REPUBLIQUE DU CAMEROUN
Paix-Travail-Patrie

MINISTERE DES ENSEIGNEMENTS SECONDAIRES

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MINISTRY OF SECONDARY EDUCATION

TEACHERS' RESOURCE UNIT
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The Teachers' Resource Unit and the Regional Inspectorate of Pedagogy in collaboration with NWAPT	SUBJECT CODE NUMBER **0780**	PAPER NUMBER **2**
GENERAL CERTIFICATE OF EDUCATION REGIONAL MOCK EXAMINATION	PHYSICS	
ADVANCED LEVEL		

Time Allowed: TWO hours
INSTRUCTIONS TO CANDIDATES

Mobile phones are **NOT ALLOWED** in the examination room.

You will be marked on your ability to use good English, to organize information clearly and to use specialist vocabulary where appropriate.

In calculations, you are advised to show all the steps in your working, giving your answer at each stage.

You are reminded of the necessity for good English and orderly presentation in your answers.

SECTION I (1 HOUR)

Answer all the questions.

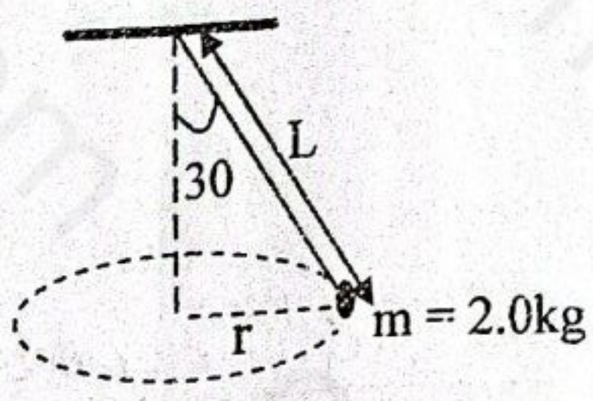
1. (a) State two factors that can be used to check the correctness of a physical equation.

   (b) The energy, W, stored in a stretched wire is given by the equation

   $$W = \frac{EAe^2}{2L}.$$

   Where, E, is the Young's modulus of elasticity of the material of the wire, A is the uniform cross-sectional area of the wire, e is the extension of the wire and, L is the original length of the wire. Determine whether the equation is homogeneous or not. **(7 marks)**

2. Figure 1 shows a mass, m attached to one end of a string of length 1.1m and whirled in a horizontal circle.



Figure

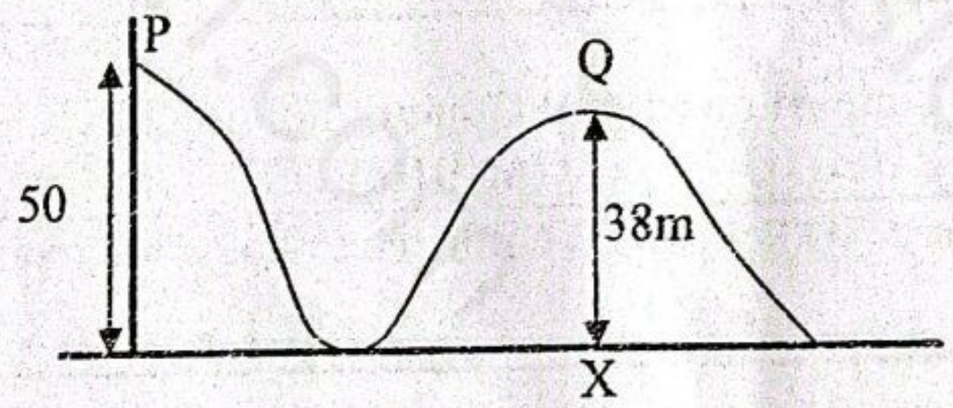
Calculate,

(a) The tension in the string.

(b) The period of revolution of the bob.

(c) The tangential velocity of the bob. **(6 marks)**

3. A 100kg mass is released at a point, P, and it moves along a frictionless track as shown in figure 2 below.



Figure

(a) State the law of conservation of mechanical energy.

(b) Calculate the maximum velocity of the mass.

(c) The net change in potential energy of the mass. **(6 marks)**

4. (a) Distinguish between a photon and an electron.

(b) Account for the conservation of energy when a photon ejects an electron from the surface of a metal.

(c) Light of wavelength 5.8×10^{-14}m falls on the surface of a certain photoelectron emitter of work function 2.16eV. Determine whether photoelectrons would be emitted or not. **(6 marks)**

5.

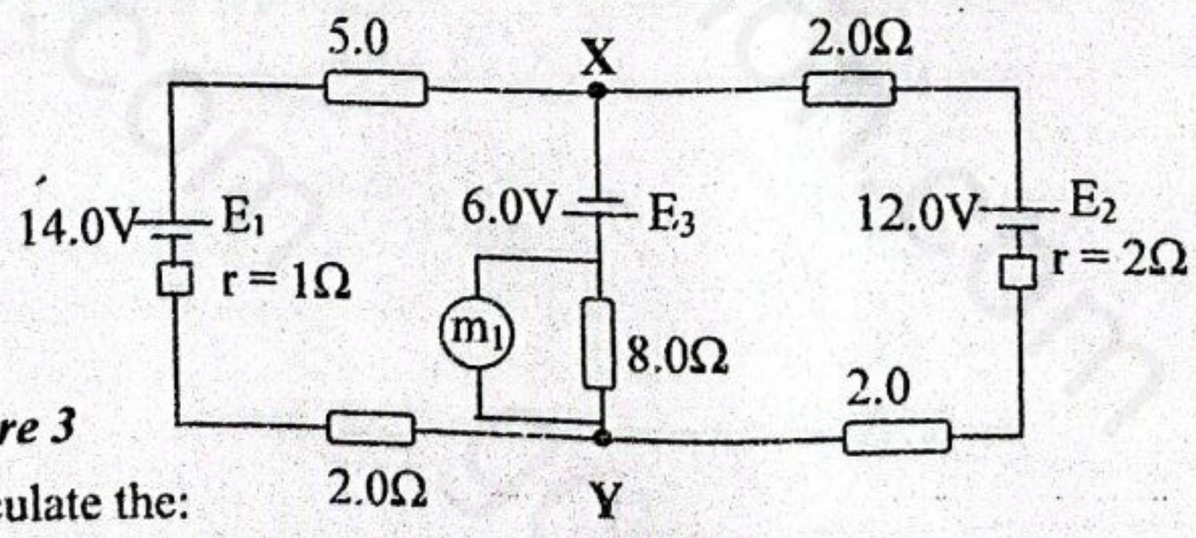


Figure 3

Calculate the:

(a) The reading of m_1.

(b) Net Potential Difference across XY. **(6 marks)**

ANSWER EITHER 6 (a), (b) and (c) or 6 (d), (e) and (f)

EITHER 6 (a), (b) and (c)

6 (a) Figure 4 below shows a 1200μF capacitor connected in series with a lamp of power rating 0.25A, 2.5V and a power supply 50Hz and a switch.

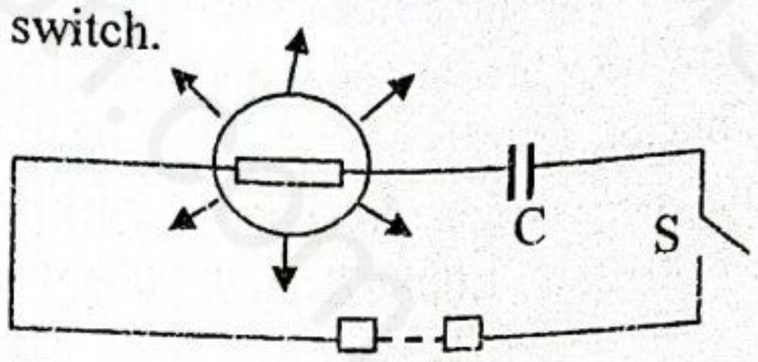


Figure $V_{r.m.s}$

Determine

(i) The root mean square supply voltage, $V_{r.m.s}$ to light up the lamp to it full brightness.

(ii) Potential difference across the capacitor and the lamp.

(iii) Verify whether the sum of the p.d across the capacitor and the lamp is equal to the root mean square supply voltage, $V_{r.m.s}$ and comment on the results **(7 marks)**

(b) (i) Differentiate between interference and diffraction of light.

A parallel beam of light of wavelength 5.5×10^{-7} m in air is incident on the slits of Young's double slit experiment. A thin film of transparent plastic of refractive index 1.48 and thickness 5.2×10^{-6}m is placed over one of the slits

(ii) Determine the increase in the optical path of the light passing through the thin film. Hence determine the number of fringes by which the central fringe is displaced.

(iii) Explain how the fringe spacing would change if

- The slit separation were increased
- The slit – screen distance were increased **(6 marks)**

(c) A space ship, transporting and distributing aid to refugee camps is traveling horizontally at a steady speed of $50ms^{-1}$ at an altitude of 300m. It releases a parcel when it is directly above a point X on a level ground, to a nearby camp. Calculate;

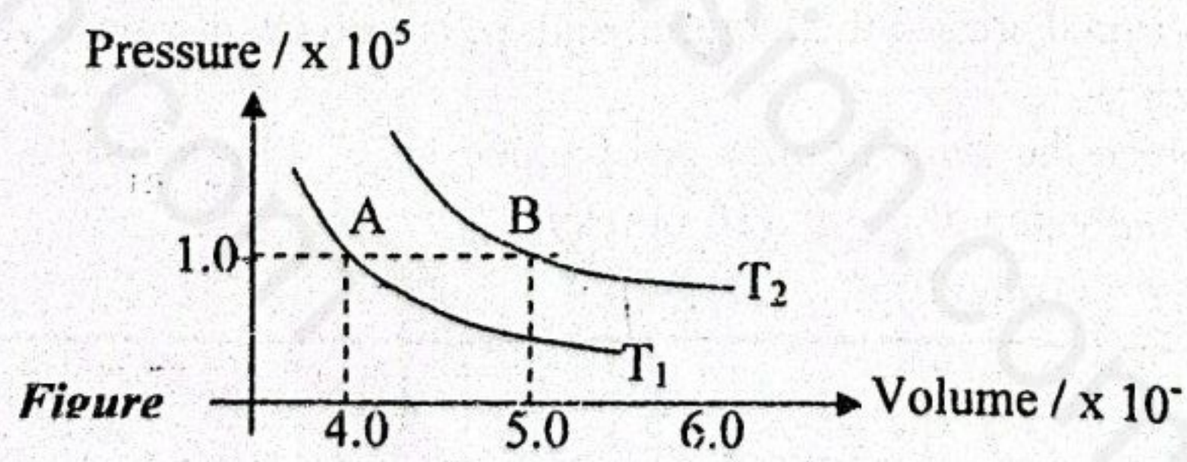
(i) The time of flight of the parcel.

(ii) The speed of impact of the parcel on the ground.

(iii) The distance of the camp from X, if the parcel did not miss its target. **(7 marks)**

OR 6 d), e) and f)

6. (d)Figure 5 below shows an ideal gas heated through an isobaric process from a temperature of 27°C.



Figure

Calculate;

(i) The external work done
(ii) The new temperature, T_2, of the gas.
(iii) The change in internal energy of the gas if its mass is 45g, molar mass 28g and heat capacity at constant volume is $0.6 Jmol^{-1}K^{-1}$.
(iv) The total heat energy gained by the gas. **(7 marks)**

(e) The stability of a nucleus depends on its **neutron – proton ratio** and **binding energy per nucleon**
(i) What are the meanings of the underlined words?
(ii) Sketch a graph to show how binding energy per nucleon varies with mass number for naturally existing nuclei.
(iii) Calculate the binding energy of an alpha particle given that the masses of proton, neutron and alpha particle are 1.00728U, 1.00867U and 4.00150U respectively and 1U = 931MeV.
(7marks)

(f) A beaker containing ice at $-4^{\circ}C$ is allowed to stand in a room until it attained an equilibrium temperature of $25^{\circ}C$ with the room. Explain the mechanisms involved in the transfer of heat energy between the beaker and the room. **(6 marks)**

SECTION II (30 MINUTES)
DATA ANALYSIS

7. In an experiment to investigate the relationship between the resistance, R, of a material and its length, L, a thin wire of the material (of diameter 1.5mm), was used and the results obtained were recorded as shown on the table below.

Resistance, R/Ω	Length, L /cm
4.6	10.0
9.2	20.0
13.8	30.0
18.4	40.0
23.1	50.0
27.5	60.0
32.2	70.0
36.8	80.0
41.3	90.0
46.1	100.0

Theory shows that the resistance of a material is related to its length by the equation

$$R = \rho \frac{L}{A}.$$

Where, **A**, is the uniform cross-sectional area of the material and, **ρ**, is a constant whose value depends on the nature of the material.
(a) Plot a suitable graph from which the value of ρcan be obtained **(9 marks)**
(b) From your graph, determine the value of **ρ.** **(10 marks)**
(c) What is the significance of **ρ?** **(1 mark)**

SECTION III (1 HOUR)

OPTIONS

Answer any two of the four options.

OPTION 1: ENERGY RESOURCES AND ENVIRONMENTAL PHYSICS.

8. (a) Hydroelectric power and nuclear energy are both energy resources from which functional energy can be obtained.
   (i) What is functional energy?
   (ii) Give one advantage and one disadvantage of hydroelectric power plant over nuclear energy power plant as a source of energy.
   (iii) Draw the energy flow block diagram for the conversion of hydroelectric energy to functional energy **(7 marks)**

   (b) Nuclear fusion has not been a common source of energy compared to nuclear fission. Explain why. **(2 marks)**

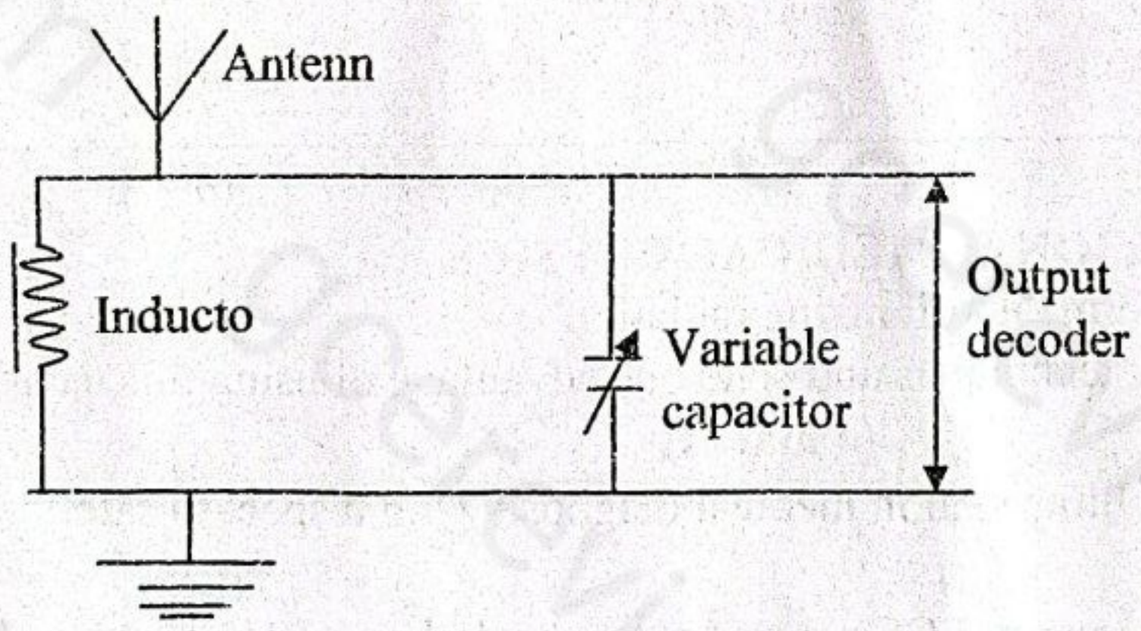
   (c) A car is packed in sun light for some time with the glasses wound up. The inside of the car soon becomes very hot as compared to the outside.
   (i) Give an explanation to the above observation.
   (ii) Name any one green house gas.
   (iii) Name any two adverse effects of the high concentration of greenhouse gasses.**(6 marks)**

(Total = 15 marks)

OPTION 2: COMMUNICATION

9. (a) In order to make information transfer and reception suitable and efficient, the information is encoded at
The transmitting end and decoded at the receiving end.
   (i) What is encoding?
   (ii) Drawn a block diagram of an encoder.**(4 marks)**

(b) The figure 6 below shows the tuning circuit of aradio receiver.



   (i) Explain how the tuning circuit functions
   (ii) Given that the coil used has an inductance of 4.0mH calculate the value for the capacitor required to tune into the broadcast for a 102MHz radio transmitter.
   (iii) What is the use of the decoder in this circuit? **(7 marks)**

(c) Give two differences between communication through local radio and communication through mobile phone. **(4 marks)**

(Total = 15 marks)

OPTION 3: ELECTRONICS.

10. (a) (i) Explain with the aid of suitable diagrams, the formation of ap-n junction in an impure semi-conductor.

(ii) By means of appropriate circuit diagram, show how a p-n junction can beforward biased.
(4 marks)

(iii) Distinguish between an AND gate and an OR gate. **(2 marks)**

(b) Figure 7shows a transistor circuit in which $I_B = 0.25$ mA, $I_C = 10.0$ mA and $V_{CE} = 4.5$ V.

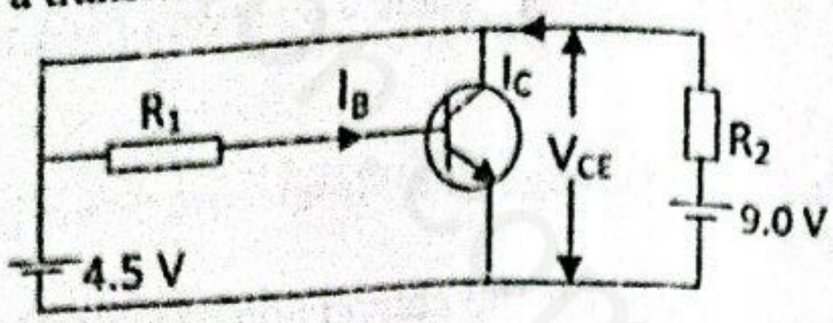


Figure 7

(i) Name the type of transistor used, and state the mode in which it is connected

(ii) Assuming that the base – emitter voltage (V_{BE}) is negligible, calculate the resistance of the resistors R_1 and R_2. **(4 marks)**

(c)Figure 7 below, shows a signal generator of output 200 Hz, 2.5Vr.m.s sinusoidal signal connected to a C.R.O. The Y-plate sensitivity and time-base of the cathode ray oscilloscope (C.R.O) are set at 2.0V/cm and 1.0ms/cm respectively.

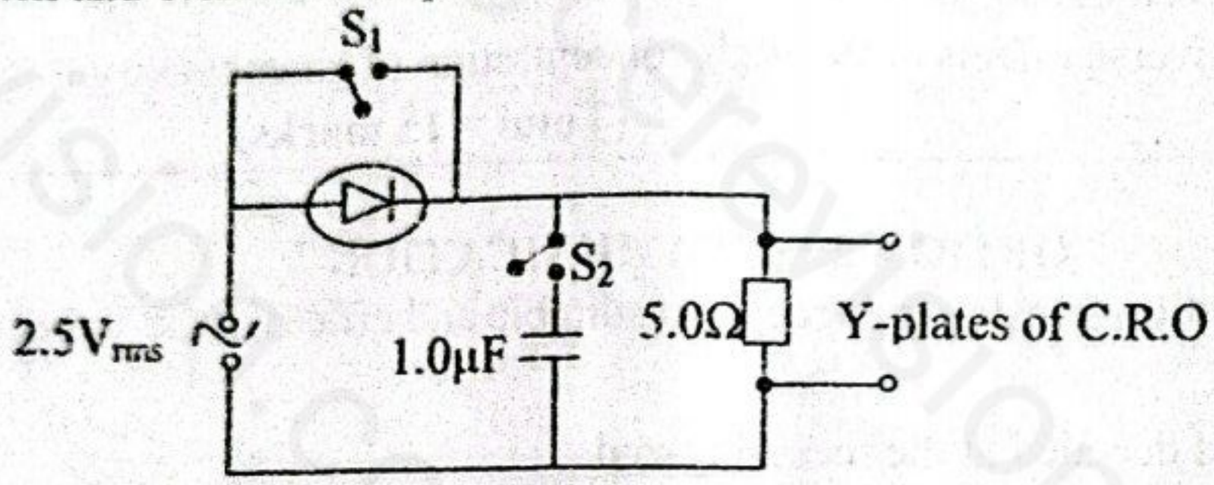


Figure 7

Sketch full-scale diagrams to show the waveform observed on the C.R.O when;

(i) $S_1$is closed and S_2 open.

(iii) S_1 and S_2 are both open. **(5 marks)**

(Total: 15 marks)

OPTION 4: MEDICAL PHYSICS

(a) (i) What do you understand by the term "non-ionizing radiation"?

(ii) Name twonon-ionizing imaging techniques and state one advantage of using this technique over an ionizing technique. **(4 marks)**

(b) Compare the use of X–rays and Ultrasound in medical diagnosis with respect to safety **(4 marks)**

(c) (i) Give the full meaning of the acronym ECG as used in medical physics. **(1 mark)**

(ii) Outline 2 uses of an ECG scan. **(2 marks)**

(d) Draw a simple diagram of the human heart, showing clearly the functional parts which enable the heart to pump blood. **(4marks)**

(Total: 15 marks)

END