Topic:- PHY MSC S2

1) An atomic transition line with wavelength 350 nm is observed to be split into three components in a spectrum of light from a sunspot. Adjacent components are separated by 1.7 pm. Determine the strength of the magnetic field in the sunspot
[Question ID = 6662]

1. 3 T [Option ID = 26642]
2. 0.03 T [Option ID = 26643]
3. 3.3 T [Option ID = 26644]
4. 0.3 T [Option ID = 26645]

Correct Answer :-

- 0.3 T [Option ID = 26645]

2) which one of the following is correct in respect of an electron and a proton having a same de-Broglie wavelength of 2 Å
[Question ID = 6663]

1. Both have same kinetic energy [Option ID = 26646]
2. Both have same velocity [Option ID = 26647]
3. Both have same momentum [Option ID = 26648]
4. The kinetic energy of proton is more than that of electron [Option ID = 26649]

Correct Answer :-

- Both have same momentum [Option ID = 26648]

3) If r_p & r_H are the radius and E_p & E_H are the energy of an electron in the n^{th} orbit of positronium atom and hydrogen atom respectively, then

[Question ID = 6664]

1. $r_p = 2\ r_H$ and $E_p = E_H/2$

   [Option ID = 26650]
2. $r_p = 2\ r_H$ and $E_p = 2\ E_H$

   [Option ID = 26651]
3. $r_p = 2\ r_H$ and $E_p = E_H/4$

   [Option ID = 26652]
4. $r_p = r_H$ and $E_p = 2\ E_H$

   [Option ID = 26653]

Correct Answer :-

- $r_p = 2\ r_H$ and $E_p = E_H/2$

  [Option ID = 26650]

4) An X-ray beam of wavelength 0.16 nm is incident on a set of planes of a certain crystal. The first Bragg reflection is observed for an incidence angle of 30°. What is the corresponding inter planar spacing?
[Question ID = 6669]

1. 0.16 nm [Option ID = 26670]
2. 0.67 nm [Option ID = 26671]
3. 1.02 nm [Option ID = 26672]
4. 0.89 nm [Option ID = 26673]

Correct Answer :-

- 0.16 nm [Option ID = 26670]

5) What is the velocity of conduction electron of silver having Fermi energy 5.52 eV
[Question ID = 6670]

1. 1.39×10^6 m/s [Option ID = 26674]
2. 2.39×10^6 m/s [Option ID = 26675]
3. 0.89×10^6 m/s [Option ID = 26676]
4. 0 [Option ID = 26677]

Correct Answer :-

- 1.39×10^6 m/s [Option ID = 26674]

6) Given that a piece of n-type silicon contains 8×10^{21} m^{-3} phosphorus impurity atoms, calculate the carrier concentration of silicon at room temperature. Given that the intrinsic electron concentration of silicon at room temperature is 1.6×10^{16} m^{-3}

[Question ID = 6671]
1. 3.2 x 10^{10} m^{-3} [Option ID = 26678]
2. [illegible] x 10^{11} m^{-3} [Option ID = 26679]
3. 1.5 x 10^{10} m^{-3} [Option ID = 26680]
4. 3.2 x 10^{11} m^{-3} [Option ID = 26681]

Correct Answer :-
- 3.2 x 10^{10} m^{-3} [Option ID = 26678]

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7) The dispersion relation for a one-dimensional monoatomic lattice chain is given by the equation, ω $= \frac{2}{a} v_s \,|\sin(\frac{Ka}{2})\,|$, where, 'a' is the interatomic spacing, $K = \frac{2\pi}{\lambda}$ and v_s has the dimension of velocity. The relation between the phase velocity V_P and group velocity V_g in the long wavelength limit is given by

[Question ID = 6674]
1. $V_P = V_g$

   [Option ID = 26690]
2. $V_P = 2V_g$

   [Option ID = 26691]
3. $V_P = V_g/2$

   [Option ID = 26692]
4. $V_P \neq V_g$

   [Option ID = 26693]

Correct Answer :-
- $V_P = V_g$

  [Option ID = 26690]

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8) The largest wavelength of light falling on double slits separated by 1.5 μm, for which there is a first order maximum is in the,
[Question ID = 6676]
1. ultraviolet range [Option ID = 26698]
2. visible range [Option ID = 26699]
3. infrared range [Option ID = 26700]
4. X-ray range [Option ID = 26701]

Correct Answer :-
- infrared range [Option ID = 26700]

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9) In a multi-stage R-C coupled amplifier, the coupling capacitor
[Question ID = 6680]
1. limits the low frequency response [Option ID = 26714]
2. limits the high frequency response [Option ID = 26715]
3. reduces the amplitude of input signal [Option ID = 26716]
4. blocks d.c. component without affecting the frequency response [Option ID = 26717]

Correct Answer :-
- blocks d.c. component without affecting the frequency response [Option ID = 26717]

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10) An AM transmitter is coupled to an aerial. The input current is found to be 5 A. With modulation the current value increases to 5.9 A. The depth of modulation is
[Question ID = 6681]
1. 83.4% [Option ID = 26718]
2. 88.6% [Option ID = 26719]
3. 78.2% [Option ID = 26720]
4. 74.3% [Option ID = 26721]

Correct Answer :-
- 88.6% [Option ID = 26719]

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11) Hexadecimal equivalent of a digital number 10011101 is
[Question ID = 6683]
1. H913 [Option ID = 26726]
2. 9D [Option ID = 26727]
3. AE [Option ID = 26728]
4. 157 [Option ID = 26729]

Correct Answer :-
- 9D [Option ID = 26727]

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12) If the doping concentration in a Si-Zener diode is increased, the Zener breakdown voltage
[Question ID = 6684]

1. Decreases [Option ID = 26730]
2. Increases [Option ID = 26731]
3. Remains unchanged [Option ID = 26732]
4. Becomes broader [Option ID = 26733]

Correct Answer :-

- Decreases [Option ID = 26730]

13) Which one of the following is an example of doubly magic nuclei

[Question ID = 6685]

1. ^{18}O

   [Option ID = 26734]
2. ^{48}Ca

   [Option ID = 26735]
3. ^{124}Sn

   [Option ID = 26736]
4. ^{204}Pb

   [Option ID = 26737]

Correct Answer :-

- ^{48}Ca

  [Option ID = 26735]

14) Which radiation has maximum ionization power?
[Question ID = 6686]

1. Alpha [Option ID = 26738]
2. Beta [Option ID = 26739]
3. Neutron [Option ID = 26740]
4. Gamma [Option ID = 26741]

Correct Answer :-

- Alpha [Option ID = 26738]

15) For beta-minus decay, which statement is TRUE?
[Question ID = 6688]

1. Daughter nuclide atomic mass (A_D) is more than that of the parent nuclide atomic mass (A_p) [Option ID = 26746]
2. Daughter nuclide atomic number (Z_D) is same that of the parent nuclide atomic number (Z_p) [Option ID = 26747]
3. Daughter nuclide neutron number (N_D) is less than that of the parent nuclide neutron number (N_p) [Option ID = 26748]
4. Daughter nuclide neutron number (N_D) is same that of the parent nuclide neutron number(N_p) [Option ID = 26749]

Correct Answer :-

- Daughter nuclide neutron number (N_D) is less than that of the parent nuclide neutron number (N_p) [Option ID = 26748]

16) The probability that student A solves the problem is 1/2, and that of B is 2/3. What is the probability that the problem is solved?

[Question ID = 6689]

1. 4/6

   [Option ID = 26750]
2. 1/3

   [Option ID = 26751]
3. 5/6

   [Option ID = 26752]
4. none of these

   [Option ID = 26753]

Correct Answer :-

- 5/6

  [Option ID = 26752]

17) Are the three points whose position vectors are 2i+3j-4k, i-2j+3k and -7j+10k collinear?

[Question ID = 6690]

1. Yes

   [Option ID = 26754]
2. No

[Option ID = 26755]
3. ...ot be determined

[Option ID = 26756]
4. None of these

[Option ID = 26757]

Correct Answer :-
- Yes

[Option ID = 26754]

18) The number of independent fundamental solutions in n-th order ordinary differential equation is
[Question ID = 6692]
1. n-1 [Option ID = 26762]
2. n [Option ID = 26763]
3. n+1 [Option ID = 26764]
4. 2n [Option ID = 26765]

Correct Answer :-
- n [Option ID = 26763]

19) If $z_1 = 2 - 3i$ and $z_2 = 4 + 6i$ then find $\frac{z_1}{z_2}$

[Question ID = 6693]
1. -5/26-6i/13

[Option ID = 26766]
2. -5/26+6i/13

[Option ID = 26767]
3. 8+18i

[Option ID = 26768]
4. 8-18i

[Option ID = 26769]

Correct Answer :-
- -5/26-6i/13

[Option ID = 26766]

20) The rank of the following matrix $\begin{pmatrix} 1 & 5 & 1 \\ 2 & 1 & 1 \\ 3 & 6 & 2 \end{pmatrix}$ is

[Question ID = 6699]
1. 1

[Option ID = 26790]
2. 2

[Option ID = 26791]
3. 3

[Option ID = 26792]
4. 4

[Option ID = 26793]

Correct Answer :-
- 2

[Option ID = 26791]

21) Two Carnot engines X and Y are operating in series. The engine X receives heat at 1200 K and rejects to a reservoir at a temperature T. The second engine Y receives the heat rejected by X and in turn rejects to a heat reservoir at 300 K. Calculate the temperature T (in Kelvin) for the situation when the efficiency of the engines is same
[Question ID = 6704]
1. 600 K [Option ID = 26810]
2. 750 K [Option ID = 26811]
3. 0 [Option ID = 26812]
4. 450 K [Option ID = 26813]

Correct Answer :-
- 600 K [Option ID = 26810]

22) A square conducting loop of mass m, side l and resistance R is dropped into a region with a uniform horizontal magnetic

... whose direction is perpendicular to the plane of the falling loop. The loop will reach a terminal velocity v given by

[Question ID = 7330]

1. $v = \dfrac{mgR}{(Bl)^2}$

   [Option ID = 29314]
2. $v = \dfrac{2mgR}{B^2l^2}$

   [Option ID = 29315]
3. $v = \dfrac{mgR}{2B^2l^2}$

   [Option ID = 29316]
4. None of these

   [Option ID = 29317]

Correct Answer :-

- $v = \dfrac{mgR}{(Bl)^2}$

  [Option ID = 29314]

23) An ideal inductor, a resistor of resistance *R* Ohms and a capacitor with adjustable capacitance are connected in series to an alternating voltage with an effective value of *V* Volts and with frequency of *f* Hz. The current flowing through the circuit when the capacitance of the capacitor is set to C_1 is the same as when the capacitance of the capacitor is set to C_2, $C_2 > C_1$. The inductance of the inductor L is given by

[Question ID = 7331]

1. $\dfrac{1}{8\pi^2 f^2}\dfrac{C_1 + C_2}{C_1C_2}$

   [Option ID = 29318]
2. $\frac{1}{8\pi^2 f^2}\frac{C_1C_2}{C_1+C_2}$

   [Option ID = 29319]
3. $\dfrac{1}{2\pi f}\dfrac{C_1C_2}{C_1-C_2}$

   [Option ID = 29320]
4. $\dfrac{1}{2\pi^2 f^2 R(C_1-C_2)}\dfrac{C_1C_2}{C_1+C_2}$

   [Option ID = 29321]

Correct Answer :-

- $\dfrac{1}{8\pi^2 f^2}\dfrac{C_1 + C_2}{C_1C_2}$

  [Option ID = 29318]

24) A cylinder of length *L* is made up of an inner core of steel of radius r_1 and an outer sheath of copper of thickness r_1. The resistivities of steel and copper are ρ_1 and ρ_2 respectively. The total resistance of the cylinder is

[Question ID = 7332]

1. $\dfrac{(\rho_1\rho_2)L}{\pi r_1^2(3\rho_1 + \rho_2)}$

   [Option ID = 29322]
2. $\dfrac{(3\rho_1 + \rho_2)L}{\pi r_1^2}$

   [Option ID = 29323]
3. $\frac{(\rho_1+\rho_2)L}{4\pi r_1^2}$

   [Option ID = 29324]
4. Cannot be determined from the information provided above

Answer :-

- $\frac{(\rho_1\rho_2)L}{\pi r_1^2(3\rho_1+\rho_2)}$

  [Option ID = 29322]

25) A meter stick is at an angle of 45° to the x' axis in its rest frame. The rod moves with a speed of $\frac{1}{\sqrt{2}}c$ along the $+x$ direction w.r.t. a frame S. The length of the rod in S is

[Question ID = 7333]

1. $\frac{\sqrt{3}}{2}$ meters

   [Option ID = 29326]
2. $\frac{\sqrt{5}}{3}$ meters

   [Option ID = 29327]
3. $\frac{\sqrt{2}}{3}$ meters

   [Option ID = 29328]
4. $\frac{2}{3}$ meters

   [Option ID = 29329]

Correct Answer :-

- $\frac{\sqrt{3}}{2}$ meters

  [Option ID = 29326]

26) An AC generator with output and frequency f is connected to the plates of an air filled parallel plate capacitor of plate area A and plate separation d. The maximum value of the displacement current is

[Question ID = 7334]

1. $\frac{2\pi \in_0 fVA}{d}$

   [Option ID = 29330]
2. $\frac{\in fV}{d}$

   [Option ID = 29331]
3. $\frac{2\pi f\varepsilon_0 A}{Vd}$

   [Option ID = 29332]
4. Cannot be determined from the information provided

   [Option ID = 29333]

Correct Answer :-

- $\frac{2\pi \in_0 fVA}{d}$

  [Option ID = 29330]

27) An electron enters a uniform magnetic field of flux density 1.2 Wb/m^2. Find the energy difference in (eV), between electrons having spins parallel and anti-parallel to the field. (Given: $\mu_B = 9.3 \ x\ 10^{-24}$ J/T)

[Question ID = 7335]

1. 3 .95 x 10^{-5} eV

   [Option ID = 29334]
2. 13.95 x 10^{-5}eV

[Option ID = 29335]
3. [illegible]5 x 10^{-5} eV

[Option ID = 29336]
4. 33.95 x 10^{-5} eV

[Option ID = 29337]

Correct Answer :-
- 13.95 x 10^{-5}eV

[Option ID = 29335]

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28) **Using the vector atom model, determine the possible values of the angular momentum of an electron in *f*- shell**

[Question ID = 7336]
1. $\frac{3\sqrt{7}}{2}\hbar$, $\frac{\sqrt{35}}{2}\hbar$

   [Option ID = 29338]
2. $\frac{2\sqrt{7}}{2}\hbar$, $\frac{\sqrt{25}}{2}\hbar$

   [Option ID = 29339]
3. $\frac{5\sqrt{7}}{2}\hbar$, $\frac{\sqrt{15}}{2}\hbar$

   [Option ID = 29340]
4. $\frac{\sqrt{7}}{2}\hbar$, $\frac{\sqrt{5}}{2}\hbar$

   [Option ID = 29341]

Correct Answer :-
- $\frac{3\sqrt{7}}{2}\hbar$, $\frac{\sqrt{35}}{2}\hbar$

[Option ID = 29338]

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29) **The two eigenvalues of the matrix $\begin{pmatrix} 1 & 1 \\ 1 & 1 \end{pmatrix}$ are**

[Question ID = 7337]
1. 2,0

   [Option ID = 29342]
2. 1,1

   [Option ID = 29343]
3. 1,2

   [Option ID = 29344]
4. 0,1

   [Option ID = 29345]

Correct Answer :-
- 2,0

[Option ID = 29342]

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30) **The commutator, $\pi[x^2, p_x]$, is equal to**

[Question ID = 7338]
1. *ihx*

   [Option ID = 29346]
2. *2ihx*

   [Option ID = 29347]
3. $2ihp_x$

   [Option ID = 29348]
4. Zero

   [Option ID = 29349]

Correct Answer :-
- *ihx*

[Option ID = 29346]

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31) A particle of mass m is confined in the ground state of a one dimensional box extending from $x = -2L$ to $x = +2L$. The wave function of the particle in this state is

... where ψ_0 is a constant. The energy eigenvalue corresponding to this state is

[Question ID = 7339]

1. $\dfrac{\hbar^2\pi^2}{32mL^2}$

   [Option ID = 29350]
2. $\dfrac{\hbar^2\pi^2}{2\ mL^2}$

   [Option ID = 29351]
3. $\dfrac{\hbar^2\pi^2}{4\ mL^2}$

   [Option ID = 29352]
4. $\dfrac{\hbar^2\pi^2}{16mL^2}$

   [Option ID = 29353]

Correct Answer :-

- $\dfrac{\hbar^2\pi^2}{32mL^2}$

  [Option ID = 29350]

32) The normalized wave functions ψ_1 and ψ_2 , correspond to the ground state and the first excited states of a particle in a potential. The operator $\hat{A}$ acts on the wave functions as $\hat{A}\psi_1 = \psi_2$ and $\hat{A}\psi_2 = \psi_1$. The expectation value of the operator $\hat{A}$ for the state $\psi = (3\psi_1 + 4\psi_2)/5$ is

[Question ID = 7340]

1. 0.96 [Option ID = 29354]
2. - 0.32 [Option ID = 29355]
3. 0 [Option ID = 29356]
4. 0.75 [Option ID = 29357]

Correct Answer :-

- 0.96 [Option ID = 29354]

33) The primitive translation vector of a two-dimensional lattice are $a = 2\hat{\imath} + \hat{\jmath}$, $b = 2\hat{\jmath}$. The primitive translation vector of its reciprocal lattice in x-direction is given by

[Question ID = 7341]

1. $a^* = \pi\hat{\imath}$

   [Option ID = 29358]
2. $a^* = 2\pi\hat{\imath}$

   [Option ID = 29359]
3. $a^* = \hat{\imath}$

   [Option ID = 29360]
4. $a^* = \pi\hat{\jmath}$

   [Option ID = 29361]

Correct Answer :-

- $a^* = \pi\hat{\imath}$

  [Option ID = 29358]

34) The mean drift speed v_d of an electron in an applied electric field E with electron density 'n' can be expressed as

[Question ID = 7342]

1. $v_d = |\sigma E/ne|$

   [Option ID = 29362]
2. $v_d = |\sigma E/e|$

[Option ID = 29363]
3. $= |\sigma e/nE|$

[Option ID = 29364]
4. none of these

[Option ID = 29365]

Correct Answer :-

- $v_d = |\sigma E/ne|$

[Option ID = 29362]

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35) An un-damped oscillator has time period $\tau_0 = 1.0$ sec. Now a little damping is added so that its time period changes to $\tau_1 = 1.001$ sec. By what factor will the amplitude of oscillation decrease after 10 cycles?

[Question ID = 7343]
1. ≈ 17

[Option ID = 29366]
2. ≈ 1

[Option ID = 29367]
3. $\approx 1/17$

[Option ID = 29368]
4. None of these

[Option ID = 29369]

Correct Answer :-

- ≈ 17

[Option ID = 29366]

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36) A kilogram of water has a constant heat capacity of 4.2 kJ/K/kg over the temperature range 0°C to 100° C. The water was initially at 0° C and is brought into contact with a heat reservoir at 100° C. When the water is in thermal equilibrium with the heat reservoir calculate the change in entropy of the universe (Water + Reservoir).

[Question ID = 7344]
1. 184.8 J/K

[Option ID = 29370]
2. 2437.8 J/K

[Option ID = 29371]
3. 0 J/K

[Option ID = 29372]
4. 1310.8 J/K

[Option ID = 29373]

Correct Answer :-

- 184.8 J/K

[Option ID = 29370]

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37) Two identical finite bodies of constant volume and of constant heat capacity at constant volume C_v, are used to drive a heat engine. Their initial temperatures are T_1 and T_2. The maximum amount of work which can be obtained from the system is

[Question ID = 7345]
1. $C_v\{2(T_1T_2)^{1/2} - (T_1 + T_2)\}$

[Option ID = 29374]
2. $C_v\,(T_1 + T_2)$

[Option ID = 29375]
3. $C_v\,(T_1T_2)^{1/2}$

[Option ID = 29376]
4. 0

[Option ID = 29377]

38) For a system of bosons, we can write the Bose-Einstein distribution function as $f(E_i) = \frac{1}{\exp(\alpha+\beta E_i)-1}$, Where, $\beta = 1/k_B T$ and $\alpha = \mu/k_B T$ (k_B = Boltzmann constant). If μ represents the chemical potential, then which one of the following is true?

[Question ID = 7346]

1. $\mu \leq 0$

   [Option ID = 29378]
2. $\mu \geq 0$

   [Option ID = 29379]
3. $\mu \leq 1$

   [Option ID = 29380]
4. $\mu \geq 1$

   [Option ID = 29381]

Correct Answer :-

- $\mu \geq 0$

  [Option ID = 29379]

39) An ideal capacitor C is charged to a voltage V_o and connected at t = 0 across an ideal inductor L (The circuit now consists of a capacitor and an inductor only). If the resonant frequency

$\omega_o = {}^{1}/_{\sqrt{LC}}$

, the voltage across the capacitor at time t > 0 is given by
[Question ID = 7347]

1. V_o [Option ID = 29382]
2. $V_o \cos(\omega_o t)$ [Option ID = 29383]
3. $V_o \sin(\omega_o t)$ [Option ID = 29384]
4. $V_o e^{-\omega_o t} \cos(\omega_o t)$

   [Option ID = 29385]

Correct Answer :-

- $V_o \cos(\omega_o t)$ [Option ID = 29383]

40) Magnetic moment of proton (μ_p) in terms of nuclear magneton (μ_N) is

[Question ID = 7348]

1. $\mu_p = 1.9\mu_N$

   [Option ID = 29386]
2. $\mu_p = 2.7\mu_N$

   [Option ID = 29387]
3. $\mu_p = 3.8\mu_N$

   [Option ID = 29388]
4. $\mu_p = 5.4\mu_N$

   [Option ID = 29389]

Correct Answer :-

- $\mu_p = 2.7\mu_N$

  [Option ID = 29387]

41) Find the eigenvalues of A+4I where I is identity matrix and A = $\begin{pmatrix} 2 & -1 \\ -1 & 2 \end{pmatrix}$

[Question ID = 7349]

1. 1,3

   [Option ID = 29390]
2. 5,7

[Option ID = 29391]
3.
[Option ID = 29392]
4. None of these

[Option ID = 29393]

Correct Answer :-
- 5,7

[Option ID = 29391]

42) The limit $\lim_{n\to\infty}\left(\frac{1}{n}\right)^{\frac{1}{n}}$ is

[Question ID = 7350]
1. $\frac{1}{e}$

[Option ID = 29394]
2. 1

[Option ID = 29395]
3. 0

[Option ID = 29396]
4. e

[Option ID = 29397]

Correct Answer :-
- 1

[Option ID = 29395]

43) $\left(\frac{1+i}{\sqrt{2}}\right)^{49}$

is equal to
[Question ID = 7351]
1. $\left(\frac{1+i}{\sqrt{2}}\right)$

[Option ID = 29398]
2. $\left(\frac{2+98i}{\sqrt{2^{49}}}\right)$

[Option ID = 29399]
3. $\left(\frac{1-i}{\sqrt{2}}\right)$

[Option ID = 29400]
4. $\left(\frac{2-98i}{\sqrt{2^{49}}}\right)$

[Option ID = 29401]

Correct Answer :-
- $\left(\frac{1+i}{\sqrt{2}}\right)$

[Option ID = 29398]

44) $\sin\left(\frac{\pi}{4}+i\right)$ is equal to

[Question ID = 7352]
1. $\frac{\sqrt{2}}{4}\left(e-\frac{1}{e}\right)+\frac{\sqrt{2}}{4}\left(e-\frac{1}{e}\right)i$

[Option ID = 29402]
2. $\frac{\sqrt{2}}{4}\left(e+\frac{1}{e}\right)+\frac{\sqrt{2}}{4}\left(e-\frac{1}{e}\right)i$

on ID = 29403]

3. $\frac{\phantom{\sqrt{2}}}{4}\left(e \quad \frac{1}{e}\right) \quad \frac{\sqrt{2}}{4}\left(\quad \frac{1}{e}\right)i$

[Option ID = 29404]

4. $\frac{\sqrt{2}}{4}\left(e - \frac{1}{e}\right) + \frac{\sqrt{2}}{4}\left(e + \frac{1}{e}\right)i$

[Option ID = 29405]

Correct Answer :-

- $\frac{\sqrt{2}}{4}\left(e + \frac{1}{e}\right) + \frac{\sqrt{2}}{4}\left(e - \frac{1}{e}\right)i$

[Option ID = 29403]

45) Two students are working on a math problem. The first student has probability ½ of solving it and the second student has probability ¾ of solving it. What is the probability that at least one of them solves the problem?
[Question ID = 7353]

1. $\frac{3}{8}$

[Option ID = 29406]

2. $\frac{5}{8}$

[Option ID = 29407]

3. $\frac{7}{8}$

[Option ID = 29408]

4. $\frac{9}{8}$

[Option ID = 29409]

Correct Answer :-

- $\frac{7}{8}$

[Option ID = 29408]

46) Expansion of the function $f(z) = \frac{1}{z^2-3z+2}$ in the region defined by $|z| > 2$ is

[Question ID = 7354]

1. $z^{-2} + 3z^{-4} + 7z^{-6} + \ldots$

[Option ID = 29410]

2. $z^{-2} + 3z^{-3} + 7z^{-4} + \ldots$

[Option ID = 29411]

3. $z^{-1} + 3z^{-2} + 7z^{-3} + \ldots$

[Option ID = 29412]

4. $z^{-3} + 3z^{-4} + 7z^{-5} + \ldots$

[Option ID = 29413]

Correct Answer :-

- $z^{-2} + 3z^{-3} + 7z^{-4} + \ldots$

[Option ID = 29411]

47) The Fourier transformation of the function $f(x) = 1 \text{ for } |x| < a$

$= 0 \text{ for } |x| > a$

is

[Question ID = 7355]

1. $\sqrt{\frac{2}{\pi}}\frac{\sin sa}{s}$

[Option ID = 29414]

2. $\sqrt{\frac{2}{\pi}}\frac{\cos sa}{s}$

[Option ID = 29415]

3. $\sqrt{\frac{\pi}{2}}\frac{\sin sa}{s}$

[Option ID = 29416]

4. $\sqrt{\frac{\pi}{2}}\frac{\cos sa}{s}$

[Option ID = 29417]

Correct Answer :-

- $\sqrt{\frac{2}{\pi}}\frac{\sin sa}{s}$

[Option ID = 29414]

48) The Laplace transformation of the function $f(t) = 2^t$ is

[Question ID = 7356]

1. $\frac{\ln 2}{s - \ln 2}$

[Option ID = 29418]

2. $\frac{1}{s - \ln 2}$

[Option ID = 29419]

3. $\frac{1}{s \ln 2 - 1}$

[Option ID = 29420]

4. $\frac{\ln 2}{s \ln 2 - 1}$

[Option ID = 29421]

Correct Answer :-

- $\frac{1}{s - \ln 2}$

[Option ID = 29419]

49) Consider a collection of non-interacting particles, each of mass m in a volume where the gravitational force is a -ve (z-direction). Consider the system is in thermal equilibrium at a temperature T. Find the partition function

[Question ID = 7357]

1. $Q_N = \left[\frac{(kT)^3}{2\pi mg\hbar^2}\right]^{N/2}$

[Option ID = 29422]

2. $Q_N = \left[\frac{2\pi mg\hbar^2}{(kT)^3}\right]^{N/2}$

[Option ID = 29423]

3. $Q_N = \left[\frac{(kT)^3}{2\pi mg\hbar^2}\right]^{N}$

[Option ID = 29424]

4. $Q_N = \left[\frac{2\pi mg\hbar^2}{(kT)^3}\right]^{N}$

[Option ID = 29425]

Correct Answer :-

- $Q_N = \left[\frac{(kT)^3}{2\pi m g h^2}\right]^{N/2}$

  [Option ID = 29422]

50) The quantum distribution function for any gas atom which follows MB, BE and FD statistics is given as a generalized single form

$f_i = g_i/[exp(\epsilon_i - \mu) / (kT + J)]$

If the distribution function follows the MB statistics in a classical limit then what will be the condition of the following. Symbols have their usual meanings

[Question ID = 7358]

1. $\frac{f_i}{g_i} \ll 1 \; ; \; J = 1$

   [Option ID = 29426]
2. $\frac{f_i}{g_i} \ll 1 \; ; \; J = 0$

   [Option ID = 29427]
3. $\frac{g_i}{f_i} \gg 1 \; ; \; J = 1$

   [Option ID = 29428]
4. $\frac{g_i}{f_i} \gg 1 \; ; \; J = -1$

   [Option ID = 29429]

Correct Answer :-

- $\frac{f_i}{g_i} \ll 1 \; ; \; J = 0$

  [Option ID = 29427]