THE UNITED REPUBLIC OF TANZANIA
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ADVANCED CERTIFICATE OF SECONDARY EDUCATION EXAMINATION
1998 PHYSICS 2

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- Define simple harmonic motion.
- Prove that, the velocity v of a particle moving in simple harmonic motion is given by: $v = w(A^2 - y^2)^{0.5}$, where A is the amplitude of oscillation, w the angular frequency and y the displacement from the mean position.
- A simple pendulum has a period of 2.8 seconds. When its length is shortened by 1.0 metre, the period becomes 2.0 seconds. From this information, determine the acceleration g , of gravity and the original length of the pendulum.
- A particle rests on a horizontal platform which is moving vertically in simple harmonic motion with an amplitude of 50 mm. Above a certain frequency the particle ceases to remain in contact with the platform throughout the motion. With a help of a diagram and illustrative equations, find;
  - the lowest frequency at which this situation occurs.
  - the position at which contact ceases.
- What is terminal velocity?
- Briefly explain an experiment designed to measure terminal velocity.
- A small sphere of radius r and density σ is released from the bottom of a column of liquid of density ρ which is slightly higher than σ . Deduce expressions for;
  - the initial acceleration of the sphere.
  - the terminal velocity of the sphere.
- Two equal drops of water are falling through air with a steady velocity of 0.15 ms^{-1} , If the drops coalesce, find their new terminal velocity.
- State Newton's laws of motion.

- Explain why a length of horse pipe which is lying in a curve on a smooth horizontal surface, straightens out when a fast flowing stream of water passes through it.
- A ball of mass 0.4 kg is dropped vertically from a height of 2.5 m on to a horizontal table and bounces to a height of 1.5 m.
  - Find the kinetic energy of the ball just before striking the table.
  - Find the kinetic energy just after impact.
  - Suggest reasons for the difference between these two values of kinetic energy.
  - What height would you expect the ball to reach after its next bounce from the table?
- A jet of water flowing with a velocity of 20 ms^{-1} from a pipe of cross-sectional area, 5.0×10^{-3} m^2 , strikes a wall at right angles and loses all its velocity.
  - What is the mass of water striking the wall per second?
  - What is the change in momentum per second of the water hitting the wall?
  - What is the force exerted on the wall?
- What is a diffraction grating?
- A diffraction grating has 5000 lines per centimetre. At what angles will bright diffraction images be observed, if it is used with monochromatic light of wavelength 6.0×10^{-7} m at normal incidence?
- A lamp emits two wavelengths, 4.2×10^{-7} m and 6.0×10^{-7} m. Find the angular separation of these two waves in the third order diffraction pattern produced by a diffraction grating having 4000 lines per centimetre, when light is at normal incidence on the grating?
- A girl is holding a metal rod in her hand and rubs its surface with fur. Explain what happens to the rod.
- Can charge be conserved? Give at least two examples to support your answer.
- The distance between the electron and proton in the hydrogen atom is about 5.3×10^{11} m. Calculate the electrical and gravitational forces between these particles. How do they compare?
- A capacitor of capacitance 3 micro$-F$ is charged until a potential difference of 200 V is developed across its plates. Another capacitor of capacitance 2 micro$-F$ developed a p.d. of 100 V across its plates on being charged.
  - What is the energy stored in each capacitor?
  - The capacitors are then connected by wires of negligible resistance, so that the plates carrying like charges are connected together. What is the total energy stored in the combined capacitors?
  - What would the time constant of the circuit be, if the resistance of each wire connecting the plates was 10Ω ?
- Define the term self inductance for a coil.
- Give the S.I units of self inductance.

- Derive an expression for the coefficient of self induction of a uniformly wound solenoid; of length 1 , cross-sectional area A having N turns in air.
- Two coils A and B have 200 and 800 turns respectively. A current of 2 amperes in A produces a magnetic flux of 1.8×10^{-4} Wb in each turn of B . Compute:
  - the mutual inductance.
  - the magnetic flux through A when there is a current of 4.0 amperes in B and
  - the emf induced in B when the current in A changes from 3 amperes to 1 ampere in 0.2 seconds.
- Describe and explain briefly a method for measuring the specific charge. Mention the errors expected in this method.
- An electron is projected horizontally with a velocity of 2.0×10^6 ms^{-1} into a large evacuated enclosure. A magnetic field which has a flux density of 15×10^{-4} tesla is directed vertically downwards throughout the enclosure. Find
  - the radius of curvature of the electron's path.
  - how many complete loops must the electron describe before it falls by 1.0 cm under the influence of gravity?
  - What would be the effect of changing the direction of the magnetic field to upwards?
- What is thermionic emission?
- Describe the function of each of;
  - the electron gun
  - the deflection system and
  - the display system of the Cathode ray Oscilloscope.
- Sketch the traces seen on the screen of a cathode ray oscilloscope when two sinusoidal potential differences of the same frequency — and amplitude are applied simultaneously to X and Y plates of a cathode ray oscilloscope, when the phase difference between them is:
  - 0° 45° 90° .
- Explain the terms: atomic mass unit, mass defect, packing fraction and binding energy.
- Discuss carbon dating.
- Find the age at death of an organism, if the ratio of amount of C14 at death to that of the present time is 10^8 and that the half life of Cl4 is 5600 years.
- Explain the following terms: Earthquake, Earthquake focus, Epicentre and Body waves.
- List down three (3) sources of earthquakes.
- Define ionosphere.
- Mention the ionospheric layers that exist during the day time.

- Give the reason for better reception of radio waves for high Frequency signals at night than during the day time.
- Explain briefly three different types of radio waves travelling from a transmitting station to a receiving antenna.