7.0 PHYSICS (232)

In the year 2010, KCSE Physics was tested in three papers; Paper 1 (232/1), Paper 2 (232/) and Paper 3 (232/3).

Paper 1 and Paper 2 were theory papers with two sections A and B. Section A had short answer questions and section B had structured questions. Candidates were required to answer all the questions in both sections. Questions in Paper 1 were drawn from heat and mechanics while questions in Paper 2 were drawn from Optics Waves, Electricity, Magnetism, and modern Physics.

Paper 3 (232/3) was a practical paper testing a variety of skills in all areas of physics.

7.1 GENERAL CANDIDATES PERFORMANCE

The candidate's performance statistics in the KCSE Physics examination over the four years are as shown in the table below.

Table 12: Candidates' overall performance in Physics in the years 2007 to 2010.

Year	Paper	Candidature	Maximum score	Mean score	Standard deviation
2007	1		80	23.46	13.43
	2		80	33.33	17.93
	3		40	25.85	07.14
	overall	**83,162**	**200**	**82.63**	**35.00**
2008	1		80	25.32	14.66
	2		80	24.17	16.34
	3		40	23.92	07.31
	overall	**93,692**	**200**	**73.42**	**35.43**
2009	1		80	26.72	16.17
	2		80	20.77	14.23
	3		40	15.22	06.29
	overall	**104,883**	**200**	**62.62**	**34.02**
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**

From the table it can be observed that:

7.1.1 The candidature increased from **104,883** in the year 2009 to **109, 811** in the year 2010, an increase of **4.928** candidates **(4.69%).**

7.1.2 There was improvement in the performance of Paper 3 (232/3) which improved from a mean of **15.22** in the year 2009 to **22.37** in the year 2010.

7.1.3 Paper 1(232/1) and Paper 2 (232/2) recorded a **decline** in performance in the year 2010.

7.1.4 There overall performance of Physics improved from a mean of **62.62** in 2009 to **70.22** in 2010.

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

7.2 PAPER 1(232/1)

Question 2

A stopwatch started 0.50s after the start button was pressed. The time recorded using the stopwatch for a ball bearing falling through a liquid was 2.53s. Determine the time of fall.

(1 mark)

Candidates were required to determine the time of fall for a ball bearing falling through a liquid using an inaccurate stop watch.5

Weakness

Students were unable to realize that this was to be treated as an error hence the need to add the error to the time recorded.

Expected response

Time = (2.53 + 0.50)s = 3.03s

Question 8

A cart of mass 30kg is pushed along a horizontal path by a horizontal force of 8N and moves with a constant velocity. The force is then increased to 14N.
Determine:

(a) the resistance to the motion of the cart; (1 mark)

(b) the acceleration of the cart. (2 marks)

Candidates were required to determine the resistance of motion of a moving cart and the acceleration of the cart.

Weakness

Students were unable to comprehend that when a body moved with uniform velocity, acceleration is zero. Some subtracted the two driving forces to find the resistance force in part (a).

Expected response

(a) Resistance = 8N

(b) $14 - 8 = 30\ a$

$$\therefore a = \frac{6}{30} ms^{-2}$$

$$= 0.2\ ms^{-2}$$

Question 14

Figure 6 shows an athlete lifting weights while standing with the feet apart.

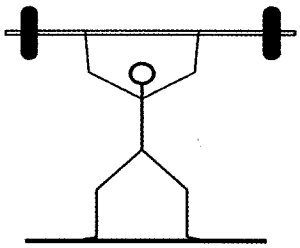


Figure 6

Explain why standing with the feet apart improves the athletes's stability. (1 mark)

Candidates were required to explain why standing with feet apart improves stability.

Weakness

Students were unable to relate increase the base area to lowering the position of the centre of gravity.
Some students related surface area to increased stability and were unable to relate center of gravity to stability.

Expected response

Increase the base area or lower the c.g.

Question 19

(a) **Figure 9** shows a velocity-time graph for the motion of a certain body.

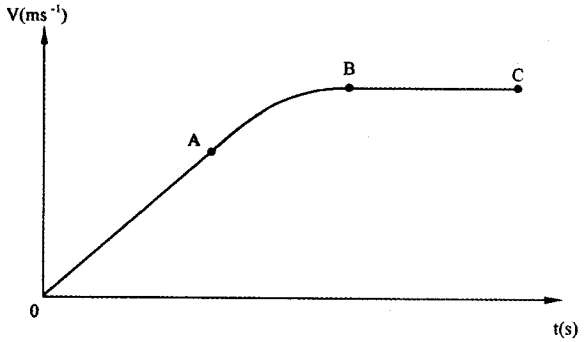


Figure 9

Describe the motion of the body in the region:

(i) OA; (1 mark)

(ii) AB; (1 mark)

(iii) BC. (1 mark)

(b) A car moving initially at $10ms^{-1}$ decelerates at $2.5\ ms^{-2}$.

(i) Determine:

(I) its velocity after 1.5s; (2 marks)

(II) the distance travelled in 1.5s; (2 marks)

(III) the time taken for the car to stop. (2 marks)

(ii) Sketch the velocity-time graph for the motion of the car up to the time the car stopped. (1 mark)

(iii) From the graph, determine the distance the car travelled before stopping. (2 marks)

Candidates were required to describe the motion of a body from a v-t graph and determine v, s, and t of a car in uniform motion.5

Weakness

Students were unable to relate area under the graph to distance covered, hence were not able to workout the distance covered.

Expected response

(a) (i) **OA** - Body moves from rest at constant acceleration.

(ii) **AB** - Body moves with decreasing acceleration.

(iii) **BC** - Body moves with constant velocity i.e. zero acceleration.

(b) (i) $u = 10\ ms^{-1}$

$a = -25\ ms^{-2}$

$t = 1.5s$

$V = u + at = 10\text{-}25 \times 1.5 = 6.25\ ms^{-1}$

(ii) $S = ut + \frac{1}{2}at^2$

$= 10(1.5) - \frac{1}{2}(2.5)\ 1.5)^2 = 12.1875m$

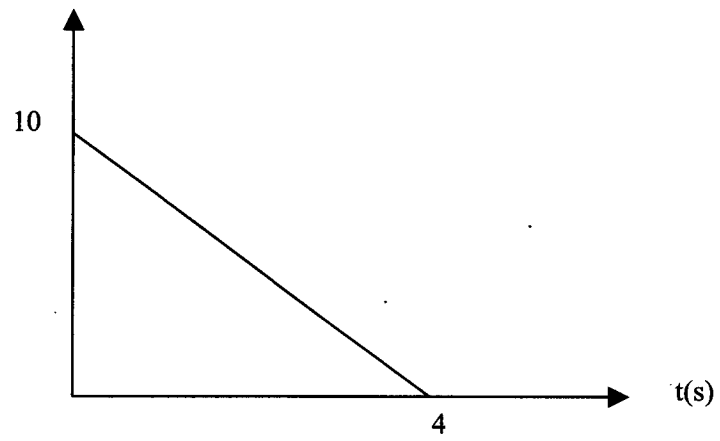
$= 12.19m$

(iii) $V = 0$

i.e. $o = 10 - 2.5t$

$\Rightarrow t = \frac{10}{2.5} s = 4s$

(c) (i)



(ii) Distance = Area of triangle

7.3 PAPER 2(232/2)

Question 4

A positively charged sphere is suspended by an insulating thread. A negatively charged conductor is suspended near it. The conductor is first attracted, after touching the sphere it is repelled. Explain this observation. (2 marks)

Candidates were required apply the law of electrostatics and understand the charging of bodies by contact.

Weakness

Many Students were unable to differentiate charges and poles of magnet i.e. confusion between basic law of electrostatics and the first law of magnetism. Some confused bodies touching to earthing of the bodies.

Expected response

Initially attracted because it is of opposite charge.

Then neutralised and charged positive and hence repel.

Question 8

A water wave of wavelength 18 mm is incident on a boundary of shallow water at right angles. If the wavelength in the shallow end is 14.4 mm, determine the refractive index of water for a wave moving from the deep to the shallow end. (3 marks)

Candidates were required to have the knowledge of the relationship between refractive index and wavelengths for a wave moving from deep to shallow regions.

Weakness

Students used sin i /sin r and could not relate it to wavelength.

Expected response

$v_1 = f\lambda_1$

$v_2 = f\lambda_2$

Refractive index

$$= \frac{v_1}{v_2} = \frac{f\lambda_1}{f\lambda_2}$$

$$= \frac{\lambda_1}{\lambda_2} = \frac{18}{14.4} = 1.25$$

Question 10

A current I flowing through a wire of resistance R was increased seven times. Determine the factor by which the rate of heat production was increased. (3 marks)

Candidates were required to determine the factor by which the rate of heat dissipation was increased.

Weakness

Most Students squared I and not 7 i.e. $7(I)^2R$ instead of $(7I)^2R$.

Expected response

I_o - Initial current

$P = I^2R = I^2_oR$;

$I_2 = 7I_o$

$P = (7I_o)^2R = 49I^2_oR$;

Power is 49 times initial value.

Question 16

(a) **Figure 10,** shows an object placed in front of a converging lens of focal length 50mm.

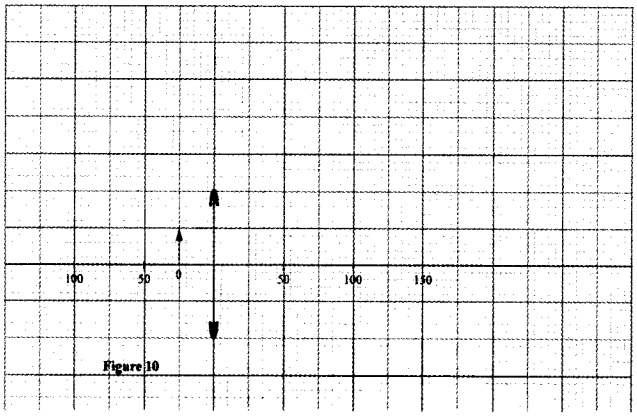


Figure 10

(i) On the same figure, draw a ray diagram showing the location of the image. (3 marks)

(ii) Use the ray diagram to determine the:
(I) image distance; (1 mark)

(II) magnification. (2 marks)

(iii) State the adjustment that should be done to obtain a larger virtual image using the same lens. (1 mark)

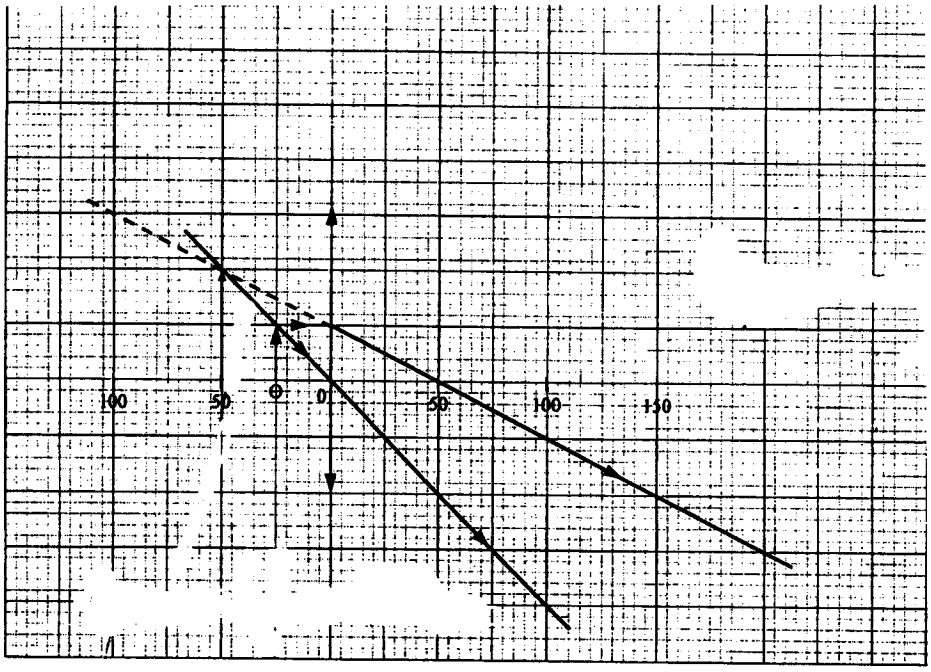
(iv) State **one** application of the arrangement in **figure 10**. (1 mark)

Candidates were required to construct ray diagrams and apply the lens formula in problem solving

Weakness

A good number of Students drew lines instead of rays (without arrows) and extrapolated backwards with complete lines instead of dotted line. A number of students confused between thin lenses and curved mirrors.

Expected response



7.4 PAPER 3(232/3)

Question 1

You are provided with the following:

- a metre rule;
- vernier callipers;
- a 300 g mass;
- two knife edges;
- some thread.

Proceed as follows:

(a) Place the metre rule on the knife edges such that each knife edge is 45 cm from the 50 cm mark (centre of the rule). See **figure** 1. Ensure that the millimetre scale of the metre rule is facing upwards. The distance **L** between the knife edges is now 900 mm.

Place the vernier callipers vertically against the metre rule at the 50 cm mark with the depth gauge lowered to touch the bench as shown in figure 1.

Record the height $\mathbf{h_o}$, of the upper edge of the metre rule at the 50 cm mark. (see **figure 1**).

$\mathbf{h_o}$ = ... mm (1 mark)

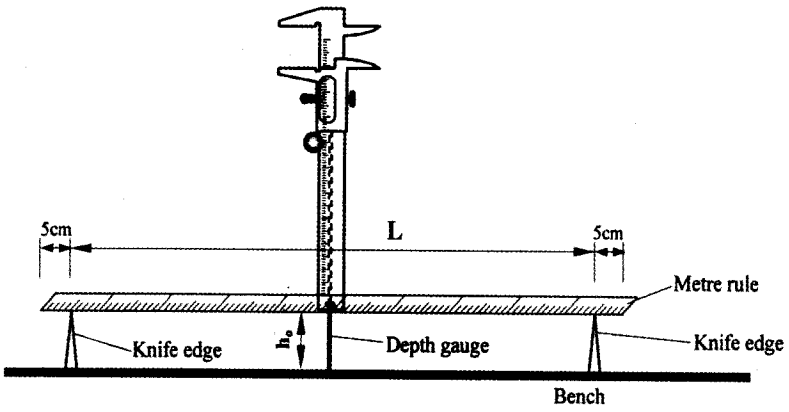


Figure 1

(b) Using the thread provided, hang the 300g mass at the 50 cm mark of the metre rule. Ensure that the mass does not touch the bench. Measure and record in table 1, the height **h** of the edge of the metre rule at the 50 cm mark.

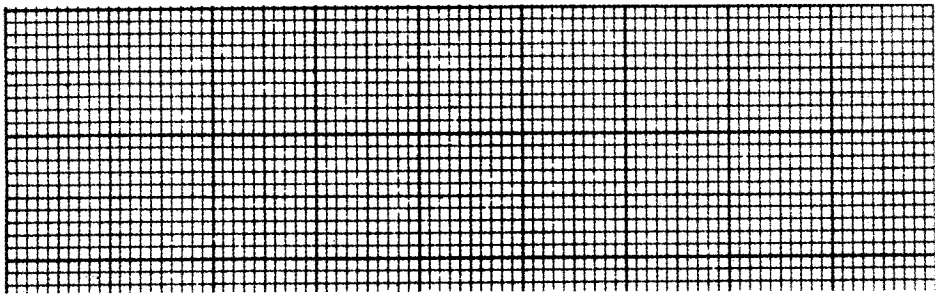
(c) With the 300g mass still at the 50 cm mark, adjust the position of the knife edges so that **L** is now 800 mm. (The knife edges should be equidistant from the centre of the metre rule). Measure and record in table 1 the height **h** of the edge of the metre rule at the 50 cm mark.

(d) Repeat the procedure in (c) for other values of **L** shown in table 1. Complete the table.

Length **L** (mm)	900	800	700	600	500
Height **h** (mm)					
Depression d (h_o-h) mm					
Log **L**					
Log d					

Table 1 (7 marks)

(e) Plot a graph of log **L** (y-axis) against log d. (5 marks)



(f) (i) Determine the slope s of the graph. (3 marks)

(ii) Evaluate $y = \frac{1}{s}$

y=..... (1 mark)

(iii) Determine G, the value of log **L**, when log d = 0.

G = ... (2 marks)

(iv) Given that $G = \frac{\log k}{y}$, determine the value of k.

k ..... (1 mark)

Candidates were required to set up the apparatus as per the diagram and follow the instructions (a to f). Candidates were also required to take measurements using a vernier caliper; record the readings to the correct number of significant figures, use logarithms and calculators, draw graphs and solve equations.

Weakness

Students were unable to:

- Read the vernier caliper in the correct
- Convert of cm to mm, choosing suitable scales.
- Record logarithms to the correct number of significant figures.
- Extrapolate the graphs.

Expected response

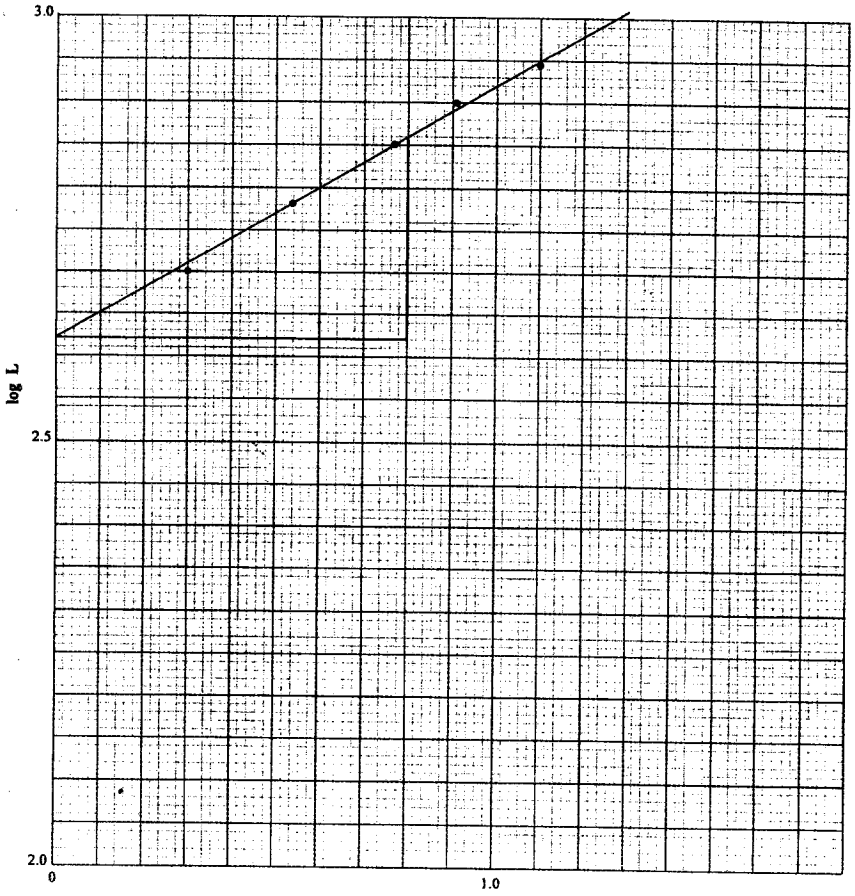
(a) $h_o = 92.8$ mm (1 mark)

(d) Table 1

Length L mm	900	800	700	600	500
Height h mm	79.8	84.7	86.9	89.4	90.8
Depression $d(h_o - h)$ mm	12.9	8.1	5.9	3.4	2.0
Log L	2.95	2.90	2.85	2.78	2.70
Log d	1.11	0.91	0.77	0.53	0.30

(7 marks)

(e) (5 marks)



(f) (i) Extraction $\frac{2.86-2.62}{0.80-0}$ (1 mark)

Subtraction and division $\frac{0.24}{0.80}$ (1 mark)

Value of S. 0.30 (1 mark)

f (ii) $\frac{1}{0.30} = 0.33$ (1 mark)

f (iii) Extrapolation (1 mark)

Reading G = 2.62 (1 mark)

f(iv)

Correct substitution of ΔX and ΔY in the equation (½)

Correct evaluation to the nearest whole number or 1 decimal place (½) (1 mark)

7.5 ADVICE TO TEACHERS

7.5.1 Learners should be guided on meaning of terms for them to be able to define with ease.

7.52 All laws must be properly explained for learners to understand their application in various situations besides being able to state the law verbatively.

7.5.3 Learners should be guided on guided on proper use of formulae and language when responding to questions to show clearly their knowledge on certain concept and skills.

7.5.4 Most topics will be better understood if a practical approach is used. Candidates are unable to describe well due to lack of knowledge and poor mastery of content.

7.5.5 Graphical analysis should be included in the teaching of physics.

7.5.6 Candidates must be advised to follow instructions in the practical paper and use the recorded data appropriately.