# THE UNITED REPUBLIC OF TANZANIA
# NATIONAL EXAMINATIONS COUNCIL
# ADVANCED CERTIFICATE OF SECONDARY EDUCATION EXAMINATION
# 2016 PHYSICS 1

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- Define the term dimension of a physical quantity.
- The number of particles $n$ crossing a unit area perpendicular to $x-$ axis in a unit time is given as $n = -D(n_2 - n_1)/(x_2 - x_1)$ where $n_1$ and $n_2$ are the number of particles per unit volume for the values of $x_1$ and $x_2$ respectively. What are the dimensions of diffusion constant $D$ ?
- Give two basic rules of dimensional analysis.
- The frequency, $f$ of a vibrating string depends upon the force applied, $F$ , the length, $l$ , of the string and the mass per unit length,$\mu$ . Using dimension show how $f$ is related to $F$ , $l$ and $\mu$ .
- What is meant by least count of a measurement?
- The period of oscillation of a simple pendulum is given by $T = 2\pi\sqrt{l/g}$ where by 100 vibrations were taken to measure 200 seconds. If the least count for the time and length of a pendulum of 1 m are 0.1 sec and 1 mm respectively, calculate the maximum percentage error in the measurement of $g$ .
- Mention two characteristics of projectile motion.
- If the range of the projectile is 120 m and its time of flight is 4 sec , determine the angle of projection and its initial velocity of projection assuming that the acceleration due to gravity $g = 10$ m/s.
- State the principles on which the rocket propulsion is based.
- A jet engine on a test bed takes in 40 kg of air per second at a velocity of 100 m/s and burns 0.80 kg of fuel per second. After compression and heating the exhaust gases are ejected at 600 m/s relative to the air craft. Calculate the thrust of the engine.
- An object of mass 2 kg is attached to the hook of a spring balance which is suspended vertically to the roof of a lift. What is the reading on the spring balance when the lift is:

  - going up with the rate of 0.2 m/s$^2$
  - going down with an acceleration of 0.1 m/s$^2$
  - ascending with uniform velocity of 0.15 m/s

- Define the term inertia.
- Why is Newton's first law of motion called the law of inertia?
- A jet of of water from a fire hose is capable of reaching a height of 20 m. If the cross sectional area of the hose outlet is $4.0 \times 10^{-4}$ m$^2$ , calculate the:
  - Minimum speed of water from the hose.
  - Mass of water leaving the hose each second.
  - Force on the hose due to the water jet.
- A boy ties a string around a stone of mass 0.15 kg and then whirls it in a horizontal circle at constant speed. If the period of rotation of the stone is 0.4 sec and the length between the stone and boy's hand is 0.50 m ;
  - Calculate the tension in the string.
  - State one assumption taken to reach the answer above.
- What do you understand by the following terms:
  - Damped oscillations.
  - Undamped oscillations.
- Sketch the waveform diagrams to represent the terms: damped oscillations undamped oscillations
- Show that the total energy of a body executing S.H.M. is independent of time.
- A mass of 05 kg connected to a light spring of force constant 20 N/m oscillates on a horizontal frictionless surface. If the amplitude of the motion 1 s 3.0 cm , calculate the;
  - Maximum speed of the mass.
  - Kinetic energy of the system when the displacement is 2.0 cm.
- What is meant by moment of inertia of a body?
- List two factors on which the moment of inertia of a body depends.
- A thin sheet of aluminum of mass 0.032 kg has the length of 0.25 m and width of 0.1 m. Find its moment of inertia on the plane about an axis parallel to the:
  - Length and passing through its centre of mass, $m$ .
  - Width and passing through the centre of mass, $m$ , in its own plane.
- Define the term angular momentum.
- A thin circular ring of mass, $M$ , and radius, $r$ , is rotating about its axis with constant angular velocity, $w_1$ . If two objects each of mass, $m$ , are attached gently at the ring, what will be the angular velocity of the rotating wheel?

- Mention one application of parking orbit.
- Briefly explain how parking orbit of a satellite is achieved.
- The earth satellite revolves in a circular orbit at a height of 300 km above the earth's surface. Find the;
  - Velocity of the satellite
  - Period of the satellite.
- Why are space rockets usually launched from west to east?
- A spaceship is launched into a circular orbit close to the earth's surface. What additional velocity has to be imparted on the spaceship if order to overcome the gravitational pull?
- Briefly explain why:
  - A body with large reflectivity is a poor emitter.
  - The earth without its atmosphere would be too cold to live.
- Identify two factors on which the coefficient of thermal conductivity of a material depend.
- A brass boiler of base area $1.50 \times 10^{-1}$ and thickness 1.0 cm boils water at a rate of 6.0 kg/min when placed on a gas Stove. Estimate the temperature of the part of the flame in contact with the boiler.
- Briefly describe the working principle of a thermocouple.
- In a certain thermocouple thermometer the e.m.f. is given by $E = a\theta + 1/2b\theta^2$ where $\theta$ is the temperature of hot junction. If a= 10 mV°$C^{-2}$ , $b = -1/20$ mV°$C^{-2}$ and the cold junction is at 0°C, calculate the neutral temperature.
- What is meant by thermal radiation?
- Briefly explain why forced convection is necessary for excess temperate less than 20 K?
- Why is the energy of thermal radiation less than that of visible light?
- A body with a surface area of 5.0 $cm^2$ and a temperature of 727°C radiates 300 joules of energy in one minute. Calculate its emissivity.
- State Newton's law of cooling.
- A body cools from 70°C to 40°C in 5 minutes. If the temperature of the surroundings is 10°C , Calculate the time it takes to cool from 50°C to 20°C.
- Define the term junction as applied in electrical network.
- What ts the physical significance of Kirchhoff's first law.
- Why is Kirchhoff's second law sometimes referred to as the voltage law?
- List down five points to be considered when applying Kirchhoff's second law in formulating analytical problems or equations.

- What is meant by the following terms:
  - Phase of alternating e.m.f.
  - Root mean square (r.m.s.) value of alternating e.m.f.
- An a.c. circuit consists of a pure resistance of $10\Omega$ is connected across an a.c. supply of 230 V , 50 Hz. Calculate the;
  - Current flowing in the circuit.
  - Power dissipated
- A 25 $\mu$F capacitor, a 0.10 H inductor and a $25\Omega$ resistor are connected in series with an a.c. source whose e.m.f. is given by $E = 310\sin(314t)$ . Determine the;
  - Frequency of the e.m.f.
  - Net reactance of the circuit.
- What is the importance of doping as applied to semiconductors?
- Distinguish between $n-$ type and $p-$ type semiconductors. Give three points.
- Why are transistors mostly used in common emitter arrangement?
- When does a transistor amplifier work as an oscillator?
- Explain the use of an op-amp as a summing amplifier.
- Name three electronic circuits in which multivibrators can be constructed.
  - List down three types of multivibrators.
  - Briefly explain the applications of multivibrators listed above.
- Mention two characteristics of op-amps.
- Briefly explain why op-amps are sometimes called differential amplifiers?
- Discuss the mode of action of each of the following sensors:
  - Thermistor (TH).
  - Light Dependent Resistor (LDR).
- Give symbols, expressions and truth tables for each of the following logic gates:
  - NAND gate .
  - Exclusive NOR gate.
- Why is NAND gate considered as basic building block for a variety of logic circuits?
- What is meant by aerial environment? Give two examples.
- Describe three ways at which the aerial environment is threatened.
- Briefly explain three major concepts on solar wind.
- How do soil environmental components influence plant growth? Give four points.