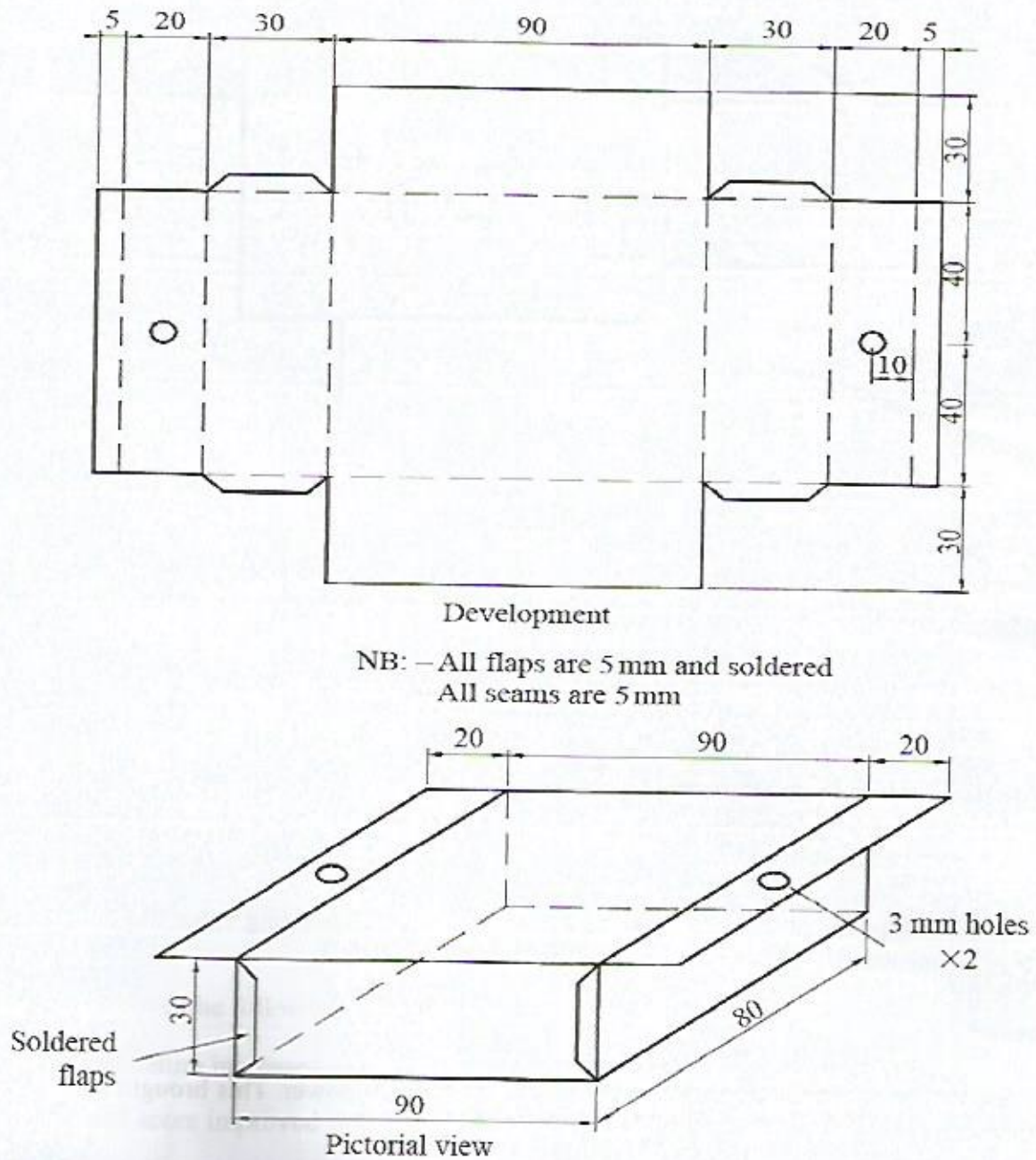


Figure 3

Weaknesses

Speed to finish the task was wanting.

Advice to teachers

Teachers to train the learners to improve on speed during practice of fabrication.

EXERCISE 4

Figure 4 shows a block diagram of the electronics circuit board provided.

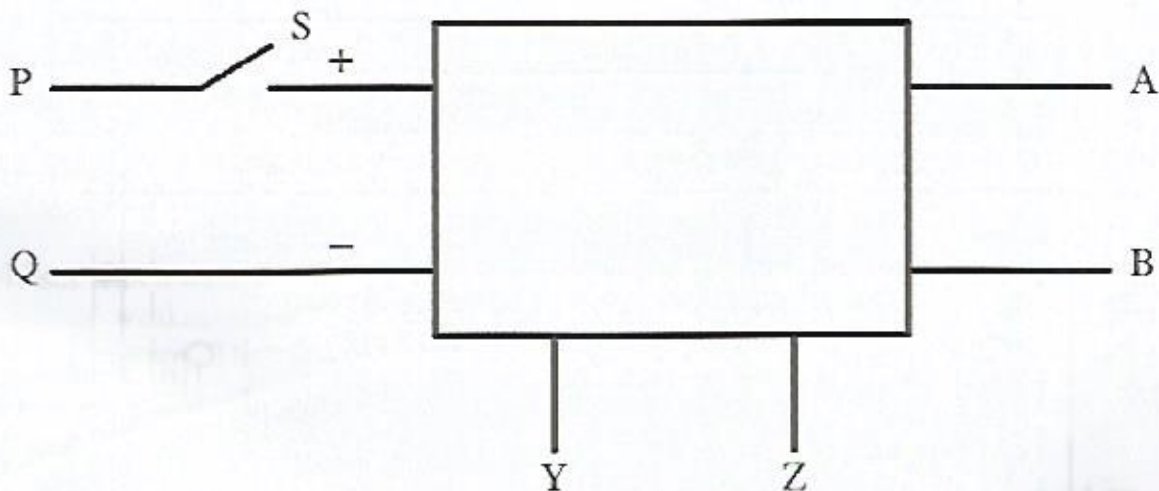


Figure 4

Perform the following tasks:

(a) With switch S open, connect the circuit to the equipment as follows:

- (i) P and Q to 9 volts D.C. power supply.
- (ii) A and B to a voltmeter.
- (iii) Y and Z to an ammeter.

(3 marks)

Let the examiner check your work.

(b) (i) Adjust the potentiometer and for each of the corresponding value of voltage measured; measure and record the current in **Table 3**.

Weaknesses

Candidates had loose terminations as the circuit is connected to power. This brought some challenge in some cases.

Advice to teachers

Teachers to train the learners to be more vigilant in circuit terminations.