1408/312
PHYSICS TECHNIQUES
June/July 2010
Time: 3 hours

THE KENYA NATIONAL EXAMINATIONS COUNCIL

SCIENCE LABORATORY TECHNOLOGY CRAFT

PHYSICS TECHNIQUES

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:

Answer booklet
Mathematical tables/calculator
Take $g = 9.8 m/s^2$
Density of water = 1000 kg m^{-3}

*This paper consists of **TWO** sections; **A** and **B**.*
*Answer **ALL** the questions in section **A** and any **TWO** questions from section **B**.*
*Each question in section **A** carries 4 marks while each question in section **B** carries 20 marks.*

This paper consists of 5 printed pages.

Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.

Turn over

Physics 2010

2010

SECTION A (60 marks)

*Answer **ALL** the questions in this section.*

1. (a) The atmospheric pressure was recorded as 750mm Hg. Determine this pressure when measured in Nm^{-2}. (Density of mercury is 13600 Kgm^{-3}, acceleration due to gravity is 9.8 NKg^{-1}). (2 marks)

   (b) State the effects of increase in temperature on resistance for the following materials:

   (i) metal; (1 mark)
   (ii) semi conductors. (1 mark)

2. A solid of relative density 1.2 and a volume of $5cm^3$ is completely immersed in water.

   Determine:

   (a) weight of solid in air; (2 marks)

   (b) upthrust on the solid. (2 marks)
   (Density of water is 1000 kg m^{-3})

3. (a) Define the following terms as used in light waves:

   (i) diffraction; (1 mark)
   (ii) refraction. (1 mark)

   (b) Sketch a diagram that demonstrates the diffraction phenomenon. (2 marks)

4. A convex mirror of focal length 25cm produces an image on its axis 8cm away from the mirror. Determine:

   (a) the position of object; (3 marks)
   (b) magnification. (1 mark)

5. A cell supplies a current of 0.8A through a 1.6Ω resistor and a current of 0.3A through a 10Ω resistor. Calculate the internal resistance of the cell. (4 marks)

6. A virtual image of 4cm is formed using a convex lens of focal length 20cm. If the size of object is 1cm, determine the position of object. (4 marks)

7. Determine the time it takes a 240V, 1200W electric immersion heater to raise the temperature of 360 litres of water in a well - lagged copper tank of mass 12 Kg from 15°C to 40°C. (Specific heat capacity of water and copper are 4200 $JKg^{-1}K^{-1}$ and 400 $JKg^{-1}K^{-1}$ respectively, density of water = 1000 Kgm^{-3}). (4 marks)

8. With the aid of a diagram, describe "divided touch" method of magnetizing an iron bar. (4 marks)

9. Differentiate the three states of matter in terms of the motion of their molecules. (4 marks)

10. Differentiate between zener and photodiodes in terms of their operations. (4 marks)

11. Describe the control of wavelength and intensity of X-rays during production in an X-ray tube. (4 marks)

12. The angle of incidence of a ray of light in air is 60°. Determine the angle of refraction in a material whose critical angle is 45.0°. (4 marks)

13. (a) State the function of a fuse. (1 mark)

(b) State the present international convention colours of the three wires for a three core-flexible cable with lead insulation. (3 marks)

14. (a) State the effect of magnetic field on the following radio active emissions:

(i) gamma rays; (1 mark)
(ii) alpha particles; (1 mark)
(iii) beta particles. (1 mark)

(b) State the most ionizing (emission) radiation. (1 mark)

15. State **four** basic applications of an electroscope. (4 marks)

SECTION B: (40 marks)

*Answer any **TWO** questions from this section.*

16. (a) Describe the application of the following in a Geiger muller tube:

(i) mica window; (2 marks)

(ii) aluminium tube with wire at the centre. (3 marks)

(b) (i) Draw a typical decay curve on a graph of activity (counts per second) against time for a radio active element. (2 marks)

(ii) Indicate clearly at least three half-life intervals on the graph in b(i) above. (3 marks)

(c) Describe the term magnetic saturation. (3 marks)

(d) Describe the electrical method of demagnetization. (4 marks)

(e) Sketch a circuit diagram that can be used to achieve full wave rectification using two diodes. (3 marks)

17. (a) The velocity of light in water is 2.2×10^8 m/s, while in glass medium velocity is found to be 2.0×10^8 m/s. Calculate the:

(i) refractive index for light passing from water to glass; (4 marks)

(ii) angle of incidence in water which would produce an angle of refraction of 30° in glass. (3 marks)

(b) Show, using a ray diagram, the advantage of a convex driving mirror over a plane mirror. (7 marks)

(c) A beaker contains 300 grams of water at 21°C. 3.5 grams of ice at 0°C is added to the water which is stirred until the ice is completely melted. Determine the:

(i) amount of heat needed to melt the ice; (2 marks)

(ii) the lowest temperature of the mixture assuming that no heat enters or leaves the system and the heat capacity of beaker is negligible. (4 marks)

18. (a) State the Archimedes principle. (2 marks)

(b) A solid of mass 2kg weighs 14 newtons when wholly submerged in water. If the density of water is 1000 kg m^{-3}. Determine the:

(i) upthrust on the solid; (3 marks)

(ii) volume of the solid; (3 marks)

(iii) relative density of solid. (2 marks)

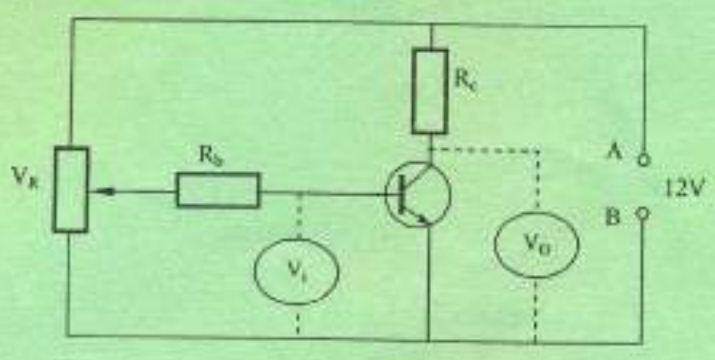
(c) (i) You are provided with three capacitors $C_1 = 1\mu F$, $C_2 = 2\mu F$, and $C_3 = 3\mu F$. Sketch a circuit diagram for the three capacitors when only:

I. C_1 is parallel to C_2; (1 mark)

II. C_2 is parallel to C_3. (1 mark)

(ii) Determine the resultant capacitance in c(i) I and c(i) II above. (8 marks)

19. (a) The figure below shows a correctly biased circuit which can be used to determine voltage characteristics of a transistor.



(i) Indicate the polarities of A and B for the 12 volts supply. (1 mark)

(ii) Name the transistor in the circuit. (1 mark)

(iii) State the relationship between potential difference across R_c and V_o. (1 mark)

(iv) Sketch the resulting graph of output voltage (Vo) against input voltage (Vi). (3 marks)

(v) Explain from the sketch graph how a transistor behaves as a switch. (3 marks)

(vi) Indicate on the graph the sections when the switch is "on" and when it is "off". (2 marks)

(b) Explain the use of the following parts in a cathode ray-tube:

(i) grid control; (2 marks)
(ii) vacuum; (2 marks)
(iii) anode. (2 marks)

(c) State the advantage of solid state devices over vacuum tubes. (3 marks)