

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



FORM SIX INTER REGIONAL EXAMINATION 2022

IRINGA, LINDI AND MOROGORO

131/2

PHYSICS 2

(For Both School and Private Candidates)

Time: 3:00 Hours

Friday 25th February, 2022 a.m

Instructions

1. This paper consists of **Six (6)** questions.
2. Answer **any 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 unauthorized 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) Pie, $(\pi) = 3.14$
 - (c) Young's modulus of copper wire, $(E) = 1.2 \times 10^{11} \text{ N/m}^2$
 - (d) Young's modulus of rubber, $(E) = 6 \times 10^8 \text{ N/m}^2$
 - (e) Surface tension of soap solution, $(\gamma) = 2.5 \times 10^{-2} \text{ N/m}$
 - (f) $\frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \text{ Nm}^2/\text{C}^2$
 - (g) Radius of the earth, $(r_e) = 6.4 \times 10^6 \text{ m}$
 - (h) Permeability of free space, $(\mu_0) = 4\pi \times 10^{-7} \text{ H/m}$
 - (i) Electronic charge, $(e) = 1.6 \times 10^{-19} \text{ C}$
 - (j) Planck's constant, $(h) = 6.63 \times 10^{-34} \text{ Js}$
 - (k) Avogadro's number, $(N_A) = 6.02 \times 10^{23} \text{ per mole}$
 - (l) Speed of light in vacuum, $(c) = 3 \times 10^8 \text{ m/s}$
 - (m) Permittivity of free space, $(\epsilon_0) = 8.85 \times 10^{-12} \text{ F/m}$

wazaelimu.com

This paper consists of 4 printed pages

Answer any **five (5)** questions.

1. (a) (i) What are the three applications of fluid dynamics in daily life **(03 marks)**
(ii) For the same applied force in honey and water, the rate of flow of honey will be less than that of water. Explain why **(02 marks)**
 - (b) A cylindrical tank of 10 cm in radius rests on platform 5 m high.
Initially, the tank was filled with water to a height of 5 m. If the plug of area $1 \times 10^{-4} \text{ m}^2$ is removed by an orifice on the side of the tank at the bottom. Calculate
(i) The initial speed with which water flows from the orifice. **(03 marks)**
(ii) The speed with which water strikes the ground. **(03 marks)**
 - (c) (i) Use the Poiseuille's theorem to show that the height of the liquid at any particular point of the volume at any time is $h = h_0 e^{-ct}$, whereby **h** is the final height of the liquid, **h₀** is the original height of the liquid, **t** is the time taken by the liquid to flow and **c** is constant. **(04 marks)**
(ii) Two tubes AB and BC of the same length and having radii of 2 mm and 1 mm respectively are joined end to end at B, a liquid flows through them and the difference between A and C is 340 mmHg. What is the difference in pressure between B and C? **(05 marks)**
-
2. (a) (i) Briefly explain why after being used for a long time, spring balances shows wrong readings. **(02 marks)**
(ii) We often wet the end of the thread before putting it through the eye of the needle. Briefly explain why? **(02 marks)**
 - (b) A string under tension is observed to vibrate with a frequency of 40 Hz in its fundamental mode, when the supports are 0.6 m apart. The amplitude of the note is 3 cm. If the string has a mass of 30g, calculate
(i) The velocity of propagation of the transverse wave in string **(03 marks)**
(ii) The tension in the string. **(03 marks)**
 - (c) (i) By means of equation or expression show how the temperature and density affect the velocity of sound waves in air. **(06 marks)**
(ii) Ultra sound of frequency **f** is incident to a blood vessel of a patient at an angle **θ**. The sound is from a transducer that sends Ultrasound and detects the sound reflected from a blood vessel of a diameter **d**. Derive an expression for the volume flow rate **Q** of the blood in patient's blood vessel. **(04 marks)**

3. (a) (i) Why work is said to be done in stretching wire? **(02 marks)**
 (ii) A uniform copper wire of length 0.6 m and cross sectional area of $1.8 \times 10^{-6} \text{ m}^2$ is extended 0.8 mm. What is the strain energy in the wire if the elastic limit is not exceeded? What is the strain energy per unit volume of the wire? **(04 marks)**
- (b) A rubber cord of a catapult has a cross sectional area of 2 mm^2 and an initial length of 0.2 m is stretched to 0.24 m to fire a small object of mass 10 g. Assuming that the elastic limit is not exceeded, calculate the initial velocity of the object when it is released. **(04 marks)**
- (c) (i) Identify three evidences that proves the existence of surface tension in water surfaces. **(03 marks)**
 (ii) Calculate the work done against surface tension forces in blowing a soap bubble of 1 cm in diameter. **(03 marks)**
 (iii) Estimate the radius of a single droplet when the rain drop of radius 0.5mm strikes the surface and breaks to 125 droplets of equal size. **(04 marks)**
4. (a) (i) Briefly explain the importance of dielectric material that are inserted in between the plates of a capacitor. **(02 marks)**
 (ii) A parallel air plate capacitor is charged to a p.d of 300 V and then connected in parallel with another capacitor of equal dimension but with ebonite as a dielectric, the p.d is found to be 75 V. Calculate the dielectric constant of the ebonite. **(05 marks)**
- (b) (i) Assuming that the earth to be an isolated conducting sphere. What is its capacitance? **(03 marks)**
 (ii) In a Van de Graff generator, the shell electrode is at $25 \times 10^5 \text{ V}$. If the dielectric strength of the gas surrounding the electrode is $5 \times 10^7 \text{ V/m}$, calculate the minimum radius of the spherical shell. **(03 marks)**
- (c) A 300 pF capacitor is charged to a p.d of 50 V and then discharged through 500 Ω resistor.
 (i) Find the initial discharge current. **(02 marks)**
 (ii) How long it will take for the p.d across the capacitor to fall to 2% of its original value. **(03 marks)**
 (iii) What is the value of time constant? **(02 marks)**
5. (a) (i) Distinguish between diamagnetic, paramagnetic and ferromagnetic materials on the basis of relative permeability μ_r . **(03 marks)**
 (ii) What are the three independent quantities which are conventionally used to describe the magnetic field on the earth's surface. **(03 marks)**

- (b) (i) Why the material used for making the core of a transformer should have narrow hysteresis loop? **(02 marks)**
- (ii) A specimen of iron is uniformly magnetized by the magnetizing field of 300 Am^{-1} . If the magnetic flux density in the specimen is 0.4 Wbm^{-2} , find the relative permeability, susceptibility and the permeability of the specimen. **(06 marks)**
- (c) Two identical wires R and S lie parallel in a horizontal plane, the axis being 10 cm apart. A current of 10 A flows in R and in the opposite direction to a current of 30 A flows in S. Neglecting the effect of the earth's magnetic flux density, calculate the magnitude of B at a point P in the plane of the wire, if P is;
- (i) Midway between R and S. **(03 marks)**
- (ii) 5 cm from R and 15 cm from S. **(03 marks)**
6. (a) (i) Explain how nuclear reactor produces electricity. **(03 marks)**
- (ii) Why is a neutron most effective as a bullet in nuclear reactions. **(03 marks)**
- (b) (i) Briefly explain why alpha particle and gold foil were used in Rutherford scattering experiment **(03 marks)**
- (ii) Hydrogen atom in its ground state is excited by means of monochromatic radiation of wavelength 9750 nm. How many different lines are possible in the resulting spectrum? Calculate the longest wavelength amongst them, assuming the ionization energy of hydrogen atom is 13.6 eV. **(05 marks)**
- (c) (i) Distinguish between nuclear fission and nuclear fusion reactions **(02 marks)**
- (ii) Assuming that the energy released by the fission of a single ${}_{92}\text{U}^{235}$ nucleus is 200MeV. Calculate the number of fission per second required to produce 1 watt of power. **(04 marks)**