

**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 $g = 9.8 \text{ m/s}^2$
- (b) Density of air $\rho_a = 1.29 \text{ kg/m}^3$
- (c) Density of water $\rho_w = 10^3 \text{ kg/m}^3$
- (d) Speed of sound in air $= 340 \text{ m/s}$
- (e) Surface tension of water, $\gamma = 0.072 \text{ N/m}$
- (f) Permiability of free space, $\mu_0 = 4\pi \times 10^{-7} \text{ H/m}$
- (g) Plank's constant, $h = 6.63 \times 10^{-34} \text{ Js}$
- (h) Reydberg's constant, $R_H = 1.1 \times 10^7 \text{ m}^{-1}$
- (i) Electronic charge, $e = 1.6 \times 10^{-19} \text{ C}$
- (j) Speed of light, $c = 3 \times 10^8 \text{ m/s}$
- (k) Mass of an electron, $m_e = 9.11 \times 10^{-31} \text{ kg}$
- (l) Pie $\pi = 3.14$

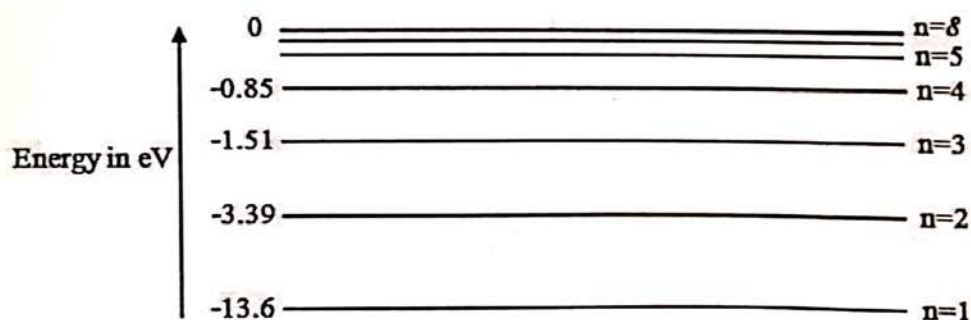


- (a) (i) Give three importance of coefficient of viscosities of liquids in daily life activities. (03 marks)
- (ii) Identify two assumptions made in deriving the Poiseuille's equation for the flow of a liquid through a narrow tube. (02 marks)
- (b) (i) If the radius of a pipe carrying liquid gets decreased 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 $26.4 \text{ m}^3/\text{minute}$. (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 $0.54 \mu\text{m}$ 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 $1.013 \times 10^5 \text{ N/m}^2$; 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 $1.673 \times 10^{-27} \text{ kg}$ falls through a distance of 1.5 cm in a uniform electric field of magnitude $2.0 \times 10^4 \text{ NC}^{-1}$. 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)