OSCILLATION

Description

1. Form the equation of S.H.M
   a) find out particle velocity
   b) relationship among particle velocity at any instant
   c) wave velocity
   d) slope of displacement curve
2. in a progressive wave total energy (kinetic + potential per unit volume) remain constant
3. simple harmonic motion and it's characteristics
4. common properties of oscillatory motion

Math

1. Derive the differential equation of SHM
2. Derive the differential equation of damped oscillatory motion and give it's general solution.
3. the resultant of 2 SHM of equal time period when they act at right angles to one another and when the pase difference is zero and $\frac{\pi}{2}$
4. Two SHMs acting simultaneously on a particle are given by the equations $y_1 = 2\sin(\omega t + \pi/6)$ and $y_1 = 3\sin(\omega t + \pi/3)$. Calculate,
   a) amplitude
   b) phase constant
   c) time period of the resultant vibration
5. Calculate the average kinetic energy and total energy of a body executing SHM
6. In one complete vibration for a vibrating particle show that the changes in displacement, velocity and acceleration for angles $0, \frac{\pi}{2}, \frac{3\pi}{2}$

WAVES

Definition

1. Phase velocity
2. wave velocity
3. Lissajous’ figures
4. Free vibration
5. Forced vibration

Description

1. Characteristics of a standing wave specifying how standing wave differs from progressive wave?
2. Short note on interference of sound waves
3. Analyze the incident when two simple harmonic waves interfere with each other considering the special case when interference phenomenon gives rise to standing wave.
4. Resonance
5. distinguish between damped and undamped vibrations
6. Form the analytical discussion of formation of a stationary wave at an open end organ pipe, find out the following features of the resultant wave
   a) Displacement
   b) Amplitude
   c) Velocity
   d) Acceleration
   e) Strain

   Also, show changes of the above features with respect with respect to position, pointing the formation of nodes and anti-nodes.

Math

1. Show that energy of a plane progressive wave is given by, $E = 2\pi^2 \rho n^2 a^2$
1. Show that the average kinetic energy of a vibrating particle is given by, $E = \pi^2 m a^2 n^2$
2. single wave propagating in any medium, wave velocity = phase velocity
3. energy density of a plane progressive wave
4. The equation of a transverse wave on a stretched string is, $y = A\sin\frac{2\pi}{\lambda}(vt - x - \phi)$

   Write down the equation of a wave that would produce a stationary wave in the string on superposition with the given wave.

THERMODYNAMICS

Definition

1. Carnot's cycle
2. Transmission of Heat
3. Thermodynamic state
4. Thermodynamic equilibrium
5. Nernst law
6. Zeroth law
7. entropy and disorder

Description

1. Describe Carnot's cycle with four processes also some practical exaples
2. Classification of transmission of heat with practical examples
3. What is the principle used in the working of a refrigerator?
4. Define co-effiecient of performance. Is it greater than I? Explain?
5. Why specific heat at constant pressure C_p is greater than that C_b, the specific heat at constant volume.
6. Zeroth law and what you infer from that?
7. Heat death of Universe

Math

1. A Carnot's engine converts one fifth of the heat input into work. If the sink temperature is reduced by 80° C, the efficiency gets doubled. Find the source and the sink temperature. Also give the consequences of the Carnot's cycle.
2. Mechanisms of conduction in metals
3. mathematical idea of Heat conduction
4. rate of heat transfer by radiation, with an unclothed person standing in a dark room whose ambient temperature is 22.0°C. The person has a normal skin temperature of 33.0°C and a surface area of 1.50 m^2. The emissivity of skin is 0.97 in the infrared, where the radiation takes place.
5. Carnot's engine working between a source temperature of T_2 and sink temperature of T1 has efficiency of 25%. If the sink temperature is reduced by 20° C, the efficiency is increased to 30%. Find the source and the sink temperature.
6. Entropy in terms of second law of thermodynamics
7. In an isochoric process at constant volume, show that the change in entropy is $\Delta S_v = C_v \ln(\frac{T_2}{T_1})$ of an ideal gas (also for isobaric process $\Delta S_p = C_p \ln(\frac{T_2}{T_1})$ – separate question)

KINETIC THEORY OF GASES

Definition

1. Degree of freedom
2. Law of equipartition of energy
3. Brownian motion

Description

1. Degrees of freedom and it's concept with suitable examples
2. Fundamental assumptions of the Kinetic theory of gases
3. mean free path
4. essential features of Brownian motion for the gaseous state of matter
5. Maxwell's Law of equipartition of energy
6. degrees of freedom for monoatomic, diatomic and triatomic molecules in the absence of vibratory motion
7. Stefan-Boltzmann, and Wiedemann-Franz Laws of transmission of heat
8. total change of entropy
   a) any reversible cyclic change
   b) irreversible process (always zero – separate question)
9. Entropy is also called thermal inertia – why?
10. Carnot's reversible heat engine and work done by it

Math

1. Show that the mean free path (λ) is equal to $\frac{RT}{\sqrt{2}\,\pi N_A P}$
2. What is the mean free path λ for oxygen molecules at temperature T = 300K and pressure p = 1.0 atm?
   a) Assume that molecular diameter is d = 290 pm and the gas is ideal.
   b) Assume the average speed of the oxygen molecules is v = 450 m/s.
   What is the average time t between successive collisions for any given molecule?
   At which rate does the molecule collide; that is, what is the frequency *f* of its collisions?
3. Total random kinetic energy of one gram of Nitrogen at 300K
4. for diatomic and triatomic gases, value of atomicity (γ) with the help of degree of freedom
5. values of the molar heat capacities C_v and C_p of a gas, if the ratio of the heat capacities is 1.33. What is the atomicity of the gas? Given, R=8.31 J/mol-k.
6. calculate the change in entropy when 10 grams of ice at 0^oC is converted into steam at 100^oC.
7. Show that a gas processing f degrees of freedom, the ratio of the two specific heats is $1+\frac{2}{f}$.
8. For monoatomic and diatomic gas calculate the ration of two specific heats.

ELECTROSTATICS

Description
1. Coulomb's law is in accordance with Newton's third law of motion – prove 2. Coulomb's law is a special case of Gauss's law – explain 3. Capacitor, also storing and discharging process

Math
1. State Gauss's law and express it in differential form and show that $\Delta \dot{E} = \frac{\text{P}}{\epsilon_0}$ 2. For an electrical dipole, show that the potential V of a dipole moment P and located at the origin is given by, $\frac{1}{4.\Pi.\%\epsilon_0} - \frac{P.r}{r^3} = \frac{1}{4.\Pi.\%\epsilon_0}.P.\Delta(\frac{1}{r})$ 3. "The electric flux through any closed surface is proportional to the enclosed electric charge" – using this idea show that $\vec{\nabla}.\vec{E} = \frac{\rho}{\epsilon_0}$ 4. Given the electric field in a region of space $\vec{E} = 2\lambda\hat{i} + 2y\hat{j} + 5z\hat{k}$. Calculate the volume charge density. 5. Apply Gauss's theorem to calculate the electric field due to an infinitely long uniformly charged straight wire. 6. A 2000 mF capacitor is charged through a 1 kW resistor using a 6V supply. Calculate a) the charging current after 2.5 second b) the charge on the plates after 2.5 second

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Ignored List (REVISION 2)

1) Doppler effect (2015-16 > 5)
2) Brownian particle's expression (2014-15 > 2(b))
2) Session 2014-15 (questions with unknown equations for me)
(blurry text issue)

** Feel free to reach me out, for my mistakes*