

THE UNITED REPUBLIC OF TANZANIA
PRESIDENT'S OFFICE,
REGIONAL ADMINISTRATION AND LOCAL GOVERNMENT
NJOMBE REGION



FORM SIX PRE – NATIONAL EXAMINATION

CODE: 131/2

PHYSICS 2

(For Both School and Private Candidates)

TIME: 03: 00 HOURS

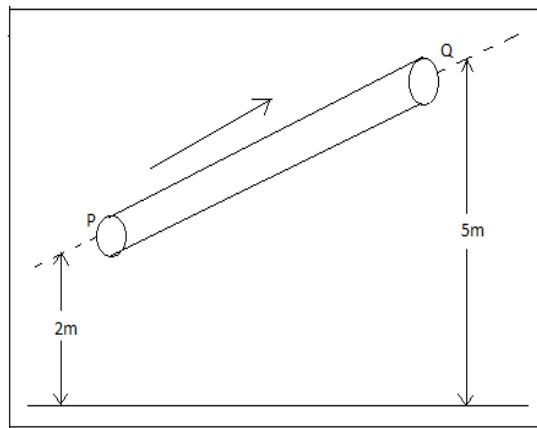
FRIDAY, 15TH March 2024 A.M

INSTRUCTIONS:

1. This paper consists of **six (6)** Questions.
2. Answer **five (5)** questions and each question carries **twenty (20)** Marks.
3. Mathematical tables and non –programmable calculators may be used.
4. Write your examination NUMBER on every page of your answer sheet or booklet(s).
5. The following information may be used if necessary;

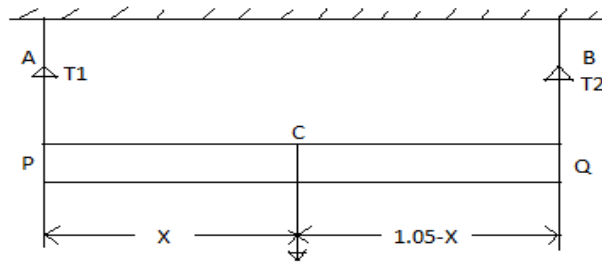
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| xi. Acceleration due to gravity $g = 9.8 \text{ ms}^{-2}$ | i. Electronic charge $e = 1.6 \times 10^{-19} \text{ C}$ |
| xii. Density of water $\rho_w = 10^3 \text{ kgm}^{-3}$ | ii. Boltzman constant $(K_B) = 1.38 \times 10^{-23} \text{ J/K}$ |
| xiii. Density of sea water $\rho_{sw} = 1000 \text{ kgm}^{-3}$ | iii. Universal gas constant $R = 8.31 \text{ J/mol K}$ |
| xiv. Density of glycerine $\rho_g = 1300 \text{ kgm}^{-3}$ | iv. Mass of proton $M_p = 1.007825 \text{ u}$ |
| xv. Density of air $\rho_a = 1.2 \text{ kgm}^{-3}$ | v. Mass of neutron $M_n = 1.008665 \text{ u}$ |
| xvi. Viscosity of Glycerine $\eta = 0.83 \text{ Pas}$ | vi. Permittivity of free space, $\epsilon_0 = 8.854 \times 10^{-12} \text{ Fm}^{-1}$ |
| xvii. Young's modulus of steel wire $Y_s = 2 \times 10^{11} \text{ Pa}$ | vii. Permiability of free space, $\mu_0 = 4\pi \times 10^{-7} \text{ Hm}^{-1}$ |
| xviii. Young's modulus of Aluminium wire $Y_a = 7 \times 10^{10} \text{ Pa}$ | viii. surface tension of water $= 7.2 \times 10^{-2} \text{ N/M}$ |
| xix. Young's modulus of rubber $Y_r = 9.8 \times 10^8 \text{ Pa}$ | ix. Pie, $\pi = 3.14$ |
| xx. Plank's constant $h = 6.62 \times 10^{-34} \text{ Js}$ | x. Velocity of sound in air $V_a = 330 \text{ m/s}$ |
| xxi. Mass of electron $M_e = 9.1 \times 10^{-31} \text{ kg}$ | |
| xxii. Mass of electron $M_e = 9.1 \times 10^{-31} \text{ kg}$ | |
| xxiii. Avogadro's number $N_A = 6.0 \times 10^{23} \text{ per mole}$ | |

1. (a) (i) Explain why the blood pressure in human is greater at the feet than at the brain? (02Marks)
- (ii) Glycerine flows steadily through a horizontal pipe or tube of length 1.5M and radius of 1cm. If the amount of glycerine collected per second at one end is $4.0 \times 10^{-3} \text{kg s}^{-1}$, What is the pressure difference between the two ends of the tube or pipe ? (03 Marks)
- (b) (i) At what speed will the velocity head of stream of water be equal to 40cm? (01 Mark)
- (ii) The reading of the pressure meter attached with a closed water pipe is $3.5 \times 10^5 \text{ Pa}$. On opening the valve of the pipe, the reading of the pressure meter is reduced to $3 \times 10^5 \text{ Pa}$. Calculate the speed of water flowing in the pipe. (04 Marks)
- (c) A non – viscous liquid of constant density 1000kg m^{-3} flows in a streamline motion along a tube of variable cross –section. The tube is kept inclined at in the vertically plane ;(see figure 1 below). The area of cross-section of the tube at the two points say P and Q at the heights 2m and 5m are respectively $4 \times 10^{-3} \text{m}^2$ and $8 \times 10^{-3} \text{m}^2$. The velocity of the liquid at point P is 1m/s. Find the work done per unit volume by the pressure and gravity forces as the liquid flows from point P to Q . (05Marks)



- (d) (i) Explain using Bernoulli's equation, Why there a lifting force produced by the flow of air past the wings of an Aeroplane or why wings help an aeroplane to rise high against gravity? (02 Marks)
- (ii) A fully loaded Boeng air craft has a mass of $3.3 \times 10^5 \text{kg}$.Its total wings area is 500m^2 . It is in the level of flight with the speed of 960km h^{-1} . Estimate the pressure difference between the lower and the upper surfaces of the wings . (03 Marks)

2. (a) (i) Identify two distinct examples between transverse wave and longitudinal wave (02 Marks)
- (ii) The third overtone of a closed pipe is found to be unison with the first overtone of an open pipe. Find the ratio of the length of the pipe. (03 Mark)
- (b) (i) State four conditions for sustainable interference (04 Marks)
- (ii) Monochromatic light of wavelength 600nm is incident normally on an optical transmission of spacing 200mm. Calculate the number of the diffracted beams, which can be observed, and the maximum possible order. (03 Marks)
- (c) (i) define the term Doppler effect (01 Marks)
- (ii) The Doppler Effect using sound waves of frequency 2.25×10^6 Hz is used to monitor the heartbeat of a fetus. A maximum beat frequency of 600Hz is observed. Assuming that the speed of sound in tissue is $1.54 \times 10^3 \text{ ms}^{-1}$ Calculate the maximum velocity of the surface of the beating heart. (03 Marks)
- (d) (i) Why soap film appeared coloured ? (02 Marks)
- (ii) A progressive wave equation is given by: $Y = A \sin(\omega t + kx)$. What do the following terms represent? ωt , kx , $(\omega t + kx)$ and $\sin(\omega t + kx)$ (02 Marks)
- 3.(a) what do you understand by following terms:
- ductile materials (01 Mark)
 - Brittle Materials (01 Mark)
 - Elastomers (01 Mark)
 - Elastic fatigue (01 Mark)
 - Elastic after effect (01 Mark)
- (b) A rod of length 1.05M having a negligible mass is supported at its ends by two wires of steel (wire A) and Aluminium wire (wire B) of equal lengths (see figure 2 below).The cross-sectional areas of wire A and wire B are 1mm^2 and 2mm^2 respectively .At what point along the rod should a mass M be suspended in order to produce .
- (i) Equal stresses in both steel and Aluminium wires (03 Marks)
- (ii) Equal strains in both steel and Aluminium wires (03 Marks)



- (c) (i) Is stress a vector quantity? (01 Mark)
(ii) To what depth must rubber ball be taken in a deep sea, so that its volume is decreased by 0.1%? (03 Marks)
- (d) (i) How is surface energy related to surface tension of the liquid ? (01 Mark)
(ii) By which phenomenon, the water rises from roots to leaves of plants. (01 Mark)
(iii) Water rises in a capillary tube to a height of 2cm. In another capillary tube, whose radius is one-third of it, how much water will rise? If the first capillary tube is inclined at an angle of 60° with the vertical, then what will be the position of water in the tube? (03 Marks)
- 4.(a)(i) What is electric field lines ? (01 Mark)
(ii) At a point charge of 3.3nc is placed in a medium of relative permittivity of 5. Calculate the electric field intensity at a point 10cm from the charge. (03 Marks)
- (b) (i) Define the term electrostatic potential . (01 Mark)
(ii) Two point charges $+20\mu\text{C}$ and $-20\mu\text{C}$ are placed 20cm apart. Calculate the electrostatic potential at a midway on the line connecting the two charges. (03 Marks)
- (c) (i) Explain three factors affecting capacitance of the capacitor. (03 Marks)
(ii) A parallel plate capacitor having plate area 100cm^2 and separation 1.0mm holds a charge of $0.12\mu\text{C}$ when connected to 120V battery. Find the dielectric constant of the material filling the gap. (03Marks)
- (d) (i) Explain why two equipotential surfaces can never intersect?(02 Marks)
(ii) Show that there is no workdone in moving a test charge over an equipotential surface (02 Marks)
(iii) Give two differences between electric potential due to a point charge and electric potential due to a dipole. (02 Marks)
5. (a) (i) State the Biot –savart law and use it to derive the expression for magnetic field at the centre of current carrying circular coil . (04 Marks)

- (ii) The electron of a hydrogen atom moves along a circular path of radius 0.5nm with a uniform speed of 4.0×10^6 m/s. Calculate the magnetic field produced by the electron at the Centre. (03 Marks)
- (b) (i) How does “one ampere “is defined in the concept of magnetic force? (02 Marks)
- (ii) State the rule that gives the direction of the force experienced by a straight current carrying conductor placed in a magnetic field. (02Marks)
- (c) Calculate the force per unit length on a long straight wire carrying a current of 6A in opposite direction with the wire carrying a current of 4A. Distance between the wires is 3cm.State the direction of the force. (04 Marks)
- (d) (i)State faradays law of electromagnetic induction . (02 Marks)
- (ii) Which factors determine the magnitude of emf induced in a coil?(03marks)
6. (a) (i) Define activity of radioactive decay (01 Mark)
- (ii) Derive an expression for the activity constant in terms of half-life. (03 Marks)
- (iii) A radioactive isotope of cobalt 60 is widely used in medicine and has a half-life of about 5.3years.What mass of the isotope is required for the activity of 1 millicurie? (04 Marks)
- (b)(i) What is the meaning of the negative energy of orbiting electron?
- (ii) Give two differences between Rutherfords model and Bohrs model of an atom (02 Marks)
- (iii) Calculate the time taken by an electron to travel the first Bohr orbit in the hydrogen atom (03 Marks)
- (c) (i) How do you account for the stability of a nucleus? (02 Marks)
- (ii) It is proposed that to use the nuclear fusion reaction
- $${}_1H^2 + {}_1H^2 \rightarrow {}_2He^4.$$

In a nuclear reactor of 200MW rating. If the energy from the above reaction is used with 25% efficiency in the reactor, how many grams of deuterium fuel will be needed per day? The masses of ${}_1H^2$ and ${}_2He^4$ are 2.014a.m.u and 4.0026a.m.u respectively. (04 Marks)