KENYA NATIONAL EXAMINATION COUNCIL
KCSE, 2014

PHYSICS PAPER 1 ANALYSIS

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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 12: candidates overall performance in the years 2010 to 2014

Year	Paper	Candidature	Maximum score	Mean score	Standard deviation
2010	1		80	26.11	16.95
	2		80	21.82	13.82
	3		40	22.37	07.81
	overall	**109,811**	**200**	**70.22**	**35.73**
2011	1		80	21.64	14.49
	2		80	29.43	16.41
	3		40	22.24	8.84
	overall	**120,074**	**200**	**73.28**	**36.72**
2012	1		80	26.46	13.72
	2		80	31.91	17.00
	3		40	17.40	6.88
	overall	**119,654**	**200**	**75.72**	**34.58**
2013	1		80	36.03	19.66
	2		80	21.34	14.37
	3		40	22.85	7.98
	overall	**119,819**	**200**	**80.20**	**38.07**
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**

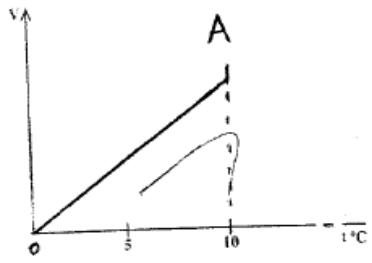
From the table it can be observed that:

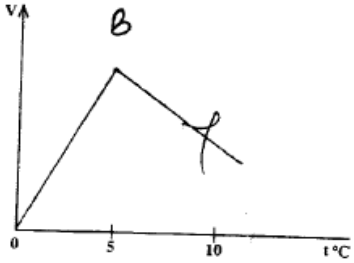
(i) The candidature increased to 131,410 in 2014 from 119,819 in 2013. This was an increase of 11,591 candidates (9.67 %); this is low compared to the overall increase in candidature.

(ii) There was improvement in the performance of papers 2. Paper 2 improved from a mean of 21.34 in the year 2013 to 27.62 in the year 2014 while Paper 1 and 3 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) There overall performance of physics dropped from a mean of 80.20 in 2013 to 77.68 in 2014. On analyzing the candidates' responses to a number of questions it was observed that some candidates proceed to respond without thinking critically and logically as is required of Physics. For example to have candidates plot the graph of volume against temperature for water starting at zero as shown in the responses below is an indication that the candidate does not understand the meaning of the y- axis starting at zero in terms of the volume.





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

3.4.2 Physics Paper 1 (232/1)

Question 3

State the reason why it is **not correct** to quote the weight of solid objects in kilograms.
(1 mark)

Candidates were required to state the reason why it is not right to quote the weight of objects in kilograms.

Weakness
Most students were not able to show the difference between mass and weight in terms of the force involved when dealing with weight.

Expected response

Weight = Mass x gravity

kilograms is the unit of measuring the mass and does not depict the force of gravity.

Question 6

An oil drop of volume V m^3 introduced on the surface of water spreads to form a patch whose area is A m^2. Derive an expression for obtaining the diameter, d of a molecule of oil. (2 marks)

Candidates were required to derive an expression for obtaining the diameter D of an oil molecule given the volume and area of the patch formed.

Weakness

Most candidates worked without realizing that the height of the cylinder formed when the oil spreads is equivalent to the diameter of the molecule. They failed to equate the volume of the drop to the volume of the oil patch.

Expected response

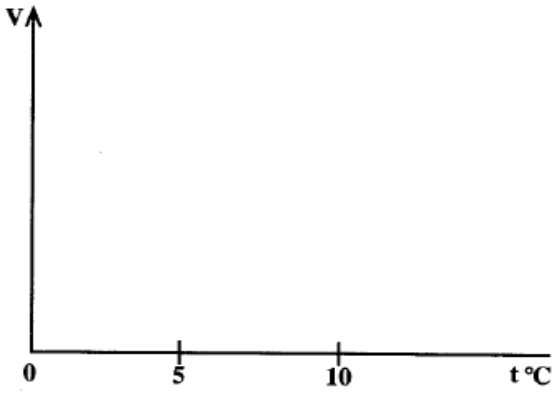
$$\text{Volume of drop} = \text{Volume of patch}$$

$$Ad = V$$

$$d = \frac{V}{A}$$

Question 12

On the axis provided, sketch the graph which shows the relationship between volume and temperature of a fixed mass of water in the temperature range 0°C to 10°C. (1 mark)

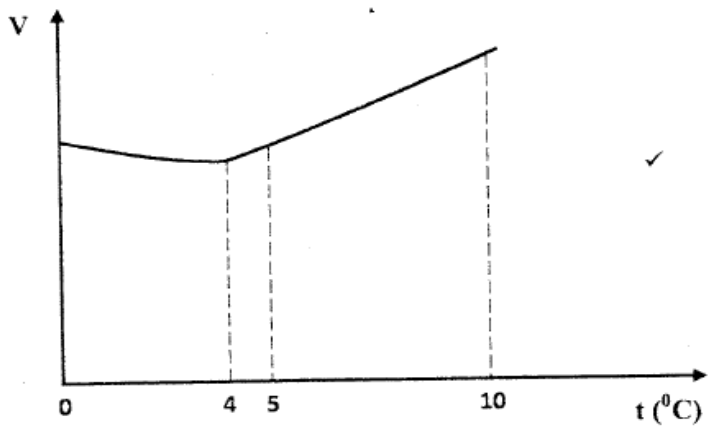


Candidates were required to plot the graph of volume against temperature for water between 0^0 c and 10^0 c.

Weakness

Some students were not aware of the fact that the slope cannot be so steep between 0^0 c and 10^0 c. Some even had graphs starting at the origin.

Expected response



✓ (1)

Question 14

In a smoke cell experiment to demonstrate Brownian motion, smoke particles are seen moving randomly. State the cause of the randomness. (1 mark)

Candidates were required to state the cause of the randomness in Brownian motion experiment.

Weakness

Though students had knowledge of Brownian option the actual cause of randomness was not coming out of their response.

Expected response

- Collisions / bombardment of particles with air molecules which are in random motion.

Question 17

(a) A long horizontal capillary tube of uniform bore sealed at one end contains dry air trapped by a drop of mercury. The length of the air column is 142 mm at 17°C. Determine the length of the air column at 25°C. (3 marks)

(b) The pressure of the air inside a car tyre increases if the car stands out in the sun for some time on a hot day. Explain the pressure increase in terms of the kinetic theory of gases. (3 marks)

(c) In an experiment to determine the specific latent heat of vapourization of water, steam of mass 10 g at 100°C is passed into 100 g of water initially at 20°C in a container of negligible heat capacity. The temperature of the water rises to 70°C.
(Take the specific heat capacity of water as 4.2×10^3 *J* kg^{-1} K^{-1} *and the boiling point of water as 100°C)*

(i) Determine the specific latent heat of vapourization of water. (4 marks)

(ii) State **two** sources of error in this experiment. (2 mark)

The question had several parts testing on different topics.
Candidates were required to explain the determine the length of an air column for a horizontal capillary tube, explain pressure increase in terms of kinetic energy and determine the specific latent heat of vaporization.

Weakness

The candidates were not able to bring out the explanations on the increase in air pressure in terms of the kinetic theory of gasses well. They failed to point out that the increased temperatures result in higher energy of the air molecules. Many candidates were not able to compute the specific latent heat of vaporization of water from the given quantities. Most candidates were not able to state the sources of error in the outlined experiment.

Expected response

(a) $l_1 = 142, \quad T_1 = 290\ K, \quad T_2 = 298\ K, l_2 = ?$

$$\frac{l_1}{T_1} = \frac{l_2}{T_2} \text{ or } \frac{V_1}{T_1} = \frac{V_2}{T_2}$$

$$l_2 = 142 \times \frac{298}{290}$$

$$= 145.9\ mm$$

(b) In the hot sun the temperature of the air increases; therefore the speed of the air molecules increases hence the rate of collisions between the molecules and tyre increases; The rate of change of momentum (pressure) of the molecules also increases.

(c) (i) Heat lost = Heat gained

$$mLv + M\,\Delta\theta C_{steam} = M\,\Delta\theta C_{water}$$

$$0.01\,Lv + 0.01 \times 30 \times 4200 = 0.1 \times 4200 \times 50$$

$$0.01\,Lv = 21000 - 1260$$

$$Lv = \frac{19740}{0.01}$$

$$= 1.974 \times 10^6\ J\,Kg^{-1}K^{-1}$$

(ii) - All the heat lost by the steam is not absorbed by the water alone.
- Reading the thermometer at wrong meniscus resulting in wrong temperatures.