Group 'A'

Multiple Choice Questions

1. Two equal drops are falling through air with a steady velocity of 5 cm/sec. If the drops coalesce, the new terminal velocity will be
   (a) 5×2 cm/sec (b) $5 \times \sqrt{2}$ cm/sec (c) $5 \times (4)^{1/3}$ cm/sec (d) $5/\sqrt{2}$ cm/sec
2. If there is a change of angular momentum from 2 J to 4 in 4 sec. Then the torque is a.
   (a) 25 J (b) 0.5 J (c) 1 J (d) 2 J
3. The kinetic energy of a particle executing simple harmonic motion is maximum when displacement is equal to
   (a) Amplitude (b) $\frac{\text{Amplitude}}{4}$ (c) $\frac{\text{Amplitude}}{2}$ (d) Zero
4. A certain amount of monoatomic gas at 27°C is suddenly compressed to 8/27 of its volume. The change in temperature will be
   a. 302° C b. 375°C c. 675°C d. 102°C
5. A Carnot engine works between a hot reservoir at temperature T_1 and a cold reservoir at temperature T_2. To increase its efficiency
   a. T_1 and T_2 both should be increased b. T_1 and T_2 both should be decreased
   c. T_1 should be decreased and T_2 increased d. T_1 should be increased and T_2 decreased
6. Two coherent monochromatic light beams of intensities I and 4I are superposed. The maximum and minimum possible intensities in the resulting beam are
   a. 5I and I b. 9I and I c. 5I and 3I d. 9I and 3I
7. A whistle giving out sound of frequency 450 Hz approaches a stationary observer at a speed of 33 m/s. The frequency heard by the observer in Hz is
   a. 400 b. 429 c. 517 d. 500
8. The quantity in electricity analogous to temperature is
   (a) resistance (b) charge (c) inductance (d) potential
9. A long wire carrying a current of 5A is placed perpendicular to magnetic field of flux density 5 Tesla. Calculate the force acting on 4m of the wire.
   (a) 25N (b) 50N (c) 100N (d) 200N
10. Which of the following given pair of metals gives maximum thermo-emf ?
    (a) Sb-Bi (b) Fe-Cu (c) Ag-Pb (d) Au-Mo
11. A particle are injected into a uniform electric field at right angles to the direction of field withα11. A proton and an equal kinetic energy. Then ratio of radii of their circular paths will be
    a. 1:1 b. 2:1 c. 1:2 d. 2 :1

Short Questions

Group 'B'

[8 × 5 = 40]

1. (i) Why the small liquid drops are spherical while large drops are flat? [1]
   (ii) Why the antiseptics used for cuts and wounds in human flesh have low surface tension? [1]
   (iii) Calculate the work done in breaking a drop of water of 2mm diameter into million droplets of same size. The surface tension of water is 72×10^{-3} Nm^{-1}. [3]
2. (i) Define the terms: couple and moment of a couple. [2]
   (ii) Derive an expression for the work done by a couple. [3]

(i) Why do bigger air bubbles rise faster than the smaller ones in boiling water?

(ii) Derive an expression for terminal velocity of a small spherical ball of radius 'a' dropped gently in a viscous liquid of density 'σ' and coefficient of viscosity. [2]

(i) How are stationary wave formed?

(ii) A wave has the equation (x in metres and 't' in seconds) $y = 0.02 \sin (30t - 4x)$. Find its [3]

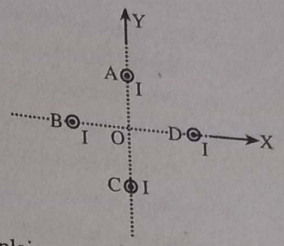
i. Frequency ii. Speed iii. wave length.

(a) Why is Cp greater than Cv?

(b) Gas in a cylinder, initially at a temperature of 10°C and pressure 1.01×10^5 Nm^{-2} is to be compressed adiabatically to one eight of its volume. Find final pressure and temperature. (Ratio of molar heat capacities = 1.40) [2]

(i) Explain why the magnetic field at the centre of the coil disappears when the circular coil is made infinitely large. [3]

(ii) What will be the resultant magnetic field at origin due to four infinite current carrying wires A, B, C, & D. Each wire carries current (I = 2A) and is equidistance (10cm) from origin. [2]



(i) Lenz law follows the principle of conservation of energy. Explain. [3]

(ii) A coil of 100 turns, each of area 2×10^{-3} m^2 has a resistance of 12 Ω. It lies in a horizontal plane in a vertical magnetic flux density of 3×10^{-3} Wbm^{-2}. What charge circulates through the coil if its ends are short-circuited and the coil is rotated through 180° about a diametrical axis? [2]

(i) What is photoelectric effect? [3]

(ii) If the wavelength of electromagnetic radiation is doubled what will happen to the energy of the photons? [1]

Light of wavelength 5×10^{-7} m falls on a sensitive metal-plate with photo electric work function 1.90 eV. Find kinetic energy of the photoelectrons emitted in electron volt. (given $h = 6.62 \times 10^{-34}$ JS) [2]

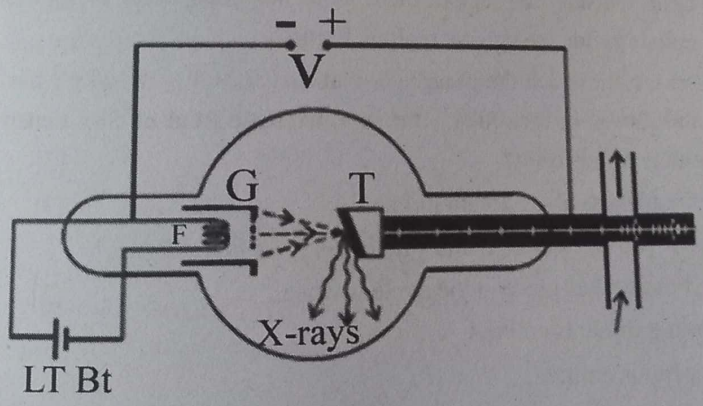
(i) Figue shows the production of x-ray

a. What type of metal is used as a traget.

b. How can you control

i. Intensity

ii. Penetrating power of the emitted x-rays?



Or i. What is rectification?

ii. How can you construct a full wave rectifier using two semiconductor diodes? Explain working.

Group 'C'

Long Answer Questions

9. (i) Define simple pendulum and second's pendulum?

(ii) Show that motion of the bub of the simple pendulum is simple harmonic obtain expression for its frequency.

(iii) A simple pendulum 5m long swings with an amplitude of 25 cm. Compute the velocity the pendulum at its lowest point and the acceleration at the end of its path.

10. (i) Why choke coil is preferable to a resistor in an ac circuit?

(ii) Derive the expression for impedance and current in LCR series circuit. Also find resonant frequency.

(iii) An ac source of 220V, 50Hz is connected to series circuit containing a resistor R and inductor L and capacitor C. If $R = 200\ \Omega$, $L = 0.5$ and $C = 10\mu F$

(a) calculate the current in the circuit,

(b) the phase angle, and

(c) the power consumed in the circuit.

Or, (i) Why do we prefer a potentiometer to measure emf of a cell rather than a volt meter?

(ii) Why do we prefer a potentiometer with a long wire?

(iii) Discuss the principle of the potentiometer and use it to compare the emf's of two cells.

(iv) The total length of the potentiometer wire is 10m. A potential gradient of 0.0015 V/cm is obtained when a steady current is passed through this wire. Calculate,

(a) the distance of null point on connecting standard cell of 1.018 V.

(b) the unknown p.d. if the null point is obtained at a distance of 940 cm, and

(c) the maximum p.d. which can be measured by this instrument.

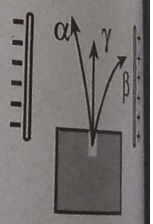
11. Discuss the trajectory of a charged particle when it is moving in a uniform magnetic field.

i. A charged particle is fired into a cubical region of space where there is uniform magnetic field. Outside this region, there is no magnetic field. Is it possible that the particle will remain inside the cubical region? Explain.

ii. An ion for which the charge per unit mass is 4.4×10^7 c/kg^{-1} has velocity of 3.52×10^6 m/s and moves in a circular orbit in a magnetic field of flux density 0.4T. What will be the radius of this orbit?

Or What is radioactivity. Explain its cause [3]

How will you identify α, β and γ radiation from given figure? [3]



What change takes place in the nucleus when [2]

i. an α particle is emitted.

ii. a γ-ray is emitted.

Group 'A'

[11 × 1 = 11]

How high does water rise in a capillary tube whose inner diameter is 0.044 mm. The surface tension of water is 73 dynes/cm
(a) 6.7 cm (b) 7.3 cm (c) 5.6 cm (d) 4.3 cm

A shell at rest explodes. The centre of mass of the fragments
(a) moves along the parabolic path (b) moves along the straight line
(c) move long an elliptical path (d) remains at rest

For a simple pendulum graph between T^2 and l comes to be
(a) Parabola (b) Straight line (c) Circle (d) ellipses

A certain amount of monoatomic gas at 27°C is suddenly compressed to 8/27 of its volume. The change in temperature will be
a. 302° C b. 375°C c. 675°C d. 102°C

A Carnot engine working between 300 K and 600 K has a work output of 800 J per cycle. What is the amount of heat energy supplied to the engine from source per cycle?
a. 800 J b. 1200 J c. 1600 J d. 2000 J

The end correction for the vibration of air column in a tube of circular cross-section will be more if the tube is.
a. increased in length b. decreased in length
c. made thinner d. made wider

If yellow light in the Young's double slit experiment is replaced by red light, the fringe width will
a. decreases b. remain unaffected
c. increase d. first increase and then decrease

Which material has the susceptibility that does not depend on temperature?
(a) Diamagnetic (b) Paramagnetic (c) Ferromagnetic (d) None of above

A transformer
(a) Changes a.c to d.c (b) changes d.c to a.c
(c) up or down a.c voltage (d) up or down d.c voltage

What is the ratio of inductive and capacitive reactance in an a.c circuit?
(a) 1 (b) $\omega^2 L$ (c) $\omega + LC$ (d) ωL

The maximum kinetic energy of photoelectron depends on
a. frequency and intensity of incident light
b. work function and intensity of incident light
c. work function of metal and frequency of incident light
d. frequency and intensity of incident light and also on the work function of metal

Group 'B'

[8 × 5 = 40]

Short Questions

1. (i) Why are light roofs blown off during cyclones or strong windstorms? [2]
   (ii) Calculate mass of an aeroplane with the wings of area 55 m^2 flying horizontally. The velocity of air above and below the wings is 155 m/s and 140 m/s respectively. [3]
2. (i) How does the K.E, P.E. and total energy of a simple harmonic oscillator vary with position? [2]

(ii) The velocity of the particle executing simple harmonic motion is 16 cms^{-1} at a distance of 8 cm from the mean position and 8 cms^{-1} at a distance of 12 cm from the mean position. Calculate the amplitude of the motion.

OR (i) An ice cube floats in a glass of water. When the ice melts, will the water level in the glass rise, fall or remain changed? Explain.

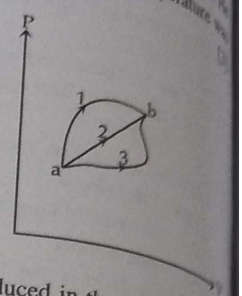
(ii) Distinguish between density and specific gravity.

(iii) A 25 cm thick block of ice bloating on fresh water can support an 80 kg man standing on it, what is the smallest area of the ice block?

3. Velocity of sound iun solid is more than that in liquid,why?

i. A man standing at one of a closed corridor 57 m long below a short blast on a whistle. He found that the time from the blast to the sixth echo was 2 seconds. If the temperature was 17°C, what was the velocity of sound at 0°C?

4. (i) A system is taken from state 'a' to state 'b' along the three paths shown in adjacent figure. Along which path is the work done by the system greatest and the least? Give reason. [2]



(ii) A Carnot engine has an efficiency of 30%. Its efficiency is to be increased to 50%. By what must the temperature of the source be increased if the sink is at 300 K? [3]

5. (i) The magnetic flux passing perpendicular to the plane of a coil is given by $\phi = 5t^2 + 4t + 2$, where ϕ is in weber and 't' in seocnds. Calculate the magnitude of instantaneous emf induced in the coil when t = 1 sec.

(ii) Define self-inductance and mutual inductance.

(iii) Derive an expression for energy stored in an inductor.

6. (i) 220V A.C is more dangerous than 220V D.C. Why?

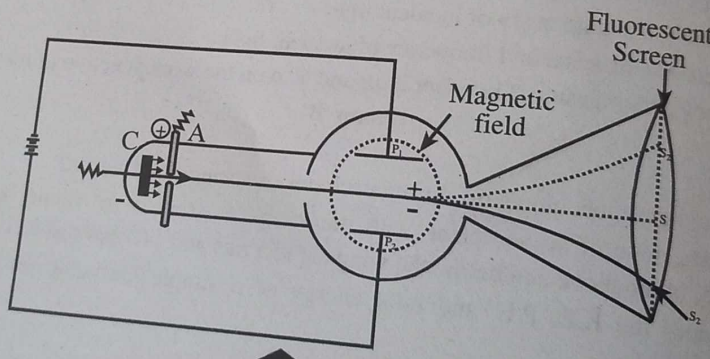
(ii) An iron cored coil of inductance 2 H and 50 Ω resistance placed in series with a resistor of 450 Ω and 220 V, 50 Hz ac supply is connected across the arrangement. Find and the voltage drop across the coil.

(a) the current following in the coil.

(b) its phase angle relative to the voltage supply.

(c) the voltage across the coil.

7. i. What is cross field?



ii. In a Thomson experiment, at what condition the beam of electron will strike at point S, S1 and S_2.

iii. In a Thomson experiment, voltage across the plates is 50V and the distance between them is 3 cm. The magnetic field applied to make the beam undeflected is 10^{-4}T. What is the velocity of the electron passing between the plates? [2]

8. i. An electron and proton have the same kinetic energy. Which one of them has the longer wavelength? [2]

ii. Derive an expression for the total energy of electron in n^{th} orbit of H-atom. [2]

OR What is Zener breakdown? [3]

Describe how a Zener diode can be used as a voltage regulator? [2]

Group 'C' [3]

Long Answer Questions **[3 × 8 = 24]**

9. (i) Define moment of inertia. What are the factors on which it depends? [2]

(ii) Derive a relation between torque applied and angular acceleration produced in a rigid body. [3]

(iii) A steel strip, clamed at one end, vibrates with a frequency of 20 Hz and an amplitude of 5mm at the free end, where a small mass of 2g is positioned. Find

(a) the velocity of the end when passing through the zero position,

(b) the acceleration at maximum displacement,

(c) the maximum kinetic and potential energy of the mass.

10. (i) A solenoid tends to contract when a current passes through it. Why? [3]

(ii) Using Biot-Savart law, derive an expression for magnetic field intensity due to a long current carrying solenoid. [2]

(iii) A coil consisting of 100 circular loops with radius of 0.6m carries a current of 5 A. At what distance from the centre, along the axis, the magnetic field magnitude 1/8 as great as it is at the centre. [3]

OR (i) What do you mean by a shunt? Describe its use in converting a galvanometer into an ammeter. [3]

(ii) State and explain Kirchhoff's laws of current and voltage. [2]

(iii) Explain how these laws are used to obtain the balanced condition of Wheatstone's bridge. [3]

11. What is stopping potential? [2]

i. Describe Millikan's laboratory method to determine Planck's constant. [3]

ii. When a light of frequency 5.4×10^{14} Hz is incident on a metal surface, the maximum energy of the electrons emitted is 1.2×10^{-19} J. If the same surface is illuminated with light of frequency 6.6×10^{14} Hz, the maximum energy of the electrons is 2×10^{-19} J. Find the value of Planck's constant. [3]

Or i. Write down laws of radioactive disintegration. [2]

ii. Derive a relation between half-life and decay constant. [3]

iii. If 4g of radioactive material of half-life period of 10 years disintegrates, find out mean life of the given sample. [3]

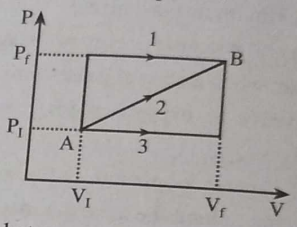
Group 'A'

1. A hole is drilled through the centre of the earth and a stone is dropped into it. When the stone reaches at the centre of the earth, its:
   (a) acceleration will be zero (b) mass will be zero
   (c) velocity will be zero (d) K.E. will be zero

2. A capillary tube when immersed vertically in a liquid records a rise of 2.0 cm. If the tube is held immersed in a liquid at an angle of 60° with the vertical, the length of the liquid column along the tube will be
   (a) 1 cm (b) 2 cm (c) $\frac{4}{\sqrt{3}}$ cm (d) 4 cm

3. Two equal drops are falling through air with a steady velocity of 5 cm/sec. If the drops coalesce, the new terminal velocity will be
   (a) 5×2 cm/sec (b) $5 \times \sqrt{2}$ cm/sec (c) $5 \times (4)^{1/3}$ cm/sec (d) $5\sqrt{2}$ cm/sec

4. A system is taken from state A to B through three different paths 1, 2, 3. The work done is maximum in
   a. process 1 b. process 2
   c. process 3 d. equal in all process



5. An ideal heat engine working between temperatures T_1 and T_2 has efficiency η. If both the temperatures are raised by 100 K each, the new efficiency of the engine will be
   a. η b. more than η
   c. less than η d. depends upon the nature of working substance

6. A cylinderical tube, open at both ends has a fundamental frequency f in air. The tube is dipped vertically in water so that half of it is in water. The fundamental frequency of air column is now
   a. f/2 b. 3f/4 c. f d. 2f

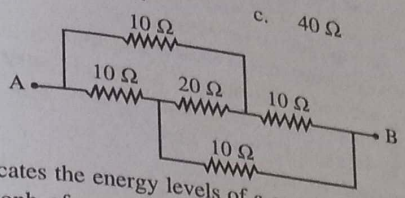
7. If yellow light in the Young's double slit experiment is replaced by red light, the fringe width will
   a. decreases b. remains unaffected
   c. increases d. first increases and then decrease

8. Two parallel conductors carrying current in same direction
   (a) attract each other (b) repel each other
   (c) neither attract nor repel each other (d) neither attract nor repel each other

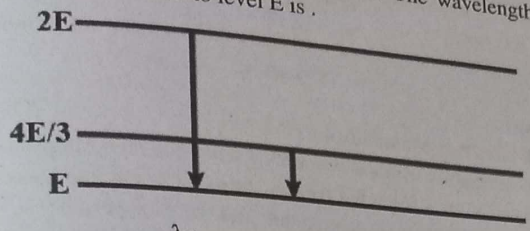
9. As the temperature of the hot junction increases, the thermo-emf
   (a) may increase or decrease (b) always decreases

10. What is the equivalent resistance of the given circuit?

a. 10 Ω b. 20 Ω c. 40 Ω d. 5 Ω



11. The following fig. indicates the energy levels of a certain atom. When the system moves from 2E level to E, a photonb of wavelength λ is emitted. The wavelength of photon produced during its transition from level 4E/3 to level E is .



a. $\frac{\lambda}{3}$ b. $\frac{\lambda a}{4}$ c. $\frac{4\lambda}{3}$ d. 3λ

Group 'B'

Short Questions [8 × 5 = 40]

1. (i) Define viscosity. Does it depend upon temperature? [2]
   (ii) What is the terminal velocity of a glass ball falling through a tall jar containing glycerin? The densities of the glass ball and glycerin are 2.6 g /cc and 1.32 g /cc respectively, the viscosity of the glycerin is 0.85 poise, and radius of the glass ball is 2 mm. [3]

2. (i) If the ice on the polar caps of the earth melts, how will it affect the duration of the day? Explain. [2]
   (ii) A flywheel of moment of inertia 0.32 Kg m^2 is rotated steadily at 120 rad^{-1} by a 50 W electric motor. Find the kinetic energy and angular momentum of flywheel and the frictional couple opposing the rotation. [3]

OR (i) Define Surface tension. [1]
   (ii) What is capillarity? [1]
   (iii) Derive an expression for the rise or fall of liquid in a capillary tube. [3]

3. (i) What is Doppler effect? [1]
   (ii) Find the change in frequency when an observer moves towards a stationary source. [2]
   (iii) A car is moving away from a stationary listener with a velocity of 20m/s. If the horn is sounding at frequency 512 Hz, calculate the change in pitch of the sound received by the listener. (Velocity of sound in air = 330ms^{-1}) [2]

4. (i) Distinguish between petrol and diesel engine.
   (ii) Explain the working mechanism of a Petrol engine with the help of a PV diagram.
   (iii) A petrol engine consumes 5 kg. of petrol per hour. If the power of engine is 20 Kw and the caloritic value of petral 11×10^3 K cal per kg. Calculate the efficiency of the engine.

5. (i) How does the thermo-emf change in a thermocouple when the temperature of the hot junction is changed? Explain. [2]

(ii) The thermo-emf (E) and the temperature of hot junction θ satisfies the relation $E = a\theta + b\theta^2$ where $a = 4.1 \times 10^{-5}$ V $(°C)^{-1}$ and $b = -4.1 \times 10^{-8}$ V $(°C)^{-2}$. If the cold junction temperature is 0°C, find the neutral temperature.

6. (i) Why voltmeter is always connected in parallel and ammeter in series?
   (ii) An electric heating element to dissipate 1.2 KW on 240V mains is to be made of Nichrom ribbon 1 mm wide and 0.05 mm thick. Calculate the length of the ribbon required if the resistivity of nichrome is 1.1×10^{-6} Ωm.
7. (i) What is work function of a metal?
   (ii) Does it depend on the intensity of incident light?
   (iii) Discuss Einstein's photoelectric equation.
8. (i) What is p-n junction?
   (ii) Describe forward biased and reverse biased condition of p-n junction.

Group 'C'

Long Answer Questions

9. (i) Define SHM. Give two examples of SHM.
   (ii) Show that the oscillation of mass suspended from helical spring is simple harmonic.
   (iii) A body of mass 2 kg is suspended from a spring of negligible mass and is found to stretch the spring 0.1 m. What is its force constant and the time period?
10. (i) Can a charged particle move through a magnetic field without experiencing any force? Explain.
    (ii) Find an expression for torque on rectangular coil in a uniform magnetic field.
    (iii) A slab of copper 2 mm thick and 1.50 cm wide, is placed in a uniform magnetic field of flux density 0.40 T, so that the maximum pass through the slab. When a current of 75 A flows through it, a potential difference of 0.81 μV is developed between the edges of the slab. Find the concentration of the mobile electrons in copper.

OR (i) Does the acceleration of a magnet falling through a long solenoid changes? Explain.
   (ii) Derive an expression for the emf induced in a coil rotating in a uniform magnetic field.
   (iii) A jet plane is flying due west at the speed of 1800 km/hr. What is the voltage difference developed between the ends of the wings 25 m long of the earth's magnetic field at that location is 5×10^{-4} T and the angle of dip is 45°.

11. (i) What is the importance of Millikan's oil drop experiment?
    (ii) In Millikan-type apparatus, the horizontal plates are 1.5 cm apart. With the electric field switched off an oil drop is observed to fall with the steady velocity 2.5×10^{-2} cm/s. When the electric field is switched on the upper plate being positive, the drop just remains stationary when the p.d. between plates is 1500V.
       (a) Calculate the radius of the drop.
       (b) How many electronic charges does it carry?
    (iii) An electron and a proton move with the same speed in a uniform magnetic field of equal magnitude. Compare the radii of their circular paths.

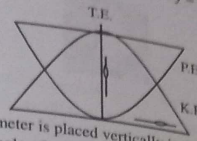
Or (i) Explain the term "decay constant".
   (ii) Derive the decay equation.
   (iii) The initial number of atoms in a radioactive element is 6×10^{20} and its half-life is 10 hours. Calculate the
      (a) number of atoms which have decayed in 30 hours.
      (b) the amount of energy liberated if the energy liberated per atom decay is 4×10^{-13} J.

Group 'A'

Multiple Choice Questions: [11 × 1 = 11]

For which value of displacement, the KE is equal to PE.

(a) $y = \frac{r}{2}$ (b) $y = \frac{r}{\sqrt{2}}$ (c) $y = \frac{r^2}{2}$ (d) $y = \frac{r^2}{\sqrt{2}}$



A capillary tube or 0.4 mm diameter is placed vertically inside a liquid of density 800 kgm^{-3}, surface tension 5×10^{-2} Nm^{-1} and angle of contact 30°. Calculate the height to which liquid rises in the capillary tube.

(a) 5.4 m (b) 0.54 m (c) 54 m (d) 0.054 m

A piece of ice is floating in water. The water level ..... if the ice melts completely.

(a) rises (b) falls (c) may raise or fall d) remains constant

The first law of thermodynamics states that energy can not be

(a) created only (b) destroyed only

(c) converted (d) created and destroyed

A Carnot engine operates at 800 K and 200 k. If the engine takes 8 J of heat then what is the amount of work done by the engine.

(a) 2 J (b) 4 J (c) 10 J (d) 6 J

The Brewster's angle for polarization is given by

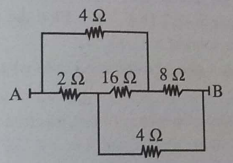
(a) $\sin^{-1}(1/\mu) = j_p$ (b) $\sin^{-1}(\mu) = j_p$ (c) $\tan^{-1}(1/\mu) = j_p$ (d) $\tan^{-1}(\mu) = j_p$

The Laplace correction was necessary to Newton's calculation of velocity of sound, because propagation of sound in a medium is

(a) Isothermal process b) Adiabatic process

(c) Isobaric process (d) Isochoric process

What is the equivalent resistance A and B?



(a) 2 Ω (b) 4 Ω (c) 8 Ω (d) 16 Ω

Two parallel conductors carrying current in opposite direction

(a) attract each other (b) repel each other

(c) neither attract nor repel each other (d) may attract or repel each other

Lenz's law is the consequences of the law of conservation of,

(a) Energy (b) Momentum (c) Charge (d) Angular momentum

11. The minimum wavelength of X-rays produced by electrons accelerated by a potential difference V volts is

(a) eV/hc (b) hc/eV (c) h/c (d) none of these

Group 'B'

Short Questions.

12. (a) A ballet dancer sometimes stretches or collapses her hands to balance her motion.

(b) Which principle of physics involved in this phenomenon? State and explain that principle.

(c) A computer disc drive is turned on starting from the rest and has constant angular acceleration. (a) how long did it take to make complete rotation and (b) what is its angular acceleration. Given that the disc took 0.750 sec for the drive to make its second revolution.

13. (a) How does the frequency of vibration of simple pendulum is related with its length? How estimate the frequency of a second's pendulum.

(b) A body is vibrating with simple harmoni motion of amplitude 15cm and frequency 4 Hz. Calculate the maximum value of acceleration and velocity.

Or, (a) A piece of ice is floating in water. Will the water level rise if the ice melts completely? Explain.

(b) A geologist finds that a moon rock whose mass is 7.2 kg has an apparent mass 5.88 kg when submerged in water. What is the density of the rock? Density of water: 1000 kg/m^3

14. (a) What is Doppler's effect in sound?

(b) What happens to the apparent frequency when both source of sound and observer move towards each other.

(c) A source of sound generates sound waves which travel with a speed of 340 ms^{-1}. The frequency of the source is 500 Hz. Find the frequency of the sound heard if both source and observer move with a speed of 30 ms^{-1} and approach one another.

15. (a) What do you mean by internal energy of a gas?

(b) Explain why Cp is greater than Cv.

(c) The density of an ideal gas is 1.6 kgm^{-3} at 27°C and 10^5 Nm^{-2} pressure. Its specific heat capacity at constant volume is 312 JKg^{-1} K^{-1}. Find the ratio of the specific heat at constant pressure to that at constant volume.

16. (a) How does the thermo-emf change in a thermocouple when the temperature of the hot junction is changed? Explain.

(b) The thermo-emf (E) and the temperature of hot junction θ satisfies the relation $E = a\theta + b\theta^2$ where $a = 4.1 \times 10^{-5}$ V, 50 Hz (°C)$^{-1}$ and $b = -4.1 \times 10^{-8}$ V (°C)$^{-2}$. If the cold junction temperature is O° C, find the neutral temperature.

17. (a) 220V A.C is more dangerous than 220V D.C. Why?

(b) An iron cored coil of inductance 2 H and 50 Ω resistance placed in series with a resistor of 450 Ω and 220 V, 50 Hz ac supply is connected across the arrangement. Find (a) the current flowing in the coil (b) its phase angle relative to the voltage supply (c) the voltage across the coil.

(a) Beams of electrons and protons having the same initial K.E. enter normally into an electric field, which beam will be more curved? Justify.

(b) Describe J.J. Thomson's experiment with necessary theory behind determination of specific charge of electron. [2]

(a) What do you mean by uncertainty principle?

(b) If an electron position can be measured to an accuracy of 10^{-9} m. How accurately can its velocity be measured? ($m_e = 9.1 \times 10^{-31}$ kg.) [3]

(a) What do you mean by rectifier?

(b) Describe the working of full wave rectifier using semiconductor diodes. [3]

Group 'C'

Long Answer Questions. [2]

(a) Why are light roofs blown off during cyclones or strong windstorms? [3]

(b) State and prove Bernoulli's theorem for the steady flow of an incompressible and non-viscous flow. **[3 × 8 = 24]**

(c) Calculate mass of an aeroplane with the wings of area 55 m^2 flying horizontally. The velocity of air above and below the wings is 155 m/s and 140 m/s respectively. (Density of air = 1.293 kg m^{-3}) [2]

(a) The magnetic flux passing perpendicular to the plane of a coil is given by $\phi = 8t^2 + 4t + 2$, where ϕ is in Weber and 't' is in seconds. Calculate the magnitude of instantaneous emf induced in the coil when t = 3 sec.

(b) Define self-inductance and mutual inductance. [1]

(c) Derive an expression for energy stored in an inductor. [2]

(d) A straight conductor of length 25 cm is moving perpendicular to its length 25 with a uniform speed of 10 m/s making an angle of 45° with a uniform magnetic field 10T. Calculate the emf induced across its length. [3]

(a) State and explain Huygen's principle. [3]

(b) Use the principle to show that a plane wave front incident obliquely on a plane mirror is reflected as a plane wave front so that the angle of incidence is equal to the angle of reflection. [3]

(c) A parallel beam of sodium light of wavelength 589.3 nm is incident normally on a diffraction grating. The angle between the two first order spectra on either side of the normal is 27°42'. What will be the number of lines per mm on the grating? [2]

(a) What is the threshold frequency for photoelectric emission? Does it depend on the intensity of light?

(b) Describe Millikan's laboratory method to determine Planck's constant. [3]

(c) The maximum energy of photoelectrons emitted from a mental plate is 1.2 ev. If the threshold wavelength is 2.48×10^{-9} m, calculate the wavelength of incident light. (Given Planck's constant is $6.62 \times 10^{-\lambda t}$ JS.) [3]

(a) If a radioactive nucleus has a half-life of one year, will it be completely decayed at the end of two year? Explain. [2]

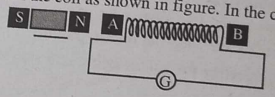
(b) Deduce the expression $N = Noe^{-24}$, where the symbols have their usual meanings.

(c) A radioactive source which has the half-life of 130 days, contains initially 1×10^{20} radioactive atoms, and the energy released per disintegration is 8×10^{-13} J, calculate the activity of the source after 260 days have elapsed and total energy released during this period. [3]

Group 'A'

Multiple Choice Questions: [1 × 1 = 10]

1. You are given a circular disc, e hollow sphere, a solid sphere and a circular ring of equal mass and radius. They start falling from the top of an inviined plane in the same time. Which one will reach bottom first?
   (a) Circuit ring (b) Solid sphere (c) Hollow sphere (d) Circular disc
2. Two equal drops are fulling through air with a steady velocity of 5 cm/sec. If the drops combine to form a new terminal velocity will be
   (a) 5 × 2 mc/sec (b) $5 \times \sqrt{2}$ cm/sec (c) $5 \times (4)^{1/3}$ (d) $5/\sqrt{2}$ cm/sec
3. A block of wood floors in the water with two-third of its volume submerged. The density of wood (in gm/cm^3) will be
   (a) 0.33 (b) 0.66 (c) 0.56 (d) 1
4. An inflated tire of a bicycle bursts. Which of the following relation between pressure P and temperature T holds well if γ is the ratio of the specific heats of air?
   a) $P^{L-T}T^{\gamma}$ (b) $P^{1-r}T^{1-r}$ (c) $P^{r}T^{1-r}$ (d) $P^{r}T^{r}$
5. Camot engine takes 300 calories of heat from a source at 500 K and rejects 150 calories of heat to the sink. The temperature of the sink is
   (a) 400 K (b) 250 K (c) 150 K (d) 100 K
6. In the propagation of light waves, the angle between the plane of vibration and plane of polarization is
   (a) 0 (b) 90° (c) 45° (d) 180°
7. The maximum wave length cf a transverse wave that can be set up in a string of length l is
   (a) ℓ (b) 2ℓ (c) $\frac{\ell}{2}$ (d) 4ℓ
8. The instrument for the accurate measurement of the emf of a cell is
   (a) ammeter (b) voitmeter (c) potentiometer (d) ohm-meter
9. When a current carrying conductor is placed in a magnetic field, the maximum force will act on the conductor when the conductor is at an angle of ..... to the magnetic field.
   (a) 45° (b) 60° (c) 30° (d) 90°
10. The agnet is moving away from the coil as shown in figure. In the coil, the current



   (a) will be zero (a) will flow from A to B
   (c) will flow from B to A (d) may flow in any direction
11. One Rutherford is equal to
   (a) 3.7×10^{10} dis/s (b) 10×10^{6} dis/s (c) 1 dis/s (d) 10^{6} dis/s

Group 'B'

Short Questious. [8 × 5 = 40]

12. (a) How does the K.E.P.E. and total energy of's simple harmonic oscillator vary with position? [2]

    (b) The displacement y of a mass vibrating with simple harmonic motion is given by y = 20 sin $10\pi t$ where y is in millimeter and t is in second. What is: (i) amplitude (ii) the period (iii) the velocity at t = 0. [3]

(a) If the ice on the polar caps of the earth melts, how will it affect the duration of the day? Explain.

(b) Speed of a body spinning about an axis increases from rest to 100 rev. min^{-1} in 5 sec., if a constant torque of 20 Nm is applied. The external torque is then removed and the body comes to rest in 100 sec, due to friction. Calculate the frictional torque. [2]

(a) An ice cube floats in a glass of water. When the ice melts, will the water level in the glass rise, fall or remain changed? Explain. [3]

(b) Distinguish between density and specific gravity. [1]

(c) A 25 cm thick block of ice bloating on fresh water can support an 80 kg ..... standing on it, what is the sinallest area of the ice block? [1]

(a) Wat do you understand by coherent sources? [3]

(b) Can two independent sources of light produce interference? [1]

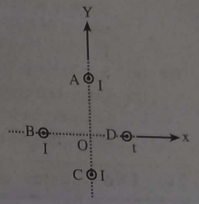
(c) In young's double slit experiment, the slits are 0.03cm apart and the screen is placed 1.5m away. The distance between the central bright fringe and fourth bright fringe is 1 cm. Calculate the wave length of light used. [1]

(a) State second law of thermodynamics. [3]

(b) A petrol engine consumes 10 kg of petrol in one hour. The calorific value of petrol is 11.4×10^3 cal/gm. The power of the engine is 20 Kwatts. Calculate the efficiency of the engine. [2]

(a) Explain why the magnetic field at the centre of the coil disappears when the circular coil is made infinitely large.

(b) What will be the resultant magnetic field at origin due to four infinite current carrying wires A, B, C, & D. Each wire carries current (1 = 2A) and is equidistance (10 cm) from origin. [3]



(a) If the number of turns of a solenoid is doubled, keeping the other factors constant, .ow does the self-inductance of the solenoid change?

(b) When a wheel with metal spokes 1.2m long is rotated in magnetic field of flux density 5×10^{-3} normal to the plane of wheel, an emf of 10^{-2}V ie-mduced between the rate of rotation of the wheel. [3]

(a) What happens to the kinetic energy of photoelectrons when the intensity of incident light is doubled? Justify your answer. [2]

(b) A UV light of 400 nm strikes a cesium surface of work function 1.9 eV. Find the vel city of electron emitted from the cesium surface $m_e = 9.1 \times 10^{31}$ kg, $c = 3 \times 10^6$ m/s $h = 6.62 \times 10^{-34}$ J.S. [3]

(a) Define half life and decay constant of a radioactive substance. [2]

(b) Establish a relation between half life and decay constant of a radioactive substance.

(a) What do you understand by Zener diode? [1]

(b) How can this be used as voltage regulator? [3]

(c) Give truth table for an OR gate. [1]

Group 'C' **[3 × 8 = 24]**

Answer Questions.

(a) Why is soap solution a better cleaning agent than ordinary water? [1]

(b) Why the antiseptics used for cuts and wounds in human flesh have low surface tension? [1]

(c) Derive an expression for the rise or fall of liquid in a capillary tube. [3]

(d) Find the work done required to break up a drop of water of radius 5×10^{-3} m into eight drops of water, assuming isothermal condition. [Surface tension of water = 72×10^{-3} N/m] [3]

Or, (a) Why choke coil is preferable to a resistor in an ac circuit?

(b) Derive the expression for impedance and current in LCR series circuit. Also find the [illegible] frequency.

(c) An ae source of 220V, 50Hz is connected to series circuit containing a resistor R and [illegible] L and capacitor C. If R = 100 Ω, L = 0.2 H and C = 8μ F. (a) calculate the current [illegible] circuit, (b) the phase angle, and (c) the power consumed in the circuit.

21. (a) State Newton's formula for the velocity of sound in gases.

(b) What correction was done by Laplace on it?

(c) a man standing at one end of a closed corridor 57 m long blow a short blast on a whistle. [illegible] found that the time from the blast to the sixth echo was 2 seconds. If the temperature was [illegible] what was the velocity of sound at 0°C?

22. (a) Describe with necessary theory of Milliken oil drop experiment to determine the value of [illegible] charge associated with an electron.

(b) What is the importance of Miilikan's oil drop experiment?

(c) In a Milliken-type apparatus the horizontal plates are 1.5 cm apart. With the electric [illegible] switched off an oil drop is observed to fall with the steady velocity 2.5×10^{-2} cms.$^{-1}$ when [illegible] field is switched on the upper plate being positive, the drop just remains stationary when [illegible] potential difference between the plates is 1500 V. Calculate the radius of the drop and [illegible] number of electronic charges. (Given-density of oil = 900 kg m^{-3} and viscosity of air = [illegible] 10 NSm^2, Neglect air density)

OR (a) Sate Boh'rs postulates.

(b) Derive expression for the radius of n^{th} orbit of hydrogen atom.

(c) Calculate the wavelength of the first line of the Balmer series, if the wavelength of the [illegible] line of this series is 4.86×10^{-7} m.

IV. Old Chpater- wies Questions Collecation

Unit 4: First Law of Thermodynamics

Formulae

. First law of thermodynamics: $\Delta Q = \Delta U + \Delta W$

Where, ΔQ = Energy supplied to the system

ΔW = External work done.

ΔU = Change in internal energy

. Isothermal process: $P_1 V_1 = P_2 V_2$

Adiabatic process: PV^{γ} = Constant