1408/312
PHYSICS
TECHNIQUES
June/July 2011
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
Scientific calculator (battery operated).

*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 8 printed pages.

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

SECTION A (60 marks)

Answer ALL the questions in this section

1. State the SI unit of the following quantities:

   (a) Weight,

   (b) Wavelength,

   (c) Magnetic flux density,

   (d) Temperature.

   (4 marks)

2. A spring extends by 1.0 cm when loaded with a mass of 20.0g. Calculate:

   (a) The spring constant, (2 marks)

   (b) The mass needed to extend the spring by 3.5 cm, (2 marks)

3. (a) Define relative density, (1 mark)

   (b) Calculate the length of a cube whose mass and density are 324g and 2.5gcm^{-3} respectively. (3 marks)

4. Calculate the local atmospheric pressure of a town which is 1,600 metres above the sea level given that average density of air is 1.30 kgm^{-3} and average value of g is 10 ms^{-2}. Take atmospheric pressure at the sea level as 103,360 Pa. (4 marks)

5. (a) Define:

   (i) Heat capacity,

   (ii) Specific latent heat.

   (2 marks)

   (b) Explain why, alcohol is more suitable as a thermometric liquid than mercury for use in extremely cold regions. (2 marks)

6. (a) Describe how you would charge a Gold-leaf electrosope negatively by induction. (2 marks)

   (b) Determine the charge on a Gold-leaf electroscope; if the deflection of the leaf decreases when a negatively charged ebonite rod is brought near the cap of the electroscope. (2 marks)

7. (a) Explain the domain theory. (2 marks)

(b) Calculate the secondary current of a step down transformer if the primary current is 0.1 A, input voltage is 240V a.c. and output voltage is 12 V a.c. (2 marks)

8. Figure 1 shows a cell of 3.0 V and internal resistance of 0.2 Ω connected in series with a 5.8 Ω resistor.

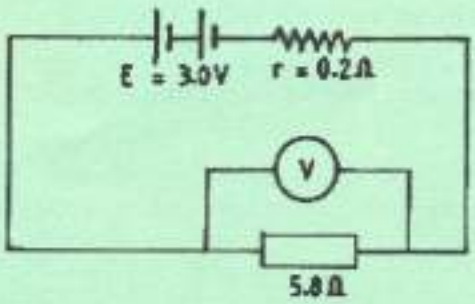

Figure 1

Calculate the voltmeter reading. (4 marks)

9. (a) Differentiate between N-type and P-type semiconductors. (2 marks)

(b) State **two** advantages of solid state transistor over the triode. (2 marks)

10. Calculate the frequency and the speed of a wave whose wavelength is 0.5 metre and period is 0.01 second. (4 marks)

11. (a) State any **two** features of a Cathode ray tube. (2 marks)

(b) State the difference between hard and soft X-rays. (2 marks)

12. (a) State the effect on atomic number and the mass number of an atom that decays by an Alpha particle. (2 marks)

(b) Explain why Gamma rays are not affected by magnetic and electric fields. (2 marks)

13. (a) Calculate the image position of an object if it is positioned 15.0 cm infront of a convex lens of focal length 10.0 cm. (3 marks)

(b) State the nature of the image in (a) above. (1 mark)

14. (a) State the use of the following features in a domestic electrical installation:

(i) Fuse,

(ii) Earth.

(2 marks)

(b) Explain why an ammeter coil should have negligible resistance while that of a voltmeter should be infinitely high. (2 marks)

15. (a) (i) What is the meaning of the term 'Myopia'?

(ii) Suggest a suitable lens for correcting 'Myopia'.

(2 marks)

(b) Explain why a camera uses convex lens and not concave lens. (2 marks)

SECTION B (40 marks)

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

16. (a) With aid of a diagram, describe the optical system of the compound microscope.

(8 marks)

(b) Figure 2 shows a circuit diagram of a project undertaken by the science laboratory students.

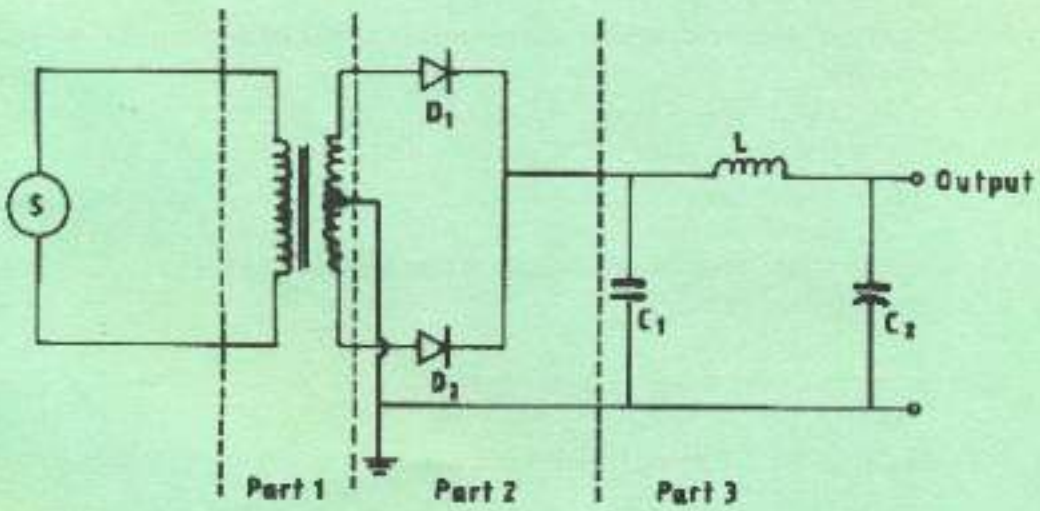

Figure 2

(i) Name the parts labelled **1**, **2** and **3**. (3 marks)

(ii) Describe the function of each of the components in part **1**, **2** and **3**. (6 marks)

(c) State **three** uses of X-rays. (3 marks)

17. (a) (i) Explain the meaning of power rating of an electric gadget and state its S.I. units. (2 marks)

(ii) Calculate the time needed to evaporate 0.5 kg of water at 20°C, if a heater of 3.0 kW is used with the initial mass of water being 1.0 kg.

NB: Assume the heater is 100% efficient and heat losses are negligible. Take specific heat capacity of water as 4200 $Jkg^{-1}K^{-1}$ and specific latent heat of vaporization as 2,260,00 Jkg^{-1}.

(8 marks)

(b) (i) Sketch a labelled circuit diagram to illustrate how a milliameter can be converted to a voltmeter. (2 marks)

(ii) Calculate the resistance required to convert a milliameter of full scale deflection 10 mA and coil resistance of 5.0 Ω into a voltmeter of full scale deflection of 5.0 V. (4 marks)

(c) The time base scale of a CRO is set to 10 cm s^{-1}. An a.c voltage tested on this scale has four full waveforms occupying 2.0 cm along the horizontal. Calculate the:

(i) Period,

(ii) Frequency of the a.c voltage.

(4 marks)

18. (a) (i) State the following laws as used in fluids:

(I) Floatation, (1 mark)

(II) Archimedes. (2 marks)

(ii) A rectangular piece of wood of mass 400g floats in water of density 1.0 gcm^{-3} with half of its volume submerged. Calculate the mass of an alloy of density 7.0 gcm^{-3} to be placed on top of the wood to fully submerge it. (7 marks)

(b) (i) Explain how a nanometer is used to measure the pressure of a gas supply. (4 marks)

(ii) Calculate the pressure of a gas supply in Pascals, if the difference in reading of the two arms of the manometer's U-tube is 40 mmHg, and that the local atmospheric pressure is 740 mmHg. Take density of mercury as 13,600 Kgm^{-3}. (6 marks)

19. (a) (i) Define capacitance and state its SI units. (2 marks)

(ii) Figure 3 shows capacitors C_1, C_2 and C_3 connected in a circuit.

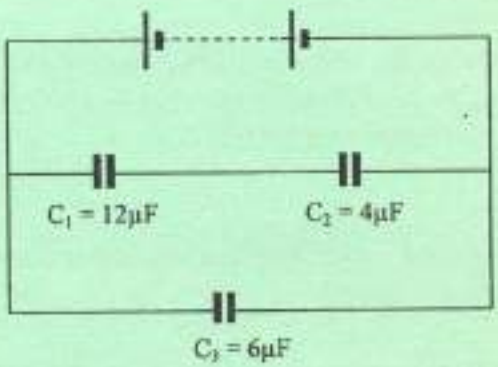

Figure 3

Calculate the following quantities:

(I) charge stored in C_3. (2 marks)

(II) Charge stored in C_1. (4 marks)

(III) P.d. across C_2. (2 marks)

(b) Figure 4 represents a coil connected to a cell.

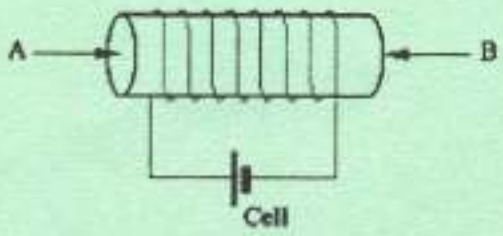

Figure 4

(i) Name the poles **A** and **B**. (2 marks)

(ii) State **two** ways of increasing the magnetic flux density in figure 4. (2 marks)

(c) Figure 5 shows a transistor in a circuit.

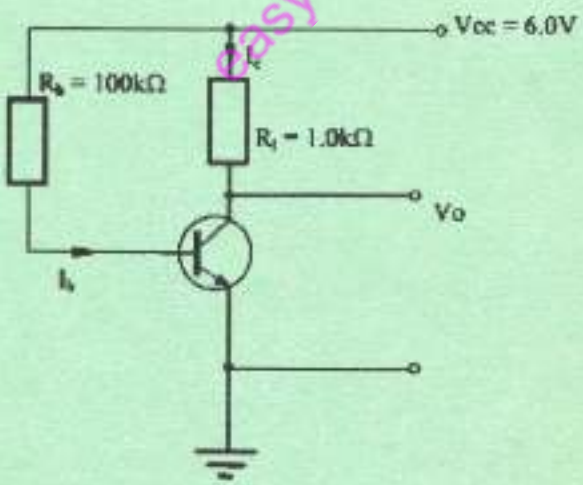

Figure 5

The forward current transfer ratio in the circuit is 50. Assuming the base-emitter voltage is negligible, calculate:

(i) I_b (2 marks)

(ii) I_c (2 marks)

(iii) V_o (2 marks)