THE UNITED REPUBLIC OF TANZANIA
NATIONAL EXAMINATIONS COUNCIL
ADVANCED CERTIFICATE OF SECONDARY EDUCATION EXAMINATION
2009 PHYSICS 2

Transcribed by: PJ Gibson

May 27, 2020

- Define the following terms:
  - Tensile stress
  - Tensile strain
  - Young's modulus
- Derive the expression for the work done in stretching a wire of length L by a load W through an extension X .
- A vertical wire made of steel of length 2.0 m and 1.0 mm diameter has a load of 5.0 kg applied to its lower end. What is the energy stored in the wire?
- A copper wire 2.0 m long and 1.22×10^{-3} m diameter is fixed horizontally to two rigid supports 2.0 m apart. Find the mass in kg of the load, which when suspended at the mid point of the wire, produces a sag of 2.0×10^{-2} m at the point.
- Define angular momentum and give its dimensions.
- A grinding wheel in a form of solid cylinder of 0.2 m diameter and 3 kg mass is rotated at 3600 rev/minute.
  - What is its kinetic energy?
  - Find how far it would have to fall to acquire the same kinetic energy as in the question above.
- What is the difference between isothermal and adiabatic processes?
  - Write down the equation of state obeyed by each process in the question above.
- Using the same graph and under the same conditions sketch the isotherms and the adiabatics.
- Derive the expression for the work done by the gas when it expands from volume V_1 to volume V_2 during an:

  - Isothermal process
  - Adiabatic process

- When water is boiled under a pressure of 2 atmospheres the boiling point is 120°C. At this pressure 1 kg of water has a volume of 10^{-3} m^3 and 2 kg of steam have a volume of 1.648 m^3 . Compute the work done when 1 kg of steam is formed at this temperature increase in the internal energy.
- State Kepler's laws of planetary motion.
- Explain the variation of acceleration due to gravity, g . inside and outside the earth.
- Derive the formula for mass and density of the earth.
- What do you understand by the term satellite?
- A satellite of mass 100 kg moves in a circular orbit of radius 7000 km around the earth, assumed to be a sphere of radius 6400 km. Calculate the total energy needed to place the satellite in orbit from the earth assuming $g = 10$ N/kg at the earth's surface.
- What is interference? Explain the term path difference with reference to the interference of two wave-trains.
- Why is it not possible to see interference when the light beams from head lamps of a car overlap?
- Discuss whether it is possible to observe an interference pattern when white light is shone on a Young's double slit experiment.
- A grating has 500 lines per millimetre and is illuminated normally with monochromatic light of wavelength 5.89×10^{-7} m.
  - How many diffraction maxima may be observed?
  - Calculate the angular separation.
- Explain the mechanism of electric conduction in:
  - Gases
  - Electrolytes
- Develop an equation for the torque acting on a current carrying coil of dimensions lxb placed in a magnetic field. How is this effect applied in a moving coil galvanometer?
- A galvanometer coil has 50 turns, each with an area of 1.0 cm^2 . If the coil is in a radian field of 10^{-2} T and suspended by a suspension of torsion constant 2×10^{-9} Nm per degree, what current is needed to give a deflection of 30° ?
- Explain the following terms:
  - Forward bias.
  - Reverse bias.
  - Inverting and non-inverting amplifier.

- Define the following:
  - Logic gate.
  - Integrated circuit.
  - Modulation.
- An operational amplifier is to have a voltage gain of 100 . Calculate the required values for the external resistances R_1 and R_2 when the following gains are required:
  - non-inverting.
  - Inverting.
- State the laws of electromagnetic induction.
- Outline four applications of eddy currents.
- A coil of 100 turns is rotated at 1500 revolutions per minute in a magnetic field of uniform density 0.05 T. If the axis of rotation is at right angles to the direction of the flux and the area per turn is 4000 mm^2 . Calculate the:
  - Frequency
  - Period
  - Maximum induced e.m.f.
  - Maximum value of the induced e.m.f. when the coil has rotated through 30° from the position of zero e.m.f.
- Give a general form expressing the force exerted on the wire carrying current i if its length l is inclined at angle angle θ to the magnetic field B .
- A wire carrying a current of 2 A has a length of 100 mm in a uniform magnetic field of 0.8 Wb/m^2 . Find the force acting on the wire when the field is at 60° to the wire.
- A wire carrying a current of 25 A and 8 m long is placed in a magnetic field of flux density 0.42 T . What is the force on the wire if it is placed:
  - At right angles to the field?
  - At 45° to the field?
  - Along the field?
- Write down Bragg's equation for the study of the atomic structure of the crystals by $X-$ rays.
- The radiation from an X — ray tube which operates at 50 kV is diffracted by is diffracted by a cubic KCl crystal of molecular mass 74.6 and density 1.99×10^3 kg/m^3 . Calculate:
  - The shortest wavelength limit of the spectrum from the tube.
  - The glancing angle for first order reflection from the planes of the crystal for that wavelength and angle of deviation of a diffracted beam.
- The radiation emitted by an X — ray tube consists of continuous spectrum with a line spectrum superimposed on it. Explain how the continuous spectrum and the line spectrum are produced.

  - Draw the graph of the spectra stated. ‘

- Explain the following observations:
  - A radioactive source is placed in front of a detector which can detect all forms of radioactive emissions. It is found that the activity registered as noticeably reduced when a thin sheet of paper is placed between the source and detector.
  - When a brass plate with a narrow vertical shit is placed in front of the radioactive source (above) and a horizontal: magnetic field normal to the line joining the source and the detector is applied, its found that the activity is further reduced.
  - The magnetic field (above) is removed and a sheet of aluminum is placed in front of the source. The activity recorded is similarly reduced.

- Define the terms laser and maser.

- Give three applications of laser.

- A laser beam has a power of 20×10^9 watts and a diameter of 2 mm. Calculate the peak values of electric field and magnetic fields.

- A 2.71 g sample of Kcl from the chemistry stock is found to be radioactive and decays at a constant rate of 4490 disintegrations per second. The decays are traced to the element potassium and in particular to the isotope ^{40} K which constitutes 1.17% of normal potassium. Calculate the half life of the nuclide.