

THE UNITED REPUBLIC OF TANZANIA  
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ADVANCED CERTIFICATE OF SECONDARY  
EDUCATION EXAMINATION  
**1999 PHYSICS 1**

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- Mention two applications and two limitations of dimensional analysis.
- The frequency  $f$  of a note produced by a taut wire stretched between two supports depends on the distance  $l$  between the supports, the mass per unit length of the wire,  $\mu$ , and the tension  $T$ . Use dimensional analysis to find how  $f$  is related to  $l$ ,  $\mu$ , and  $T$ .
- Define momentum
- Define impulse of a force
- A jet of water emerges from a hose pipe of a cross-sectional area  $5.0 \times 10^{-3} \text{ m}^2$  with a velocity of 3.0 m/s and strikes a wall at right angle. Assuming the water to be brought to rest by the wall and does not rebound, calculate the force on the wall.
- What do you understand by the term escape velocity?
- Calculate the escape velocity from the moon's surface given that a man on the moon has 1/6 his weight on earth. The mean radius of the moon is  $1.75 \times 10^6 \text{ m}$ .
- Give two similarities between simple harmonic motion and circular motion.
- On the same set of axes, sketch how energy exchange (kinetic to potential) takes place in an oscillator placed in a damping medium.
- State the parallel axis theorem.
- Show that the Kinetic energy (K.E.) of rotation of a rigid body about an axis with a constant angular velocity  $\omega$  is given by  $KE = 1/2 I \omega^2$  where  $I$  is the moment of inertia of the rigid body about the given axis.
- Distinguish between static and dynamic friction.
- With the help of a well labelled diagram briefly explain how you will determine the coefficient of viscosity of a liquid by a constant pressure head apparatus in the laboratory.

- Explain in terms of surface energy, what is meant by the surface tension,  $\gamma$  of a liquid.
- What energy is required to form a soap bubble of radius 1.00 mm if the surface tension of the soap solution is  $2.5 \times 10^{-4} \text{ N/m}^2$  ?
- Write down the equation of continuity of a fluid defining all your symbols.
- The velocity at a certain point in a flow pipe is  $1.0 \text{ ms}^{-1}$  and the gauge pressure there is  $3 \times 10^5 \text{ N/m}^2$  . The cross-sectional area at a point 10 m above the first is half that at the first point. If the flowing fluid is pure water, calculate the gauge pressure at the second point.
- What do you understand by the term: Thermodynamic temperature scale
- What do you understand by the term: Triple point of water
- The resistance of a platinum wire at a temperature  $T^\circ\text{C}$  measured on a gas scale is given by  $R(T) = R_0(1 + aT + bT^2)$  .
  - What temperature will the platinum thermometer indicate when the temperature on the gas scale is  $200^\circ\text{C}$  ? (take  $a = 3.8 \times 10^{-3}$  and  $b = -5.6 \times 10^{-7}$  )
- What is the coefficient of thermal conductivity of a material?
- The temperature difference between the inside and outside of a room is  $25^\circ\text{C}$  . The room has a window of an area  $2 \text{ m}^2$  and the thickness of the window material is 2 mm. Calculate the heat flow through the window if the coefficient of thermal conductivity of the window material is 0.5 SI units.
- Write down the equation of state of an ideal gas defining all the symbols used.
- If the root-mean-square velocity of a hydrogen molecule at  $0^\circ\text{C}$  is 1840 m/s, find the root-mean-square velocity of the molecule at  $100^\circ\text{C}$  .
- What is the difference between refraction and diffraction as applied to waves?
- A parallel beam containing two wavelengths 600 nm and 602 nm is incident on a diffraction grating with 400 lines per mm. Calculate the angular separation of the first order spectrum of the two wavelengths. ( $1 \text{ nm} = 10^{-9} \text{ m}$ )
- What is a “Doppler Effect”?
- A whistle sound of frequency 1200 Hz was directed to an approaching train moving at 48 km/h . The whistle-man then listened to the beats between the emitted sound and that reflected from the train. What is the beat frequency detected by the whistle-man?
- Explain why an uncharged metal is attracted by a charged one?
- Charges  $Q_1 = 1.2 \times 10^{-12} \text{ C}$  and  $Q_2 = -4 \times 10^{-12} \text{ C}$  are placed 5.0 m apart in air. A third charge  $Q_3 = 1 \times 10^{-14} \text{ C}$  is introduced midway between them. Find the resultant force on the third charge.
- State Kirchhoff’s laws of circuit analysis
- Write down an expression for the forces on an electron when moving perpendicular to: an electric field

- Write down an expression for the forces on an electron when moving perpendicular to: a magnetic field.
- An electron is moving in a uniform electric field of intensity  $1.2 \times 10^5 \text{ Vm}^{-1}$ . Find the acceleration of the electron.
- What is a resonant frequency of an oscillator?
- Draw the symbol of  $n - p - n$  transistor.
- Distinguish between insulators, semi-conductors and metals as far as conduction is concerned.
- What is the “work function” of a metal?
- The work function of a metal is 2.0 eV. Calculate the stopping potential when the metal is illuminated by light of frequency of  $6.0 \times 10^{14} \text{ Hz}$ .
- What is nuclear fusion
- What is nuclear fission?