

Engr. Muhammad Zaeem's Preparation Paper For Board Examination 2024-25 (Physics of CLASS – XII PE/PM & CS)



Important Multiple Choice Questions

1. Light passing near a massive object like a star will bend due to:
 * Gravitational lensing * refraction * reflection * diffraction
2. The work function for a certain sample is 2.3 eV. The stopping potential for electrons ejected from the sample by 7.0×10^{14} Hz electromagnetic radiation is:
 * 0 * 0.6 V * 2.3 V * 2.9V * 5.2V
3. The ruby laser is an example of:
 * Optical pumping * Electrical pumping * Chemical pumping * Thermal pumping
4. If a Radium has half-life 5years. Thus for a nucleus in a sample of radium, the probability of the decay in the ten years is: * 50% * 75% * 100% * 60%
5. Doubling the voltage of an X-ray tube: * Halves the intensity * Doubles the intensity
 * Quadruples the intensity * Keeps the intensity unchanged
6. In Compton Scattering from stationary particles the maximum change in wavelength can be made smaller by using: * high frequency radiation * lower frequency radiation
 * more massive particle * less massive particle
7. In AC circuit, the term 'Reactance' represent the:
 * Capacitive and inductive opposition to current flow * Resistance to DC current only
 * Total Impedance, including resistance & phase angle * Ohmic resistance only
8. Laminated iron cores are used in electric motors and transformers to:
 * reduce the weight of the device * enhance the mechanical strength
 * minimize eddy current losses and reduce heating * increase the magnetic permeability of the core
9. An electron moves parallel to a uniform magnetic field. What is the magnitude of force experienced by electron? * Maximum, since the electron is moving in the same direction as the field
 * Minimum, since the electron is moving in perpendicular to the field
 * Zero, the electron is moving parallel to the field * Depends on the speed of electron
10. Second law of thermodynamics states that:
 * Energy can't be converted * Entropy decreases over time
 * Heat flows from cold to hot * Entropy increases over time
11. During an adiabatic compression process, what happens to the internal energy of the system:
 * Increases * Decreases * Remains Constant * Depends upon the specific heat
12. A domestic pressure cooker is based on:
 * Adiabatic process * Isothermal process * Isochoric process * Isobaric process
13. The relationship between temperature and average kinetic energy of particles in a gas is:
 * Temperature is inversely proportional to average kinetic energy
 * Temperature is directly proportional to average kinetic energy
 * Temperature is independent of average kinetic energy
 * Temperature is proportional to the square of average kinetic energy
14. In air at S.T.P, the average speed of the:
 * Oxygen molecules is greater than Nitrogen molecules * Nitrogen molecules is greater than Oxygen molecules
 * Oxygen molecules is approximately equal to Nitrogen molecules
 * Helium atoms is greater than both Oxygen and Nitrogen molecules
15. In which thermodynamic process does a system exchange heat with its surroundings but undergoes no change in temperature? * Isothermal process * Adiabatic process * Isobaric process
 * Isochoric process
16. What is internal energy in a thermodynamic system?
 * The energy associated with motion * The energy associated with the system's position
 * The sum of kinetic and potential energy * The total energy contained within the system
17. A refrigerator with its door open. The temperature of the room will:

- * Rise * Fall * Remains the same * Rise or fall depending on the area of the room
18. Which device is not used in a diesel engine:
 * Outlet Valve * Piston * Sparking Plug * Injector
19. To measure a higher voltage, what should you do with the voltmeter's internal resistance?
 * Increase it * Decrease it * Keep it the same * It doesn't affect the measurement
20. Eddy currents produce:
 * Static electricity in conductive material * Alternating magnetic fields with no heating effects
 * Magnetic fields that oppose the inducing field and cause heating in conductors
 * Uniform electric fields that have no impact on power generation
21. An inductor stores electric potential energy in:
 * The electric field around it * The magnetic field within its coil
 * The capacitance of its windings * The heat generated by its resistance
22. In alternating current, the flow of electric charge periodically reverses direction. The term for this specific phenomenon is:
 * Alternation * Oscillation * Cycle * Resistance
23. The reciprocal of Bulk Modulus is called:
 * Compressibility * Volume Stress * Modulus of Rigidity * Volume Strain
24. The primary purpose of a truth table in digital electronics is to:
 * Determine input voltage * Measure circuit resistance
 * Analyze output states based on input combinations * Calculate circuit power
25. Objects cannot exceed the speed of light because:
 * Their mass becomes infinite * Their length becomes zero * Time slows down to zero * They lose all energy
26. Compton scattering from electrons is most easily observed for:
 * Infrared light * Visible light * Ultraviolet light * X-rays
27. In the equation ${}^{27}_{13}\text{Al} + {}^4_2\text{He} \longrightarrow {}^{30}_{15}\text{P} + \text{X}$, The correct symbol for X is:
 * ${}^{-1}_0\text{e}$ * ${}^1_1\text{H}$ * ${}^4_2\text{He}$ * ${}^1_0\text{n}$
28. If the temperature is kept constant and the volume of a gas is doubled, then pressure of a gas is:
 * Reduced to 2 of original value * Doubled * Reduced to 4 of original value * Quadrupled
29. Working principle of transformer is:
 * Mutual Induction * Self Induction * Charge * Energy
30. In purely resistive AC circuit, the phase difference between current and voltage is:
 * 90° * 180° * 0° * 45°
31. For a metallic crystal, delocalized electrons occupy/or:
 * there are no delocalized electrons * conduction band * valence band
 * conduction and valence bands
32. In a 2-input OR gate, when both inputs are '1' then the output will be:
 * 0 * undefined * Both 1 and 0 * 1
33. One Henry is equal to:
 * Vs^{-1}A * $\text{Vs}\cdot\text{A}$ * $\text{Vs}^{-1}\text{A}^{-1}$ * VsA^{-1}
34. A free electron has a momentum of $5.0 \times 10^{-24} \text{ kgms}$ its wavelength is
 * $1.3 \times 10^{-8} \text{ m}$ * $1.3 \times 10^{-10} \text{ m}$ * $2.1 \times 10^{-11} \text{ m}$ * $2.1 \times 10^{-13} \text{ m}$
35. What is the purpose of the torsion spring in a galvanometer?
 * to provide restoring force * to provide magnetic field * to measure current * to amplify current
36. A straight wire carries a current vertically upwards through a uniform magnetic field directed into the page. Which of the following describes the direction of the force acting on the wire?
 * downward * upward * to left * to right
37. What is the specific temperature at which the triple point of water occurs?
 * 373.16 K * 100°C . * 273.16 K * 0°C .
38. In electromagnetic braking, kinetic energy is transformed into
 * thermal energy * potential energy * chemical energy * electrical energy
39. If you want to increase the range of an ammeter (i.e., measure higher currents. how should you modify the shunt resistance?
 * increase the shunt * add a high resistance in series with shunt
 * decrease the shunt * keep shunt the same

40. Why is a coil with a soft iron core expected to have a greater self-inductance compared to an air-core coil?
 * soft iron has low resistance than air * soft iron has greater temperature coefficient than air
 * soft iron is better conductor than air * soft iron has high permeability than air
41. A refrigerator operates based on the principle that
 * heat flow spontaneously from cold to hot body * work must be done to move heat from cold to hot body
 * heat is converted completely into work * the entropy of the system decreases
42. In an AC generator, what component is primarily responsible for the change in magnetic flux through the coil leading to the generation of the alternating current?
 * the slip rings * the brushes * armature * the extremal magnetic field
43. A transformer is working normally; suddenly you make the incoming electricity switch direction much faster what's likely to happen inside transformer?
 * It work better because flux changes faster * the core gets extra hotter because of eddy current
 * output voltage remains the same but less currents flows out * the transformer starts turning AC into DC
44. If the peak voltage in a resistive Ac circuit is doubled, what is the effect on the peak current and the power dissipated?
 * The peak current doubles and the power quadruples
 * The peak current is halved and the power remains same
 * The peak current remains same and the power is halved
 * The peak current quadruples and the power doubles
45. How does the force extension graph help in material selection in engineering applications?
 * It solely determines the materials density * It provides information about cost of the material
 * It indicates the color and appearance of material
 * It predicts the material's performance under different loading conditions
46. If two events are simultaneous in one inertial frame of reference what can be said about those same events in another inertial frame of reference moving relative to the first
 * they may or may not be simultaneous * they will never be simultaneous
 * the time order of the events is not absolute * they will always be simultaneous
47. Wein's displacement law relates the wavelength at which the intensity of blackbody radiation is maximum to
 * the energy density * temperature of the blackbody * frequency of the radiation * Plank's constant
48. Which of the following is true for gamma decay but NOT true for beta decay?
 * the atomic number changes * the energy of the nucleus changes
 * the mass number changes * a new element is formed
49. How does the entropy of a system change when it absorbs heat at a constant temperature?
 * it decreases * it remains constant * it increases * it depends on the volume
50. For an ideal gas, the root mean square speed of molecules is 500 m/s at 300 K. If the temperature Is raised to 900 K, what will be the corresponding root mean square speed, assuming the molecular mass remains constant?
 * 1000 m/s * 866 m/s * 458m/s * 376 m/s
51. Which temperature scale is used in scientific measurements and has no negative values?
 * Celsius * Kelvin * Fahrenheit * Rankine
52. Which of the following correctly applies the first law of t thermodynamics to both an isolated system and a cyclic process?
 * $Q = 0, \Delta U \neq 0$ * $\Delta U \neq 0, Q = 0$ * $\Delta U = 0, Q \neq 0$ * $\Delta U = 0, Q = W$
53. What happens If an ideal voltmeter Is connected in series in a circuit?
 * It measures the current in the circuit. * It blocks the current flow completely.
 * It does not affect the circuit. * It measures the resistance of the circuit.
54. It an electron and proton enter in a magnetic field of induction with same momentum perpendicularly, the relationship between magnetic force of electron to proton is
 * $\frac{F_e}{F_p} = \frac{q_e}{q_p}$ * $\frac{F_e}{F_p} = \frac{m_e}{m_p}$ * $\frac{F_e}{F_p} = \frac{p_e}{p_p}$ * $\frac{F_e}{F_p} = \frac{v_e}{v_p}$
55. In an AC generator, the frequency of the output current depends on:
 * The speed of rotation of the coil. * The strength of the magnetic field.
 * The resistance of the coil * The number of turns in the coil.
56. In an RL series circuit connected to an AC source, the phase angle between the voltage and current

depends on:

- * The frequency of the AC source.
- * The voltage of the source.
- * The inductance and resistance values.
- * The current in the circuit.

57. Which of the following is an example of a relativistic effect?

- * A clock on a moving spaceship tick slower compared to a clock on Earth.
- * A clock on Earth ticks slower than a clock on a moving spaceship.
- * Objects in motion get heavier as their speed decreases.
- * Time remains unaffected by the velocity of objects.

58. Which phenomenon provides evidence for the particle nature of light through Compton scattering?

- * The absorption of light by a black body.
- * The diffraction of light through a crystal
- * The shift in wavelength of X-rays when scattered by electrons.
- * The interference pattern in a double-slit experiment.

59. In the stimulated emission process of a laser, what role does the incoming photon play?

- * It excites an electron to a higher energy state
- * It causes spontaneous emission of photons.
- * It stimulates the release of another photon with the same energy and phase.
- * It absorbs energy from the excited electron.

60. You have a security system with two sensors. The alarm rings if at least one sensor detects motion. Which logic gate is used here?

- * XOR gate
- * NOT gate
- * OR gate
- * AND gate

61. Copper is classified as which type of material based on its magnetic properties?

- * Ferromagnetic
- * Diamagnetic
- * Paramagnetic
- * Ferromagnetic

62. Which of the following correctly represents the comparison of the charge-to-mass ratio (a/m) for an electron, proton, and alpha particle?

- * (q/m) alpha > (q/m) proton > (q/m) electron
- * (q/m) alpha > (q/m) electron > (q/m) proton
- * (q/m) proton > (q/m) alpha > (q/m) electron
- * (q/m) electron > (q/m) proton > (q/m) alpha

63. In a series RLC circuit, when does the current lead the voltage?

- * When $X > X_c$
- * When $X_c > X_L$
- * $X_c = X_L$
- * When $R = 0$

64. Standard conditions of temperature and pressure (STP) refer to a gas at:

- * 0°C and 1 atm.
- * 20°C and 1 atm.
- * 25°C and 1 atm.
- * 30°C and 1 atm.

65. The Avogadro's number of molecule in

- * One mole of a substance
- * One kg of substance
- * One kg of hydrogen gas
- * One m³ of a gas

66. In an isochoric process, what is the primary feature?

- * Constant temperature
- * No work done
- * No Heat exchange
- * Constant volume

67. During an isobaric process, what remain constant

- * Internal energy
- * Volume
- * Pressure
- * Temperature

68. The net change in entropy as a system in a natural process is.

- * Infinite
- * Positive
- * Zero
- * Negative

69. The magnetic field inside along the solenoid

- * Equals to zero
- * Uniform
- * decreases as we go away from the center to surface
- * increases as we go towards

70. The frequency of standard household alternating current in Pakistan is

- * 60 Hz
- * 100 Hz
- * 120 Hz
- * 50 Hz

71. What is the power factor of a purely resistive circuit?

- * -1
- * 1
- * 0.5
- * 0

72. Substance which can be stretched to cause large strains are called.

- * Elastomer
- * Plastic
- * Ductile
- * Brittle

73. A semiconductor is an element with a valence electron.

- * One
- * Eight
- * Two
- * Four

74. A pure semiconductor is known as

- * Transistor
- * Diode
- * Intrinsic
- * Extrinsic

75. The behavior of 2 input AND gate when both switches are closed, Lamp is

- * Flickering
- * Blinking
- * OFF
- * ON

76. An object at rest of mass of 1 kg. What is its mass when it is moving at a speed of 0.9c?

- * 1.2 kg.
- * 2.3 kg
- * 1kg
- * Infinite

77. The General Theory of Relativity was a new way of understanding of
 * Mass * Force * The speed of light * Gravity
78. The amount of energy which is necessary to start photo electric emission is called:
 * Littlest * Minimum * Average * Maximum
79. Atomic spectra are also known as
 * Line Spectra * Discrete Spectra * Emission Spectrum * Continuous Spectra
80. The radioactive isotope used for the diagnosis of brain tumors is;
 * Cobalt-60 * Phosphorus-32 * Iodine-131 * Sodium-24
81. According to law of radioactive decay, the negative rate of decay is proportional to the total number of;
 * nuclei present in the sample at an instant * nuclei present in the sample at time $t = 0$
 * unstable nuclides present in the sample at an instant * unstable nuclides present in the sample at $t = 0$
82. Beyond Yield point a solid material deforms;
 * elastically and obeys Hooke's law * plastically and obeys Hooke's law
 * elastically and does not obey Hooke's law * plastically and does not obey Hooke's law
83. In the voltage in an AC circuit is represented by the equation $V = \{331 \sin(377t)\}$ volts then rms voltage will be;
 * 220V * 331V * 377V * 622V
84. A proton enters in a uniform magnetic field of induction 0.300T in a direction making an angle of 30° with the direction of the field. If the speed of the proton is 10^4 m/s, then the magnetic deflecting force will be;
 * 2.4×10^{-16} N * 2.4×10^{-15} N * 4.16×10^{-16} N * 4.16×10^{-15} N
85. If the average kinetic energy of gas molecules at 27°C is E than at 327°C kinetic energy will be;
 * E * 2E * E/2 * E/4
86. The clock in a moving frame moving with relativistic speed, the ticks;
 * slower * faster * same * stop
87. Heat capacity depends upon
 * Amount * Material & input * material * None of these
88. The half-life of Radium is 1600 years. After 6400 years the sample of surviving radium will be its:
 * $1/4^{\text{th}}$ * $1/16^{\text{th}}$ * $1/8^{\text{th}}$ * Half

Important Short Question Answers

- Derive an expression for the force experienced by current carrying conductor in a uniform magnetic field.
- Derive an expression for the energy stored in an inductor for AC Current
- Derive an equation for resultant voltage, impedance and phase angle in AC series RC OR RL circuits. Also draw a labelled diagram
- What is rectification? How full wave rectification is obtained? Explain with the help of labelled diagram.
- What are logic gates? How many basic types of logic gates are there? Draw a truth table for AND gate with two inputs along with labelled diagram. OR Describe the binary equation of OR gate or AND gate for three inputs.
- Derive the expression for COP of refrigerator.
- Define entropy and explain the increase in entropy means degradation of energy
- On the basis of KMT of gases show that $\frac{1}{2}mv^2 = \frac{3}{2}KT$
- Define the terms heat and temperature with different scales. Describe the triple point of water.
- Define valence band and conduction band, classify solids on the basis of energy bands.
- Explain the process of pair production briefly OR What are black body radiations. State laws of black body radiations.
- Define Young's Modulus and Shear Modulus also write their expressions OR Distinguish between ferromagnetic, paramagnetic and diamagnetic material. Also define Curie Point.
- Prove that $C_p - C_v = R$
- Write down four steps of the working of petrol engine
- What is superconductor? Discuss its application in MRI.
- What is half-life of a radioactive element? Explain how half-life of radioactive element can be determined.
- Describe the behavior of capacitor OR inductor in AC circuits with mathematical expression

Important Numerical

- ✓ 1. A 50.0 g sample of carbon is taken from the pelvis bone of a skeleton and is found to have a carbon - 14 decay rate of 200.0 decays/min. It is known that carbon from a living organism has a decay rate of 15.0 decays/min-g and that C-14 has a half-life of 5730 years = 3.01×10^9 min. Find the age of the skeleton.
- ✓ 2. Cut-off frequency for the photoelectric effect in some materials is 8×10^{13} Hz. When the incident light has a frequency of 1.2×10^{14} Hz, the stopping potential is measured as 0.16 V. Estimate a value of Planck's constant from these data and determine the percentage error of your estimation.
- ✓ 3. An FM radio transmitter has a power output of 100 kW and operates at a frequency of 94 MHz, how many photons per second does the transmitter emit?
- ✓ 4. How fast would a rocket have to go relative to an observer for its length to be contracted to 99% of its length at rest?
- ✓ 5. A farmer making juice fills a glass bottle to the brim and caps it tightly. The juice expands more than the glass when it warms up in such a way that the volume increases by 0.2% (i.e., $\frac{\Delta V}{V} = 2 \times 10^{-3}$) relative to the space available. Calculate the normal force exerted by the juice per square centimeter if its bulk modulus is 1.8×10^9 N/m². Assuming that the bottle does not break.
- ✓ 6. An inductor have reactance of 500Ω is connected with alternating voltage 220V and frequency of 50 Hz.
- ✓ 7. Calculate the inductance of the solenoid
8. A conductor of length 0.4 m moves at a velocity of 5 m/s perpendicular to a magnetic field of 0.3 T. Calculate the motional EMF induced in the conductor.
- ✓ 9. A coil with an inductance of 0.5 H experiences a rate of change of current of 2 A/s. Calculate the induced EMF in the coil.
10. Compute the magnitude of the magnetic field of a long, straight wire carrying a current of 1A at distance of 1m from it. Compare it with Earth's magnetic field which is 50 μT
11. A heat engine performs work of 0.4166 watts in one hour and rejects 4500J of heat to the sink. What is the efficiency of engine?
- ✓ 12. Find the binding energy of ${}^7_3\text{Li}$ (atomic mass 7.016003u, mass of proton 1.0073u, mass of neutron 1.0087u).
OR Find the binding energy of ${}^{126}_{52}\text{Te}$ in MeV if (atomic mass 125.9033u, mass of proton 1.0073u, mass of neutron 1.0087u)
- ✓ 13. A light source of wavelength illuminates a metal and ejects photoelectrons with a maximum kinetic energy of 1eV. A second light source with half the wavelength of the first ejects photoelectrons with a maximum kinetic energy of 4eV. Determine the work function of the metal
- ✓ 14. At what speed is a particle moving if the mass is equals to three times its rest mass?
15. In a series RL circuit the resistance R is 25Ω, and the inductance L is 0.1H. Calculate the phase angle and impedance at a frequency of 80Hz.
- ✓ 16. In an RLC Circuit, the resistance R is 50Ω, the inductance L is 0.1H and the capacitance C is 50μF. Calculate the resonance frequency
17. What will be the mutual inductance of two coils when the change of a current of 3 Amp. In one coil produces the change of flux of 6×10^{-4} Weber in the second coil having 2000 turns?
18. A galvanometer has a resistance of 50Ω and it deflects full scale when a current of 500μA flows in it. How can it be converted into ammeter of range of 15A and voltmeter of range 300V?
19. A step down transformer having 4000 turns in primary is used to convert 440 V to 220 V. The efficiency of the transformer is 90 % and 9KW output is required. Determine the input power, the number of turns in the secondary coil and the current in the primary coil and secondary coil. **OR** A step down transformer reduces 1100V to 220V. The power output is 12.5KW and the overall efficiency of the transformer is 90%. The primary windings have 1000 turns. How many turns do the secondary have? What is power input? What is the current in each coil
20. An air storage tank whose volume is 112 liters contain 3kg of air at a pressure of 18 atmospheres. How much air would have to be forced into the tank to increase the pressure to 21 atmospheres, assuming no change in temperature. **OR** A scientist stores 44gm of gas in a tank of pressure 2200 atm. Overnight the tank develops a slight leakage and the pressure drops to 1500 atm. Calculate the mass of the gas escape.
- ✓ 21. Calculate the root mean square speed of hydrogen molecule at 500K (mass of proton = 1.676×10^{-27} kg and $K = 1.38 \times 10^{-23}$ J/Molecule-K)
22. What is the COP of a refrigerator that operates with Carnot efficiency between temperature -3°C and +27°C?

23. What is the flux density at a distance of 0.1m in air from a long straight conductor carrying a current of 6.5A? Calculate the force per meter on a similar parallel conductor at a distance of 0.1m from the first carrying a current of 3A ($\mu_0 = 4\pi \times 10^{-7} \text{ Wb/Am}$)
24. In 9 days the number of radioactive nuclei decreases to one eighth present initially what is the half-life of the material?
25. A photon with a wavelength of $6 \times 10^{-12} \text{ m}$ collides with an electron. After the collision, the photon wavelength is found to have been changed by exactly as Compton's wavelength $2.43 \times 10^{-12} \text{ m}$. What is the photon's wavelength after collision?
26. Calculate the wavelength of X-rays if the energy of one photon emitted by X-ray machine is $1.9878 \times 10^{15} \text{ J}$
27. In a RL circuit the resonance is 30Ω and the inductance is 0.2H. Calculate the total impedance at a frequency of 60Hz
28. At what speed is a particle moving if the mass is equal to three times of its rest mass? **OR** A particle of rest mass m_0 moves with speed $\frac{c}{\sqrt{2}}$. Calculate its mass, momentum, total energy and kinetic energy.
29. What is the change in internal energy of 200g of nitrogen as it is heated from 10°C to 30°C at constant volume ($C_p = 29.11 \text{ KJ/mol.}$)
30. A pair of adjacent coils has a mutual inductance of 850mH. If the current in the primary coil changes from 0 to 20Amp in 0.1s, then what will be the change in magnetic flux in the secondary coil of 800 turns?
31. An RLC series circuit has a 40Ω resistor 3mH inductor and $5\mu\text{F}$ capacitor. Find the circuits impedance at 50Hz.
32. The pole of a horse shoe magnet measures 8cm x 4cm. The magnetic flux between the magnetic poles is 80mT. Outside of the magnet the flux density is zero. Calculate the magnetic flux density between the poles of a magnet.
33. A copper penny has a mass of 0.3gm. Determine the energy in MeV that would be required to break all the copper nuclei into their constituent protons and neutrons. Ignore the energy that binds the electrons to the nucleus and the energy binds one atom to another in the structure of the metal. For simplicity, assume that all the copper nuclei are $^{63}_{29}\text{Cu}$ (at. mass = 62.939598u, $m_p = 1.007276\text{u}$, $m_n = 1.008665\text{u}$)
34. Calculate the change in entropy when 100gm of water is heated from 90°C to 130°C . Specific heat of water is 4200 J/Kg.K.
35. A wire of 2.2 m long and 2.25mm in diameter, when stretched by a weight of 8.8kg, its length has been increased by 0.25mm. Find stress, strain and Young's modulus of the material of wire. **OR** A mild steel wire of radius 0.55mm and length 3.5m is stretched by a force of 52N. Calculate longitudinal stress and longitudinal strain ($Y = 2.1 \times 10^{11} \text{ N/m}^2$)
36. A sample of an ideal gas undergoes an isobaric expansion at constant pressure. The gas consists of two moles, with an initial temperature of 27°C and a final temperature of 500K. During this process, the change in internal energy of the gas is 2.37BTU. Determine the work done by the gas and the heat supplied during this expansion. **OR** A system undergoes an isobaric process where the pressure is kept constant at 15KPa. If the volume increases from 0.05m^3 to 0.08m^3 and change of internal energy of the system is 150J. Calculate the heat added to the system.
37. An ammeter is connected using a shunt resistance to extend its range. The value of the shunt resistance is 0.1Ω the internal resistance of galvanometer 50Ω and the full scale deflection voltage of the galvanometer is 1mV. Find the range of ammeter when the galvanometer is connected with shunt.
38. A heat engine performs work done at the rate of 5MW. The efficiency of the engine is 40%. Calculate the heat loss by the engine in 5 hours. **OR** A heat engine works at the rate of 500KW. The efficiency of engine is 30%. Calculate the loss of heat per hour
39. X-rays with an energy of 300KeV undergo Compton Scattering with a target. If the scattered X-rays are detected at 60° relative to the incident X-rays, determine the Compton's shift at this angle.
40. A coil with a circular cross section and an area of 20cm^2 has a magnetic field of 0.5T due to steady current I. When the current is suddenly switched off, a back emf of 5mV is induced in the coil over a time of interval 0.1s. Determine the number of turns in the coil.
41. The threshold wavelength of metal is 3000\AA . The ultraviolet light of wavelength 2500\AA falls on its metal surface. Calculate the maximum K.E of photoelectrons emitted ($h = 6.63 \times 10^{-34} \text{ Js}$, $c = 3 \times 10^8 \text{ m/s}$).
42. A 200gm piece of metal is heated to 150°C and then dropped into a aluminum calorimeter of mass 500g containing 500g of water initially at 25°C . Find the final equilibrium temperature of the system ($C_{\text{metal}} = 128.100 \text{ J/Kg.K}$, $C_{\text{calorimeter}} = 903 \text{ J/Kg.K}$, $C_{\text{water}} = 4200 \text{ J/Kg.K}$) **OR** A 50 g piece of copper at 100°C is

placed in 200 g of water at 20°C. If the final temperature of the system is 21.8°C, calculate the specific heat capacity of copper. (Specific heat capacity of water = 4.18J/g°C)

43. Find the current required to produce a field of induction $B = 2.512 \times 10^{-3} \text{ T}$ in a 50cm long solenoid having 4000 turns of wire ($\mu_0 = 4\pi \times 10^{-7} \text{ Wb/Am}$)
44. An emf of 45mV is induced in a coil of 500 turns when the current in the neighboring coil changes from 10A to 14A in 0.2 seconds. What is the mutual inductance of the coils? What is the rate of change of flux in the second coil?
45. Calculate the density of hydrogen gas considering it to be an ideal gas when the root mean square velocity of hydrogen molecules is 1850m/sec at 0°C and 1 atmospheric pressure.

Important Long Question Answers

1. State First Law of Thermodynamics. Explain any two of the following a) isothermal process b) adiabatic process c) isobaric process in details.
2. Derive expression for efficiency of Carnot engine by discussing four necessary processes. Draw PV-diagram of the whole Carnot Cycle.
3. State Ampere's Law. Derive expression for magnetic field of solenoid.
4. Discuss Sir J.J Thomson Experiment to determine charge to mass ratio of an electron with the help of relevant mathematical expressions and labelled diagram.
5. What is Photoelectric Effect? What remarkable experimental results are obtained about the photoelectric emission? Give Einstein's explanation of the photoelectric effect on the basis of quantum theory of radiation.
6. What is transformer? On what principle it works. Discuss its construction and working to derive relation between no. of turns, current and emf. Also discuss types of transformer.
7. Show that the pressure of an ideal gas is $P = \frac{1}{3} \rho \overline{v^2}$, where ρ is the density of the gas.
8. Synthesize hysteresis loop for relationship between magnetic field strength and magnetizing current.
9. What is Laser? Its principle? Explain He-Ne Laser in detail.
10. State Faraday's law of electromagnetic induction and also describe Mutual induction **OR** self-induction with its relevant mathematical expressions
11. What are inertial and non-inertial frames of references? One example of each is required. Explain the four important results arrived at by Einstein on the basis of Special Theory of Relativity.
12. Explain the force extension graph in detail (stress and strain curve)
13. Describe the construction and working of Moving Coil galvanometer. Also show that the deflection produced in the coil is proportional to the current passing through it.
14. What is AC generator also describing its working with graphical representation. Also derive the relevant expressions for EMF induce in AC generator.
15. Discuss the behavior of RLC parallel circuit, including the phasor diagram, waveforms of currents through each element of circuit and the supplied voltage and derive the expression for its impedance.

"Great things never come from comfort zones—push your limits, and let your hard work speak for itself!"

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