ALL INDIA TEST SERIES
FOR
GATE (PHYSICS) 2026
Full Length Test – 01

TIME: 3 HOURS **MAXIMUM MARKS: 100**

This question paper consists of **2 sections**, General Aptitude (GA) for **15 marks** and subject specific GATE paper for **85 marks**. Both these sections are compulsory.
The GA section consists of **10** questions. Question numbers 1 to 5 are of 1-Mark each, while question numbers 6 to 10 are of 2-Mark each. The subject specific GATE paper section consists of **55** questions, out of which question numbers 11 to 35 are of 1-mark each, while question numbers 36 to 65 are of 2-mark each.

The question paper may consist of questions of **Multiple Choice Question Type** (MCQ), **Multiple Select Question Type** (MSQ) and **Numerical Answer Type** (NAT).
Question number 11 to 27 and Question number 36 to 54 are **Multiple Choice Question Type** (MCQ).
Question number 28 to 32 and Question number 55 to 58 are **Multiple Select Question Type** (MSQ).
Question number 33 to 35 and Question number 59 to 65 are **Numerical Answer Type** (NAT).
Multiple choice type questions will have four choices against A, B, C, D, out of which only **ONE** is the correct answer.
Multiple Select Questions will have four choices against A, B, C, D, out of which **one or more than one choice(s)** are correct.

For numerical answer type questions, each question will have a numerical answer and there will not be any choices.

All questions that are not attempted will result in zero marks. However, wrong answers for multiple choice type questions (MCQ) will result in **NEGATIVE** marks. For all MCQ questions a wrong answer will result in deduction of $\frac{1}{3}$ marks for a 1-mark question and $\frac{2}{3}$ marks for a 2-mark question.

There is **NO NEGATIVE MARKING** for questions of **MULTIPLE SELECT QUESTION TYPE** and **NUMERICAL ANSWER TYPE**.
Non-programmable type Calculator is allowed. Charts, graph sheets, and mathematical tables are **NOT** allowed in the Examination Hall. You must use the Scribble pad provided to you at the examination centre for all your rough work. The Scribble Pad has to be returned at the end of the examination.

GENERAL APPTITUDE

Q1 – Q5 carry 1 Mark each.

Q1. A________event occurred in front of police but the police failed to_______in time.

The words that best fill the blanks in the above sentence are

(a) Pleasant, aware (b) Superlative, reserve

(c) Tragic, respond (d) Boring, employ

Q2. In the interval $\frac{9\pi}{4} \le x \le \frac{7\pi}{2}$, the solution of trigonometric equation $1+\cos 2x = 2$ is

(a) $\frac{9\pi}{4}$ (b) $\frac{5\pi}{2}$ (c) 3π (d) $\frac{7\pi}{2}$

Q3. The area of a regular hexagon is $24\sqrt{3}$. What is the sum of all its sides?

(a) 24 (b) 28 (c) 32 (d) 36

Q4. An immediate cabinet meeting was called to discuss the_______situation.

The word that best fills the blank in the above sentence is

(a) emerge (b) emerging (c) implicate (d) implicating

Q5. Q is some distance to the East of $P \cdot Q$ is also $1m$ to the west of $R.R$ is also 4m to the south of S. If the shortest distance between P and S is $5m$. Then the shortest distance between P and Q is

(a) $0.5m$ (b) $1.0m$ (c) $2.0m$ (d) $2.5m$

Q6 – Q10 carry 2 Mark each.

Q6. A number of solders are standing in a row all facing the same direction. Soldier ‘P is 20^{th} from left end while solider Q is 40^{th} from the right end. There are 5 soldiers between P and R and there are 18 soldiers between Q and R. If R is between P and Q then the total number of soldiers is

(a) 83 (b) 84 (c) 85 (d) 86

Q7. In a college 1000 students appeared for tests in Math, Hindi, and English. 200 students passed in Math, 250 passed in Hindi and 175 passed in English. 20 students passed in both Hindi and English. 30 students passed in both Math and English. 10 students passed in Math and Hindi. If 5 students passed in all three subjects then the number of students who are unable to pass even in a single subject is

(a) 400 (b) 410 (c) 420 (d) 430

Q8. If $x^8+\frac{1}{x^8}=2$ then the value of $x^2+\frac{1}{x^2}$ is

(a) 0 (b) 1 (c) 2 (d) 4

Q9. There are n points in a plane such that no three of them is collinear. The total number of triangles that can be constructed by joining these points is

(a) $\frac{n^3+3n^2+2n}{6}$ (b) $\frac{n^3-3n^2+2n}{6}$ (c) $\frac{n^3+3n^2+2}{4}$ (d) $\frac{n^3-3n^2-2n}{4}$

Q10. A train travels from city P to city Q and returns to city P by the same route. The speed of the train for onward and return Journey are constant at $60\,km/hr$ and $x\,km/hr$ respectively. If the average speed for the entire Journey is $48\,km/hr$, the value of x is

(a) 30 (b) 40 (c) 45 (d) 50

Q11-Q27 carrying 1 mark each.

Q11. If the Lagrangian is defined as $L=\frac{1}{2}m\left(\frac{dq}{dt}\right)^2-\frac{1}{2}m\omega^2q^2+\alpha q\left(\frac{dq}{dt}\right)$, which one of the following is TRUE?

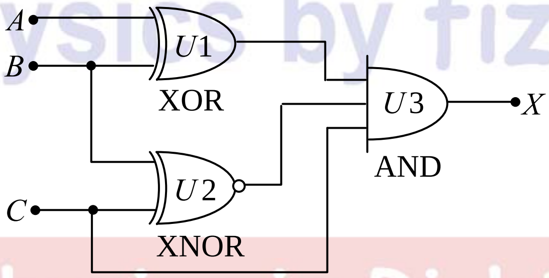
(a) The solution of given Lagrangian is free particle .

(b) The solution of given Lagrangian is harmonic oscillator particle

(c) The solution of given Lagrangian is damped oscillator particle

(d) The solution of lagrangian is forced oscillation

Q12. For the logic circuit shown in figure, the required input condition (A,B,C) to make the output $(X)=1$ is,



(a) 1,0,1 (b) 0,0,1 (c) 1,1,1 (d) 0,1,1

Q13. Consider the differential equation $\frac{d^2x}{dt^2}-3\frac{dx}{dt}+2x=0$. If $x=0$ at $t=0$ and $x=1$ at $t=1$, the value of x is

(a) $\frac{1}{e^2-e}\left(e^{2t}-e^t\right)$ (b) $\frac{1}{e^2-e}\left(e^{2t}+e^t\right)$

(c) $\frac{1}{e-e^2}\left(e^{2t}-e^t\right)$ (d) $\frac{1}{e-e^2}\left(e^{2t}+e^t\right)$

Q14. The ground state of La^{3+} (rare earth icon) is ${}^1S_0$. Which of the following is correct is correct about La^{3+} ions.

(a) It is paramagnetic (b) It is diamagnetic

(c) It is anti-ferromagnetic (d) It is ferri-magnetic

Q15. Which of the following potential will give parabolic phase curve for energy $E > 0$?

(a) $V(x) = \begin{cases} 0, 0 < x < a \\ \infty, otherwise \end{cases}$ (b) $V(x) = kx^2$

(c) $V(x) = -kx^2$ (d) $V(x) = k|x|$

Q16. N number of ideal gaseous molecules are confined into volume V. If internal energy per unit particle is U at absolute temperature T. The mean number of impacts between the molecules of the gas and wall per unit time per unit area as function of U is given by

(a) $\frac{N}{V}\sqrt{\frac{U}{3\pi m}}$ (b) $\frac{N}{V}\sqrt{\frac{2U}{3\pi m}}$ (c) $\frac{N}{V}\sqrt{\frac{3U}{2m}}$ (d) $\frac{N}{V}\sqrt{\frac{U}{3m}}$

Q17. If the electric and magnetic fields are unchanged when the potential $\vec{A}$ changes (in suitable units) according to $\vec{A} \to \vec{A} + 3\hat{r}$, where $\vec{r} = r(t)\hat{r}$, then the scalar potential Φ must simultaneously change to

(a) $\Phi - r$ (b) $\Phi - \partial r/\partial t$ (c) $\Phi - 3\partial r/\partial t$ (d) $\Phi - 2\partial r/\partial t$

Q18. A two-state quantum system has energy eigenvalues $\pm \in$ corresponding to the normalized states $|\psi_\pm\rangle$. At time $t = 0$, the system is in quantum state $\frac{1}{\sqrt{2}}\left[|\psi_+\rangle + |\psi_-\rangle\right]$. The wave function after time $t = h/(6\in)$

(a) $\psi = \frac{1}{\sqrt{2}} e^{i\frac{2\pi}{3}}\left[|\psi_+\rangle + |\psi_-\rangle\right]$ (b) $\psi = \frac{1}{\sqrt{2}} e^{-i\frac{2\pi}{3}}\left[|\psi_+\rangle + |\psi_-\rangle\right]$

(c) $\psi = \frac{1}{\sqrt{2}}\left[|\psi_+\rangle e^{\frac{i\pi}{3}} + |\psi_-\rangle e^{-\frac{i\pi}{3}}\right]$ (d) $\psi = \frac{1}{\sqrt{2}}\left[|\psi_+\rangle e^{\frac{-i\pi}{3}} + |\psi_-\rangle e^{\frac{i\pi}{3}}\right]$

Q19. Nuclear spin – parity of ${}^{14}_{7}N$ nucleus is

(a) 1^- (b) 1^+ (c) 2^- (d) 2^+

Q20. The quark content of $\bar{K}_0$ meson is

(a) $\bar{u}s$ (b) $\bar{d}s$ (c) $d\bar{s}$ (d) $u\bar{s}$

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Q21. Which of the following is correct for polarizability?

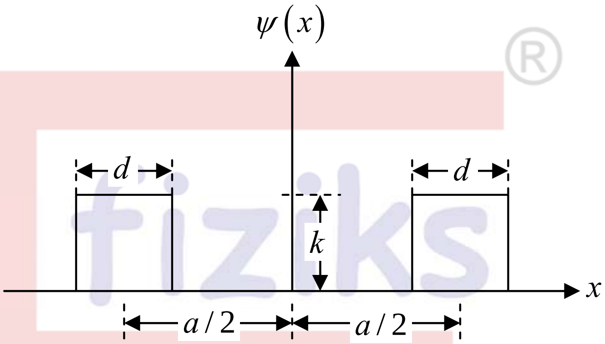
(a) Electronic polarizability is temperature dependent

(b) Ionic polarizability is temperature dependent

(c) Dipolar polarizability is temperature dependent

(d) Electronic polarizability is frequency independent

Q22. The wave function $\psi(x)$ of a particle is as shown below



Here k is a constant, and $a > d$. Find the value of k such that ψ is normalized

(a) $k = \frac{1}{\sqrt{d}}$ (b) $k = \frac{1}{\sqrt{2d}}$ (c) $k = \frac{1}{2\sqrt{d}}$ (d) $k = \sqrt{\frac{2}{d}}$

Q23. Radius of ${}^{64}_{24}Cu$ nucleus is measured to be 4.8×10^{-15} m. The radius of ${}^{27}_{12}Mg$ is

(a) 1.8 fm (b) 3.1 fm (c) 3.6 fm (d) 4.2 fm

Q24. A relativistic particle of mass m is moving speed v. The value of v at which its kinetic energy is equal to rest mass energy is

(a) $\frac{\sqrt{3}}{2}c$ (b) $\sqrt{\frac{3}{2}}c$ (c) $\frac{2}{3}c$ (d) $\sqrt{\frac{2}{3}}c$

Q25. The Hamiltonian operator for a two-level quantum system is $H = \begin{pmatrix} E_0 & 0 \\ 0 & -E_0 \end{pmatrix}$. If the state of the system at $t = 0$ is given by $|\psi(0)\rangle = \frac{1}{\sqrt{2}}\begin{pmatrix} 1 \\ 1 \end{pmatrix}$ then $\left|\langle\psi(0)|\psi(t)\rangle\right|^2$ at a later time t is

(a) $\frac{1}{2}\cos^2\left(\frac{E_0 t}{\hbar}\right)$ (b) $\frac{1}{2}\sin^2\left(\frac{E_0 t}{\hbar}\right)$

(c) $\cos^2\left(\frac{E_0 t}{\hbar}\right)$ (d) $\sin^2\left(\frac{E_0 t}{\hbar}\right)$

Q26. The electronic configuration of Manganese is $[Ar]3d^5 4s^2$. The ground state term of the Manganese is

(a) ${}^6S_{5/2}$ (b) ${}^6P_{7/2}$ (c) ${}^6D_{5/2}$ (d) ${}^6D_{7/2}$

Q27. If $\vec{s}_1$ and $\vec{s}_2$ are the spin operators of the two electrons of a He atom, the value of $\langle \vec{s}_1 . \vec{s}_2 \rangle$ for the ground state is

(a) $-\frac{3}{4}\hbar^2$ for both singlet and triplet

(b) $\frac{3}{4}\hbar^2$ for both singlet and triplet

(c) $\frac{3}{4}\hbar^2$ for triplet and $-\frac{3}{4}\hbar^2$ for singlet

(d) $-\frac{3}{4}\hbar^2$ for triplet and $\frac{3}{4}\hbar^2$ for singlet

Q28-Q32 carrying 1 mark each.

Q28. A parallel-plate capacitor has plate separation d. The space between the plates is empty. A battery supplying voltage V_0 is connected across the capacitor, resulting in electromagnetic energy U_0 stored in the capacitor. A dielectric, of dielectric constant k, is inserted so that it just fills the space between the plates. If the battery is still connected, then which of the following statements are true?

(a) The electric field is $\frac{V_0}{kd}$

(b) The electric field $\frac{V_0}{d}$

(c) The energy stored in the dielectric is kU_0

(d) The energy stored in the dielectric is U_0

Q29. A periodic function $f(x) = x^2$ for $-\pi < x < \pi$ is expanded in a Fourier series. Which of the following statement(s) is/are correct?

(a) Coefficients of all the sine terms are zero

(b) The first term in the series is $\frac{\pi^2}{3}$

(c) The second term in the series is $-4\cos x$

(d) Coefficients of all the cosine terms are zero

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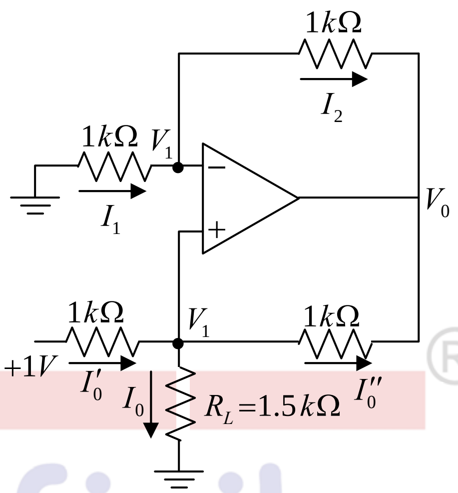
Q30. For the given circuit, identify the correct statement(s)



(a) $I_0 = 1mA$

(b) $V_0 = 3V$

(c) If R_L is doubled, I_0 will change to $0.5mA$

(d) If R_L is doubled, V_0 will change to $6V$

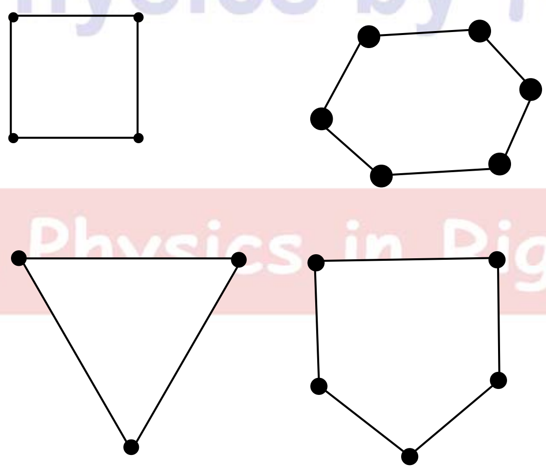
Q31. A particle is represented by a wavefunction

$\psi(x) = A\exp\left[-\frac{4x^2}{x_0^2} - 2ik_0x\right]$

where $A, x_0 \& k_0$ are constant. Which of the following statement is/are correct?

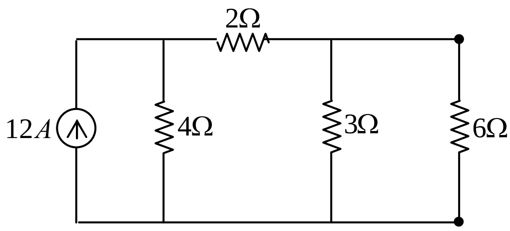
(a) $\langle x \rangle = 0$ (b) $\langle x^2 \rangle = \frac{x_0^2}{16}$ (c) $\langle p \rangle = -2\hbar k_0$ (d) $\Delta p = \frac{4\hbar}{x_0}$

Q32. Which of the following is/are allowed Bravais lattice in two-dimension?



Q33-Q35 carrying 1 mark each.

Q33. For the circuit shown in figure, the voltage across $6\,\Omega$ resistance is____________ V



Q34. If the density function of a random variable X is

$$f(x)=\begin{cases} kx^2, & 1\le x\le 5 \\ 0 \quad , & \text{otherwise} \end{cases}$$

Then the probability that the random variables assumes value between 2 to 4 is_______

Q35. A particle of unit mass moves along the x-axis under the influence of a potential, $V(x)=x(x-2)^2$. The particle is found to be in stable equilibrium at the point $x=2$. The time period of oscillation of the particle is________________(Upto two decimal places)

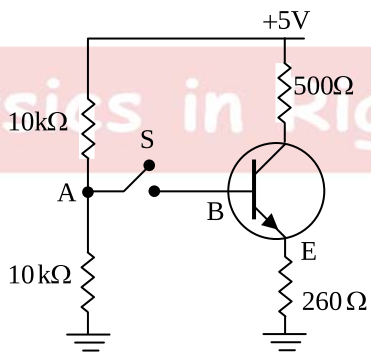
Q36-Q54 carrying 2 marks each.

Q36. A particle of mass m is moving under the action of a generalized potential $V(q,\dot{q})=\frac{1+\dot{q}}{q^2}$ then Lagrangian equation of motion is given by

(a) $m\ddot{q}-\frac{2\dot{q}^2}{q^3}=0$ (b) $m\ddot{q}+\frac{2\dot{q}^2}{q^3}=0$

(c) $m\ddot{q}-\frac{4\dot{q}}{q^3}-\frac{2\dot{q}^2}{q^3}=\dot{0}$ (d) $m\ddot{q}+\frac{4\dot{q}}{q^3}+\frac{2\dot{q}^2}{q^3}=\dot{0}$

Q37. For the transistor shown in the figure, the dc current gain β_{dc} = 50 and V_{BE} = 0.7 V. The switch S is initially open. If the switch S is closed, the voltage at point A is:



(a) $1.0\,V$ (b) $2.0\,V$ (c) $3.0\,V$ (d) $4.0\,V$

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Q38. Consider a particle of mass m in a one dimensional infinite potential well of width w:

$$V(x)=\begin{cases}0 & 0\le x\le 2a\\ \infty & \text{otherwise}\end{cases}.$$

The particle is subjected to perturbation of the form $W(x)=a\varepsilon\delta\left(x-\frac{a}{2}\right)$. The changes in the energy level of the particle in the first order of λ is

(a) $\begin{cases}\frac{\varepsilon}{2} & , n \ odd\\ \frac{\varepsilon}{4} & , n \ even\end{cases}$

(b) $\begin{cases}\frac{\varepsilon}{2} & , n \ odd\\ \varepsilon & , n=even\end{cases}$

(c) $=\begin{cases}\frac{\varepsilon}{2} & , n \ odd\\ \varepsilon & , n=2,6, \ ...\\ 0 & , n=4,8...\end{cases}$

(d) $=\begin{cases}\varepsilon & , n \ odd\\ \frac{\varepsilon}{2} & , n=2,6, \ ...\\ 0 & , n=4,8...\end{cases}$

Q39. The Fourier transform of $f(x)=\begin{cases}|x| & -1<x<1\\ 0 & \text{otherwise}\end{cases}$

(a) $\sqrt{\frac{2}{\pi}}\left[\frac{\cos\omega-\omega\sin\omega-1}{\omega^2}\right]$

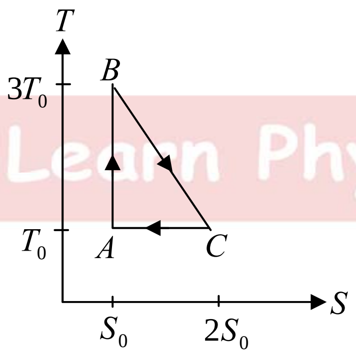
(b) $\sqrt{\frac{2}{\pi}}\left[\frac{\cos\omega+\omega\sin\omega-1}{\omega^2}\right]$

(c) $\sqrt{\frac{2}{\pi}}\left[\frac{\cos\omega+\omega\sin\omega+1}{\omega^2}\right]$

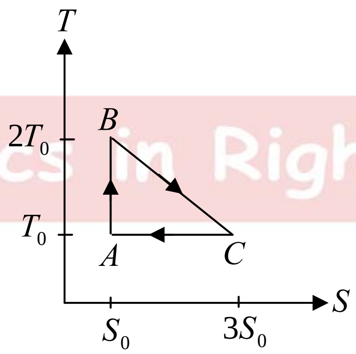
(d) $\sqrt{\frac{2}{\pi}}\left[\frac{\cos\omega-\omega\sin\omega+1}{\omega^2}\right]$

Q40. Which one of the following reversible cycles, represented by right angled triangles in a T-S diagram, is the least efficient?

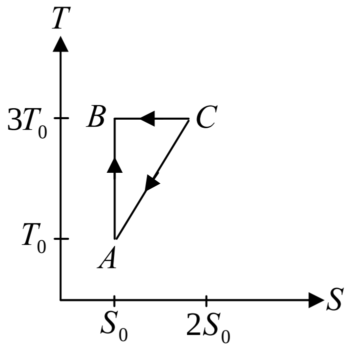
(a)



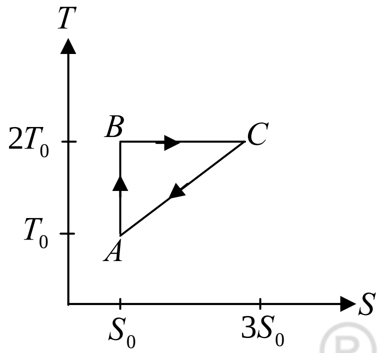
(b)



(c)



(d)



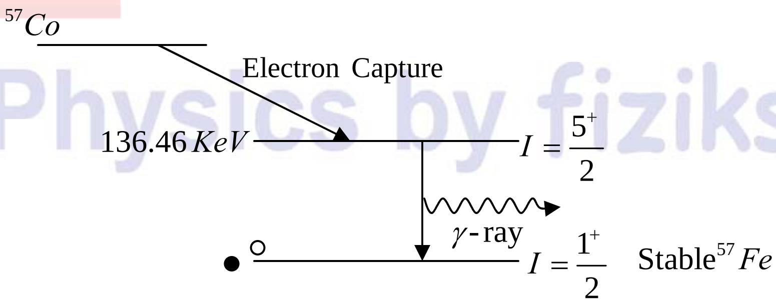
Q41. In the ideal double-slit experiment, when a glass-plate (refractive index 1.5) of thickness t is introduced in the path of one of the interfering beams (wavelength λ), the intensity at the position where the central maximum occurred previously remains unchanged. The minimum thickness of the glass-plate is

(a) 2λ (b) $\frac{2\lambda}{3}$ (c) $\frac{\lambda}{3}$ (d) λ

Q42. The miller indices of a plane passing through the three points having co-ordinates $\left(\frac{1}{2},\frac{1}{2},\frac{1}{2}\right),\left(\frac{1}{4},\frac{1}{2},\frac{1}{2}\right)$ and $\left(\frac{1}{3},\frac{1}{4},\frac{1}{2}\right)$ are

(a) (001) (b) (121) (c) (123) (d) (223)

Q43. The nucleus of ^{57}Co converted to ^{57}Fe after electron capture.



The excited nuclei of ^{57}Fe returns to ground state after γ- decay of energy $136.46\,keV$ as shown in the figure. The type of multipole-radiation is

(a) $E1$ (b) $M1$ (c) $E2$ (d) $M2$

Q44. The equation of state of a gas is given by

$$V = \frac{RT}{P} - \frac{b}{T}$$

where R is the gas constant and b is another constant parameter. The specific heat at constant pressure is C_P and the specific heat at constant volume is C_V, then $C_P - C_V$ is given by

(a) $R\left(1-\frac{bP}{RT^2}\right)^2$ (b) $R\left(1-\frac{RT^2}{bP}\right)^2$ (c) $R\left(1+\frac{RT^2}{bP}\right)^2$ (d) $R\left(1+\frac{bP}{RT^2}\right)^2$

Q45. Which of the following interaction is allowed?

(a) $\pi^- + p \to \Sigma^+ + K^-$ (b) $\pi^+ \to e^+ + \gamma$

(c) $\Omega^- \to \Sigma^- + \pi^0$ (d) $K^- + p \to \Omega^- + K^+ + K^0$

Q46. In a normal Zeeman effect experiment, spectral splitting of the line at the wavelength $656\,nm$ corresponding to the transition $3^1\mathrm{P}_2 \to 3^1\mathrm{S}_1$ is to be observed. The spectrometer has a resolution of $0.008\,nm$. Minimum magnetic field needed to observe this is

(a) $3T$ (b) $2T$ (c) $1T$ (d) $0.4T$

Q47. The ground state of Hydrogen atom is ${}^2\mathrm{S}_{1/2}$ state. The difference in energy levels arising in the presence of $0.5T$ magnetic field is $\left(\mu_B = 9.27\times10^{-24}\,JT^{-1}\right)$

(a) $5.8\times10^{-5}\,eV$ (b) $5.8\times10^{-4}\,eV$ (c) $5.8\times10^{-3}\,eV$ (d) $5.8\times10^{-2}\,eV$

Q48. The work done in bringing a charge $+q$ from infinity in free space, to a position at a distance d in front of a infinite grounded metal surface is $-\alpha\frac{q^2}{32\pi\varepsilon_0 d}$. Find the value of α.

(a) 2 (b) 8 (c) 12 (d) 17

Q49. Lattice constant of Bcc metal is $4.28A^0$. It's Hall coefficients is $\alpha\times10^{-10}\,m^3/C$. (2 decimal places). Find the value of α.

(a) 1.15 (b) 2.45 (c) 3.45 (d) 5.45

Q50. The laplace transform of Bessel's equation $(n=0)$ leads to

$$\left(s^2+1\right)f'(s)+sf(s)=0$$

If $f(s)$ is given by $f(s)=\frac{c}{\sqrt{s^2+k}}$ then find the value of k.

(a) 1 (b) 2 (c) 3 (d) 4

Q51. Two solid spheres A and B have same emissivity. The radius of A is eight times the radius of B and temperature of A is four the temperature of B. Find the ratio of the rate of heat radiated from A to that from B.

(a) 512 (b) 1024 (c) 2021 (d) 3000

Q52. Assume that a lamp radiates $5\ Watts$ of power in free space uniformly in all directions. Find the magnitude of electric field strength (in V/m) at a distance $1\,m$ from the lamp.

(a) 17.32 (b) 19.41 (c) 21.12 (d) 27.24

Q53. A charged particle, A, moving at a speed much less than c, decelerates uniformly. A second particle, B, has one-half the mass, twice the charge, three times the velocity, and four times the acceleration of particle A. Find the ratio P_B/P_A of the power radiated according to classical electrodynamics.

(a) 36 (b) 64 (c) 128 (d) 256

Q54. A solid melts into a liquid via first order phase transition. The relationship between the pressure P and the temperature T of the phase transition is $P = -2T + P_0$, where P_0 is a constant. The entropy change associated with the phase transition is 1.0 $J\,mole^{-1}\,K^{-1}$. Here $\Delta v = v_{liquid} - v_{solid}$ is the magnitude of change in molar volume at the phase transition, then find the value of Δv .

(a) 0.5 (b) 0.65 (c) 0.85 (d) 0.95

Q55-Q58 carrying 2 marks each.

Q55. In presence of a magnetic field $B\hat{j}$ and an electric field $(-E)\hat{k}$, a particle moves undeflected. Which of the following statements are correct?

(a) The particle has positive charge, velocity $= -\frac{E}{B}\hat{i}$

(b) The particle has positive charge, velocity $= \frac{E}{B}\hat{i}$

(c) The particle has negative charge, velocity $= -\frac{E}{B}\hat{i}$

(d) The particle has negative charge, velocity $= \frac{E}{B}\hat{i}$

Q56. A periodic function $f(x) = x^2$ for $-\pi < x < \pi$ is expanded in a Fourier series. Which of the following statement(s) is/are correct?

(a) Coefficients of all the sine terms are zero

(b) The first term in the series is $\frac{\pi^2}{3}$

(c) The second term in the series is $-4\cos x$

(d) Coefficients of all the cosine terms are zero

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Q57. For the given circuit, identify the correct statement(s)

(a) $I_0 = 1mA$

(b) $V_0 = 3V$

(c) If R_L is doubled, I_0 will change to $0.5mA$

(d) If R_L is doubled, V_0 will change to $6V$

Q58. Consider an spin-half system $\left(s = \pm\frac{1}{2}\right)$ where each spin (dipole) has two options of orientations. Let the interaction energy of spin with external magnetic field is given by $\pm\varepsilon$, where $\varepsilon = \mu H$, μ being the magnetic moment of a spin. When this system is placed in an external magnetic field H, and kept at temperature T, then which one of the followings is/are true? [M is net magnetization, C is heat capacity U is total energy of the system, S is the entropy].

(a) $U = N\varepsilon \tanh\left(\varepsilon/k_B T\right)$

(b) $M = N\mu \tanh\left(\varepsilon/k_B T\right)$

(c) $C = Nk_B\left(\beta\varepsilon\right)^2 \sec h^2\left(\dfrac{\varepsilon}{k_B T}\right)$

(d) $C = Nk_B\left(\beta\varepsilon\right)^2 \tanh^2\left(\dfrac{\varepsilon}{k_B T}\right)$

Q59-Q65 carrying 2 mark each.

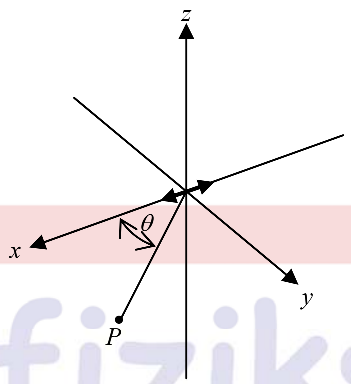
Q59. The intermediate Z-boson has mass $90\,GeV/c^2$, which mediate the weak interaction. The range of the weak interaction is___________$\times 10^{-18}\,m$. (Upto two decimal places)

Q60. In a cyclotron, α-particles are accelerated using RF source of frequency $15\,MHz$. Then the frequency of RF source if α-particles are replaced by ${}_2He^3$ particle is_______________MHz.

Q61. Consider a two-dimensional electron gas with a density n. Then Fermi energy $\left(E_F\right)$ of the system is proportional to n^p. The value of p is___________

Q62. The refractive index of a medium in which the electric field of an electromagnetic wave is given in MKS units by $\vec{E} = E_0\cos\left(10^7 x + 10^7 y - 10^{15} t\right)\hat{z}$ is_____________(write upto two decimal point)

Q63. A charged particle oscillates harmonically along the x-axis as shown in the figure. The radiation from the particle is detected at a distant point P, which lies in the xy-plane. The electric field at P is in the xy-plane and has a maximum amplitude at $\theta =$ __________degree



Q64. A solid sphere of radius R has a charge density, given by

$$\rho(r) = \rho_0\left(1-\frac{r}{R}\right)$$

where r is the radial coordinate and ρ_0, a and R are positive constants. Then $\dfrac{E_{r=R/2}}{E_{r=R}}$ is_______________

Q65. The wavefunction of a hydrogen atom is given by the following superposition of energy eigen functions $\psi_{nlm}(\vec{r})$ (n,l,m are the usual quantum numbers):

$$\psi(\vec{r}) = \frac{\sqrt{2}}{\sqrt{7}}\psi_{100}(\vec{r}) - \frac{3}{\sqrt{14}}\psi_{210}(\vec{r}) + \frac{1}{\sqrt{14}}\psi_{322}(\vec{r})$$

The ratio of expectation value of the energy to the ground state energy is_____________

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