TEST SERIES GATE 2019

BOOKLET SERIES D

FULL LENGTH TEST - 2

Paper Code: PH

Test Type: TEST SERIES

Duration: 3:00 Hours

PHYSICS-PH

Date: 24-01-2019

Maximum Marks: 100

Read the following instructions carefully:

1. Attempt all the 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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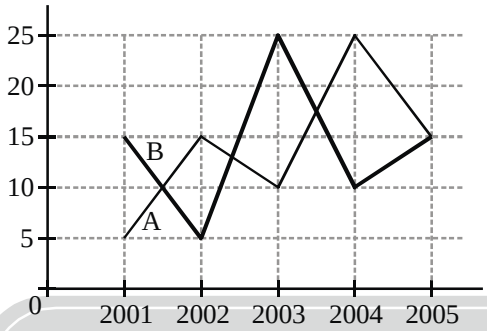
Q.1-Q. 5 carry ONE mark each.

1. Seven persons A, B, C, D, E, F, G are sitting in a row facing North. If
(1) A sits in the middle.
(2) F and C are equidistant from E.
(3) A is to the right of E.
(4) C is between A and G.
(5) B is not at any of the extreme end positions.
Who is sitting at the left of B ?
(a) B (b) C (c) D (d) F

2. Below given is the graphical representation of the production of ore of two companies A and B over the years (2001 to 2005) in million metric ton (MMT).



Average production of ore of company A is what percentage of total production of company B over the years?
(a) 30 (b) 20 (c) 10 (d) 40

3. A man leaves his home and walks at a speed of 10 km/hr, reaching the bus stop 10 mins after the bus had departed. If he had walked at a speed of 15 km/hr, he would have reached the bus stop 20 mins, earlier. What is the distance (in km) from his home to bus stop ?
(a) 15 (b) 20 (c) 10 (d) 12

4. The word 'errata' means
(a) in harmony (b) list of errors (c) last resort (d) to infinity

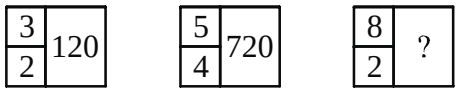
5. An expert judge in matters of taste is called
(a) cosmopolitan (b) nomad (c) connoisseur (d) agnostic

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

6. A can do a work in 20 days, while B can do the same work in 10 days. A work for 4 days and B works for 5 days and leaves the work. The remaining work is done by C in 3 days. In how many days A, B and C working together can complete the work ?
(a) 4 (b) 6 (c) 3 (d) 5

7. What is the probability of being the sum of 9 from the throw of two unbiased dice
(a) $\frac{1}{4}$ (b) $\frac{1}{9}$ (c) $\frac{1}{12}$ (d) $\frac{1}{6}$

8. Based on the pattern followed in (I), and (II) find out what should come in place of question mark (?) in (III) ?



(I) (II) (III)

(a) 900 (b) 990 (c) 100 (d) 984

9. In the following question, out of the four alternatives, select the alternative which best expresses the meaning of the idiom/phrase.
To keep the wolf from the door
(a) Be safe from an evil person
(b) Have enough money to avert hunger or starvation
(c) Be afraid to take up challenges
(d) When poverty comes from the door, love flies out from the window

10. The act of killing for compassionate reasons is called _____
(a) Euthanasia (b) Vespacide (c) Avicide (d) Feticide

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

11. A photon of frequency $\frac{2m_e c^2}{h}$ scatters off a free electron of mass m_e by an angle $\frac{\pi}{3}$. The fractional decrase in photon energy will be _____(Upto one decimal place).

12. A 1-D finite well of width a has a depth of $V_0 = \frac{25\pi^2\hbar^2}{8ma^2}$ (m is electron mass). The maximum number of electrons that can be bound in this potential is _____[Answer should be an integer].

13. Given the following table,

Group-I	**Group - II**
(P) $\frac{d}{dx}$	(1) $e^{i\pi/2}$
(Q) $e^{d/dx}$	(2) $e^{i\pi}$
(R) $i\frac{d}{dx}$	(3) $\frac{i\pi}{e^4}$

Which of the following correctly matches operator from **Group-I** to corresponding possible eigenvalue in **Group-II**?
(a) P-1, Q-3, R-2 (b) P-2, Q-3, R-1 (c) P-3, Q-2, R-1 (d) P-1, Q-2, R-3

14. The ground state energy when 12 non-interacting spin-$\frac{3}{2}$ particles of mass m are placed in a 3-D isotropic harmonic oscillator of frequency ω is
(a) $20\,\hbar\omega$ (b) $12\,\hbar\omega$ (c) $16\,\hbar\omega$ (d) $26\,\hbar\omega$

15. A spherical shell of radius R, centered at the origin, has potential,

$$V = \begin{cases} V_0 & for\ \ r < R \\ \frac{V_0 R}{r} & for\ r > R \end{cases}$$

The electrostatics energy stored in the system is
(a) $4\pi\varepsilon_0 V_0 R$ (b) $4\pi\varepsilon_0 V_0^2 R$ (c) $2\pi\varepsilon_0 V_0^2 R$ (d) $2\pi\varepsilon_0 V_0 R$

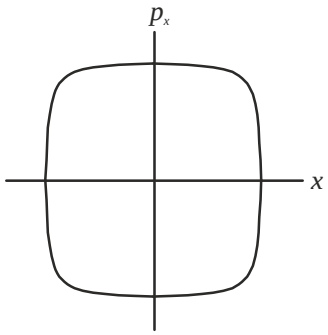
16. In cylinderical coordinates, $B = \frac{2}{r}\hat{\phi}T$. The magnetic flux passing through the surface defined by $0.5 \le r \le 2.5$ and $0 \le z \le 2.0$ is _____Wb. (Upto two decimal places).

17. An ideal gas (of adiabatic exponent γ) is expanded so that the amount of heat transferred is equal to the decrease of its internal energy. The equation of state of the process is, then, given by

(a) $TV^{(\gamma-1)/2} = \text{constant}$ (b) $TV^{(\gamma-2)/2} = \text{constant}$

(c) $TV^{(\gamma-1)/4} = \text{constant}$ (d) $TV^{(\gamma-2)/4} = \text{constant}$

18. The phase space trajectory of a particle of mass m in one dimension under an external potential $V(x)$ and bounded between $-a$ and $+a$ is drawn as follows:



The dependence of external potential $V(x)$ on x is given by

(a) x (b) x^2 (c) x^3 (d) x^4

19. For a gas under isobaric conditions, its volume V varies with temperature T as $V \propto T^{3/2}$. The coefficient of volume expansion is proportional to V^n. The value of n is _____. (Specify your answer to two places after decimal point).

20. Consider blackbody radiation in a cavity of volume V and temperature T. The entropy of the radiation depends on temperature as T^m. The value of m is _____(Specify your answer in integer).

21. The R_∞ is Rydberg constant for infinitely large nucleus mass. The mass of hydrogen nucleus is equal to mass of proton m_p, mass of Helium nucleus is equal to four time mass of proton i.e. $4m_p$, wavelength of the line (n = 3 to n = 2) for hydrogen atom is λ_H and wavelength of the line (n = 6 to n = 4) for He^+ is λ_{He}, then the value of $\lambda_H - \lambda_{He}$ is equal to (m_e = mass of electron)

(a) $\dfrac{36\, m_e}{5\, R_\infty\, m_p}$ (b) $\dfrac{27\, m_e}{5\, R_\infty\, m_p}$ (c) $\dfrac{5\, m_e}{36\, R_\infty\, m_p}$ (d) $\dfrac{5\, m_e}{27\, R_\infty\, m_p}$

22. The number of terms for the configuration 4d5d in L-S coupling are _____(answer should be an integer).

23. The vector expression $\vec{\nabla}\cdot\left(\vec{\nabla}\times\vec{A}\right)$ can be written in tensor form as

(a) $g_{ij}\dfrac{\partial}{\partial x^i}\dfrac{\partial}{\partial x^j}A_k$ (b) $g_{ij}\delta^j_k\dfrac{\partial}{\partial x^i}\dfrac{\partial}{\partial x^j}A_k$ (c) $\in_{ijk}\dfrac{\partial}{\partial x^i}\dfrac{\partial}{\partial x^j}A_k$ (d) $\in_{ijk}\dfrac{\partial}{\partial x^i}A_k\dfrac{\partial}{\partial x^j}$

24. For any two vectors $\vec{k}$ and $\vec{V}$, $\vec{k}\times\vec{V}$ is solenoidal if

(a) $\vec{k}$ is solenoidal but $\vec{V}$ is not (b) $\vec{k}$ is solenoidal whereas $\vec{V}$ is irrotational

(c) $\vec{k}$ and $\vec{V}$ are both solenoidal (d) $\vec{k}$ and $\vec{V}$ are both irrotational

25. If the trace and determinant of a 2×2 matrix are

$$Tr(A) = 4,\ Det(A) = -12$$

Then the eigenvalues of the matrix are

(a) (3, –4) (b) (4, –3) (c) (–6, 2) (d) (6, –2)

26. The Hamiltonian of a system is independent of the coordinate q and is given by $H = kp^4$, where k is a constant. The value of Poisson bracket $\{q^2, H\}$ is $\beta kp^3 q$. Then β is equal to _____(answer should be an integer).

27. Consider a radioactive nucleus that moves with a constant speed of 0.5c relative to the labouratory. The nucleus decays and emits an electron with a speed of 0.9c relative to the nucleus along the direction of motion. The velocity of the electron in laboratory frame is _____*c*. (in units of *c*). (Upto three decimal places).

28. Consider a particle of mass *m* moving in one dimension under a force with the potential $U(x) = k\left(2x^3 - 5x^2 + 4x\right)$, where the constant $k < 0$. Which among the following statements is correct?

(a) $x = 1$ and $x = \frac{2}{3}$ are both unstable equilibrium points

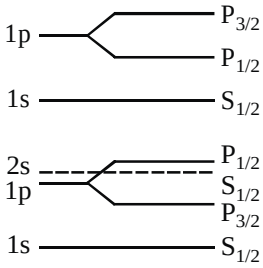
(b) $x = 1$ is anunstable equilibrium point and $x = \frac{2}{3}$ is a stable equilibrium point.

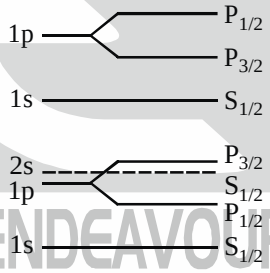
(c) $x = 1$ is a stable equilibrium point and $x = \frac{2}{3}$ is an unstable equilibrium point.

(d) $x = 1$ and $x = \frac{2}{3}$ are both stable equilibrium points.

29. Which of the following is *not* the properties of the nuclear force :
(a) The interaction between two nucleons consists lowest order of an attractive central potential.
(b) The nucleon-nucleon interactions is independent of the spin.
(c) The nucleon-nucleon force is charge symmetric.
(d) The nucleon-nucleon interaction becomes repulsive at very short distance.

30. If in the shell model, potential is written as $V_{\text{total}} = V(r) + f(r)\,\vec{L}\cdot\vec{S}$, then the shell structure of nucleon can be written as

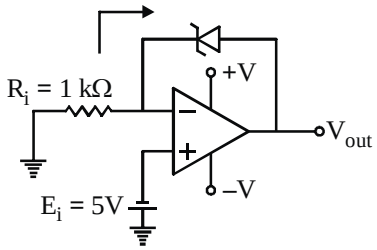
(a)


(b)


(c)

(d)

31. The f_{max} for an output amplifier that have a slew rate of 5V/μs and a peak output voltage of 10V is (in kHz)



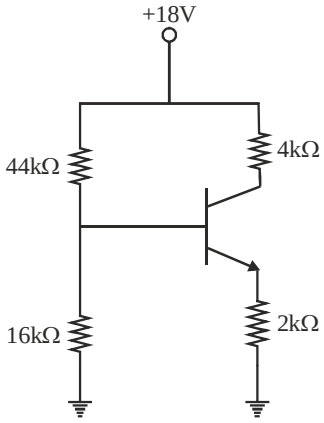
(a) 34.92 (b) 64.80 (c) 79.6 (d) 0

32. Which of the following is equivalent to the dual form of $Y = A\cdot B + \bar{B}\cdot C + \bar{C}\cdot A$?

(a) $(A + \bar{B})(B + \bar{C})(C + \bar{A})$ (b) $(A + B)(\bar{B} + C)(\bar{C} + A)$

(c) $\overline{AB} + B\bar{C} + C\bar{A}$ (d) $(\bar{A} + \bar{B})(B + C) + (C + A)$

33. Consider the circuit shown in the figure Assume base-to-emitter voltage $V_{BE} = 0.8\,V$. and common base current gain(α) of the transistor is unity.



The value of the collectro-to-emitter voltage V_{CE}(in volts) is _____

34. The maximum radius of the interstitial sphere that can just fit into the void between the body centered atoms of bcc structure, is _____*r*. [where *r* is the radius of atoms](Upto three decimal places)

35. In three dimensional two metals A and B have the number density of free electrons in the ratio $n_A : n_B = 1 : 2$. The ratio of the cube of their Fermi energies is
(a) 2 : 3 (b) 1 : 2 (c) 1 : 4 (d) 4 : 1

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

36. $\left[L_yL_z, L_xL_y\right]$ is equal to,
(a) $+i\hbar\left(L_xL_yL_x + L_z^2L_y + L_y^3\right)$ (b) $-i\hbar\left(L_xL_yL_x + L_z^2L_y + L_y^3\right)$
(c) $i\hbar\left(L_xL_yL_x - L_z^2L_y + L_y^3\right)$ (d) $-i\hbar\left(L_xL_yL_x + L_z^2L_y - L_y^3\right)$

37. The state of a particle of mass *m* in a 1-D harmonic oscillator of frequency ω is

$$|\psi\rangle = \frac{1}{2}\left[|0\rangle + \sqrt{3}|1\rangle\right]$$

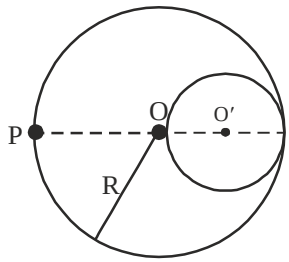
$\langle x\rangle$ for the particle at $t = \frac{\pi}{3\omega}$ is _____(in units of $\sqrt{\frac{\hbar}{m\omega}}$). [Upto two decimal places]

38. A 1-D harmonic oscillator of frequency ω is perturbed by a Hamiltonian of the form $H_p = \lambda\, e^{-kx^2}$, where λ and *k* are positive constants. The first order correction to ground state energy for a particle of mass *m* of wavefunction, $\psi_0(x) = \left(\frac{m\omega}{\pi\hbar}\right)^{1/4} e^{-\frac{m\omega x^2}{2\hbar}}$ will be

(a) $\lambda\left(1-\frac{\hbar k}{m\omega}\right)^{-1/2}$ (b) $\lambda\left(1+\frac{\hbar k}{m\omega}\right)^{1/2}$ (c) $\lambda\left(1+\frac{\hbar k}{m\omega}\right)^{-1/2}$ (d) $\lambda\left(1-\frac{\hbar k}{m\omega}\right)^{1/2}$

39. The spin-state of an electron is represented by, $|\chi\rangle = \frac{1}{5}\begin{pmatrix}3\\4i\end{pmatrix}$ in the $\hat{S}_z$ basis. If P_x and P_y are probabilities of finding $+\frac{\hbar}{2}$ after measuring $\hat{S}_x$ and $\hat{S}_y$ on this state, $\frac{P_x}{P_y}$ is equal to _____(Upto two decimal places).

40. A cylinder of radius R carrying current I. Now, if we make a cylinderical cavity of radius $R/2$. The cross-section has been shown in figure, and assume that the points P, O and O' are in same straight line.

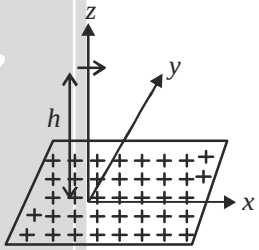


The magnetic field at P will be _____ $\frac{\mu_0 I}{\pi R}$. (Upto two decimal places).

41. A plane electromagnetic wave, $\hat{x}E_0\, e^{i(kz-\omega t)}$ after passing through an optical element emerges as $\left(\frac{E_0}{2}\hat{x}+\frac{\sqrt{3}E_0}{2}\hat{y}\right)e^{i(kz-\omega t)}$. The optical element is

(a) Quarter wave plate whose optical axis making 30º with x-axis.
(b) Quarter wave plate whose optical axis making 60º with x-axis.
(c) Half wave plate whose optical axis making 30º with x-axis.
(d) Half wave plate whose optical axis making 60º with x-axis.

42. An electric dipole moment is placed at h distance above of an infinite thin conducting plane carrying σ surface charge density as shown in figure,



(a) The dipole will have only translation motion along $\hat{z}$
(b) The dipole will have only rotational motion
(c) The dipole will have both rotational as well as translational
(d) None of the above are correct.

43. For a gas of atoms of mass 2×10^{-27} kg and particle density 6.4×10^{22} m^{-3} at 50K, which of the following statistics is applicable?
(a) Classical statistics (b) Quantum statistics
(c) Either classical or quantum statistics (d) Neither classical nor quantum statistics

44. For a system of 2 classical particles, each of which can occupy any of two energy levels $-\frac{\varepsilon}{2}$ and $\frac{\varepsilon}{2}$, the probability of the finding the system at temperature T, with average energy zero is

(a) $\frac{2}{2+\cosh\left(\frac{\varepsilon}{k_BT}\right)}$ (b) $\frac{2}{2-\cosh\left(\frac{\varepsilon}{k_BT}\right)}$ (c) $\frac{1}{1+\cosh\left(\frac{\varepsilon}{k_BT}\right)}$ (d) $\frac{1}{1-\cosh\left(\frac{\varepsilon}{k_BT}\right)}$

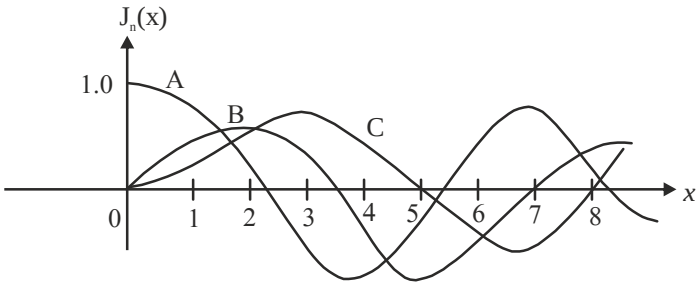
45. A system of non-interacting spin half fermions with Fermi energy E_F has the density of states proportional to $E\sqrt{E}$, where E is the energy of a particle. The ratio of fermi energy and ground state energy per particle at zero Kelvin is _____(Specify your answer to one place after decimal places).

46. A thermally insulated container is divided into equal parts, each of volume V_0 by a separating wall. One part contains an ideal gas at 300K and the other part is completely evacuated. If the separating wall is suddenly removed and the gas occupies the whole container, the temperature of the gas in the final state is _____ºC. [Specify your answer one place after the decimal points].

47. The first member of the principal series of sodium has a wavelength of 5893Å. The first excited S state of sodium lies 3.42 eV above the ground state. The wavelength of the first line of sharp series is _____Å. (Upto two decimal places).

48. The moment of inertia of H_2 molecule is 4.5×10^{-48} kg–m^2 considering it as rigid rotator. If the average translational kinetic energy of an H_2 molecule equals the energy difference between the ground and first excited rotational states, then the temperature of H_2 molecule is _____Kelvin. (Upto two decimal places).

49. Consider the given figure for the Bessel function,



Then,

(a) $A=J_0(x), B=J_2(x), C=J_1(x)$ (b) $A=J_1(x), B=J_0(x), C=J_2(x)$

(c) $A=J_2(x), B=J_1(x), C=J_0(x)$ (d) $A=J_0(x), B=J_1(x), C=J_2(x)$

50. The value of the integral,

$$\frac{h}{2\omega i}\int_{-\infty}^{\infty}\frac{e^{i\omega t}d\omega}{E_0-i\Gamma/2-\hbar\omega}, t>0$$

(a) 0 (b) $e^{-iE_0t/\hbar}\,e^{\Gamma t/\hbar}$ (c) $e^{-iE_0t/\hbar}\,e^{-\Gamma t/2\hbar}$ (d) $e^{-\Gamma t/2\hbar}$

51. The radioactive decay of two different nuclides are governed by the equations,

$$\frac{dN_1}{dt}=-\lambda_1N_1, \qquad \lambda_1=0.3$$

$$\frac{dN_2}{dt}=\lambda_1N_1-\lambda_2N_2, \quad \lambda_2=0.6$$

If $N_1(0)=100, N_2(0)=0$, then $N_2(10)=$ _____

(answer should an integer)

52. The Laurent expansion of $f(z)=\dfrac{ze^z}{(z-1)}$ about $z=1$ is

(a) $e\left[\dfrac{2}{(z-1)}+1+\dfrac{1}{2}(z-1)+\dfrac{1}{6}(z-1)^2+.....\right]$ (b) $e\left[\dfrac{2}{(z-1)}+2+\dfrac{3}{2}(z-1)+\dfrac{2}{3}(z-1)^2+.....\right]$

(c) $e\left[\dfrac{1}{(z-1)}+1+\dfrac{1}{2}(z-1)+\dfrac{1}{6}(z-1)^2+.....\right]$ (d) $e\left[\dfrac{1}{(z-1)}+2+\dfrac{3}{2}(z-1)+\dfrac{2}{6}(z-1)^2+.....\right]$

53. The Hamiltonian of a system is given by

$$H = \frac{p_x^2}{2m} + \frac{1}{2}kx^2 + 2x$$

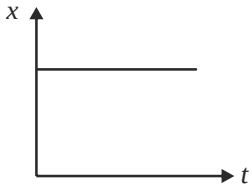
If the phase space trajectory of the particle is an ellipse of eccentricity, $e = \frac{\sqrt{3}}{2}$ and $m = 1$, then the angular frequency of small oscillations about stable equilibrium point is _____(upto two decimal places)

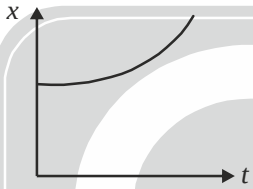
54. Consider two inertial frames S and S' with spacetime coordinates x, y, z, t and x', y', z', t' respectively. Frame S' moves along the x-axis with speed v relative to S frame. The origins coincide at $t = t' = 0$. An event occurs in S at $x = 9\times10^8$ m and in S' at $x' = 3\times10^8\ m, t' = 1s$. The value of v is _____$\times10^8$ m/s. (Upto one decimal place).

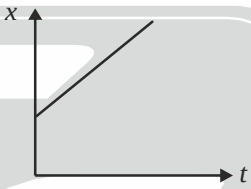
55. Consider a point particle moving in one dimension whose Lagrangian is given by

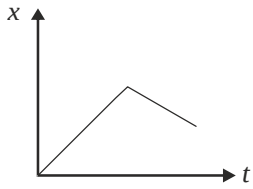
$$L = \dot{x}x + \frac{1}{2}\dot{x}^2.$$

If at $t = 0$, the particle is at position $x = x_0$, $x_0 > 0$ and $\dot{x} = v_0$, $v_0 > 0$, then the plot of x vs t is

(a) 

(b) 

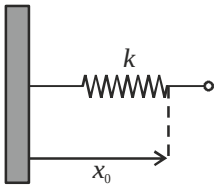
(c) 

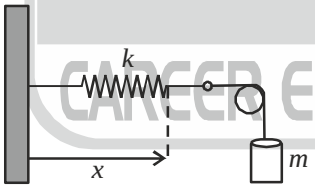
(d) 

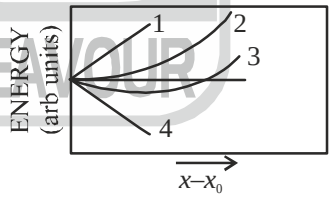
56. Assume that a star has uniform density. The gravitational pressure P is related to volume V as

(a) $V^{-4/3}$ (b) $V^{-1/3}$ (c) $V^{-2/3}$ (d) $V^{1/3}$

57. Consider the spring-and-mass arrangement below with no mass the spring has a rest length x_0. Now, a mass m is introduced as shown in figure. Which curve in the gray box best represents the variation in total energy of this system?







(a) curve number-1 (b) curve number-2 (c) curve number-3 (d) curve number-4

58. Assume that famous scientist R. Feynman made a painting of purely carbon content. If weight of painting decreases by half when he visited it after 45 years of gap. The approximate age that the painting will survive

(a) 65 years (b) 50 years (c) 200 years (d) 90 years

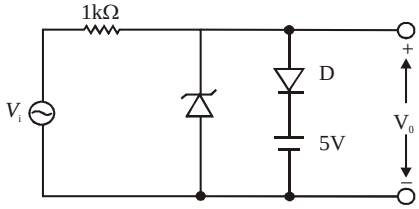
59. Consider the high energy decay process

I. $\pi^- + p \to \pi^0 + n$ **II.** $\pi^0 \to \gamma + \gamma$ **III.** $n \to p + \pi^-$

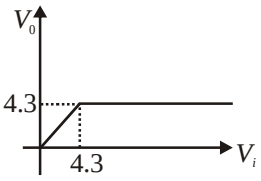
Then,

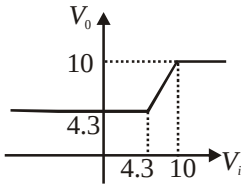
(a) Process-I is allowed through strong, but process-II is allowed through EM decay.
(b) Process-I and process-III are allowed.
(c) Process-II and process-III are allowed.
(d) Both the process-I and process-II are allowed through strong interaction.

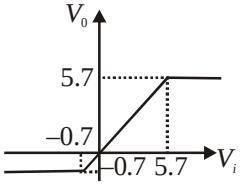
60. A clipper circuit is shown below

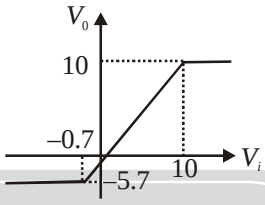


Assuming forward voltage drop of the diodes to be 0.7 V, the input-output transfer characteristics of the circuit is

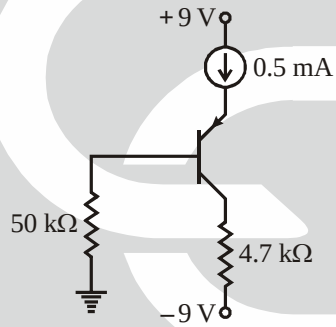
(a) 

(b) 

(c) 

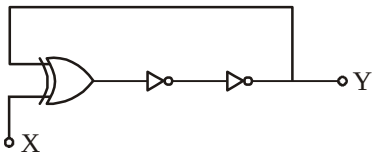
(d) 

61. In the circuit shown below if $\beta = 50$, the power dissipated in the transistor is



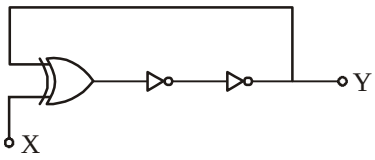
(a) 3.87 mW (b) 10.46 mW (c) 7.49 mW (d) 18.74 mW

62. All the logic gates in the circuit shown below have finite propagation delay. The circuit can be used as a clock generator, if



(a) $X = 0$ (b) $X = 1$ (c) $X = 0$ or 1 (d) $X = Y$

63. All the logic gates in the circuit shown below have finite propagation delay. The circuit can be used as a clock generator, if



(a) $X = 0$ (b) $X = 1$ (c) $X = 0$ or 1 (d) $X = Y$

64. Fe(iron) exhibits bcc structure at room temperature. Which of the following reflection would be absent in XRD pattern of Fe at room temperature?
(a) (220) (b) (112) (c) (012) (d) (211)

65. Consider the interface $z = 0$ between two dielectrics. The electric field in the region $z \geq 0$ and region $z \leq 0$ are $\vec{E}_1 = 5\hat{i} - 2\hat{j} + 3\hat{k}$ and $\vec{E}_2 = 5\hat{i} - 2\hat{j} + 4\hat{k}$ respectively. If the k_1 and k_2 are dielectric in region 1 and region 2, then the value of k_2/k_1 is _____.

[Specify your answer upto two digits after the decimal point]

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Space for rough work

PHYSICS-PH

GATE TEST SERIES-D

Date: 24-01-2019

FULL LENGTH TEST SERIES-2

ANSWER KEY

1. (d)	**2.** (b)	**3.** (a)	**4.** (b)	**5.** (c)
6. (a)	**7.** (b)	**8.** (b)	**9.** (b)	**10.** (a)
11. (0.4 to 0.6)	**12.** (3 to 3)	**13.** (a)	**14.** (d)	
15. (c)	**16.** (6.40 to 6.48)	**17.** (a)	**18.** (d)	
19. (–0.75 to –0.60)	**20.** (3 to 3)	**21.**(b)	**22.** (18 to 18)	
23. (c)	**24.** (d)	**25.** (d)	**26.** (8 to 8)	
27. (0.993 to 0.998)	**28.** (b)	**29.** (b)	**30.** (a)	
31. ()	**32.** ()	**33.** ()	**34.** ()	
35. (c)	**36.** (d)	**37.** (0.29 to 0.33)	**38.** (c)	
39. (0.48 to 0.52)	**40.** (0.40 to 0.44)	**41.** (c)	**42.** (b)	
43. (a)	**44.** (c)	**45.** (1.3 to 1.5)	**46.** (26.5 to 27.5)	
47. (9485.13 to 9485.18)	**48.** (119.60 to 119.65)	**49.** (d)	**50.** (c)	
51. (9 to 10)	**52.** (d)	**53.** (0.69 to 0.73)	**54.** (2.23 to 2.25)	
55. (d)	**56.** (a)	**57.** (c)	**58.** (a)	
59. (a)	**60.** ()	**61.** ()	**62.** ()	
63. ()	**64.** (c)	**65.** (0.70 to 0.80)		