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ADVANCED CERTIFICATE OF SECONDARY EDUCATION EXAMINATION
2015 PHYSICS 1

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- What is meant by random errors?
  - Briefly explain two causes of random errors in measurements.
- The period T of oscillation of a body is said to be 1.5 ± 0.002 s while its amplitude A is 0.3 ± 0.005 m and the radius of gyration k is $0.28 + 0.004$ m. If the acceleration due
  - to gravity g was found to be related to T , A and k by the equation $(gA)/(4\pi^2) = (A^2 + k^2)/T^2$, find the:
  - Numerical value of g in four decimal places
  - Percentage error in g .
- State the law of dimensional analysis.
- The largest mass, m of a stone that can be moved by the flowing river depends on the velocity of flow v, the density ρ of water, and the acceleration due to gravity g . Show that the mass, m varies to the sixth power of the velocity of flow.
- Define the term trajectory.
- Briefly explain why the horizontal component of the initial] velocity of a projectile always remains constant.
- List down two limitations of projectile motion.
- A body projected from the ground at the angle of 60° is required to pass just above the two vertical walls each of height 7 m. If the velocity of projection is 100 m/s, calculate the distance between the two walls.
- A fireman standing at a horizontal distance of 34 m from the edge of the burning story building aimed to raise streams of water at an angle of 60° into the first floor through an open window which is at 20 m high from the ground level. If water strikes on this floor 2 m away from the outer edge,

  - Sketch a diagram of the trajectory.
  - What speed will the water leave the nozzle of the fire hose?

- Mention three effects of looping the loop.
  - Why there must be a force acting on a particle moving with uniform speed in a circular path? Write down an expression for its magnitude.

- A driver negotiating a sharp bend usually tend to reduce the speed of the car.
  - What provides the centripetal force on the car?
  - Why is it necessary to reduce its speed?

- A ball of mass 0.5 kg is attached to the end of a cord whose length is 1.5 m then whirled in horizontal circle. If the cord can withstand a maximum tension of 50 N calculate the:
  - Maximum speed the ball can have before the cord breaks.
  - Tension in the cord if the ball speed is 5 m/s

- Briefly explain why the motion of a simple pendulum is not strictly simple harmonic?
  - Why is the velocity and acceleration of a body executing simple harmonic motion (S.H.M.) out of phase?

- A body of mass 0.30 kg executes simple harmonic motion with a period of 2.5 s and amplitude of 4.0×10^{-2} m. Determine the:
  - Maximum velocity of the body.
  - Maximum acceleration of the body.
  - Energy associated with the motion.

- A particle of mass 0.25 kg vibrates with a period of 2.0 s. If its greatest displacement is 0.4 m what is its maximum kinetic energy?

- Define moment of inertia of a body.
  - Briefly explain why there is no unique value for the moment of inertia of a given body?

- State the principle of conservation of angular momentum.
  - A horizontal disc rotating freely about a vertical axis makes 45 revolutions per minute. A small piece of putty of mass 2.0×10^{-2} kg falls vertically onto the disc and sticks to it at a distance of 5.0×10^{-2} m from the axis. If the number of revolutions per minute is thereby reduced to 36 , calculate the moment of inertia of the disc.

- Define the term tangential velocity.

- Explain why the astronaut appears to be weightless when traveling in the space vehicle.

- State Newton's law of gravitation.
  - Use Newton's law of gravitation to derive Kepler's third law.

- Briefly explain why Newton's equation of universal gravitation does not hold for bodies falling near the surface of the earth?
- Show that the total energy of a satellite in a circular orbit equals half its potential energy.
- What would be the length of a day if the rate of rotation of the Earth were such that the acceleration due to gravity $g = 0$ at the equator?
- Calculate the height above the Earth's surface for a satellite in a parking orbit.
- What is meant by a thermometric property?
- Mention three qualities that make a particular property suitable for use in a practical thermometer.
- Define coefficient of thermal conductivity.
- Write down two characteristics of a perfectly lagged bar.
- A thin copper wall of a hot water tank having a total surface area of 5.0 m^2 contains 0.8 cm^3 of water at 350 K and is lagged with a 50 mm thick layer of a material of thermal conductivity 4.0×10^{-2} W/mK. If the thickness of copper wall is neglected and the temperature of the outside surface is 290 K,
  - Calculate the electrical power supplied to an immersion heater.
  - If the heater were switched off, how long would it take for the temperature of hot water to fall by 1 K?
- The element of an electric fire with an output of 1000 W is a cylinder of 250 mm long and 15 mm in diameter. If it behaves as a black body, estimate its temperature.
- What is meant by the following terms:
  - Internal resistance of a cell.
  - Drift velocity.
- What is a potentiometer.
  - Mention two advantages and two disadvantages of potentiometer.
- Distinguish between ohmic and non-ohmic conductor. Give one example in each
- Sketch the diagram showing the variation of current with potential difference across the following:
  - Filament electric bulb.
  - Gas-filled diode.
- A wire of diameter 0.1 mm and resistivity $1.69 \times 10^{-8}\Omega$ m with temperature coefficient
  - of resistance of 4.3×10^{-3} K^{-1} was required to make a resistance,
  - What length of the wire is required to make a coil with a resistance of 0.5Ω ?
  - If on passing a Current of 2 A the temperature of the coil above rises by 10°C, what error would arise in taking the potential drop as 1.0 V

- Mention four important properties of a semiconductor.
- Applying the concept of doping, explain how a free electron and a positive charge can be created in a semiconductor crystal.
- Why a $p-n$ junction diode when connected in a circuit and then reversed gives a very small leakage current across the junction?
  - How is the size of the current stated in above dependent on the temperature of the diode?
- List three properties of operational amplifiers.
- What is meant by the term negative feedback? Give four advantages of using it in an op-amp or any type of voltage amplifier.
- Define closed loop gain.
- Derive an expression of the closed loop gain for an inverting op-amp voltage amplifier with an input resistor R , and a feedback resistor.
- Give one advantage of frequency modulation (FM) as compared to amplitude modulation (AMT).
- Briefly explain the importance of bandwidth of an amplitude modulation (AM) signal.
- State the function of a modulator in radios.
- Sketch a block diagram to show the general plan of any communication system.
- The amplitude modulated (AM) broadcast band ranges from 450 to 1200 kHz. If each station modulates with audio frequencies up to 5.5 kHz, determine the
  - Bandwidth needed for each station.
  - Total bandwidth available.
- What is the origin of earthquake?
- List down three sources of earth's magnetism.
- A large explosion at the earth's surface creates compressional (P) and shear (S) waves moving with a speed of 6.0 km/s and 3.5 km/s respectively. If both waves arrive at seismological station with 30 s interval, calculate the distance measured between seismological station and the site of explosion.
- Explain three techniques applicable for improving soil environment for the best plant growth.