THE UNITED REPUBLIC OF TANZANIA
NATIONAL EXAMINATIONS COUNCIL OF TANZANIA
ADVANCED CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

131/2 **PHYSICS 2**

(For Both School and Private Candidates)

Time: 3 Hours **Year: 2022**

Instructions

1. This paper consists of a total of **six (6)** questions.
2. Answer **five (5)** questions.
3. Each question carries **twenty (20)** marks.
4. Mathematical tables and non-programmable calculators may be used.
5. Cellular phones and any unauthorised materials are **not** allowed in the examination room.
6. Write your **Examination Number** on every page of your answer booklet(s).
7. The following information may be useful:

(a) Acceleration due to gravity $g = 9.8\ m/s^2$

(b) Density of air $\rho_a = 1.29\ kg/m^3$

(c) Density of water $\rho_w = 10^3\ kg/m^3$

(d) Speed of sound in air = 340 m/s

(e) Surface tension of water, $\gamma = 0.072\ N/m$

(f) Permiability of free space, $\mu_0 = 4\pi \times 10^{-7}\ H/m$

(g) Plank's constant, $h = 6.63 \times 10^{-34}\ Js$

(h) Reydberg's constant, $R_H = 1.1 \times 10^7\ m^{-1}$

(i) Electronic charge, $e = 1.6 \times 10^{-19}\ C$

(j) Speed of light, $c = 3 \times 10^8\ m/s$

(k) Mass of an electron, $m_e = 9.11 \times 10^{-31}\ kg$

(l) Pie $\pi = 3.14$

(a) (i) Give three importance of coefficient of viscosities of liquids in daily life activities. **(03 marks)**

(ii) Identify two assumptions made in deriving the Poiseuille's equation for the flow of a liquid through a narrow tube. **(02 marks)**

(b) (i) If the radius of a pipe carrying liquid gets decreased by 8%, how much would the pressure difference between the ends of the constricted pipe will increase to maintain a constant flow rate? **(03 marks)**

(ii) Describe the mode of action of a Pitot-static tube and apply Bernoulli's equation to obtain the formulae used to measure the velocity of a flowing liquid. **(06 marks)**

(c) (i) Under what circumstance does Torricelli's theorem apply? **(02 marks)**

(ii) Water is maintained at a height of 10 m in a tank. Calculate the diameter of the circular hole needed at the base of the tank to discharge water at the rate of 26.4 m^3/minute. **(04 marks)**

2. (a) (i) Give a concrete reason behind a straight line propagation of light irrespective of its wave nature. **(03 marks)**

(ii) In a Young's double slit experiment, the green light of mercury of wavelength 0.54 μm was used with a pair of parallel slits of separation 0.6 mm. If the fringes were observed at a distance of 40 cm from the slit; calculate the distance of separation between the fringes. **(04 marks)**

(b) (i) Identify two cases in which there is no Doppler effect in sound. **(02 marks)**

(ii) A car is sounding a horn which produces a note of frequency 500 Hz. If it approaches and then passes a stationary observer Q at a steady speed of 20 m/s; calculate the change in pitch of the note as heard by Q. **(05 marks)**

(c) (i) What properties of a medium are responsible for propagation of a wave through it? Give two points. **(02 marks)**

(ii) A horizontal stretched elastic string of length and mass of 3.0 m and 12 kg respectively is subjected to a tension of 1.6 N. If a transverse wave of frequency 40 Hz is propagated down the string; determine the distance between successive crests of this wave motion. **(04 marks)**

3. (a) (i) What is meant by the angle of contact between the liquid and a solid as used in properties of matter? **(01 mark)**

(ii) Outline four factors on which the value of angle of contact depends. **(04 marks)**

(b) (i) Give a qualitative distinction between surface tension and surface energy of a liquid. **(03 marks)**

(ii) A small air bubble of radius 0.1 mm is situated just below the water surface. If the atmospheric pressure is 1.013×10^{5} N/m^{2}; determine the pressure inside the air bubble. **(04 marks)**

(c) (i) Stipulate four practical applications of capillarity in daily life activities. **(04 marks)**

(ii) Water rises in a capillary tube to a height of 2.0 cm. Compute the height at which water will rise in another capillary tube whose radius is $\frac{1}{3}$ of the first tube. **(04 marks)**

4. (a) (i) State Coulomb's law. **(01 mark)**

(ii) A proton of mass 1.673×10^{-27} kg falls through a distance of 1.5 cm in a uniform electric field of magnitude 2.0×10^{4} NC^{-1}. If air resistance and acceleration due to gravity are neglected, calculate its time of fall. **(06 marks)**

(b) A 100 V battery terminals are connected to two large and parallel plates which are 2 cm apart. If the field in the region between the plates is nearly uniform, determine the force on an electron in this field. **(05 marks)**

(c) If an electron is released from rest from the upper plate inside the field in 4 (b), determine;

(i) the velocity with which it will hit the lower plate. **(03 marks)**

(ii) its kinetic energy and the time it will take for the whole journey. **(05 marks)**

5. (a) (i) Why do magnetic lines of force always form a closed loop? **(02 marks)**

(ii) A force of 0.025 N was experienced by a test wire of length 0.05 m placed in a magnetic field of strength 0.2 T carrying a current of 2.5 A. Calculate the angle between the wire and the field lines. **(04 marks)**

(b) (i) Identify two classes of magnetic materials which are weakly affected by magnetic field. **(02 marks)**

(ii) A toroid with an air core, carrying a current of 0.15 A has a mean circumference of 50 cm and 500 number of turns. Determine its magnetizing force and magnetic flux density. **(05 marks)**

(c) (i) Briefly explain the cause of earth's magnetic field. **(03 marks)**

(ii) An aircraft is flying horizontally at 860 km/hr in a region where the vertical component of the earth's magnetic field is 6.0×10^{-5} T. If its wing span is of 54 m; determine the potential difference induced between one wing tip and the other. **(04 marks)**

6. (a) (i) What is meant by energy level? **(01 mark)**

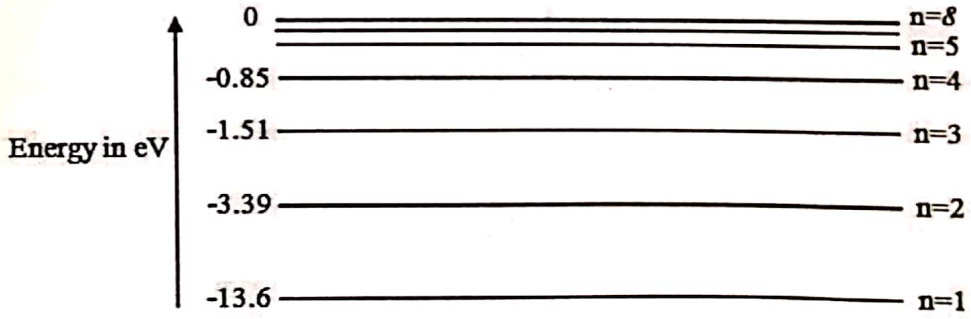
(ii) How does ionization energy differ from excitation energy? **(03 marks)**

(b) (i) Why did the Thompsons's model fail? **(02 marks)**

(ii) Identify four applications of Cathode ray oscilloscope. **(04 marks)**

(iii) Calculate the wavelength of the most energetic x-rays produced by a tube operating at 1.5×10^5 V. **(04 marks)**

(c) Study the following Figure of the energy level diagram for hydrogen atom and then answer the questions that follow.



(i) Calculate the frequency and the wavelength of the radiation emitted as a result of an electron transition from $n=3$ to $n=2$. **(04 marks)**

(ii) What is the energy at the level where $n=5$? **(02 marks)**