8.0 PHYSICS (232)

In the year 2011, 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.

8.1 GENERAL CANDIDATES PERFORMANCE

The candidate's performance statistics in the KCSE physics examination since the year 2006 when the syllabus was revised are as shown in the table below.

Table 20: candidates' overall performance in the years 2006 to 2011

Year	Paper	Candidature	Maximum score	Mean score	Standard deviation
2006	1		80	24.00	15.62
	2		80	35.75	17.05
	3		40	20.88	07.22
	overall	**72,299**	**200**	**80.63**	**37.00**
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**
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**

From the table it can be observed that:

7.1.1 The candidature increased from 109, 811 in the year 2010 to 120,074 in the year 2011, an increase of 10,263 candidates (9.34%)
7.1.2 There was improvement in the performance of Paper 2 (232/2) which improved from a mean of 21.82 in the year 2010 to 29.43 in the year 2011.
7.1.3 Paper 1(232/1) and paper 3 (232/3) recorded a decline in performance in the year 2011.
7.1.4 There overall performance of physics improved from a mean of 70.22 in 2010 to 73.28 in 2011.

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

8.2 Paper 1(232/1)

Question 4

Figure 3 shows an aluminium tube tightly stuck in a steel tube.

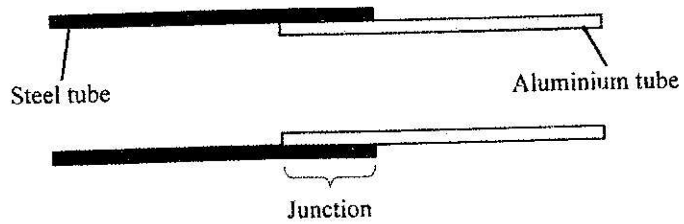


Figure 3

Explain how the two tubes can be separated by applying a temperature change at the junction given that aluminium expands more than steel for the same temperature rise.

Candidates were required to explain how the tubes can be separated given that the inner tube expand more than the outer one.
Weakness
Students were unable to realize that this required cooling and not heating.

Expected response

Cooling;
Aluminium contracts more than steel for the same temperature change;

Question 7

Figure 6 shows a small toy boat floating on water in a basin. **X** and **Y** are two points near the toy.

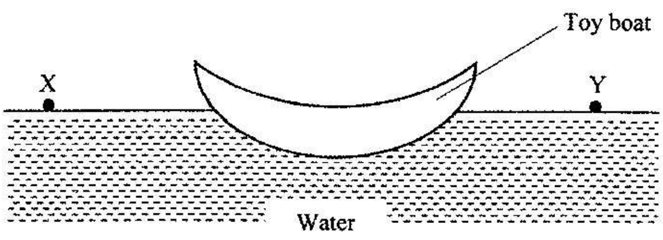


Figure 6

When a hot metal rod is dipped into the water at point **X**, the toy is observed to move towards **Y.** Explain this observation. (2 marks)

Candidates were required to use knowledge on factors that affect surfaces tension to explain why then toy boat moved towards Y.

weakness

Students were confused between surface tension and density, waves and convectional currents

Expected response

Surface tension at X is reduced;

Higher surface tension at Y pulls the boat;

Question 15

Figure 10 shows a simple pendulum of length 80cm. The pendulum bob whose mass is 50g oscillates between points **A** and **B**, through its rest position **C**. **A** and **B** are both 10cm higher than **C**.

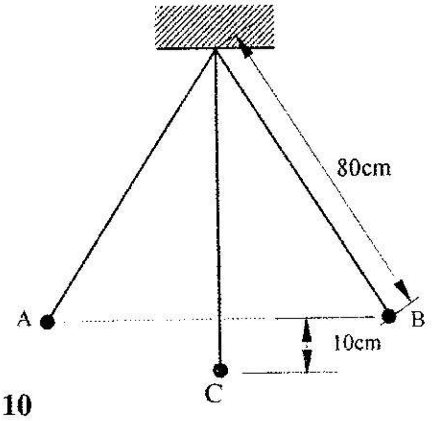


Figure 10

(a) (i) Indicate with an arrow, on the path **ACB**, the direction of the greatest velocity of the bob as it moves from **A** to **B**.

(ii) State the form of energy possessed by the pendulum bob at point **A**.

(b) Determine:

(i) the velocity of the bob at point **C**,

(ii) the tension in the string as the bob passes point **C.**
(take acceleration due to gravity $g = 10\ m/s^2$)

(c) After some time, the pendulum comes to rest at point **C.** State what happens to the energy it initially possessed. (1 mark)

Candidates were required exhibit knowledge on energy transformations in the motion of a pendulum.

Weakness

Students were unable to were unable to relate the energy changes to circular motion.
Some students were not able to show the direction of the greatest velocity.

Expected response

(a) (i) Arrow tangent at C;
(ii) Potential energy.

(b) (i) $Mgh = \frac{1}{2}mv^2$

$v = \sqrt{2 \times 10 \times 0.1}$
$= 1.41\ ms^{-1}$;

(ii) $\text{Tension} = \frac{mv^2}{r} + mg$

$= \frac{0.05}{0.8} \times 2 + 0.05 \times 10$;

$= 0.625\ N$;

(c) Used to do work against air resistance;
Converted to heat energy.

Question 18

(a) **Figure 15** shows a metal bolt which is threaded.

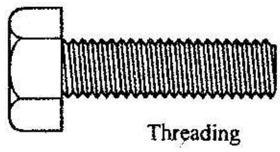


Figure 15

Explain how a metre rule can be used to measure the pitch (distance between adjacent peaks) of the threading.

(b) **Figure 16** shows a screw jack whose screw has a pitch of 1mm, and has a handle of 25 cm long.

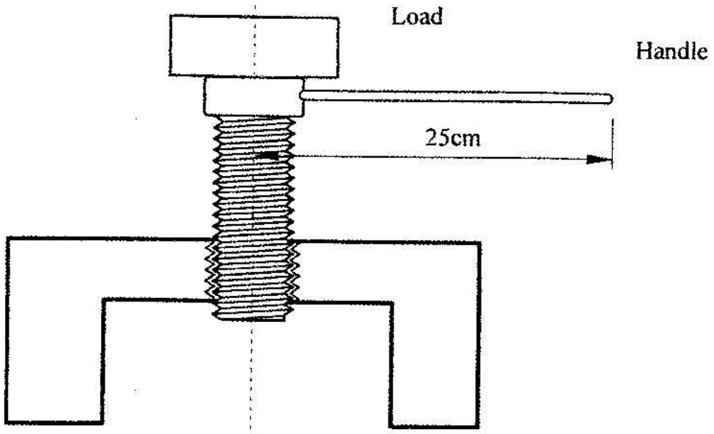


Figure 16

Determine the velocity ratio of the jack.

(c) A bullet of mass 60g travelling at $800ms^{-1}$ hits a tree and penetrates a depth of 15 cm before coming to rest.

(i) Explain how the energy of the bullet changes as it penetrates the tree.

(ii) determine the average retarding force on the bullet.

Candidates were required describe how the pitch of a screw can be determined and calculate the velocity ratio of a screw jack. Part c required explanation of energy changes as a bullet penetrates a tree.

Weakness

Most students confused between pitch and peak. They were unable to relate forces to energy changes.

Expected response

(a) Measure length of threaded part;
Divide the length by number of threads;

(b) Distance moved by effort $= 2\pi r$ cm
$= 50\pi$ cm;
Distance moved by load $= 0.1$ cm.

$$\text{Velocity ratio} = \frac{\text{Effort distance}}{\text{Load distance}};$$
$$= \frac{50\pi}{0.1}$$
$$= 1570.7963$$
$$= 1571;$$

(c) From kinetic energy to heat and sound;
K.E = the work done against friction;
$\frac{1}{2} \times 0.06 \times 800 \times 800 = F \times 0.15;$
$F = 12800N;$

8.4 Paper 2(232/2)

Question 7

Figure 5, shows a motor connected to a magnetic switch called a relay operated by an ordinary switch S_1. Use the information in the figure to answer questions 7 and 8.

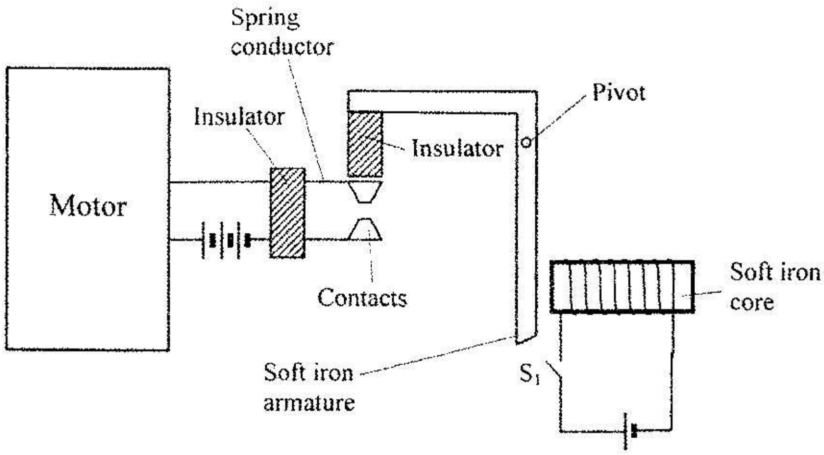


Figure 5

Explain how the relay switches on the motor when S_1 is closed.

Candidates were required explain the working of a simple relay and the difference between soft and hard magnetic materials.

Weakness

Many students were unable to differentiate between soft and hard magnetic materials in relation to retaining magnetism.

Expected response

When S is closed, current flows in solenoid magnetizing the iron core; this attracts the iron armature closing the contacts; this causes current to flow in the motor circuit;Motor keeps running continuously;

Question 18

(a) State **two** differences between cathode rays and electromagnetic radiations.

(b) **Figure 10,** shows the main features of a cathode ray oscilloscope (CRO).

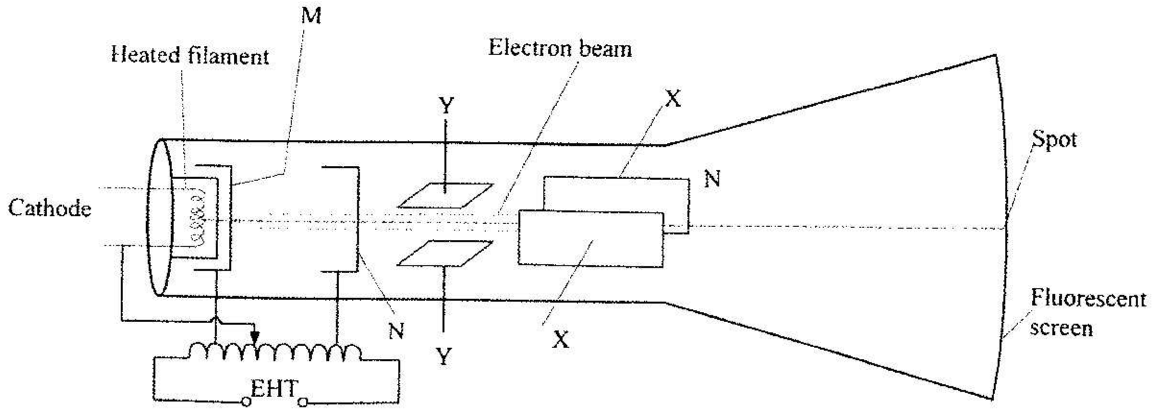


Figure 10

(i) Name the parts labelled M and N.

M ....

N ....

(ii) Explain how electrons are produced in the tube.

Candidates were required explain the working of a Cathode Ray Oscilloscope.

Weakness

A good number of Students were not able to explain how electrons are produced and where connections are made.

Expected response

a) -Cathode rays have charge but e.m radiations don't have charge;
-Cathode rays are particles and have a mass but e.m radiations are waves;
-Cathode rays travel at a speed depending on the accelerating voltage but e.m radiations travel at the speed of light in vacuum;
- Different in the mode of production.

(b) (i) M - grid;

N - accelerating anode/anode/vacuum;

(ii) Cathode is heated by filament;
electrons are released from cathode;
by thermionic emission

(iii) (I) across Y-Y plates.
(II) across X-X plates. (2 marks)

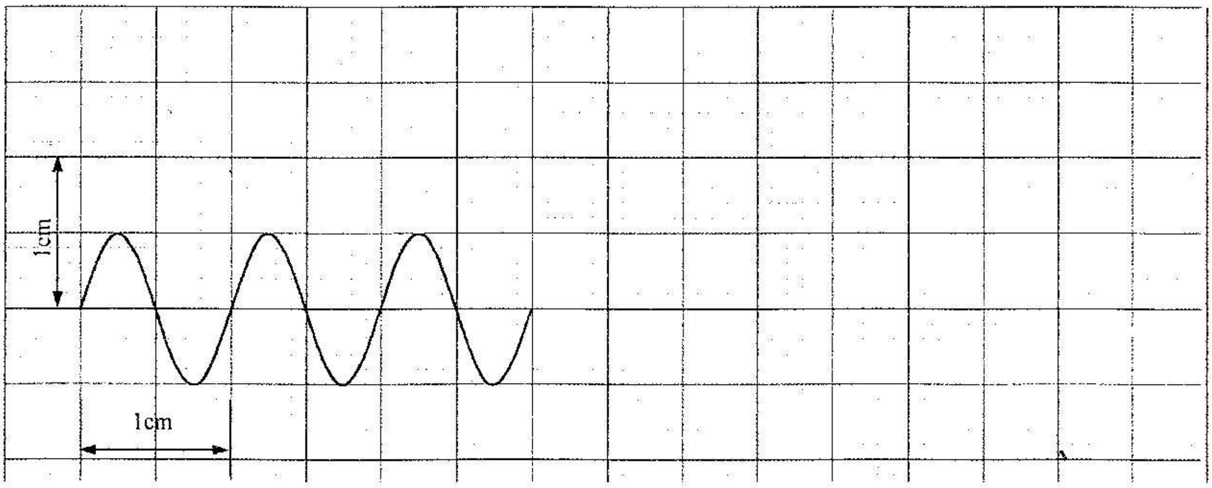
(iv) to reduce collisions, (hence ionization) with air molecules in the tube.

(1 mark)

(c) (i) peak-to-peak voltage = 5 x 2

= 10v

(ii)



Question 19

(a) When a radiation was released into a diffusion cloud chamber, short thick tracks were observed. State with a reason, the type of radiation that was detected. (2 marks)

(b) The half-life of an element X is 3.83 days. A sample of this element is found to have an activity rate of 1.6 x 10^3 disintegrations per second at a particular time. Determine its activity rate after 19.15 days. (2 marks)

(c) State what is meant by an extrinsic semiconductor. (1 mark)

Candidates were required state types of radiations, determine half life and explain the depletion layer.

Weakness

Most candidates were not able to relate half life and activity rate. Some lacked knowledge on biasing of a diode and rectification.

Expected response

(a) α - radiation;

short range with intense ionization hence thick tracks;

(b) No. of half-lifes = $\frac{19.15}{3.83} = 5$

Activity

Days	0 0	1 3.83	2 7.66	3 11.49	4 15.32	5 19.15
Activity	1.6×10^3	8×10^2	4×10^2	2×10^2	1×10^2	0.5×10^2

Activity $= 0.5 \times 10^2$

= 50 disintegrations per second

c) A semiconductor in which impurities have been added to change conductivity.

(d) By connecting it in forward biased mode (i.e. P to + and n to -)

8.5 Paper 3(232/3)

Question2

Part A

You are provided with the following:

- a 100ml glass beaker.
- a weighing balance (to be shared).
- a liquid labelled L.
- a measuring cylinder.

Proceed as follows:

(a) Measure and record the mass M_1 of the empty beaker.

M_1 ....g

(b) Measure and pour 2ml of liquid L into the beaker. Measure and record the mass M_2 of the beaker + liquid L.

M_2 ....g

(c) Determine the density d of the liquid L.

d = ...

Part B

You are provided with the following:

- a retort stand, boss and clamp.
- 2 boiling tubes.
- a thermometer.
- some distilled water in a beaker labelled W.
- some liquid in a beaker labelled L.
- a large beaker containing some water.
- a measuring cylinder.
- a stopwatch.
- a tripod stand and wire gauze.
- a cardboard with a hole in the middle.
- a burner.

Proceed as follows:

(d) Clamp one boiling tube on the retort stand. Measure and pour 45ml of the distilled water (W) into the boiling tube. Set up the apparatus as shown in figure 4.

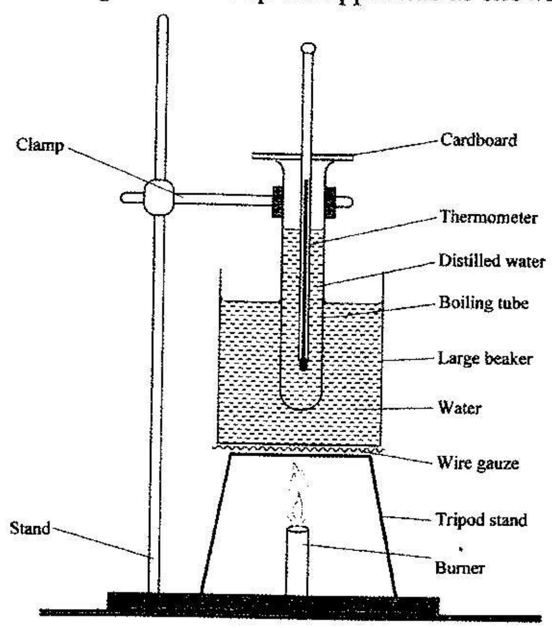


Figure 4

(e) Heat the water in the large beaker until the temperature of the distilled water reaches 85^0C. Remove the boiling tube from the hot water by lifting up the retort stand and placing it a way from the burner.

(f) Stir the water in the boiling tube using the thermometer. Record in the table 2 the temperature of the distilled water at intervals of 30 seconds starting at 80^0C until it drops to 60^0C. *(Stir the distilled water before taking any reading).*

Table 2

Time in minutes	0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5
Temperature of W (^0C) (to the nearest 0.5)										
Temperature of L (^0C) (to the nearest 0.5)										

Time in minutes	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0
Temperature of W (^0C) (to the nearest 0.5)											
Temperature of L (^0C) (to the nearest 0.5)											

(g) Using the second boiling tube, repeat the procedure in (d), (e) and (f) using 45ml of liquid L instead of distilled water. Record your results in the same table. (4 marks)

Candidates were required to set up the apparatus as per the diagram and follow the instructions (at g).

Candidates were required to heat water and liquid L to 85^0 each and record the cooling temperature in 10 minutes, draw the graphs of temperature against time and solve equations.
Weakness
Students were unable to:

- realize that the temperature was reducing as the liquid cooled and recorded the temperature when still heating.
- Some students did not follow instructions on recording temperature until it cooled to 60^0 and went ahead to record lower temperatures hence spend more time than was required and were not able to complete the experiment.

Expected response
PART A

(a) $M_1 = 53.5g$
(b) $M_2 = 73.0g$
(c) Correct mass liquid L = 19.5 g.
density = evaluate from candidates values of M_1 and M_2

PART B

(f) Table 2

Time in minutes	0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5
Temperature of W(°C)	80	79	77.5	76	75	74	72.5	71	70	69
Temperature of L(°C)	80	76	75	72	70	68	66	64.5	62.5	61.0

Time in minutes	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0
Temperature of W(°C)	68	67	66	65	64.5	63.5	62.5	61.5	61	60	
Temperature of L(°C)	59										

Correct temperatures of distilled water

6 points x
5 to 9 points
Correct temperatures of L
8 and more
4 to 7 points

(h) Graphs (see attached graphs)

(i) - axis labelled + units
- appropriate scale
- points plotted correctly
  6 correct points
  3- 5 correct points
- smooth curve

(ii) - points plotted correctly

- 6 correct points

- 3 - 5 correct points
- smooth curve points

(i) (i) (value obtained from the graph

(value obtained from the graph

(j) correct evaluation

$r = 3.0 \pm 0.1$

Advice to Teachers

- Learners should be guided on meaning of terms for them to be able to define with ease.
- Learners should be guided on proper use of formulae and language when responding to questions to show clearly their knowledge on certain concept and skills.
- 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.
- Graphical analysis should be included in the teaching of physics.
- Candidates must be advised to follow instructions in the practical paper and use the recorded data appropriately.
- During teaching learners must be made to relate the concepts to real life experiences.

The graph below shows clearly the performance trends in physics since 2006.