THE UNITED REPUBLIC OF TANZANIA
NATIONAL EXAMINATIONS COUNCIL
ADVANCED CERTIFICATE OF SECONDARY EDUCATION EXAMINATION
2015 PHYSICS 2

Transcribed by: PJ Gibson

May 27, 2020

- Write down the Bernoulli's equation for fluid flow in a pipe and indicate the term which will disappear when the fluid is stopped.
- Name the principle on which the continuity equation is based.
- Basing on the applications of Bernoulli's principle, briefly explain why two ships which are moving parallel and close to each other experience an attractive force.
- A sphere is dropped under gravity through a fluid of viscosity, η . Taking average acceleration as half of the initial acceleration, show that the time taken to attain terminal velocity is independent of fluid density.
- Water is flowing through a horizontal pipe having different cross-sections at two points A and B . The diameters of the ippe at A and B are 0.6 m and 0.2 m respectively. The pressure difference between points A and B is 1 m column of water. Calculate the volume of water flowing per second.
- The flow rate of water from a tap of diameter 1.25 cm is 3 litres per minute. The coefficient of viscosity of water is 10^{-3} Ns/m^2 . Determine the Reynolds' number and then state the type of flow of water.
- Air is moving fast horizontally past an air-plane. The speed over the top surface is 60 m/s and under the bottom surface is 45 m/s. Calculate the difference in pressure.
- Define the following terms:
  - Damped oscillations
  - Forced oscillations
  - Resonance
- What is meant by Doppler effect?
  - Write down three uses of Doppler effect.

- A source of sound emits waves of frequency, f , and is moving with a speed of u_s towards the listener and away from the listener. Derive an expression for apparent frequency f_A of sound in each case if the velocity of sound wave in air is v.
- A whistle emitting a sound of frequency 440 Hz is tied to a string of 1.5 m length and rotated with an angular velocity of 20 rad/s in the horizontal plane. Calculate the range of frequencies heard by an observer stationed at a large distance.
- A police on duty detects a drop of a 10% in the pitch of the horn of a motor car as it crosses him. Calculate the speed of the car.
- What is meant by the statement that light is plane polarized.
- State Brewster's law.
- Sunlight is reflected from a calm lake. The reflected sunlight is totally polarized. What is the angle between the sun and the horizon.
- State four conditions for sustained interference of light.
- In a Young's double slit experiment the interval between the slits is 0.2 mm. For the light of wavelength 6.0×10^{-7} m, Find the distance of the second dark fringe from the central fringe.
- Distinguish between diffraction and diffraction grating.
- A parallel beam of the monochromatic light is incident normally on a diffraction grating. The angle between the two first-order spectra on either side of the normal is 30° . Assume that the wavelength of the light is 5893×10^{14} m. Find the number of ruling per mm on the grating and the greatest number of bright images obtained.
- Define the following materials as classified on the basis of elastic properties:
  - Ductile materials
  - Brittle materials
  - Elastomers
- Briefly explain why the stretching of a coil spring is determined by its shear modulus.
- A copper wire of negligible mass, 1 m long and cross-sectional area 10^{-5} m^2 is kept on a smooth horizontal table with one end fixed. A ball of 1 kg is attached to the other end. The wire and the ball are rotating with an angular velocity of 35 rad/s. If the elongation of the wire is 10^{-3} m, find Young's modulus of wire. If on increasing the angular velocity to 100 rad/s, the wire breaks down, find the breaking stress.
- Differentiate bulk modulus from shear modulus.
- Two wires, one of steel and one of phosphor bronze each 1.5 m long and 2 mm diameter are joined end to end as a composite wire of length 3 cm. What tension in the composite wire will produce total extension of 0.064 cm?
- Differentiate electric potential from electric potential difference.
- Sketch a graph of variation of electrical potential from the centre of a hollow charged conducting sphere of radius, r , up to infinity. Explain the shape of the graph.

- Two bodies A and B are 0.1 m apart. A point charge of 3×10^{-3} μC is placed at A and a point charge of $1 \times 10^{-9} \mu C$ is placed at B . C is the point on the straight line between A and B , where the electric potential is zero. Calculate the distance between A and C .
- A square ABCD has each side of 100 cm. Four points charges of $+0.04$ μC, -0.05 μC, $+0.06$ μC, and $+0.05$ μC are placed at A , B , C , and D respectively. Calculate the electric potential at the centre of the square.
- What do you understand by dielectric constant?
- When are the capacitors said to be connected in parallel?
- The parallel plate capacitor consisting of two metal plates each of area 20 cm^2 placed at 1 cm apart are connected to the terminals of an electrostatic voltmeter. The system is charged to give a reading of 120 V on the voltmeter scale. When the space between the plates is filled with a glass of dielectric constant of 5 , the voltmeter reading falls to 50 V. What is the capacitance of the voltmeter? You may assume that volutage recorded by a voltmeter is directly proportional to the scale reading.
- A 4.0 μF capacitor is charged by 12 V supply and is then discharged through $1.5 M\Omega$ resistor.
  - Obtain the time constant.
  - Calculate the charge on the capacitor at the start of the discharge.
  - What will the value of the charge on the capacitor, the potential difference across the capacitor and the current in the circuit be 2 seconds after the discharge starts?
- Distinguish between self-inductance and mutual inductance.
- A horizontal straight wire 0.05 m long weighing 2.4 g/m is placed perpendicular to a uniform horizontal magnetic field of flux density 0.8 T. If the resistance of the wire is 7.6Ω/m, calculate the potential difference that has to be applied between the ends of the wire to make it just self-supporting.
- Two very long wires made of copper and of equal lengths are placed parallel to each other in such a way that they are 10 cm apart. If the total power dissipated in the two wires is 75 W, find the force between them if the resistivity of the copper wire is $1.69imes10^{-8}\Omega m$ and of diameter 2 mm.
- Explain the statement that, a sinusoidal current, of peak value 5 A passed through an a.c. ammeter reads $5/\sqrt{2}$ A.
- Show that the average power transferred to an a.c. circuit is, in general, given by EIR/Z , where R is the resistance in the circuit defined to be the real part of complex impedance and Z is its impedance.
- A coil which has an inductance of 0.2 H and negligible resistance is in series in a resistor, whose resistance is 60Ω . The pair is connected across a 50 V supply alternating at $100/\pi$ Hz. Calculate the toal impedance of the circuit and its power factor.
- Show that the de Broglie hypothesis of matter wave are in agreement with Bohr's theory.

- A 10 kg satellite circles the Earth once every 2 hours in an orbit having a radius of 8000 km. Assuming Bohr's angular momentum postulate applies to the satellite just as it does to an electron in the hydrogen atom, find the quantum number of the orbit of the satellite.
- Why are the energy levels labelled with negative energies?
- Ultraviolet light of wavelength 3600×10^{-10} m is made to fall on a smooth surface of potassium. Determine:
  - The maximum energy of emitted photoelectrons
  - The stopping potential.
  - The velocity of the most energetic photoelectrons given that work function for potassium is 2 eV.
- Define activity and half-life.
- Give any four uses of LASER lgith.
- The half-life of radioactive substance is 1 hour. How long will it take for 60% of the substance to decay?
- What is a nuclear reactor?
  - Briefly explain any three main components in a nuclear reactor.
- Sketch the binding energy curve.
  - State any two conclusions that can be drawn from the curve above.
- If the mass of deuterium nucleus is 2.015 a.m.u, that of one isotope of helium is 3.017 a.m.u. and that of neutron is 1.009 a.m.u., calculate the energy released by the fusion of 1 kg of deuterium.
  - Suppose 50% of this energy was used to produce 1 MW of electricity, for how many days would be able to function.