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**Previous Year Paper
(Physics)
06 Aug, 2023 Shift 2**



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Notations :

- 1.Options shown in green color and with ✓ icon are correct.
- 2.Options shown in red color and with ✗ icon are incorrect.

Question Paper Name :	Physics 6th Aug 2023 Shift 2
Subject Name :	Physics
Creation Date :	2023-08-06 15:25:03
Duration :	120
Total Marks :	100
Display Marks:	Yes
Calculator :	None
Magnifying Glass Required? :	No
Ruler Required? :	No
Eraser Required? :	No
Scratch Pad Required? :	No
Rough Sketch/Notepad Required? :	No
Protractor Required? :	No
Show Watermark on Console? :	Yes
Highlighter :	No
Auto Save on Console?	Yes
Change Font Color :	No
Change Background Color :	No
Change Theme :	No
Help Button :	No

Show Reports : No

Show Progress Bar : No

Physics

Group Number : 1

Group Id : 59425350

Group Maximum Duration : 0

Group Minimum Duration : 120

Show Attended Group? : No

Edit Attended Group? : No

Break time : 0

Group Marks : 100

Is this Group for Examiner? : No

Examiner permission : Cant View

Show Progress Bar? : No

Physics

Section Id : 59425358

Section Number : 1

Section type : Online

Mandatory or Optional : Mandatory

Number of Questions : 100

Number of Questions to be attempted : 100

Section Marks : 100

Enable Mark as Answered Mark for Review and Clear Response : Yes

Maximum Instruction Time : 0

Sub-Section Number : 1

Sub-Section Id : 59425368

Question Shuffling Allowed : Yes

Is Section Default? : null

Question Number : 1 Question Id : 5942534911 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

The Eigen values of the matrix $\begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$ are

Options :

1. ✗ 4, 4, 1

2. ✓ 1, 1, 4

3. ✗ 1, 0, 4

4. ✗ 4, 4, 0

Question Number : 2 Question Id : 5942534912 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

The residue of $\cot(z)$ at $z = 0$ is

Options :

1. ✓ 1

2. ✖ -1

3. ✖ 0

4. ✖ $\pi/2$

Question Number : 3 Question Id : 5942534913 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

Using Rodrigue's formula for Legendre polynomial the value of

$$\int_{-1}^{+1} x^2 P_5(x) dx \text{ is}$$

Options :

1. ✖ 1

2. ✖ 2

3. ✔ 0

4. ✖ -2

Question Number : 4 Question Id : 5942534914 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

The Laplace transform $L\left\{\frac{e^{at}-1}{a}\right\}$ is

Options :

1. ✖ $\frac{1}{s-a}$

2. ✔ $\frac{1}{s(s-a)}$

3. ✖ $\frac{1}{s(s-a)^2}$

4. ✖ $\frac{1}{s^2(s-a)^2}$

Question Number : 5 Question Id : 5942534915 Question Type : MCQ Option Shuffling : Yes Is

Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum

Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

In case of Hermite polynomials $H_3(x)$ is

Options :

1. ✖ $4x^2-2$

2. ✔ $8x^3-12x$

3. ✖ $2x$

4. ✖ $16x^4 - 48x^2 + 12$

Question Number : 6 Question Id : 5942534916 Question Type : MCQ Option Shuffling : Yes Is
Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum
Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

If Fourier transform $FT[f(t)] = f(s)$, then $FT[f(t+a)]$ (where $a = \text{constant}$) is

Options :

1. ✔ $e^{isa}f(s)$

2. ✖ $e^{-isa}f(s)$

3. ✖ $e^{isa}f(s+a)$

4. ✖ $e^{-isa}f(s+a)$

Question Number : 7 Question Id : 5942534917 Question Type : MCQ Option Shuffling : Yes Is
Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum
Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

Two blocks of equal masses each equal to m , are joined with spring as shown below. They execute small oscillations on a friction less surface, then the normal frequencies of oscillation of the system from the following may be



A) $\sqrt{\frac{2k}{m}}$ B

B) $2\sqrt{\frac{k}{m}}$ C

C) $\sqrt{\frac{m}{2k}}$ D

D) $\sqrt{\frac{2m}{k}}$

Choose the correct answer.

Note: For this question, discrepancy is found in question/answer. Full Marks is being awarded to all candidates.

Options :

1. A and C only

2. A and B only

3. A only

4. B only

Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

Match the list I with list II

List I

- A) Lagrange's Equation
- B) Hamilton's canonical equations of motion
- C) Hamiltonian
- D) D'Alembert's Principle

List II

- i) $\sum p_j \dot{q}_j - L$
- ii) $\frac{d}{dt} \left(\frac{\partial L}{\partial \dot{q}_j} \right) - \frac{\partial L}{\partial q_j} = 0$
- iii) $\dot{q}_j = \left(\frac{\partial H}{\partial p_j} \right); \dot{p}_j = - \left(\frac{\partial H}{\partial q_j} \right)$
- iv) $(F_i^{(a)} - \vec{P}_i) \cdot \partial \vec{r}_i$

Choose the correct answer.

Options :

1. ✓ A - ii; B - iii; C - i; D - iv

2. ✗ A - iv; B - iii; C - ii; D - i

3. ✗ A - iii; B - iv; C - i; D - ii

4. ✗ A - i; B - ii; C - iv; D - iii

Question Number : 9 Question Id : 5942534919 Question Type : MCQ Option Shuffling : Yes Is

Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum

Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

The generalised coordinate q_k of a classical system with Lagrangian L is said to be cyclic if

Options :

1. ✗

$$\left(\frac{\partial L}{\partial \dot{q}_k}\right) = 0$$

2. ✓
$$\left(\frac{\partial L}{\partial q_k}\right) = 0$$

3. ✗
$$\left(\frac{\partial L}{\partial q_k}\right) = \dot{q}_k$$

4. ✗
$$\frac{d}{dt}\left(\frac{\partial L}{\partial \dot{q}_k}\right) = \frac{\partial L}{\partial q_k}$$

Question Number : 10 Question Id : 5942534920 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

The product of momentum and velocity of light in vacuum is given by the relation below. Identify the correct expression

Options :

1. ✗
$$pc = \sqrt{T(T + 4m_0c^2)}$$

2. ✗
$$pc = \sqrt{T(T + 3m_0c^2)}$$

3. ✓
$$pc = \sqrt{T(T + 2m_0c^2)}$$

4. ✗
$$pc = \sqrt{T(T + m_0c^2)}$$

Question Number : 11 Question Id : 5942534921 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

If a rigid body rotating about any axis having angular velocity ω , moment of inertia I , torque τ and angular acceleration α then

Options :

1. ✖ $\tau = I\omega$

2. ✖ $\tau = \omega/\alpha$

3. ✔ $\tau = I\alpha$

4. ✖ $\tau = I/\omega$

Question Number : 12 Question Id : 5942534922 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

What is true in general when two particles collide?

- A) In perfectly elastic collision, there is a complete loss of kinetic energy
- B) Forces involved in an elastic collision are conservative
- C) Kinetic energy of particles after collision in inelastic collision is always less than kinetic energy before collision

Choose the correct answer.

Options :

1. ✗ C only
2. ✗ B only
3. ✗ A, B and C
4. ✓ B and C only

Question Number : 13 Question Id : 5942534923 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

If the electric field (E) is solenoidal then which of the following is true?

Options :

1. ✗ $\oint \vec{E} \cdot d\vec{l} = 0$
2. ✓ $\oint_s \vec{E} \cdot d\vec{s} = 0$
3. ✗ $\nabla \times \vec{E} \neq 0$
4. ✗ $\nabla^2 \vec{E} = 0$

Question Number : 14 Question Id : 5942534924 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

The electric field outside a uniformly charged sphere of radius 'a' with enclosed charge q is

Options :

1. ✖ $\frac{q}{4\pi\epsilon_0 a}$

2. ✔ $\frac{q}{4\pi\epsilon_0 a^2}$

3. ✖ $\frac{q}{4\pi\epsilon_0}$

4. ✖ $\frac{q}{4\pi\epsilon_0 a^3}$

Question Number : 15 Question Id : 5942534925 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

If the potential $V = -3x^2 + 4y + 3z^2$, then the electric field at the point (2, 3, 3) is

Options :

1. ✔ $12i-4j-3k$

2. ✖

$$6i+4j+3k$$

3. ✖ $12i+4j+4k$

4. ✖ $6i-4j-3k$

Question Number : 16 Question Id : 5942534926 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

Match the following

A) Gauss law

i) $\nabla \cdot \vec{B} = 0$

B) Non-existence of magnetic dipoles

ii) $\nabla \times \vec{B} = \mu_0 \mathbf{J}$

C) Faraday's law

iii) $\nabla \times \vec{E} = -\frac{\partial \mathbf{B}}{\partial t}$

D) Ampere's law

iv) $\nabla \cdot \vec{E} = \frac{\rho}{\epsilon_0}$

Choose the correct answer.

Options :

1. ✖ A - i; B - ii; C - iii; D - iv

2. ✔ A - iv; B - i; C - iii; D - ii

3. ✖ A - i; B - ii; C - iv; D - iii

4. ✖ A - iii; B - ii; C - iv; D - i

Question Number : 17 Question Id : 5942534927 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

At the interface of two dielectric media which of the following is FALSE?

Options :

1. ✖ Tangential component of E is continuous
2. ✖ Normal component of B is continuous
3. ✖ Normal component of D is continuous if the surface charge is zero
4. ✔ Tangential component of H is continuous

Question Number : 18 Question Id : 5942534928 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

Maxwell equations for harmonic fields having angular frequency ω are

Options :

1. ✖ $\nabla \cdot \vec{B} = 0; \nabla \times \vec{H} = J + \mu jD; \nabla \times \vec{E} = -j\omega B; \nabla \cdot \vec{D} = \rho$
2. ✔ $\nabla \cdot \vec{B} = 0; \nabla \times \vec{H} = J + j\omega D; \nabla \times \vec{E} = -j\omega B; \nabla \cdot \vec{D} = \rho$

3. ✖ $\nabla \cdot \vec{B} = 0; \nabla \times \vec{H} = J; \nabla \times \vec{E} = -B; \nabla \cdot \vec{D} = \rho$

4. ✖ $\nabla \cdot \vec{B} = 0; \nabla \times \vec{H} = 0; \nabla \times \vec{E} = -B; \nabla \cdot \vec{D} = \rho$

Question Number : 19 Question Id : 5942534929 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

Wave length (in nm) of an electron accelerated by 100 Volts potential is
(charge of electron = 1.6×10^{-19} C, mass = 9.1×10^{-31} Kg)

Note: For this question, discrepancy is found in question/answer. Full Marks is being awarded to all candidates.

Options :

1. 12

2. 122

3. 1225

4. 12250

Question Number : 20 Question Id : 5942534930 Question Type : MCQ Option Shuffling : Yes Is

Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum

Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

A particle is in the second excited state in a one dimensional box of length 1m . Its momentum (in Kg-m/s) is (h is plank's constant)

Options :

1. ✓ h

2. ✗ $1.5h$

3. ✗ $0.5h$

4. ✗ $2h$

Question Number : 21 Question Id : 5942534931 Question Type : MCQ Option Shuffling : Yes Is

Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum

Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

Uncertainty in energy (ΔE) of a stationary state is

Options :

1. ✓ $\Delta E = 0$

2. ✗ $\Delta E < 0$

3. ✗ $\Delta E > 0$

4. ✖ $\Delta E = \pm 1$

Question Number : 22 Question Id : 5942534932 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

Product of mass and time derivative of expectation value of momentum is equal to expectation value of force i.e., $\frac{d}{dt}\langle P \rangle = \langle F \rangle$, this is

Options :

1. ✔ Ehrenfest theorem

2. ✖ Unsold theorem

3. ✖ Evart theorem

4. ✖ Viral theorem

Question Number : 23 Question Id : 5942534933 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

Projection operator $|\varphi_i\rangle\langle\varphi_j|$ summed over complete basis is _____ operator.

Options :

1. ✖ Unit

2. ✖ Inverse

3. ✔ Identity

4. ✖ Conjugate

Question Number : 24 Question Id : 5942534934 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

Match the Eigen values of different angular momenta operators

- | | |
|------------------|---------------------|
| A) Spin S_z | i) $l(l+1)\hbar^2$ |
| B) Orbital L^2 | ii) $J(J+1)\hbar^2$ |
| C) Orbital L_z | iii) $m\hbar$ |
| D) Total J^2 | iv) $s\hbar$ |

Choose the correct answer.

Options :

1. ✖ A - i; B - iii; C - ii; D - iv

2. ✖ A - iii; B - i; C - iv; D - ii

3. ✔ A - iv; B - i; C - iii; D - ii

4. ✖ A - ii; B - iii; C - iv; D - i

Question Number : 25 Question Id : 5942534935 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

Match the following

- | | |
|---|---|
| A) Helmholtz free energy | i. $-kT \log Z$ |
| B) II law of thermodynamics | ii. Bose Einstein statistics |
| C) He^4 | iii. Entropy |
| D) $\left(\frac{\partial T}{\partial V}\right)_S$ | iv. $-\left(\frac{\partial P}{\partial S}\right)_V$ |

Choose the correct answer.

Options :

1. ✓ A - i; B - iii; C - ii; D - iv

2. ✗ A - iv; B - iii; C - ii; D - i

3. ✗ A - iii; B - iv; C - i; D - ii

4. ✗ A - i; B - ii; C - iv; D - iii

Question Number : 26 Question Id : 5942534936 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

Identify the property of entropy from the following

- A) Entropy remains constant in an adiabatic process
- B) Entropy remains constant in a cyclic process
- C) In a reversible process the entropy of the system becomes zero
- D) At absolute zero fluids are assumed to have zero entropy

Choose the correct answer.

Options :

1. ✖ A and C only
2. ✖ A and D only
3. ✔ A, C and D only
4. ✖ A, B and C only

Question Number : 27 Question Id : 5942534937 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

An ideal gas in a cylinder is compressed adiabatically to one third of its initial volume. During this process 20J work is done on the gas by compressing agent. Which of the following statement/s is/are true for this case?

- A) The internal energy decreases by 20J.
- B) Temperature of the gas decreases.
- C) The internal energy increases by 20J.
- D) The change in the internal energy in this process is zero.

Choose the correct answer.

Options :

1. ✔ A only

2. ✖ A and B only
3. ✖ A, B and D only
4. ✖ C only

Question Number : 28 Question Id : 5942534938 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

The black body at a temperature of 10000 K emits a radiation whose intensity spectrum peaks at 1000 nm. If the temperature is reduced to 500 K, the spectrum will peak at

Options :

1. ✔ 20 μm
2. ✖ 200 μm
3. ✖ 2000 nm
4. ✖ 20 nm

Question Number : 29 Question Id : 5942534939 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

In case of classical partition function in canonical distribution a single diatomic molecule possesses _____ rotational degrees of freedom

Options :

1. ✓ 2

2. ✗ 3

3. ✗ 1

4. ✗ 5

Question Number : 30 Question Id : 5942534940 Question Type : MCQ Option Shuffling : Yes Is

Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum

Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

In Gibb's paradox, two equal volumes of the same gas are at the same temperature and pressure and contains the same number of molecules then the total change in the entropy of the system

Options :

1. ✗ $2k \log_e 2$

2. ✗ 0

3. ✓ $2Nk \log_e 2$

4. ✖ $2N \log_2$

Question Number : 31 Question Id : 5942534941 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

The values of voltage (V_D) across a tunnel diode corresponding to peak and valley currents are V_p and V_v respectively. The range of tunnel diode voltage V_D for which the slope of I- V_D characteristics is negative would be

Options :

1. ✖ $V_D < 0$

2. ✖ $0 < V_D < V_p$

3. ✔ $V_p < V_D < V_v$

4. ✖ $V_D > V_v$

Question Number : 32 Question Id : 5942534942 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

If the A.C. input to a full-wave rectifier has a peak value of 40 V, the diode Peak Inverse Voltage is

Options :

1. ✖ 40 V

2. ✖ 20 V

3. ✔ 80 V

4. ✖ 10 V

Question Number : 33 Question Id : 5942534943 Question Type : MCQ Option Shuffling : Yes Is
Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum
Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

Low 3-dB frequency with feedback of a single stage RC coupled amplifier is

Options :

1. ✖ $f_L(1 + \beta A_0)$

2. ✔ $f_L / (1 + \beta A_0)$

3. ✖ $f_L / \beta A_0$

4. ✖ $f_H / \beta A_0$

Question Number : 34 Question Id : 5942534944 Question Type : MCQ Option Shuffling : Yes Is
Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum

Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

Which among the following semiconductor is a direct band gap semiconductor?

Options :

1. ✓ GaAs

2. ✗ GaP

3. ✗ AlSb

4. ✗ SiC

Question Number : 35 Question Id : 5942534945 Question Type : MCQ Option Shuffling : Yes Is

Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum

Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

The condition for sustained oscillations for an RC phase shift oscillator is

Options :

1. ✗ $h_{fe} = 59$

2. ✓ $h_{fe} = 23 + 29R/R_L + 4R_L/R$

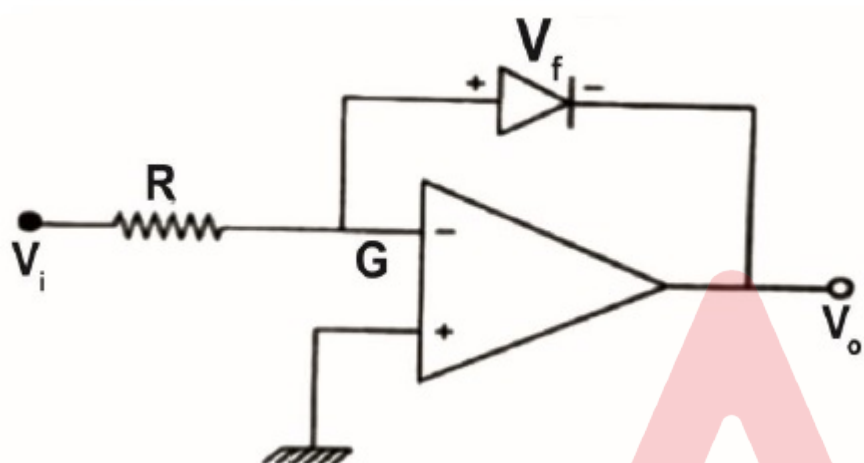
3. ✗ $h_{fe} = 23 + 29R/R_L$

4. ✗ $h_{fe} = 23 + 29R_L/R + 4R/R_L$

Question Number : 36 Question Id : 5942534946 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

The output of the following integrated circuit is



Options :

1. ✓ $-(\eta kT/e) \ln(v_i/I_s R)$
2. ✗ $(\eta kT/e) \ln(v_i/I_s R)$
3. ✗ $-(\eta kT/e) \text{ antilog}(v_i/I_s R)$
4. ✗ $(\eta kT/e) \text{ antilog}(v_i/I_s R)$

Question Number : 37 Question Id : 5942534947 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

To build a modulus-10 counter, the number of JK flip-flops required is

Options :

1. ✖ 3

2. ✔ 4

3. ✖ 5

4. ✖ 6

Question Number : 38 Question Id : 5942534948 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

Fine structure of hydrogen spectra can be explained by considering

Options :

1. ✖ relativistic effect

2. ✔ spin orbit interaction

3. ✖ spin-spin interaction

4. ✖ spin lattice interaction

Question Number : 39 Question Id : 5942534949 Question Type : MCQ Option Shuffling : Yes Is
Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum
Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

Anomalous Zeeman effect is observed in

Options :

1. ✓ weak magnetic fields
2. ✗ strong magnetic fields
3. ✗ weak electric fields
4. ✗ strong electric fields

Question Number : 40 Question Id : 5942534950 Question Type : MCQ Option Shuffling : Yes Is
Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum
Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

Visible region in optical absorption of a material is due to

Options :

1. ✗ atomic transitions
2. ✗ molecular transitions
3. ✓ electronic transitions

4. ✖ nuclear transitions

Question Number : 41 Question Id : 5942534951 Question Type : MCQ Option Shuffling : Yes Is
Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum
Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

IR Absorption is due to

Options :

1. ✔ vibrations of atoms in a molecule

2. ✖ transitions of electrons

3. ✖ rotation of atoms

4. ✖ dipole transitions

Question Number : 42 Question Id : 5942534952 Question Type : MCQ Option Shuffling : Yes Is
Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum
Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

As a result of isotope effect the spectral lines are

Options :

1. ✖ split

2. ✓ shifted

3. ✗ merged

4. ✗ disappear

Question Number : 43 Question Id : 5942534953 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

Proportional Splitting of spectral lines in presence of applied electric fields is known as

Options :

1. ✗ normal Zeeman effect

2. ✗ anomalous Zeeman effect

3. ✓ linear stark effect

4. ✗ non-linear stark effect

Question Number : 44 Question Id : 5942534954 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

The ground state of an atom in a $2S_{1/2}$ state. The difference in energy levels arising in presence of a weak magnetic field B (where μ_B is Bohr magneton) is

Options :

1. ✗ $\mu_B.B$

2. ✗ $3\mu_B.B$

3. ✗ $4\mu_B.B$

4. ✓ $2\mu_B.B$

Question Number : 45 Question Id : 5942534955 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

If K is the wave vector of incident x-ray and G be the reciprocal lattice vector, then the condition for Bragg's reflection is given by

Options :

1. ✗ $|K| = |G|$

2. ✓ $2K.G = G^2$

3. ✗ $K = G$

4.

✘ $K = |G|$

Question Number : 46 Question Id : 5942534956 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

Which of the following CANNOT be explained by considering a harmonic approximation to the lattice vibrations in the solids?

Options :

1. ✓ Thermal expansion

2. ✘ Debye's Law

3. ✘ Optical branches of the lattice

4. ✘ Dulong-Petit's law

Question Number : 47 Question Id : 5942534957 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

The heat capacity of superconducting state is proportional to

Options :

1. ✘ $k_B T$

2. ✖ $k_B T^3$

3. ✔ $e^{-\Delta/k_B T}$

4. ✖ $k_B T^2$

Question Number : 48 Question Id : 5942534958 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

The radiation of body centred atom is 'r', then the lattice parameter is

Note: For this question, discrepancy is found in question/answer. Full Marks is being awarded to all candidates.

Options :

1. $\frac{4r}{\sqrt{2}}$

2. $\frac{4r}{\sqrt{3}}$

3. $\frac{\sqrt{3}}{4r}$

4. $\frac{\sqrt{3}r}{2}$

Question Number : 49 Question Id : 5942534959 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

In the edge dislocation

Options :

1. ✗ The angle between Burgers vector and dislocation line has any value between 0° to π
2. ✓ Burger's vector is perpendicular to dislocation line and lies in the slip plane
3. ✗ The angle between Burger's vector and dislocation line is 45°
4. ✗ Burger's vector is parallel to the dislocation line

Question Number : 50 Question Id : 5942534960 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

The lattice parameters a, b and c of an orthorhombic crystal are related by $a = 2b = 3c$.
The separation between the (1 1 0) planes is

Options :

1. ✗ $\frac{a}{2}$

2. ✖ $\frac{a}{\sqrt{14}}$

3. ✖ $\frac{a}{\sqrt{3}}$

4. ✔ $\frac{a}{\sqrt{5}}$

Question Number : 51 Question Id : 5942534961 Question Type : MCQ Option Shuffling : Yes Is
Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum
Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

A superconducting lead has a critical temperature of 7.26 K at zero magnetic field and a critical field of 8×10^5 A/m at 0 K, then critical field at 5 K is

Options :

1. ✖ 4.2×10^{-5} A/m

2. ✖ 1.48×10^{-6} A/m

3. ✖ 4.2×10^6 A/m

4. ✔ 4.2×10^5 A/m

Question Number : 52 Question Id : 5942534962 Question Type : MCQ Option Shuffling : Yes Is

Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum

Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

According to liquid drop model, the nucleus

Options :

1. ✗ is similar to a liquid drop with electromagnetic fields
2. ✓ is a liquid drop with constant density
3. ✗ is similar to a liquid drop with viscous magnetic field
4. ✗ is similar to a liquid with high surface tension

Question Number : 53 Question Id : 5942534963 Question Type : MCQ Option Shuffling : Yes Is

Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum

Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

The set consisting of magic numbers only is

Note: For this question, discrepancy is found in question/answer. Full Marks is being awarded to all candidates.

Options :

1. 2, 8, 20, 50, 82, 126

2. 2, 8, 22, 28, 52, 80, 126
3. 2, 8, 20, 28, 52, 80, 126
4. 2, 8, 20, 52, 80, 126

Question Number : 54 Question Id : 5942534964 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

Read the following about Nuclear forces and identify the correct answer

- A) Very strong in nature
- B) Charge independent
- C) Long range forces
- D) Spin independent

Options :

1. ✖ A, B and C only
2. ✖ A, C and D Only
3. ✔ A and B Only
4. ✖ C and D Only

Question Number : 55 Question Id : 5942534965 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

Identify the properties of neutrino

- A) Neutrino has no charge
- B) Neutrino is integral spin particle
- C) Neutrino has extremely small mass
- D) Neutrino has its spin anti parallel to its momentum

Choose the correct answer.

Options :

1. ✗ A and D only
2. ✓ A, C and D only
3. ✗ A, B and C only
4. ✗ B and C only

Question Number : 56 Question Id : 5942534966 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

Nuclear fusion requires high temperature because

Options :

1. ✓ The particles cannot come closer unless they are moving rapidly

2. ✖ All nuclear reactions absorb heat
3. ✖ The binding energy must be supplied from an external source
4. ✖ The mass defect must be supplied

Question Number : 57 Question Id : 5942534967 Question Type : MCQ Option Shuffling : Yes Is
Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum
Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

Which of the following statement about Uranium is **INCORRECT**?

Options :

1. ✔ U^{235} is an unstable isotope and undergoes spontaneous fission
2. ✖ U^{235} breaks up into fragments when bombarded with neutrons
3. ✖ Fast neutrons trigger the fission process in U^{235}
4. ✖ U^{235} is fissionable by thermal neutrons

Question Number : 58 Question Id : 5942534968 Question Type : MCQ Option Shuffling : Yes Is
Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum
Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

The volume of the nucleus of an atom is proportional to the

Options :

1. ✖ Proton number
2. ✖ Electron number
3. ✖ Neutron number
4. ✔ Mass number

Question Number : 59 Question Id : 5942534969 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

Laplace equation is a _____ equation

Options :

1. ✖ Hyperbolic
2. ✖ Parabolic
3. ✔ Elliptic
4. ✖ Linear

Question Number : 60 Question Id : 5942534970 Question Type : MCQ Option Shuffling : Yes Is
Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum
Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

Newton Raphson method is used for finding square root of 8. After two iterations the
root is found to be

Options :

1. ✖ 2
2. ✖ 2.5
3. ✔ 2.85
4. ✖ 3

Question Number : 61 Question Id : 5942534971 Question Type : MCQ Option Shuffling : Yes Is
Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum
Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

Newton's forward interpolation formula is used for _____ intervals

Options :

1. ✖ open
2. ✖ unequal
3. ✖ closed

4. ✓ equal

Question Number : 62 Question Id : 5942534972 Question Type : MCQ Option Shuffling : Yes Is
Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum
Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

For given data $\Delta^2 y_0$ is

X	20	25	30	35
Y	12	15	20	25

Options :

1. ✗ 0

2. ✗ -1

3. ✓ -2

4. ✗ 5

Question Number : 63 Question Id : 5942534973 Question Type : MCQ Option Shuffling : Yes Is
Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum
Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

Fourth order Runge-Kutta method gives y_{n+1} values as
(the terms used have their usual meaning)

Options :

1. ✓ $y_{i+1} = y_i + h(k_1 + 2k_2 + 2k_3 + k_4)/6$
2. ✗ $y_{i+1} = y_i + h(k_1 + k_2)/2$
3. ✗ $y_{i+1} = y_i + h(k_1 - 2k_2 - 2k_3 + k_4)/6$
4. ✗ $y_{i+1} = y_i + h(k_1 + k_2 + k_3 + k_4)/4$

Question Number : 64 Question Id : 5942534974 Question Type : MCQ Option Shuffling : Yes Is
Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum
Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

Let $G = \{-1, 1, i, -i\}$ where $I = \sqrt{-1}$ be a group, then the order of the element i is

Options :

1. ✗ 0
2. ✗ 1
3. ✗ 2
4. ✓ 4

Question Number : 65 Question Id : 5942534975 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

The solution of the Hamilton-Jacobi equation is

Options :

1. ✖ Hamilton principle function is the generating function of a canonical transformation to canonical variables that are all constants.
2. ✖ The time dependent quantum mechanical wave function.
3. ✔ Hamilton's principle function which is the generating function of a canonical transformation to canonical variables that are all canonical momenta.
4. ✖ Hamilton's principle function which is the generating function of a canonical variables that are all not constants.

Question Number : 66 Question Id : 5942534976 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

Identify the expression representing Poisson bracket $[F, G]$

Options :

1. ✔ $\sum_i \left(\frac{\partial F}{\partial q_i} \cdot \frac{\partial G}{\partial p_i} - \frac{\partial F}{\partial p_i} \cdot \frac{\partial G}{\partial q_i} \right)$
2. ✖

$$\sum_i \left(\frac{\partial F}{\partial q_i} \cdot \frac{\partial G}{\partial p_i} + \frac{\partial F}{\partial p_i} \cdot \frac{\partial G}{\partial q_i} \right)$$

3. ✖
$$\sum_i \left(\frac{\partial G}{\partial q_i} \cdot \frac{\partial F}{\partial p_i} - \frac{\partial G}{\partial p_i} \cdot \frac{\partial F}{\partial q_i} \right)$$

4. ✖
$$\sum_i \left(\frac{\partial G}{\partial q_i} \cdot \frac{\partial F}{\partial p_i} + \frac{\partial G}{\partial p_i} \cdot \frac{\partial F}{\partial q_i} \right)$$

Question Number : 67 Question Id : 5942534977 Question Type : MCQ Option Shuffling : Yes Is
Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum
Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

Jacobi identity for Poisson bracket is

Options :

1. ✖
$$[X, [Y, H]] - [Y, [H, X]] - [H, [X, Y]] = 0$$

2. ✖
$$[X, [Y, H]] + [Y, [H, X]] - [H, [X, Y]] = 0$$

3. ✖
$$[X, [Y, H]] - [Y, [H, X]] + [H, [X, Y]] = 0$$

4. ✔
$$[X, [Y, H]] + [Y, [H, X]] + [H, [X, Y]] = 0$$

Question Number : 68 Question Id : 5942534978 Question Type : MCQ Option Shuffling : Yes Is
Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum

Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

The Jacobi's form of the least action principle is

Options :

1. ✓
$$\Delta \int_{t_1}^{t_2} \sqrt{2m(H - V)} ds = 0$$

2. ✗
$$\Delta \int_{t_1}^{t_2} \sqrt{2m(H + V)} ds = 0$$

3. ✗
$$\Delta \int_{t_1}^{t_2} \sqrt{2m(L - V)} ds = 0$$

4. ✗
$$\Delta \int_{t_1}^{t_2} \sqrt{2m(L + V)} ds = 0$$

Question Number : 69 Question Id : 5942534979 Question Type : MCQ Option Shuffling : Yes Is

Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum

Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

The value of the Poisson bracket $[\vec{x} \cdot \vec{r}, \vec{y} \cdot \vec{p}]$ where $\vec{x}$ and $\vec{p}$ are constant vectors, is

Options :

1. ✗ $\vec{x} - \vec{y}$

2.

✗ $\vec{x} \cdot \vec{y}$

3. ✓ $\vec{x} \vec{y}$

4. ✗ $\vec{x} + \vec{y}$

Question Number : 70 Question Id : 5942534980 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

For the given generating function $F = \frac{1}{2} \sqrt{km} q^2 \cot Q$ then p and q in terms of (P, Q) is given by

Options :

1. ✗ $p = \sqrt{2P\sqrt{km}} \sin Q, q = \sqrt{\frac{2P}{\sqrt{km}}} \cos Q$

2. ✓ $p = \sqrt{2P\sqrt{km}} \cos Q, q = \sqrt{\frac{2P}{\sqrt{km}}} \cos Q$

3. ✗ $p = \sqrt{2kmP} \cos Q, q = \sqrt{2Qkm} \sin P$

4. ✗ $p = \sqrt{2kmP} \cos Q, q = \sqrt{2Pkm} \sin Q$

Question Number : 71 Question Id : 5942534981 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum

Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

In homogenous wave equation for scalar and vector potentials
($\square^2$ =de Alembertian operator, ∇^2 = Laplacian operator)

Options :

1. ✓ $\square^2\psi = 0$

2. ✗ $\nabla^2\psi=0$

3. ✗ $\nabla^2\psi + d\psi/dt = 0$

4. ✗ $\square^2\psi = \nabla^2\psi$

Question Number : 72 Question Id : 5942534982 Question Type : MCQ Option Shuffling : Yes Is

Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum

Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

In dilute plasma, the skin depth at low frequencies is equal to (ω_p = plasma frequency)

Options :

1. ✗ ω_p/c

2. ✓ c/ω_p

3. ✗ $\frac{c}{\sqrt{\omega - \omega_p}}$

4. ✖ $\frac{C}{\sqrt{\omega + \omega_p}}$

Question Number : 73 Question Id : 5942534983 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

The loss less wave guide characteristic impedance is given by

Options :

1. ✔ $\sqrt{\frac{L}{C}}$

2. ✖ $\sqrt{\frac{C}{L}}$

3. ✖ $\sqrt{\frac{\omega L}{C}}$

4. ✖ $\sqrt{\frac{CL}{\omega}}$

Question Number : 74 Question Id : 5942534984 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

Which of the following is Lorenz gauge condition?
(A vector potential, V scalar potential, J current density)

Options :

1. ✗ $\nabla^2 A = 0$
2. ✗ $\nabla A = 0$
3. ✓ $\nabla A = -\frac{1}{c^2} \frac{\partial V}{\partial t}$
4. ✗ $\nabla^2 A = \mu J$

Question Number : 75 Question Id : 5942534985 Question Type : MCQ Option Shuffling : Yes Is
Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum
Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

A plane electromagnetic wave propagating in a lossless dielectric media has electric
field $E(x, y, z, t) = E_0(x) \exp\{ik_0(-ict + x + \sqrt{3}z)\}$

(Here c = velocity of light in free space, E_0 , k_0 constants and x and z are unit vectors
along x and z directions). The relative dielectric constant of the media is

Options :

1. ✓ 4
2. ✗ 2
3. ✗ 1

4. ✖ 9

Question Number : 76 Question Id : 5942534986 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

The magnetic field of the TE_{11} mode of a rectangular wave guide of dimensions $a \times b$ is $H_z = H_0 \cos(0.2\pi x) \cos(0.3\pi y)$. The dimensions of wave guide (in cm) are

Options :

1. ✖ 3.33, 2.5

2. ✖ 0.4, 0.3

3. ✖ 0.3, 0.2

4. ✔ 5, 3.33

Question Number : 77 Question Id : 5942534987 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

A particle in a central potential has $l = 2\hbar$ and $s = \hbar$. The maximum degeneracy associated with spin-orbit interaction is

Options :

1. ✖ 3

2. ✖ 5

3. ✔ 7

4. ✖ 9

Question Number : 78 Question Id : 5942534988 Question Type : MCQ Option Shuffling : Yes Is
Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum
Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

A constant perturbation $H' = a$ is used for one dimensional oscillator of potential
 $V(x) = \frac{1}{2}m\omega^2 x^2$. The I order ground state energy is
(given that the wave function is $\varphi(x) = \sin \pi x$)

Options :

1. ✔ $a\pi$

2. ✖ a/π

3. ✖ π/a

4. ✖ $A\pi/4$

Question Number : 79 Question Id : 5942534989 Question Type : MCQ Option Shuffling : Yes Is
Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum
Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

Energy of a relativistic particle of mass m is given by
(p = momentum, c - velocity of light)

Options :

1. ✗ p^2c^2

2. ✗ mc^2

3. ✓ $\sqrt{p^2c^2 + m^2c^4}$

4. ✗ $\sqrt{p^2c^2 - m^2c^4}$

Question Number : 80 Question Id : 5942534990 Question Type : MCQ Option Shuffling : Yes Is

Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum

Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

The Klein-Gordon equation of relativistic quantum mechanics is

Options :

1. ✓ $\left(\frac{1}{c^2} \frac{\partial^2}{\partial t^2} - \nabla^2\right) \psi + \frac{m^2c^2}{\hbar^2} \psi = 0$

2. ✗ $\left(\frac{1}{c^2} \frac{\partial^2}{\partial t^2} - \nabla^2\right) \psi = 0$

3. ✖ $\left(\frac{1}{c^2} \frac{\partial^2}{\partial t^2} + \nabla^2\right) \psi + \frac{m^2 c^2}{\hbar^2} \psi = 0$

4. ✖ $\left(\frac{1}{c^2} \frac{\partial^2}{\partial t^2} - \nabla^2\right) \psi + \frac{mc}{\hbar^2} \psi = 0$

Question Number : 81 Question Id : 5942534991 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

Dirac equation of relativistic quantum mechanics uses the following Hamiltonian

Options :

1. ✖ $\sqrt{p^2 c^2 + m^2 c^4}$

2. ✔ $c\alpha p + \beta mc^2$

3. ✖ $pc + mc^2$

4. ✖ $c\alpha p - \beta mc$

Question Number : 82 Question Id : 5942534992 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

The commutator $[\sigma_x, \sigma_y]$, where σ are pauli matrices is

Options :

1. ✓ $2i\sigma_z$

2. ✗ σ_z

3. ✗ 0

4. ✗ $2\sigma_x$

Question Number : 83 Question Id : 5942534993 Question Type : MCQ Option Shuffling : Yes Is

Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum

Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

The first derivative of Gibb's function with respect to temperature and pressure is continuous at transition point is

- A) Second order phase transition
- B) First order phase transition
- C) Gibb's function remains constant in both phases

Choose the correct answer

Options :

1. ✓ A only

2. ✗ B only

3. ✗ C only

4. ✗ B and C only

Question Number : 84 Question Id : 5942534994 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

Choose the correct statement

Options :

1. ✖ All Ferro-magnets are paramagnetic at zero Kelvin.
2. ✔ The spontaneous magnetization disappears above Curie temperature for a Ferromagnetic material.
3. ✖ In Ferromagnetic materials at Curie temperature the spontaneous magnetization attains a constant value.
4. ✖ Palladium is the example for Ferromagnetic substance.

Question Number : 85 Question Id : 5942534995 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

Consider a random walk in one dimension, a drunken person takes 'N' steps of equal length 'l', let $P(m, N)$ be the probability that he is at a point 'm' steps away after N steps, then the number of distinct sequences that reach 'm' is

Options :

1. ✖
$$W(m) = \frac{1}{\frac{1}{2}(N+m)! \frac{1}{2}(N-m)!}$$

2. ✖
$$W(m) = \frac{1}{\frac{1}{2}(N+m-1)! \frac{1}{2}(N-m+1)!}$$

3. ✔
$$W(m) = \frac{N!}{\frac{1}{2}(N+m)! \frac{1}{2}(N-m)!}$$

4. ✖
$$W(m) = \frac{N!}{\frac{1}{2}N! \frac{1}{2}m!}$$

Question Number : 86 Question Id : 5942534996 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

Diffusion of gases is mainly due to

Options :

1. ✔ a concentration gradient of molecules

2. ✖ pressure difference

3. ✖ Newton's law of cooling

4. ✖ Joule Kelvin effect

Question Number : 87 Question Id : 5942534997 Question Type : MCQ Option Shuffling : Yes Is
Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum
Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

According to classical Langevin's theory the expression for diamagnetic susceptibility
is

Options :

1. ✓ $-\frac{\mu_0 Z e^2 N}{6m} \cdot \bar{r}^2$

2. ✗ $\frac{\mu_0 Z e^2}{6m} \cdot \bar{r}^2$

3. ✗ $-\frac{\mu_0 Z e^2 N}{m} \cdot \bar{r}^2$

4. ✗ $-\frac{\mu_0 Z e N}{6m} \cdot \bar{r}^2$

Question Number : 88 Question Id : 5942534998 Question Type : MCQ Option Shuffling : Yes Is
Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum
Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

The diffusion coefficient of electrons in silicon at 300 K is ($\mu_e=0.19 \text{ m}^2/\text{Vs}$)

Options :

1. ✗ $0.045 \text{ m}^2/\text{Vs}$

2. ✓

0.0045 m²/Vs

3. ✗ 0.45 m²/Vs

4. ✗ 0.00045 m²/Vs

Question Number : 89 Question Id : 5942534999 Question Type : MCQ Option Shuffling : Yes Is

Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum

Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

Which of the following option is appropriate for the TGA and DTA?

Options :

1. ✗ TGA and DTA measures only weight

2. ✓ TGA measures only weight while DTA measures other effects

3. ✗ TGA and DTA measures only temperature

4. ✗ TGA measures only temperature while DTA measures other effects

Question Number : 90 Question Id : 5942535000 Question Type : MCQ Option Shuffling : Yes Is

Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum

Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

Which of the following statement is true for the optical grating?

Options :

1. ✖ It gives 1 dimensional analogue of the 2 dimensional process
2. ✖ It gives 2 dimensional analogue of the 3 dimensional process
3. ✖ It gives 3 dimensional analogue of the 1 dimensional process
4. ✔ It gives 1 dimensional analogue of the 3 dimensional process

Question Number : 91 Question Id : 5942535001 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

In electron microscopy which of the following is NOT used for electron gun?

Options :

1. ✖ W wire
2. ✖ LaB₆ crystal
3. ✖ W single crystal
4. ✔ KrF

Question Number : 92 Question Id : 5942535002 Question Type : MCQ Option Shuffling : Yes Is
Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum
Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

NMR can be explained using

Options :

1. ✗ Newton's equations
2. ✓ Bloch's equations
3. ✗ Deslander's table
4. ✗ Briett's Scheme

Question Number : 93 Question Id : 5942535003 Question Type : MCQ Option Shuffling : Yes Is
Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum
Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

In NMR, the _____ absorb(s) a _____ photon.

Options :

1. ✗ inner shell electrons, UV
2. ✗ inner shell electrons, radio frequency
3. ✗ precessing nucleus, UV

4. ✓ precessing nucleus, radio frequency

Question Number : 94 Question Id : 5942535004 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

The nuclear relaxation characterized by T_1 relaxation is NOT

Options :

1. ✗ spin-lattice relaxation
2. ✗ longitudinal relaxation
3. ✓ spin-spin relaxation
4. ✗ relaxation along the z axis

Question Number : 95 Question Id : 5942535005 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

Which of the following particle is a Fermion?

Options :

1. ✗ α particle

2. ✓ ${}^4\text{Be}^7$ nucleus

3. ✗ Hydrogen atom

4. ✗ Deuteron

Question Number : 96 Question Id : 5942535006 Question Type : MCQ Option Shuffling : Yes Is
Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum
Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

Match the following associated interactions

- | | |
|--|---------------------|
| A) $\pi^+ \rightarrow \mu^+ + \nu_\mu$ | i) strong |
| B) $\pi^0 \rightarrow \gamma + \gamma$ | ii) electromagnetic |
| C) $\pi^0 + n \rightarrow \pi^- + p$ | iii) weak |

Choose the correct answer.

Options :

1. ✓ A - iii; B - ii; C - i

2. ✗ A - i; B - ii; C - iii

3. ✗ A - ii; B - i; C - iii

4. ✗ A - iii; B - i; C - ii

Question Number : 97 Question Id : 5942535007 Question Type : MCQ Option Shuffling : Yes Is

Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum

Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

The charm quark S is having charm quantum number $C=1$. Gellmann-Nishijima formula for electric charge is

Options :

1. ✖ $I_3 + (1/2)(B - S - C)$

2. ✖ $I_3 + (1/2)(B - S + C)$

3. ✖ $I_3 + (1/2)(B + S - C)$

4. ✔ $I_3 + (1/2)(B + S + C)$

Question Number : 98 Question Id : 5942535008 Question Type : MCQ Option Shuffling : Yes Is

Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum

Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

A particle which is a composite state of three quarks u , d and s has electric charge, spin and strangeness respectively, equals to

Options :

1. ✔ $0, \frac{1}{2}, -1$

2. ✖ $0, 0, 1$

3. ✖ $1, \frac{1}{2}, -1$

4. ✗ $-1, -\frac{1}{2}, 1$

Question Number : 99 Question Id : 5942535009 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

An electron incident on a glass block of refractive index 1.5 emits Cerenkov radiation at an angle of 45° to its direction of motion. The speed of the electron is in (c = velocity of light)

Options :

1. ✗ $0.85 c$

2. ✓ $0.943 c$

3. ✗ c

4. ✗ $1.512 c$

Question Number : 100 Question Id : 5942535010 Question Type : MCQ Option Shuffling : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 1 Wrong Marks : 0.25

The number of Cerenkov photons produced by a particle travelling at $\beta = 0.95$ in water ($n = 1.33$) in the response range ($3500\text{--}5500 \text{ \AA}$) per unit path length (cm) is

Options :

1. ✖ 78

2. ✖ 128

3. ✖ 158

4. ✔ 178

