TEST SERIES GATE 2018

BOOKLET SERIES C

Paper Code: PH

Test Type: TEST SERIES

Duration: 3:00 Hours

PHYSICS

Date: 19-01-2018

Maximum Marks: 100

Read the following instructions carefully:

1. Attempt all questions.
2. This question paper consists of **2 sections**, General Aptitude (GA) for **15 marks** and the 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.
3. The question paper may consist of questions of **multiple choice type** (MCQ) and **numerical answer type**.
4. Multiple choice type questions will have four choices against (a), (b), (c), (d), out of which only **ONE** is the correct answer.
5. For numerical answer type questions, each question will have a numerical answer and there will not be any choices**.**
6. 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 ⅓ marks for a **1-mark** question and ⅔ marks for a **2-mark** question.
7. There is **NO NEGATIVE MARKING** for questions of **NUMERICAL ANSWER TYPE**.
8. Non-programmable type Calculator is allowed

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Q.1-Q. 5 carry ONE mark each.

1. A contract is to be completed in 46 days and 117 men were set to work, each working 8 hours a day. After 33 days, 4/7 of the work is completed. How many additional men may be employed so that the work may be completed in time, each man now working 9 hours a day ?
(a) 61 (b) 71 (c) 81 (d) 72

2. Five cities A, B, C, D and E are famous for their lovely garden, fancy jewellery, educational institute, blue pottery and scents but not in the same order.
(i) A and C are neither educational institutes nor have gardens.
(ii) B and E are not famous for jewellery or pottery.
(iii) Scents and jewellery have nothing to do with A.
(iv) D and E are not famous for garden and jewellery.
(v) D is not famous for educational institutes.
Blue pottery is available in which of the following cities ?
(a) A (b) C (c) E (d) B

3. If $|4x-7|=9$, then the value of $4|x|-|-x|$ is
(a) $12, \frac{3}{2}$ (b) $-12, -\frac{3}{2}$ (c) $\frac{3}{2}, 9$ (d) $\frac{2}{3}, 9$

4. Errata: Books: flaws:?
(a) Manuscripts (b) Metals (c) Speech (d) Charter

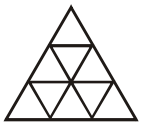
5. Which is the correct form of incorrect sentence: He is such a writer that everybody should read his books.
(a) Correct: He is such a writer that everybody should read its books
(b) Correct: He is such a writer that everybody should read books
(c) Correct: He is such a writer so everybody should read his books
(d) Correct: He is such a writer as everybody should read his books.

Q.6-Q. 10 carry TWO marks each.

6. If ACNE is coded as 3, 7, 29, 11, then BOIL will be coded as :
(a) 5, 31, 21, 25 (b) 5, 31, 19, 25 (c) 5, 29, 19, 25 (d) 5, 29, 19, 27

7. Akhilesh speaks truth in 40% cases and Suvidhi in 60% of the cases. In what percentange of cases are they likely to contradict each other, narrating the same incident ?
(a) 24% (b) 36% (c) 48% (d) 50%

8. Find total number of triangles in



(a) 11 (b) 12 (c) 13 (d) 14

9. What is antonyms of word Din?
(a) Arrival (b) Calm (c) Noise (d) sun light

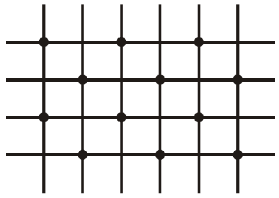
10. What is synonym of word Enigma?
(a) Minor fight (b) Puzzle (c) Arrival (d) high expectation

Q.11-Q.35 carry one mark each.

11. Velocity of electron in $n = 3$ in hydrogen atom is V_H and velocity of electron in $n = 3$ in positronium (electron bound to positron) V_p is
(a) $2\ V_H$ (b) V_H (c) $V_H/2$ (d) $VH/2^2$

12. Given that the reduced mass of CO is 1.14×10^{-25} kg. Planck's constant is 6.626×10^{-34} Js and force constant is 187 nm the spacing between the vibrational energy levels will be
(a) 8.22 eV (b) 8.39×10^{-2} eV (c) 8×10^2 eV (d) 2 eV

13. A hypothetical two dimensional crystal consisting of atoms arranged on a square grid as shown in figure :



The reciprocal basis vectors can be written as

(a) $\frac{\pi}{a}\left(\hat{i}+\hat{j}\right)$ and $\frac{\pi}{a}\left(\hat{i}-\hat{j}\right)$ (b) $\frac{\pi}{a}\hat{i}$ and $\frac{\pi}{a}\hat{j}$

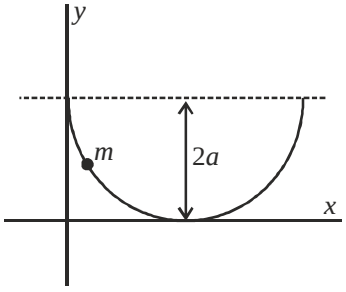
(c) $\frac{\pi}{a}\left(-\hat{i}-\hat{j}\right)$ and $\frac{\pi}{a}\left(\hat{i}-\hat{j}\right)$ (d) $-\frac{\pi}{a}\hat{i}$ and $-\frac{\pi}{a}\hat{j}$

14. Which of the following statement is TRUE ?
(a) In Fe crystal the easy directions of magnetisation are cube edges.
(b) In Nickel crystal the easy direction of magnetisation are cube edges.
(c) In cobalt crystal hard the direction of magnetisation is hexagonal axis.
(d) In Fe crystal the hard direction of magnetisation are cube edges.

15. In simple cubic crystal E versus k relation is given by $E(k) = E_0 - \alpha - 4\beta\left[\cos(k_x a) + \cos(k_y a) + \cos(k_z a)\right]$.
The difference between maximum and minimum energy is
(a) 12β (b) $\alpha - 12\beta$ (c) $\alpha + 12\beta$ (d) 24β

16. A sphere has uniform polarization. Which of the following statements is not correct ?
(a) Electric field inside the sphere is uniform
(b) A symptotically electric field varies as $1/r^3$
(c) On the surface of sphere electric field is radial at all points
(d) Potential at centre is zero but not at other points inside sphere (Assume potential at uniformly is taken to be zero).

17. A bead slides without friction a frictionless wire in the shape of a cycloid (shown in figure) with equation $x = a(\theta - \sin\theta), y = a(1+\cos\theta)$ where $0 \le 0 \le 2\pi$. The Lagrangian of the system is



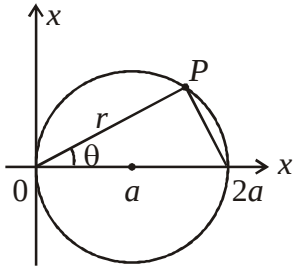
(a) $2ma\left[a\sin^2\frac{\theta}{2}\dot{\theta}^2 - g\cos^2\frac{\theta}{2}\right]$ (b) $2ma\left[a\dot{\theta}^2 - g\right]\cos^2\frac{\theta}{2}$

(c) $2ma\left[a\cos^2\frac{\theta}{2}\dot{\theta}^2 - g\sin^2\frac{\theta}{2}\right]$ (d) $2ma\left[a\dot{\theta}^2 - g\right]\sin^2\frac{\theta}{2}$

18. If in a rigid rotator of mass *m*, the energy of fourth excited is ε_0, then energy of the first excited state is (in terms of ε_0) _____.

19. In copper assuming that each atom contributes one free electron for conduction. Resistivity of copper is 1.7×10^{-6} ohm-cm. Atomic weight 63.54 density 8.96 gm/c.c. The mobility of electrons in copper is _____ cm^2/volt-sec.

20. A particle moves in a circular orbit (shown in figure) which passes through O, under the influence of a central force at point O. Point P is the position of the particle at any time t. The law of force is proportional to



(a) $-\frac{1}{r^2}$ (b) r (c) $-\frac{1}{r^5}$ (d) $\frac{1}{r^3}$

21. A body at rest spontaneously breaks up into two parts which move in opposite directions. The parts have rest masses of 3 kg and 5.33 kg and respective speeds of 0.8*c* and 0.6*c*. The rest mass of the original body is _____ kg (up to two decimal places)

22. A force is given by $\vec{F} = (-4x - 3y + az)\hat{i} + (bx + 3y + 5z)\hat{j} + (4x + cy + 3z)\hat{k}$, where *a, b, c* are constant. If F is conservative force, then the value of |*abc*| is _____.

23. The function $(A \oplus B)$ is to be realized using only 2-input NAND gates. The minimum number of 2-input NAND gates required for such a realization is _____

24. Number of minimum NAND gate for designing $x + \bar{x}y + \bar{x}yz$ is
(a) 2 (b) 3 (c) 4 (d) 5

25. Suppose $J_n(x)$ and $J_{-n}(x)$ are two linearly independent solutions of the differential equation

$$x^2y'' + xy' + (x^2 - v^2)y = 0 \ (v \text{ is half integer})$$

Then, the value of $J_{1/2}^2(x) + J_{-1/2}^2(x)$ is equal to _____/πx. (An integer)

26. The value of the limit , $\lim_{x \to 0} \frac{\ell n(1+px) - \ell n(1+qx)}{x}$

is equal to

(a) 0 (b) $p - q$ (c) $\frac{p}{q}$ (d) ∞

27. A quantum mechanical particles of mass 'm' moves under the following potential,

$$V(x, y) = \frac{1}{2} m\omega^2 (9x^2 + y^2)$$

The energy eigenvalues of the particle, are (*n* = 0, 1, 2, ...)

(a) $\left(n + \frac{3}{2}\right)\hbar\omega$ (b) $(n+2)\hbar\omega$ (c) $2(n+1)\hbar\omega$ (d) $(n+1)\hbar\omega$

28. The degeneracy of the fourth energy level of a 3-dimensional isotropic quantum harmonic oscillator, is equal to _____(an integer).

29. If $\hat{A}, \hat{B}$ are two quantum mechanical operators, such that $\left[\hat{A}, \hat{B}\right] = \hat{I}$, then the commutator bracket $\left[\hat{A}^2, \hat{B}^2\right]$ can be written as

(a) $4\hat{A}\hat{B}$ (b) $2\left(\hat{A}\hat{B} + \hat{B}\hat{A}\right)$ (c) 0 (d) $2\left(\hat{A}\hat{B} - \hat{B}\hat{A}\right)$

30. The total power emitted by a spherical black body of radius 1 unit at a temperature 'T' is 1 unit. The total power emitted by another spherical black body of radius 0.25 unit at a temperature '3T', will be _____units. (Upto two decimal places)

31. Consider the following matrix:

$$A = \begin{bmatrix} 1 & 1 \\ -1 & 1 \end{bmatrix}$$

The phase difference between the eigenvalues of the matrix *A*, will be
(a) 0º (b) 45º (c) 90º (d) 180º

32. If the reactions $\mu^+ \to e^+ + \nu_e + X$ and $\Sigma^- \to n + Y$ are governed by weak interactions, then the particle Z in the reaction, $Y \to Z + X$ is

(a) π^- (b) $\bar{\nu}_\mu$ (c) μ^- (d) ν_μ

33. In an alpha decay ${}_Z X^A \to {}_2He^4 + {}_{Z-2}Y^{A-4}$ at rest, if Q is energy released, m_X, m_{He} and m_Y are rest masses of the particles, then the velocity of alpha particle v_{He} is given by

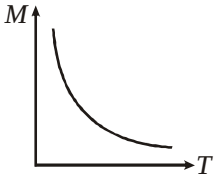
(a) $\sqrt{\dfrac{2Qm_{He}}{m_Y\left(m_{He}+m_Y\right)}}$ (b) $\sqrt{\dfrac{2Q\,m_Y}{m_{He}\left(m_Y+m_{He}\right)}}$ (c) $\sqrt{\dfrac{2Q}{m_{He}\left(m_{He}+m_Y\right)}}$ (d) $\sqrt{\dfrac{2Q}{m_{He}\,m_Y}}$

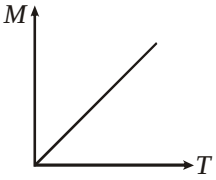
34. What is the change of entropy involved in heating a gram-atomic weight of silver at constant volume from 0º to 30 ºC. The value of C_v over this temperature may be taken as a constant equal to 5.85 cal/deg·mole ?
(a) 0.61 J/K (b) 6.10 cal/K (c) 0.61 cal/K (d) 6.10 J/K

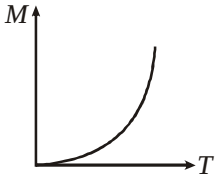
35. It is found for a simple magnetic system that if the temperature *T* is held constant and the magnetic field *H* is changed to $H + \Delta H$, the entropy *S* changes by an amount ΔS,

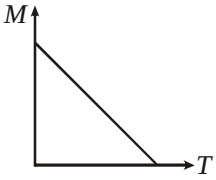
$$\Delta S = -\frac{CH\,\Delta H}{T^2}$$

The magnetization *M* depends on the temperature as

(a) 

(b) 

(c) 

(d) 

Q.36-Q.65 carry TWO marks each.

36. The number of spectroscopic terms resulting from the LS coupling of a 2p electron and 2s electron is _____.

37. In copper at 1000 K, the energy at which the probability that a conduction electron state will be occupied 0.90 is _____ eV. (Given the fermi energy of the copper is 7 eV).

38. Electric field in a region due to superposition of two electromagnetic wave is given as $\vec{E} = \vec{E}_0 \cos(kx) \cos(\omega t)$. Average value of poynting vector is

(a) $\frac{\varepsilon_0 E_0^2 \omega}{k}$ (b) $\frac{\varepsilon_0 E_0^2 \omega}{2k}$ (c) $\frac{2\varepsilon_0 E_0^2 \omega}{k}$ (d) 0

39. Consider a long solenoid carrying at a steady current. By suitable choice of guage transformation we can make vector potential zero.

(a) Only for inside region (b) Only for outside region
(c) Both inside and outside region (d) Neither inside nor outside

40. The Hamiltonian of a system is given by $H = \frac{p_x}{x^m} - \frac{p_y}{y^n} + V(x, y)$. For what values of *m* and *n*, will the trajectory of system on *x*-*y* plane is a circle of radius $\sqrt{2}$ units?

(a) $m = 1,\ n = 2$ (b) $m = n = 2$ (c) $m = n = 1$ (d) $m = 2,\ n = 1$

41. Consider the following transformations

A : Q = $2q + 3p$, $p = q + 2p$

B : Q = $p + iq$, $p = \frac{p - iq}{2i}$ (where $i = \sqrt{-1}$)

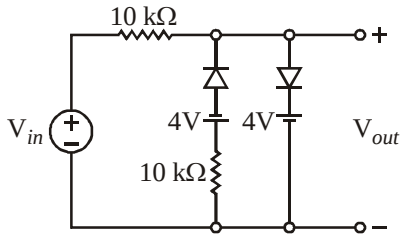
Which one of the following is a canonical transformation?

(a) Only A (b) Only B
(c) Both A and B (d) Neither A nor B

42. A thin rod of length *l* in the shape of a semicircle is pivoted at one of its ends such that it is free to oscillate in its own plane. The frequency of small oscillations of the semicircular rod is $f = \frac{1}{2\pi}\sqrt{\frac{g\sqrt{\pi^2 + \alpha}}{2l}}$. The value of α is _____ . (Here *g* is acceleration due gravity).

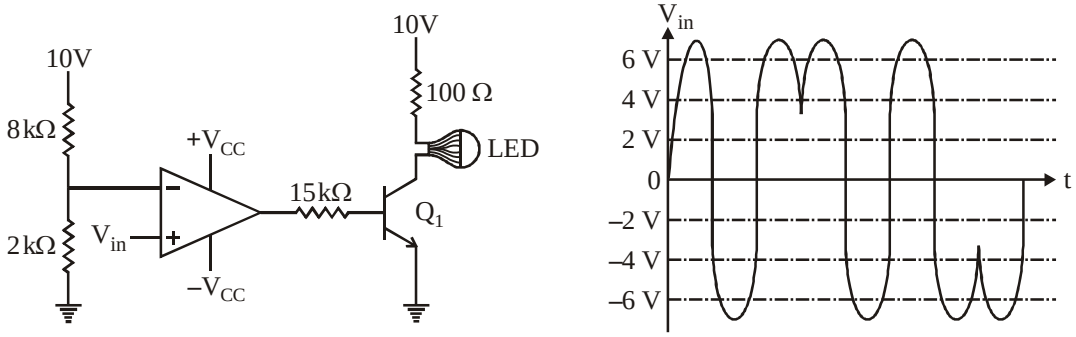
43. For a system, Lagrangian $L = \frac{\dot{q}^2}{2} + \frac{1}{2q^2}$. If *H* is the corresponding Hamiltonian then the value of Poisson bracket $\{p, H\}$ is $-\frac{\alpha}{q^3}$. The value of α is _____

44. A voltage signal 10 sin ωt is applied to the circuit with ideal diodes, as shown in figure. The maximum, and minimum values of the output waveform V_{out} of the circuit are respectively.



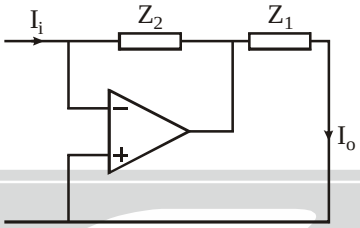
(a) +10 V and –10 V (b) +4 V and –4 V (c) +7 V and –4 V (d) +4 V and –7 V

45. The following signal V_{in} of peak voltage 8V is applied to the non-inverting terminal of an ideal op-amp. The transistor has $V_{BE} = 0.7\,V$, $\beta = 100$; $V_{LED} = 1.5\,V$, $V_{CC} = 10\,V$ and $-V_{CC} = 10\,V$.



The number of times the LED glows is _____

46. In the circuit shown below, what is the value of transfer function I_o/I_i?



(a) $-\frac{Z_2}{Z_1}$ (b) $-\frac{Z_1}{Z_2}$ (c) $1+\left(\frac{Z_2}{Z_1}\right)$ (d) $1+\left(\frac{Z_1}{Z_2}\right)$

47. Consider the following function:

$$f(x) = \begin{cases} [x] & \text{for } x \geq 0 \\ 0 & \text{for } x < 0 \end{cases}$$

where [x] denotes the greatest integer not exceeding 'x'. The Laplace transform of the function $f(x)$ is

(a) $\frac{e^{-s/2}}{2s\sinh(s/2)}$ (b) $\frac{e^{-s}}{2s\sinh(s/2)}$ (c) $\frac{e^{-s/2}}{2s\tanh(s/2)}$ (d) $\frac{e^{-s}}{2s\tanh(s/2)}$

48. The value of the integral

$$\int_{-\infty}^{\infty} \left(4x^2 + 3x - 2\right) \cdot \delta\left(x^2 - 5x + 4\right) dx$$

is equal to _____(upto two decimal places)

49. Consider the scattering of two identical protons. If the two particles are in spin triplet state, then the differential cross-section relates to the scattering amplitude as

(a) $\frac{d\sigma}{d\Omega} = |f(\theta)|^2 + |f(\pi-\theta)|^2$ (b) $\frac{d\sigma}{d\Omega} = \frac{1}{2}|f(\theta) + f(\pi p - \theta)|^2 + \frac{1}{2}|f(\theta) - f(\pi-\theta)|^2$

(c) $\frac{d\sigma}{d\Omega} = |f(\theta) - f(\pi-\theta)|^2$ (d) $\frac{d\sigma}{d\Omega} = |f(\theta) + f(\pi-\theta)|^2$

50. Consider a spinless particle of mass 'm' moving in an infinite square well potential of the length 'L' i.e.

$$V(x)=\begin{cases}0 & \text{for } -\dfrac{L}{2}<x<\dfrac{L}{2}\\ \infty & \text{otherwise}\end{cases}$$

If a perturbation $V_p(x)=\lambda V_0 L\delta^2\left(x^2-\dfrac{L^2}{16}\right)\ [\lambda<<1]$, is applied, then first order correction to energy of the ground state will be

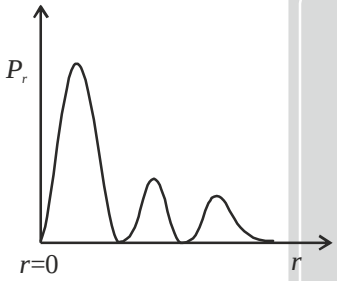
(a) 0 (b) $\dfrac{\lambda V_0}{L}$ (c) $\dfrac{2\lambda V_0}{L}$ (d) $\dfrac{4\lambda V_0}{L}$

51. A quantum mechanical system consists of one-dimensional box of length L. Five identical non-interacting spin-3/2 particles, are placed inside the box and the ground state energy of the system is found to be 32 eV. If eleven such identical particles are placed inside the box, then the ground state energy of the system will be _____eV. (an integer)

52. A particle in the 3s state of hydrogen has the wavefunction

$$\psi_{3s}(r)=A\cdot\left(27-18r+2r^2\right)e^{-r/3}$$

where 'r' is the radial probability density in the given state, will vary with r as

(a)


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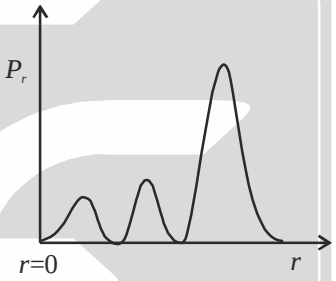

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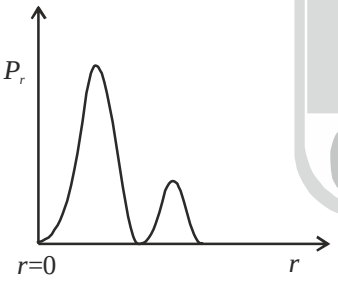
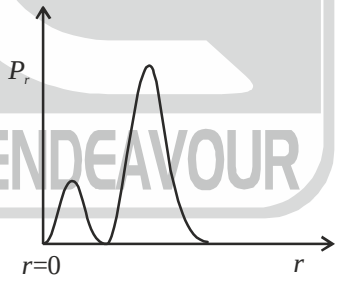


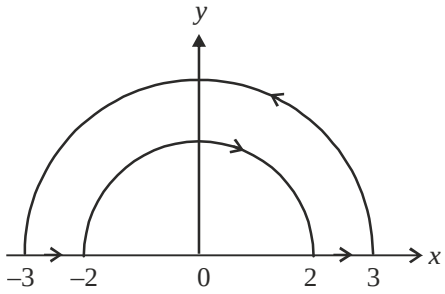
(d)


53. A particle of mass 'm' is moving under an attractive delta potential $V(x)=-V_0\delta(x)[V_0>0]$ and the particle is initially in the ground state of the potential. Now, if the strength of the potential 'V_0' is suddenly changed to '$2V_0$', then the probability of the finding the particl in the ground state of the new potential, will be _____(upto two decimal places)

54. The value of the complex integral:

$$\int_C\left(z/z^*\right)dz$$

where C is the boundary of the half annulus (as shown in figure below), is _____(upto two decimal places)



55. Choose the INCORRECT statement from the following

(a) In reaction $p + p \to k^+ + \Sigma^+$, baryon number, the isospin and the third component of isospin are not conserved

(b) In reaction, $p + n \to \Lambda^0 + \Sigma^+$, the strangeness number and the third component of isospin are not conserved

(c) The reaction, $\Omega^- \to \Xi^0 + k^-$ is forbidden

(d) The reaction $\pi^- + p \to \Sigma^+ + k^-$ is governed by strong interaction

56. The magnetic dipole moment for the ground state of $_{29}Cu^{63}$ nucleus as given by shell model is _____μ_N. (upto two decimal placs), where μ_N is nuclear magneton.
[Given : $g_l = 1$, $g_s = 5.59$ for proton and $g_l = 0$ and $g_s = -3.83$ for neutron]

57. A two-level system of $N = n_1 + n_2$ particles is distributed among two eigenstates 1 and 2 with eigenenergies E_1 and E_2 respectively. The system is in contact with a heat reservoir at temperature T. If a single quantum emission into the reservoir occurs, population changes $n_2 \to n_2 - 1$ and $n_1 \to n_1 + 1$ take place in the system. For $n_1 \gg 1$ and $n_2 \gg 1$, the entropy change of the two level system is

(a) $\frac{k_B}{2}\ln\left(\frac{n_2}{n_1}\right)$ (b) $k_B \ln\left(\frac{n_1}{n_2}\right)$ (c) $k_B \ln\left(\frac{n_2}{n_1}\right)$ (d) $2k_B \ln\left(\frac{n_1}{n_2}\right)$

58. Given a system of two distinct lattice sites, each occupied by an atom whose spin $(s = 1)$ is so oriented that its energy takes one of three values $\varepsilon = 1, 0, -1$ with equal probability. The atoms do not interact with other. The ensemble average values $\bar{U}$ for the energy U of the system, assumed to be that of the spins only, is

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

59. A one-dimensional quantum harmonic oscillator (whose ground state energy is $\frac{\hbar\omega}{2}$) is in thermal equilibrium with a heat bath at temperature T. What is the value of ΔE, the root-mean-square fluctuation in energy about $\langle E \rangle$?

(a) $\frac{\hbar\omega}{2\sinh\left(\frac{\hbar\omega}{2kT}\right)}$ (b) $\frac{\hbar\omega}{2\cosh\left(\frac{\hbar\omega}{2kT}\right)}$ (c) $2\hbar\omega\sinh\left(\frac{\hbar\omega}{2kT}\right)$ (d) $2\hbar\omega\cosh\left(\frac{\hbar\omega}{2kT}\right)$

60. Consider an ideal gas whose entropy is given by

$$S = \frac{n}{2}\left[\sigma + 5R\,\ell n\frac{U}{n} + 2R\,\ell n\frac{V}{n}\right],$$

where n = number of moles, R = universal gas constant, U = internal energy, V = volume, and σ = constant. The value of the specific heats at constant pressure is _____nR(upto first decimal place)

61. A parallel plate capacitor has circular plats of radius R and plate separation d << R. The potential difference between the plates varies as $V = V_0 \sin \omega t$. The total displacement current between the plates is

(a) $\frac{\varepsilon_0 V_0 \omega \pi R^2}{d} \sin \omega t$ (b) $\frac{\varepsilon_0 V_0 \omega}{d} \sin \omega t$

(c) $\frac{\varepsilon_0 V_0 \omega \pi R^2}{d} \cos \omega t$ (d) $\frac{\varepsilon_0 V_0 \omega}{d} \cos \omega t$

62. A charge particle q of mass *m* moving with a non-relativistic velocity $\vec{v}_0$ enters into a magnetic field $\vec{B}$ at angle α. The power radiated by the charge particle is

(a) $\frac{q^4 v_0^2 B^2}{6\pi m \varepsilon_0 c^3}$ (b) $\frac{q^4 v_0^2 B^2 \cos^2 \alpha}{6\pi \varepsilon_0 m c^3}$ (c) $\frac{q^4 v_0^2 B^2 \sin^2 \alpha}{6\pi \varepsilon_0 m c^3}$ (d) 0

63. A light beam is incident normally on an air-dielectric interface. On reflection intensity of the beam reduced by 4%. The dielectric constant of the dielectric is _____.

64. Two point charges of charge +*e* each are located at ends of a line of length 2ℓ, that rotates with a constant angular frequency ω about an axis perpendicular to the line and through its centre. The magnetic dipole moment of the charge distribution about centre is

(a) $\frac{e\omega\ell^2}{2}$ (b) $e\omega\ell^2$ (c) $\frac{e\omega\ell^2}{4}$ (d) $\frac{e\omega\ell^2}{8}$

65. In the Bethe-Weizsäcker semi-empirical mass formula the coulomb repulsion term is

(a) $-\frac{3}{5}\left(\frac{e^2}{4\pi\varepsilon_0}\right)\frac{z^2}{A^{1/3}}$ (b) $-\frac{3}{5}\left(\frac{e^2}{4\pi\varepsilon_0}\right)\frac{z(z-1)}{A^{1/3}}$

(c) $\left(\frac{e^2}{8\pi\varepsilon_0}\ \frac{z^2}{A^{1/3}}\right)\times 10^{15}$ (d) $\left(\frac{e^2}{8\pi\varepsilon_0}\ \frac{z(z-1)}{A^{1/3}}\right)\times 10^{15}$

Space for rough work

PHYSICS-PH

Date: 19-01-2018

GATE TEST SERIES-C

ANSWER KEY

1. (c)	**2.** (a)	**3.** (a)	**4.** (b)
5. (d)	**6.** (b)	**7.** (c)	**8.** (c)
9. (b)	**10.** (b)	**11.** (b)	**12.** (b)
13. (a)	**14.** (a)	**15.** (d)	**16.** (c)
17. (a)	**18.** (1.66)	**19.** (43.20 to 43.30)	**20.** (c)
21. (11.66 to 11.67)	**22.** (60)	**23.** (4)	**24.** (b)
25. (2)	**26.** (b)	**27.** (b)	**28.** (10)
29. (b)	**30.** (0.19 to 0.21)	**31.** (c)	**32.** (c)
33. (b)	**34.** (c)	**35.** (a)	**36.** (4)
37. (6.75 to 6.85)	**38.** (d)	**39.** (b)	**40.** (c)
41. (c)	**42.** (4)	**43.** (1)	**44.** (d)
45. (3)	**46.** (a)	**47.** (a)	**48.** (2.54 to 2.59)
49. (c)	**50.** (d)	**51.** (188)	**52.** (b)
53. (0.86 to 0.91)	**54.** (1.30 to 1.36)	**55.** (d)	**56.** (3.72 to 3.85)
57. (c)	**58.** (a)	**59.** (a)	**60.** (3.5)
61. (c)	**62.** (c)	**63.** (**2.20 to 2.30**)	**64.** (b)
65. (d)			