3.4 PHYSICS (232)

The KCSE physics syllabus was tested in two theory papers (232/1 and 232/2) and one practical paper (232/3).

3.4.1 General Candidates' Performance

The candidate's performance statistics in the KCSE physics examination for the last seven years are as shown in the table below.

Table 13: Candidates' overall performance in the years 2016 to 2022

Year	Paper	Candidature	Maximum score	Mean score	Standard deviation
2016	1		80	32.49	19.3
	2		80	29.91	19.19
	3		40	17.15	6.56
	overall	**149,790**	**200**	**79.53**	**42.40**
2017	1		80	24.57	15.82
	2		80	26.22	18.22
	3		40	19.33	8.33
	overall	**160,182**	**200**	**70.09**	**39.59**
2018	1		80	22.98	14.87
	2		80	22.13	14.15
	3		40	19.43	8.5
	overall	**172,676**	**200**	**68.54**	**35.31**
2019	1		80	25.63	13.83
	2		80	20.43	14.28
	3		40	19.13	7.98
	overall	**184,559**	**200**	**65.18**	**33.96**
2020	1		80	21.58	12.96
	2		80	25.93	15.89
	3		40	23.55	9.04
	overall	**217,126**	**200**	**71.03**	**35.03**
2021	1		80	21.12	16.28
	2		80	17.59	11.21
	3		40	21.00	08.29
	overall	**253,963**	**200**	**59.39**	**33.00**
2022	1		80	22.42	17.23
	2		80	21.69	15.71
	3		40	22.01	08.57
	overall	**276,296**	**200**	**66.12**	**38.69**

The chart below shows a summary of the trend in Physics for the last seven years.

From the table and chart, it can be observed that:

(i) The candidature increased to 276296 in 2021 from 253,963 in 2020. This was an increase of 22,333 candidates (8.79 %).

(ii) There was an improved in the performance of Physics in all the three papers with the overall performance improving to a mean of **66.12** in 2022 as compared to **59.39** in 2021.

(iii) The standard deviation in all the Physics papers remains near normal. This shows proper discrimination between the high and low achievers.

An analysis of the student's responses revealed that there is still lack of knowledge on comparative words that show the differences in the physical characteristics or behavior of materials. Application of the knowledge in the new tasks is challenging most candidates.

The following is a discussion of some of the questions in which candidates performed poorly.

3.4.1 Physics Paper 1 (232/1)

Question 8

Figure 3 shows a set up in which a spring with a pointer is attached to a wooden strip that has a hanging hook. A graph paper is fixed along the strip to be used to calibrate the spring

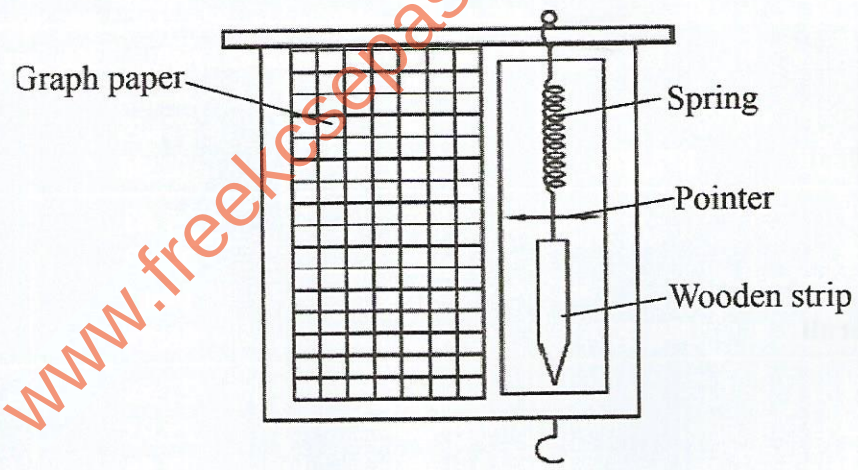


Figure 3

A mass of 100 g is provided. Explain how the spring balance can be calibrated. (3 marks)

Candidates were expected to use the graph grid to calibrate the spring by getting the 0 N point and the 1 N point then count the number of units between appropriately.

Weakness

Many learners failed to show the determination of the minimum and maximum points and further subdivision to obtain the scale. They failed to relate the grid provided to the mm scale.

Expected response

8. - With no mass on the hook, mark the pointer position on the graph paper as O g or 0 N mark.√
   - Suspend the 100 g mass on the hook and mark the pointer position on the graph paper as the 100 g or I N mark.√
   - Count the number of divisions between the 0 g mark and the 100 g mark, divide and label equal divisions accordingly /appropriately.√

3 marks

Question 18

18. (a) A weighing balance placed on the floor of a lift is used to measure the weight of abody of mass 80 kg. Determine the reading on the balance when the lift moves upwards: (acceleration due to gravity g is 10ms –2)

(i) with uniform velocity (3 marks)

(ii) with an acceleration of 3ms –2 (3 marks)

(b) Explain why a person standing on a boat is likely to fall into the water when attempting to jump to the shore. (3 marks)

(c) A box is moved 30m along a surface whose frictional force is 1000N with uniform velocity. Determine the work done against friction. (2 marks)

Candidates were required to determine the weight of a body in a lift in when moving upwards, use Newton's laws 3rd law of motion to explain reaction when a person jumps off the boat and determine the work done against friction when a box is moved along a surface.

Weakness

Many candidates were unable to relate the forces, many failed to show understanding of zero acceleration when a body has uniform velocity. Many failed to see action and reaction as one jumps off the boat, failed to realize the role of friction in backward motion and some used wrong units for the work done.

Expected response

18. (a)	(i) At uniform velocity, W = mg √ W = 80 × 10 √ = 800 *N* √	3
	(ii) The reaction R = w + ma √ = (80 × 10) + (80× 3) √ = 1040 N √	3

(b)	On attempting to jump the person exerts a backward force on the boat which √ exerts an equal forward force on the person because of the low friction between the boat and water, the boat moves backwards √ hence reduces the forward force on the person.√	3
(c)	$W = F \times d$ √ $= 1000 \times 30$ $= 30000\ J$ √	2

3.4.3 Physics Paper 2 (232/2)

Question 10

10. During an experiment to investigate the relationship between the angle of incidence i, and angle of refraction r for a ray of light travelling from air to glass, the values of sin i and sin r were determined.

(a) On the axes provided, sketch the graph of sin i against sin r for the values that were obtained. (1 mark)

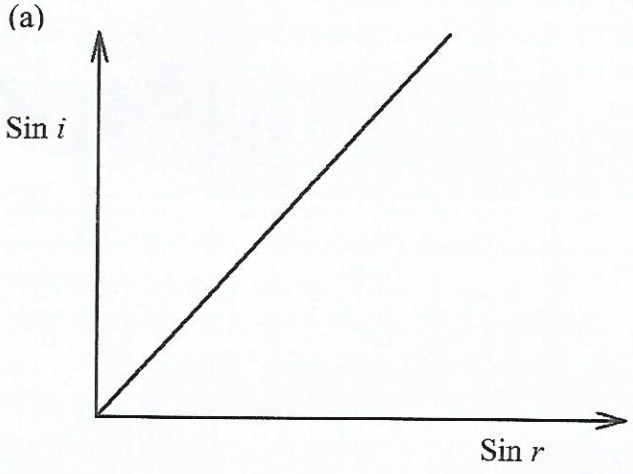
(b) State how the refractive index of the glass can be obtained from the graph. (1 mark)

Candidates were required to use Snell's law to interpret the graph relationship between sin *i* and sin *r*.

Weakness

Some candidates used free hand to draw the straight-line graph, while others drew lines with negative gradient. Graphical analysis remains a great challenge to many students.

Expected response

10.	(a)  	(1 mark)
	(b) By obtaining the gradient of the graph $n = \frac{\Delta \sin i}{\Delta \sin r}$ √	(1 mark)

Question15

15. (a) State the function of the ring main circuit in a domestic wiring system. (1 mark)

(b) Figure 6 shows a circuit consisting of switches S1, S2, S3 and three identical lamps L1, L2 and L3 connected to the mains supply through a fuse.

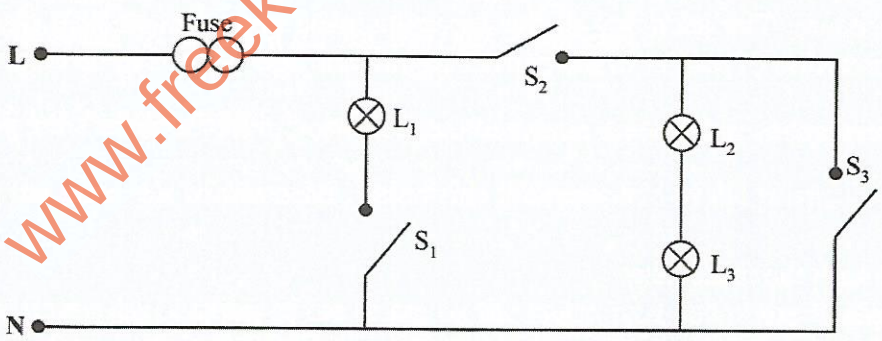


Figure 6

(i) Identify two faults in the circuit. (2 marks)

(ii) State the reasons for the answers in 15(b)(i). (2 marks)

(iii) Describe how the brightness of lamps L1, L2 and L3 compare when the switches S1 and S2 are closed. (2 marks)

(iv) Explain the answer in 15(b)(iii). (2 marks)

Candidates were required to explain the domestic wiring system.

Weakness

Many candidates showed confusion between the mains supply and the main ring circuit. Very many candidates were not able to identify the faults in the circuit. A number failed to explain how the lights wired in series behave when the switch is closed.

Expected response

15.	(a) Supplies current √ to the sockets.	(1 mark)
	(b) (i) - S_1 is connected √ to the neutral - S_3 is not necessary √ - L_2 and L_3 are in series	(2 marks)
	(ii) - Switch S_1 should be √ in live wire (Lamp is still live even with the switch open) - S_3 will short √ circuit the mains supply. - L_2 and L_3 should be connected in parallel.	(2 marks)
	(iii) L_1 is brighter than √ L_2 and L_3 L_2 and L_3 have same √ brightness	(2 marks)
	(iv) L_1 is on full √ voltage from the mains while L_2 and L_3 share the voltage from √ the mains.	(2 marks)

3.4.4 Physics Paper 3 (232/3)

In this practical paper many candidates displayed knowledge of the apparatus and mastery of experimental procedure. The accuracy of the apparatus used continues to be a challenge for many candidates. Interpretation of results in the correct significant figures need to be emphasized.

However, from the responses that were analyzed the following practical tasks were poorly performed.

Question 2

You are provided with the following:
– A piece of thread
– A metre rule
– A triangular glass prism
– A 50 g mass
– A boss, a clamp and a stand
– Some water in a beaker
– Some tissue paper
– Liquid L
– An ammeter
– A voltmeter
– A wire labelled P
– A wire labelled Q
– A switch
– Two dry cells
– 9 connecting wires

– A wire mounted on a metre rule labelled AB
– A centre zero galvanometer
– A jockey

Proceed as follows:

PART A

(a) Using a piece of thread, a clamp and a stand, suspend the metre rule so that it balances horizontally about its centre of gravity.

(b) On the metre rule, suspend the glass prism at the 70cm mark and the 50g mass at a distance Xcm from the Centre of Gravity (CoG) so that the metre rule balances horizontally as shown in **Figure 2.**

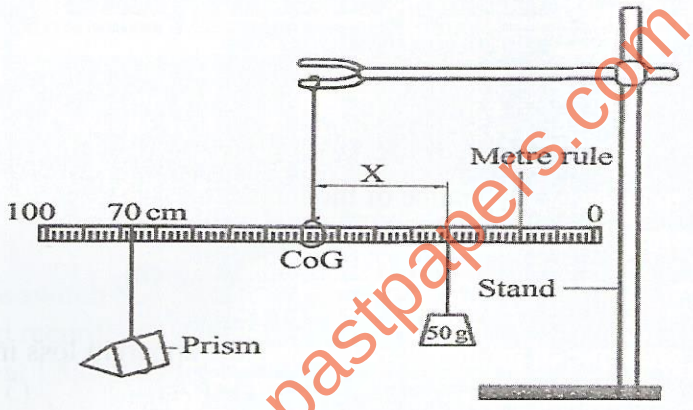


Figure 2

Maintain the prism at the 70cm mark throughout the experiment

(i) Record the balance length X.
X 5 ..... cm (1 mark)

(ii) Using the principle of moments, determine the mass Mo of the prism.
(3 marks)

(c) While maintaining the position of the prism on the metre rule, lower the clamp to adjust the height of the prism until it is fully submerged in water as shown in **Figure 3.** Ensure that the prism does not touch the sides of the beaker.

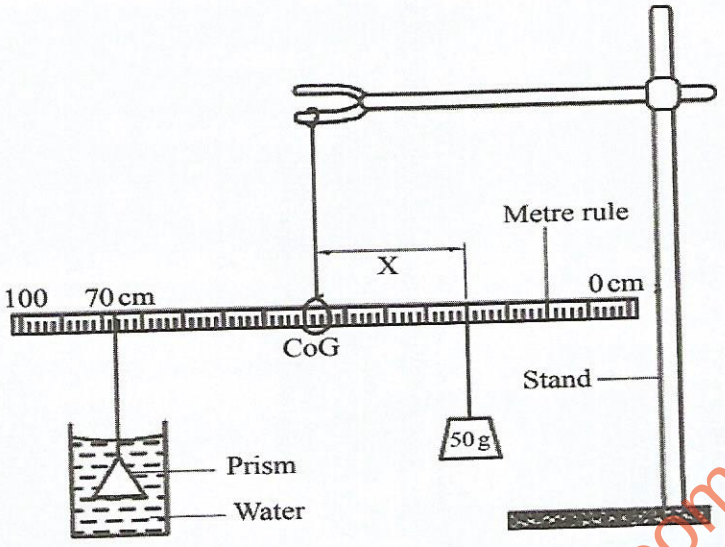


Figure 3

(d) Adjust the distance X to restore the balance of the metre rule.

(i) Record the new balance length X1.

X1 5 ..... cm (1 mark)

(ii) Using the principle of moments, determine the apparent loss in mass M1 of the prism in water. (3 marks)

(iii) Determine the value of μ given that: M1 5 M0 2 μ. (1 mark)

(iv) State the quantity represented by μ. (1 mark)

(e) Using tissue paper, dry the prism. Replace the water with liquid L and repeat the procedure in part (c) and adjust the distance X to restore the balance of the metre rule

(i) Record the new balance length X_2.

X_2 = ... cm (1 mark)

(ii) Given that

$$X = \frac{RX_1 - SX_2}{R - S},$$

where S= 1000 kgm^{-3}, determine the quantity *R* and state its SI unit. (3 marks)

PART B

(f) Use the apparatus provided to set up the circuit shown in **Figure 4**.

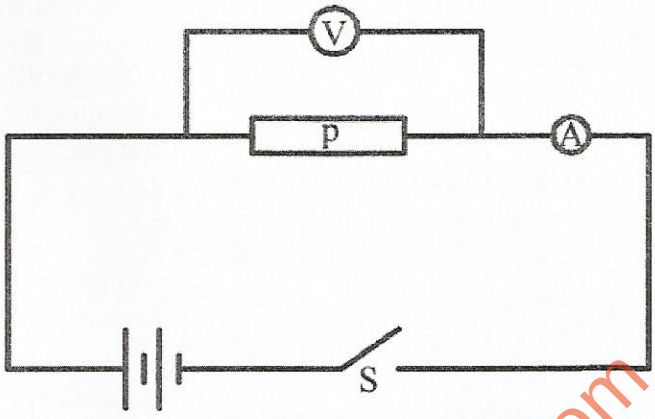


Figure 4

(g) Close the switch S.

(h) Read and record:

(i) Current I 5 ..... (A) (1 mark)

(ii) Voltage V 5 ..... (V) (1 mark)

(i) Determine resistance of P. (1 mark)

(j) Disconnect the circuit in **Figure 4** and use the apparatus to connect the circuit in **Figure 5.**

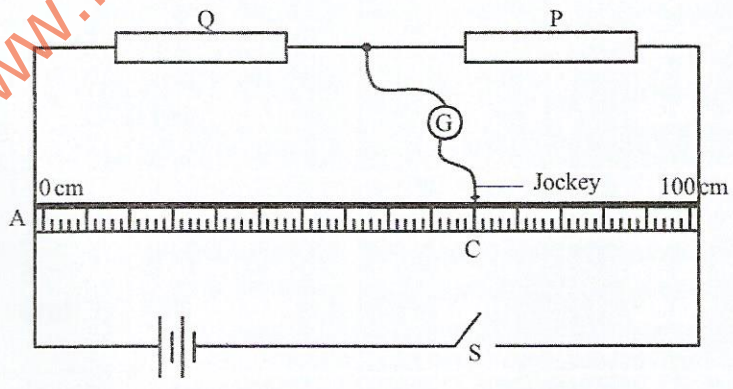


Figure 5

(k) Close the switch S. Using the jockey tap the wire AB at various points to obtain point C where the galvanometer shows zero deflection.

(l) Record the balance length AC = L

L =..... cm (1 mark)

(m) Determine the resistance of Q. Given that $\frac{Q}{L} = \frac{P}{100 - L}$ (2 marks)

Candidates were required to convert units, locate the center of gravity of a meter rule using the principle of moments measure distances, voltage current and determine the density of the object using a combination of the principle of moments and Archimedes principle.

Weakness

Candidates failed to convert units accurately and recorded values without paying attention to the number of decimal places.

3.4.5 Advice to teachers

- There should be emphasis on use of key words in given concepts and proper explanation of the physics behind the concepts.
- Candidates should be advised to follow the procedure during practical examinations and use their results appropriately.
- Practical lessons must be carried out as is required in the syllabus to have learners master the concepts.
- The accuracy of the instrument used while making measurements should be considered all the time.
- Logical analysis of concepts and critical thinking must be encouraged during the teaching / learning process.