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 five years are as shown in the table below.

Table : Candidates' overall performance in the years 2014 to 2018.

Year	Paper	Candidature	Maximum score	Mean score	Standard deviation
2014	1		80	30.41	17.24
	2		80	27.62	16.15
	3		40	19.68	6.78
	overall	**131,410**	**200**	**77.68**	**37.30**
2015	1		80	36.01	17.81
	2		80	28.92	15.98
	3		40	22.71	7.62
	overall	**139,100**	**200**	**87036**	**37.58**
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**

From the table it can be observed that:

(i) The candidature increased to 172,676 in 2018 from 160,182 in 2017. This was an increase of 12,494 candidates (7.79 %); this is low compared to the overall increase in candidature.

(ii) There was a slight improvement in the performance of paper 3. Paper 3 improved from a mean of 19.33 in the year 2017 to 19.43 in the year 2018 while Paper 1 and 2 registered a drop in the performance as is shown n the table.

(iii) The standard deviation in all the Physics papers continues to be large but normal. This shows a clear discrimination between the high and low achievers.

(iv) The overall performance of physics dropped from a mean of 70.09 in 2017 to 68.54 in 2018.

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.

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

3.4.2 Physics Paper 1 (232/1)

Question 3

Describe how the knowledge of the oil drop experiment may be used to estimate the area of oil spillage from a ship in the sea assuming the surface water is not disturbed. (3 marks)

Candidates were required to state apply the knowledge on the oil drop experiment in daily life situations.

Weakness

Most students were not able to apply the knowledge learnt in the oil drop experiment to show how the area covered by spilled oil can be determined.

Expected response

- Using the same oil spilled, to measure a known volume.
- Determine the area of spread of the measured volume (on the same water (sample).
- Estimate the area of spread on the sea

Question 7

A wooden cube of side 0.5 m floats in water fully submerged. Determine the weight of the cube. (*density of water* = *1 gcm*$^{-3}$). (2 marks)

Candidates were required to show understanding of the law of floatation

Weakness

Some candidates showed lack of knowledge on conversion of units. Others used the wrong symbols of density, while some had no idea what to do.

Expected response

Volume of water displaced = 0.5 x 0.5 x0.5

= $0.125m^3$

W of cube. = weight of water displaced (a floating body)

= 1 x 125000g

= 125kg

= 1.25×10^3 N

Question 10

Figure 6 shows the relationship between volume and pressure for a certain gas.

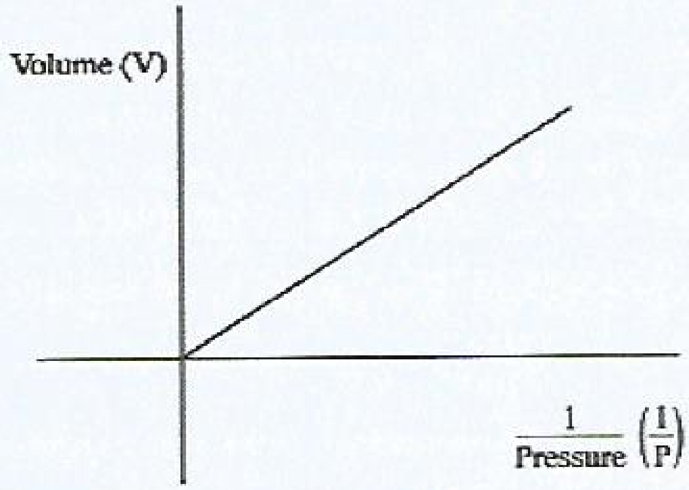


Figure 6

Name the law that the gas obeys. (1 mark)

Candidates were required to state the law that shows the relationship between volume and pressure of a gas.

Weakness

Some students failed to distinguish between the gas laws.

Expected response

Boyle's law.

Question 17

17. (a) State Pascal's principle of transmission of pressure in liquids. (1mark)

(b) Figure 10 shows heights of two immiscible liquids X and Y in a U-tube (drawn to scale)

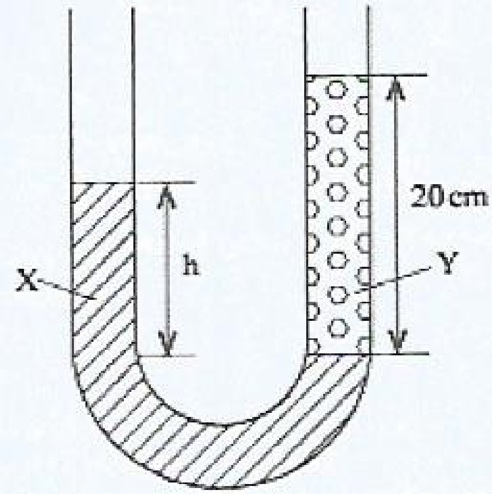


Figure 10

(i) State with a reason which of the two liquids X and Y has a higher density. (2 marks)

(ii) Determine the value of h. (2 marks)

(iii) Given that the density of liquid Y is ρ, write down an expression for the density d of liquid X in terms of ρ. (2 marks)

(c) (i) With the aid of a diagram, describe how a liquid may be siphoned from one container to another using a flexible tube. (3 marks)

(ii) State one application of the siphon. (1 mark)

Candidates were required to state Pascal's principle, relate height to pressure and have knowledge on application of pressure, how the siphon works.

Weakness

Most students could not state Pascal's principle, many could not link the height to the pressure and also explain how siphoning is done.

Expected response

a) Pressure applied at one part in a liquid is transmitted equally to all other parts of the enclosed liquid.

b) (i) Liquid *y* is denser since it rises to a smaller height i.e. the atmospheric pressure supports a lower height of y than *x*.

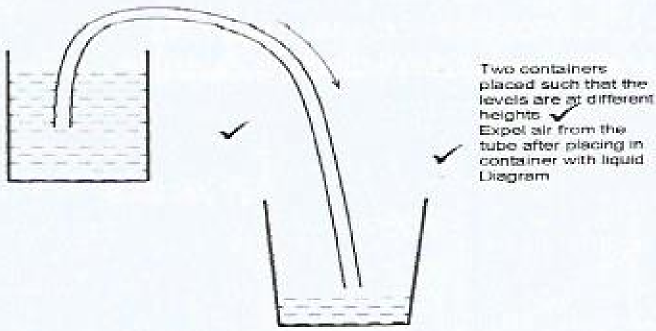
(ii) $h = \frac{2.2}{3.6} \times 20$

$= 12.22$ cm

(iii) $\frac{d}{p} = \frac{3.6}{2.2} = 1.636$ ✓

$d = 1.6\rho$ ✓

c.(i)



(ii) The flushing of a toilet or Drinking using a straw.

3.4.3 Physics Paper 2 (232/)

Question 4

State what happens to the image formed by a pin hole camera when the size of the hole is increased. (1 mark

Candidates were required to state characteristics of images formed by the pin hole camera.

Weakness

Many students were unable to bring out the idea of being blurred, and a good number used the term clearer to mean brighter.

Expected response

The image is blurred, or Brighter

Question 7

Figure 2 shows the image of an object O placed on the principle axis of a convex mirror.

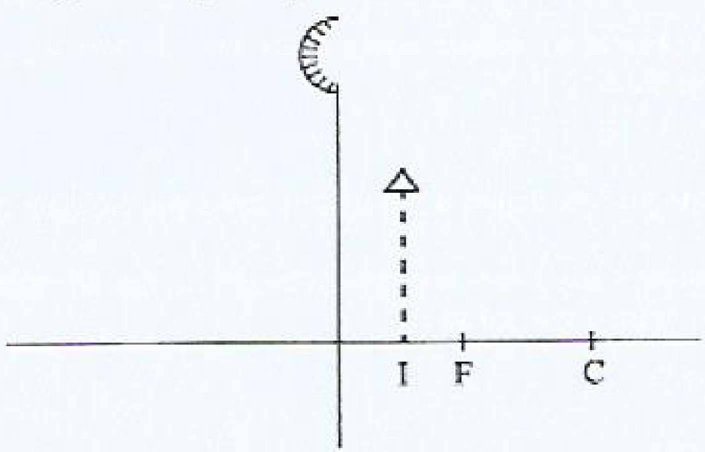


Figure 2

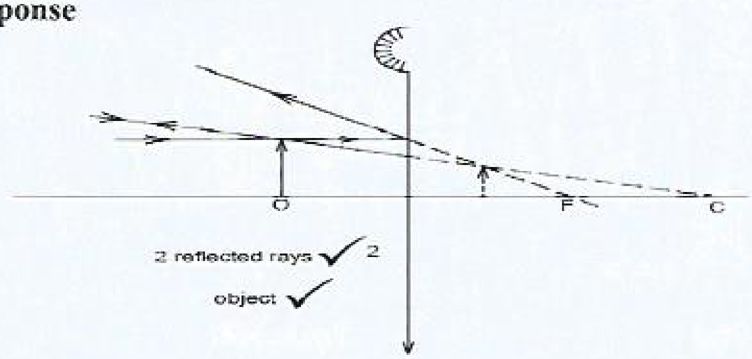
On the figure, draw a ray diagram to locate the object. (3 marks

Candidates were required to draw a ray diagram from the image to show the object.

Weakness

Many students confused between thin lenses and curved mirrors. Candidates found it difficult to reverse the rays from the image to obtain the object.

Expected response



Question 12

State the purpose of manganese (IV) oxide in a dry cell. (1 mark)

Candidates were required to show an understanding of how the simple cell functions.

Weakness

Some candidates lacked understanding on the parts and defects of the simple cell.

Expected response

It acts as a depolarizer. √

Question19

(a) Figure **8** shows two waves of nearly equal frequency produced simultaneously.

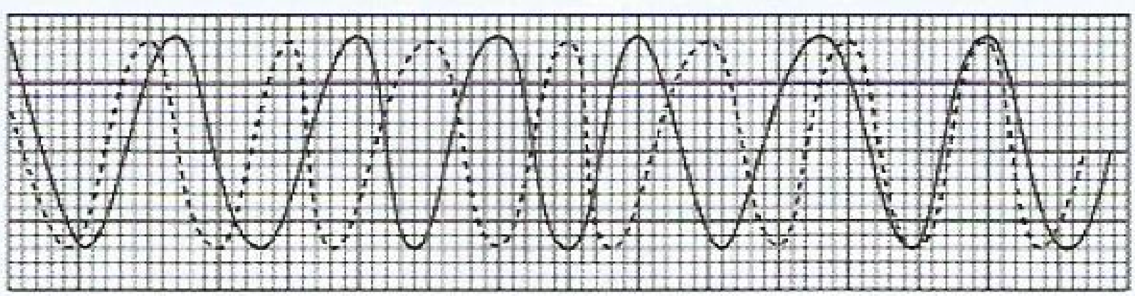


Figure 8

On the space provided, sketch the resultant of the two waves. (2 marks)

(b) **Figure 9(a)** and **9(b)** show barriers placed in the path of plane waves.

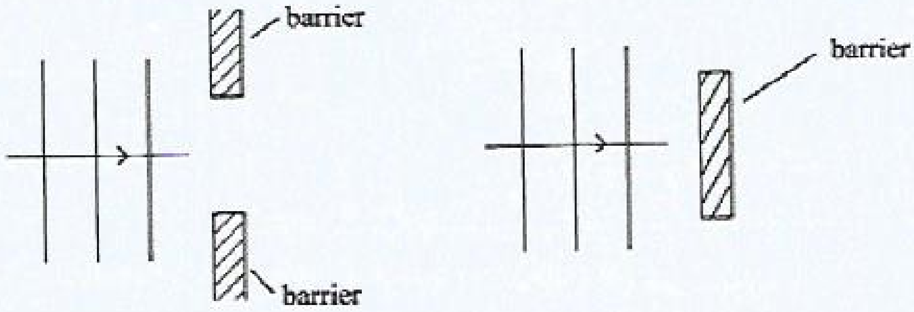


Figure 9(a) **Figure 9(b)**

On each figure, sketch the pattern of waves after they pass the barrier. (2 marks)

(c) **Figure 10** shows a displacement distance graph for a certain wave motion.

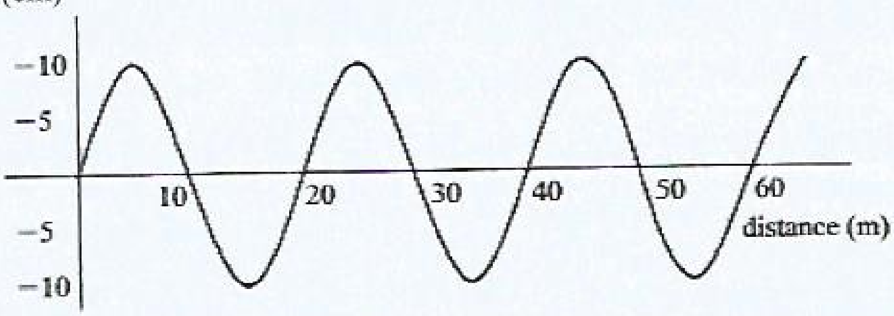


Figure 10

(i) Indicate on the figure with letters A and B any two points that are in phase. (1 mark)

(ii) Determine the:
(I) amplitude of the wave (1 mark)
(II) wavelength of the wave (1 mark)

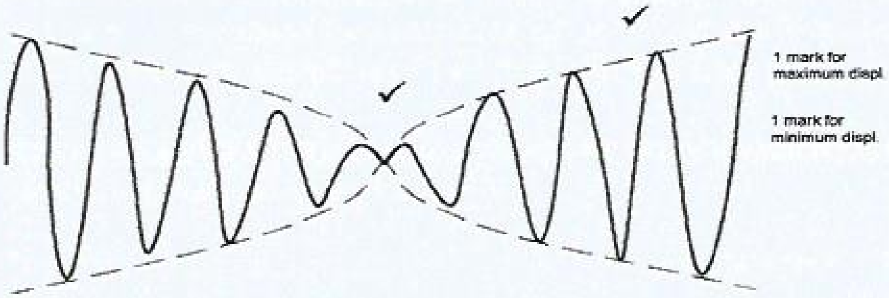
Candidates were required to draw waves to show how interference occurs, draw waves to show diffraction and evaluate amplitude and wavelengths from graphs.

Weakness

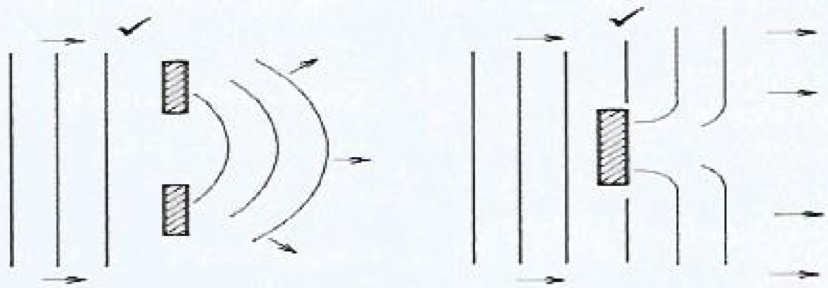
Most candidates failed to interpret the graphs correctly and do not know how wavelength remains the same after diffraction. They don't know how wavelength is related to the spacing between lines showing the wave fronts.

Expected response

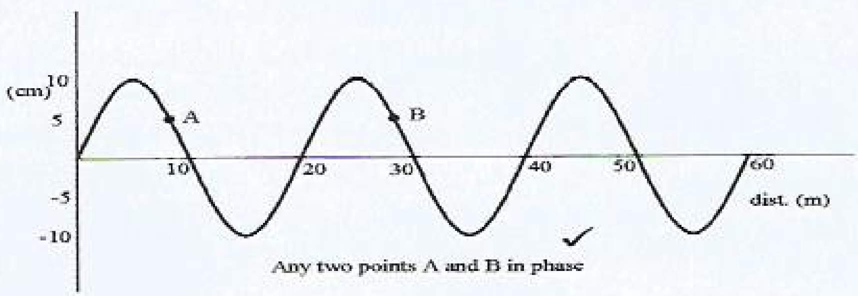
a.



(b)



c) (i)



ii) (I) Amplitude = 10cm

(II) Wavelength = 20m

iii. I $T = \frac{1}{f} = \frac{1}{50}$

$= 0.025$

II $V = fx$

$= 20 \times 50$

$= 1000\ ms^{-1}$

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.

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

Question 2

You are provided with the following:

- (i) A voltmeter
- (ii) A resistor labelled 10Ω
- (iii) A resistance wire mounted on a half metre rule labelled X
- (iv) Two cells in a cell holder
- (v) A switch
- (vi) Eight connecting wires
- (vii) A micrometer screw gauge
- (viii) A resistor labelled 10 KΩ
- (ix) A galvanometer
- (x) A beaker containing a liquid labelled L
- (xi) Two copper plates
- (xii) A resistance wire labelled AB and mounted on a millimetre scale
- (xiii) A jockey
- (xiv) A vernier calliper

Proceed as follows:

PART A

(a) Measure and record the diameter d of the resistance wire x (1 mark)

d = ... mm

=............................ m

b. Set up the circuit as shown in **Figure 2.**

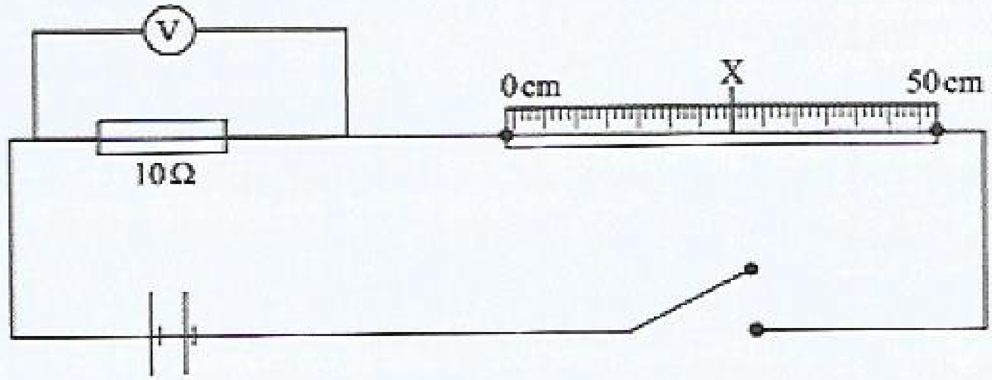


Figure 2

(i) Close the switch and record the potential difference V_1 across the 10Ω resistor.

V_1 = ... (1 mark)

(ii) Open the switch. Determine the current I flowing in the circuit. (2 marks)

(c) (i) Now connect the voltmeter across wire X. Close the switch and record the potential difference V_2 across wire X.

V_2 = ... (1 mark)

(ii) Determine the resistance R of wire X. (2 marks)

(iii) Determine K the resistance per metre of wire X. (1 mark)

(iv) Determine Q given that $Q = \frac{\pi K d^2}{4}$ (*where d is in metres*). (2 marks)

PART B

(d) (i) Using the vernier callipers measure and record the width W of one of the copper plates

W = ... cm (1 mark)

(ii) Determine the area A of a 5 cm length of the copper plate

A = ... cm^2 (1 mark)

(e) Using stands and clamps, hold the copper plates in the beaker such that both plates:

(i) reach the bottom of the beaker;

(ii) are parallel, vertical and facing each other;

(iii) are separated from each other by a distance S.

(f) Connect the copper plates to the circuit as shown in **Figure 3**.

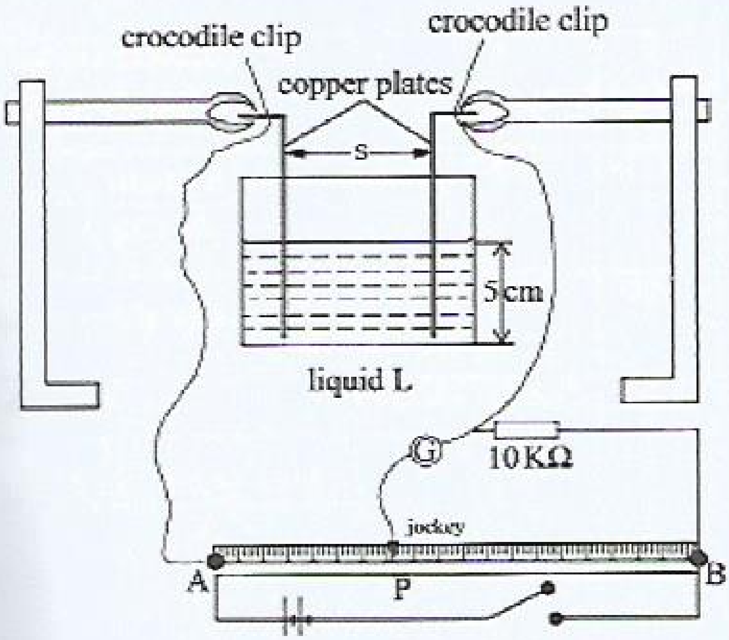


Figure 3

(g) Set the separation distance between the copper plates S to 3 cm. Using the jockey tap wire AB at various points to obtain a point P at which the galvanometer does not show any deflection. Record the balance length L (from A to P) in **Table 2.**

(h) Repeat part (g) for other values of S shown in **Table 2** and complete the table. (6 marks)

Table 2

Plate separation distance S (cm)	3	4	5
Balance length L (cm)			
Resistance R = $\frac{(10\times10^3)L}{(100-L)}$			
Resistance per unit length $K=\frac{R}{S}$			
constant Z = A.K.			

(i) Determine the average value of Z. (2 marks)

Candidates were required to measure the diameter of a wire, connect a circuit, measure the resistance, determine the resistivity and then evaluate some constant Q. the simple cell set up was required in part B. From the results many candidates may have failed to follow the instruction well and ensure the plates did not touch to cause a short circuit.

Expected response

Question 2

a) d = 0.36 mm±0.05

$=3.6\times10^{-4}m$

b) (i) V_1 = 1.7 V±0.2

(ii) $I=\frac{V}{R}$

$=\frac{1.7}{10}$

= 0.17 A

c) (i) $V_2 = 1.0\ V \pm 0.2$

(ii) $R = \frac{V}{I}$

$= \frac{1}{0.17}$

$= 5.88\ \Omega$

(iii) $K = 5.88 \times 2$

$= 11.76\ \Omega m^{-1}$

Or

$\frac{5.88}{0.5} = 11,76\ \Omega m^{-1}$

(iv) $Q = \pi \frac{Kd^2}{4}$

$= \pi \frac{11.76 \times (3 \times 10^{-4})^2}{4}$

$= 119.7 \times 10^{-8}$

d) (i) W = 5.0cm±0.10

(ii) Area = 5 x 5.0

= $25.00cm^2$

h) **Table 2**

Plate separation distance(s) (cm)	3	4	5
Balance Length l (cm)	79.5	82.4	86.2
Resistance $R = \left(\frac{10 \times 10^3 L}{100 - L}\right)$	38.8	46.8	62.5
Resistance per unit length $K = \frac{R}{S}$	12.9	11.7	12.5
Constant Z = A. K	325.73	295.43	315.63

i) $Z\ average = \frac{325.73 + 295.43 + 315.63}{3}$

= 312.26

ADVICE TO TEACHERS

1. Candidates ought to be advised on the need to use comparative words appropriately.
2. Practical lessons must be carried out as is required in the syllabus to have learners master the concepts.
3. Logical analysis of concepts and critical thinking must be encouraged during the teaching / learning process.
4. The candidates should learn to utilize the information provided.

The graph below shows clearly the performance trends in physics since 20012.