

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



FORM SIX PRE-MOCK EXAMINATION

131/2

PHYSICS 2

(For Both School and Private Candidate)

Time 3 Hours

August 2024

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 phone and any unauthorized materials are not allowed in the examination room.
6. Write your examination number on every page of your answer sheet(s)/ booklet(s).
7. The following information may be used;
 - (a) *Plank's constant* $h = 6.63 \times 10^{-34} Js$
 - (b) *Electronic charge* $e = 1.6 \times 10^{-19} C$
 - (c) *Speed of light* $C = 3 \times 10^8 m/s$
 - (d) *Permeability of free space* $\mu_0 = 4\pi \times 10^{-7} H/m$
 - (e) *Permittivity of free space* $\epsilon_0 = 8.9 \times 10^{-12} C^2 N^{-1} m^{-2}$
 - (f) *Surface tension of mercury* $\gamma = 0.54 N/m$
 - (g) *Density of mercury* $\rho = 13600 kg/m^3$
 - (h) *Linear expansivity of steel* $\alpha = 12 \times 10^{-6} K^{-1}$
 - (i) *Young's modulus of steel* $Y = 2 \times 10^{11} N/m^2$
 - (j) *Coefficient of viscosity of air* $\eta = 1.8 \times 10^{-5} Pas$
 - (k) *Acceleration due to gravity* $g = 9.8 m/s^2$

(l) Atomic masses of ${}_{92}^{238}\text{U} = 238.12492u$, ${}_{90}^{234}\text{Th} = 234.11650u$, ${}_{2}^{4}\text{He} = 4.00387u$ and $1u = 931.5\text{Mev}$.

Answer five (5) questions.

1. (a) A sphere was dropped in a cylinder containing liquid and starts to move from rest. Justify the three forces acting on the sphere and specify their directions. (6 marks)
 - (b) (i) A liquid contained in a vessel was heated to a certain degree. How did heat affects the viscosity of the liquid? (2 marks)
 - (ii) In Millikan's oil drop experiment, an uncharged drop of radius $2.0 \times 10^{-5}\text{m}$ and density of $1.2 \times 10^3 \text{Kgm}^{-3}$ was involved in that experiment. Determine the terminal speed and the viscous force on the drop at that speed (Neglecting buoyancy of the drop due to air) (6marks)
 - (c) (i) Write the Bernoulli's equation and define all terms involved (2marks)
 - (ii) An amount of oil was flowing out of the horizontal pipe of uniform cross sectional area between two points separated by a distance of 1km. If the pressure falls by 5Nm^{-2} , determine the change in kinetic energy per Kg of the oil flowing at these points (Density of oil $= 800\text{Kgm}^{-3}$) (4marks)
2. (a) (i) A diver under water is unable to hear the sound produced in air. Explain (2 marks).
- (ii) A distant coming train produced sound. An observer placed his ear near the rails heard sounds. Explain giving reasons (2 marks)
- (iii) A tuning fork of frequency 220HZ produces sound waves of wavelength 1.5m in air at NTP. Calculate the increase in wavelength when the temperature of air is 27°C (4 marks)
- (b) (i) The pitch of an organ pipe is higher on a hot summer day than on winter day. Explain (2 marks)
- (ii) A plane progressive wave is represented by the equation $Y = 0.2\sin 2\pi(60t - \frac{x}{5})$ where x and y are in meter and t in seconds. Determine the phase difference in radian between a point 0.25m from the fixed point and a point 1.50m from the same fixed point (4 marks)
- (c) (i) Explain the meaning of the terms redshift and blue shift (2 marks)
- (ii) The radius of curvature of the convex surface of a Plano convex lens is 120cm. The lens is Plano-convex down a plane of glass plate and is illuminated above with a red light. If the diameter of the third bright ring in the insuring interference pattern is 2.79mm. Find the wavelength of red light used. (4 marks)
3. (a) (i) It is not possible to separate two pieces of paper joined by a glue. Give reason (2marks)

- (ii) Show that the excess pressure inside a soap bubble floating in a soap solution of surface tension γ is given by $\Delta P = \frac{4\gamma}{r}$ where r is the radius of the soap bubble (4 marks)
- (b) (i) It is believed that a strong wall of the house is the one plastered with cement. Give the reason behind that believe. (2 marks)
- (ii) The antiseptics used for cuts and wounds in human flesh have low surface tension. Explain (2 marks)
- (iii) A capillary tube immersed in water of surface tension $7.0 \times 10^{-2} \text{ Nm}^{-1}$ and rises 6.2cm. By what depth will mercury be depressed if the same capillary is immersed in it, Given that the angle of contact between mercury and glass is 140° (4 marks)
- (c) (i) Evaporation is cooling .Elaborate this statement (2 marks)
- (ii) A steel wire 8.0 m long and 4.0 mm diameter is fixed to rigid supports. Calculate the increase in tension when the temperature falls by 10°C (4 marks)
4. (a) (i) Vehicles carrying inflammable materials have long chains that hang down and drag on the ground. Explain giving reason (2 marks)
- (ii) What are the properties of equipotential surface? Give four points (4 marks)
- (b) (i) Do free electrons travel to region of higher or lower potential?(2 marks)
- (ii) A capacitor of capacitance C is fully charged by a 200V battery. It is then discharged through a small coil of resistance wire embedded in a thermally insulated block of specific heat capacity $2.5 \times 10^{-2} \text{ JKg}^{-1}\text{K}^{-1}$ and mass of 0.1Kg. If the temperature of the block is raised by 0.4K. What is the value of C ? (5 marks)
- (c) (i) It is dangerous to touch the terminals of a high voltage capacitor even after the charging circuit is turned off. Justify this statement (2 marks)
- (ii) In a vibrating reed experiment, two parallel plates with an area of 0.12m^2 are separated by a distance 2mm by a dielectric. The battery of 150V charges and discharges the capacitor at a frequency of 50HZ and a current of $20\mu\text{A}$ is produced. Calculate the relative permittivity of the dielectric and the new capacitance if the dielectric is half withdrawn from the plates. (5 marks)
5. (a) (i) Materials used for making cores of a transformer have narrow hysteresis loop. Give reason behind this fact (2marks)
- (ii) A specimen of iron is uniformly magnetized by the magnetizing field of 300Am^{-1} If the magnetic flux density in the specimen is 0.4wbm^{-2} .Find the relative permeability susceptibility and permeability of the specimen (6 marks).
- (b) (i) Give the difference between the terms magnetically soft and magnetically hard materials (2 marks)
- (ii) State the condition which makes the magnetic force on a moving charge in a magnetic field to be maximum (2 marks)

(iii) State the position of the rotating coil in the magnetic field at which the induced e.m.f is zero Give reason (3 marks)

(c) (i) Define Ampere (1 mark)

(ii) A conductor of length 4.0 m carrying a current of 2.0 A is held parallel to an infinitely long conductor carrying current of 10A at a distance of 100mm . Find the force on small conductor. (4 marks).

6. (a) Define the following terms as applied in modern physics;

- (i) Atomic spectra (1 mark)
- (ii) Excitation potential (1 mark)
- (iii) Work function (1 mark)
- (iv) Binding energy (1 mark)

(b) (i) Outline the four success of Bohr's atomic theory (4 marks)

(ii) Calculate the wavelength of the most energetic X-rays produced by a tube operating at 1.5×10^5 V. (4 marks)

(c) Disintegration of ${}_{92}^{238}\text{U}$ to give alpha particles can be represented by the following equation ${}_{92}^{238}\text{U} \rightarrow {}_{90}^{234}\text{Th} + {}_2^4\text{He} + \text{Q}$ Use this equation to calculate;

(i) The total energy Q released in the disintegration reaction (4 marks)

(ii) The kinetic energy of alpha particles when the nucleus was at rest before disintegration (4 marks).