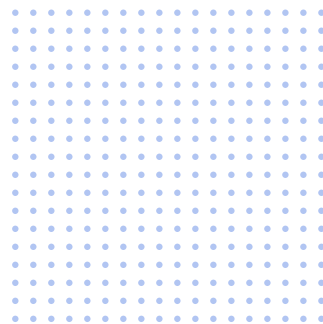




FOR JNU EE EXAM PREPARATION

JNU EE 2022 Question Paper · Ph.D Nanoscience - Physical Sciences

EXAM

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YEAR

2022

TYPE

Question Paper

SUBJECT

Ph.D Nanoscience - Physical Sciences



राष्ट्रीय परीक्षा एजेंसी
National Testing Agency
Excellence in Assessment

Test Date : 09 Dec 2022

Test Slot : Slot 2

Subject : PBPS-Nanoscience Physical Sciences

Sl. No.1

QBID:1042101

. Unit of Young's modulus is

1. Nm^2
2. Nm^{-2}
3. Nm
4. Nm^{-1}

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=14401]

2[Option ID=14402]

3[Option ID=14403]

4[Option ID=14404]

Sl. No.2

QBID:1042102

Unit of Shear Modulus is

1. Nm^2
2. Nm
3. Nm^{-2}
4. Nm^{-1}

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=14405]

2[Option ID=14406]

3[Option ID=14407]

4[Option ID=14408]

Sl. No.3

QBID:1042103

In an isothermal expansion of an ideal gas

1. Heat supplied to the gas is equal to the work done by the gas
2. Heat supplied to the gas is more than the work done by the gas
3. Heat supplied to the gas is less than the work done by the gas
4. Heat supplied to the gas can be greater than or less than the work done by the gas

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=14409]

2[Option ID=14410]

3[Option ID=14411]

4[Option ID=14412]

Sl. No.4

QBID:1042104

Which of the following is an intensive variable

1. ΔQ , Heat supplied to the system by the surrounding
2. ΔV , Change in volume of the system
3. P , Pressure
4. $P\Delta V$

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=14413]

2[Option ID=14414]

3[Option ID=14415]

4[Option ID=14416]

Sl. No.5

QBID:1042105

The potential energy of the molecules of ideal gas is-

1. Equal to their kinetic energy
2. Equal to the internal energy
3. Equal to the external work
4. Zero

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=14417]

2[Option ID=14418]

3[Option ID=14419]
4[Option ID=14420]

Sl. No.6
QBID:1042106

The total energy of the molecules of ideal gas is-

1. Equal to their kinetic energy
2. Equal to the internal energy
3. Equal to the external work
4. Zero

- (1) 1
(2) 2
(3) 3
(4) 4

1[Option ID=14421]
2[Option ID=14422]
3[Option ID=14423]
4[Option ID=14424]

Sl. No.7
QBID:1042107

In a cyclic process,

1. Work done is zero
2. Work done by the system is equal to the net quantity of heat given to the system
3. Work done is independent of the net quantity of heat given to the system
4. The internal energy of the system increases

- (1) 1
(2) 2
(3) 3
(4) 4

1[Option ID=14425]
2[Option ID=14426]
3[Option ID=14427]
4[Option ID=14428]

Sl. No.8
QBID:1042108

The efficiency of carnot heat engine operating between heat reservoirs at temperatures 327°C and 27°C is,

1. 25 %
2. 75 %
3. 50 %
4. 100 %

- (1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=14429]

2[Option ID=14430]

3[Option ID=14431]

4[Option ID=14432]

Sl. No.9**QBID:1042109**

Kinetic energy of atoms of an ideal gas,

1. Depends on the temperature of the gas
2. Is independent of the temperature of the gas
3. Depends on the volume occupied by the gas at standard temperature and pressure
4. Depends on the materials used to make the container of the gas

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=14433]

2[Option ID=14434]

3[Option ID=14435]

4[Option ID=14436]

Sl. No.10**QBID:1042110**

What is the flux through a square of 4m^2 area parallel to the xz plane due to uniform electric field of 50 N/C along x axis and 10 N/C along z axis.

1. $240\text{ Nm}^2\text{C}^{-1}$
2. $0\text{ Nm}^2\text{C}^{-1}$
3. $40\text{ Nm}^2\text{C}^{-1}$
4. $200\text{ Nm}^2\text{C}^{-1}$

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=14437]

2[Option ID=14438]

3[Option ID=14439]

4[Option ID=14440]

Sl. No.11**QBID:1042111**

What is the net flux due to a uniform electric field of 10 N/C along x axis through a cube of side 2 m oriented so that its faces are parallel to the coordinate planes.

1. $10 \text{ Nm}^2 \text{ C}^{-1}$
2. $20 \text{ Nm}^2 \text{ C}^{-1}$
3. $0 \text{ Nm}^2 \text{ C}^{-1}$
4. $40 \text{ Nm}^2 \text{ C}^{-1}$

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=14441]

2[Option ID=14442]

3[Option ID=14443]

4[Option ID=14444]

Sl. No.12

QBID:1042112

Electric potential due to an electric dipole moment centered at origin at large distances (r) varies as,

1. $1/r$
2. $1/r^2$
3. $1/r^3$
4. r

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=14445]

2[Option ID=14446]

3[Option ID=14447]

4[Option ID=14448]

Sl. No.13

QBID:1042113

A point charge $+10 \mu\text{C}$ is at the center of a cube with edge of 0.1 m. What is the magnitude of the electric flux through the four vertical faces of the cube. ($\epsilon_0 = 8.854 \times 10^{-12} \text{ N}^{-1} \text{ m}^2 \text{ C}^{-2}$)

1. $7.53 \times 10^5 \text{ Nm}^2 \text{ C}^{-1}$
2. $1.13 \times 10^6 \text{ Nm}^2 \text{ C}^{-1}$
3. $1.88 \times 10^5 \text{ Nm}^2 \text{ C}^{-1}$
4. $0 \text{ Nm}^2 \text{ C}^{-1}$

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=14449]

2[Option ID=14450]

3[Option ID=14451]

4[Option ID=14452]

Sl. No.14**QBID:1042114**

A point charge $+10 \mu\text{C}$ is at the center of a cube with edge of 0.1 m . What is the magnitude of the electric flux through the bottom and top faces of the cube.

$$(\epsilon_0 = 8.854 \times 10^{-12} \text{ N}^{-1}\text{m}^2\text{C}^{-2})$$

1. $7.53 \times 10^5 \text{ Nm}^2\text{C}^{-1}$

2. $1.13 \times 10^6 \text{ Nm}^2\text{C}^{-1}$

3. $1.88 \times 10^5 \text{ Nm}^2\text{C}^{-1}$

4. $3.76 \times 10^5 \text{ Nm}^2\text{C}^{-1}$

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=14453]

2[Option ID=14454]

3[Option ID=14455]

4[Option ID=14456]

Sl. No.15**QBID:1042115**

Magnitude of electric field due to two identically charged infinite plane sheets with a uniform surface charge density σ , at a position between the sheets is

1. $\sigma/(2\epsilon_0)$,

2. σ/ϵ_0

3. 0

4. $2\sigma/\epsilon_0$

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=14457]

2[Option ID=14458]

3[Option ID=14459]

4[Option ID=14460]

Sl. No.16**QBID:1042116**

If the radius of the circular current loop is doubled, the magnetic moment is

1. quadrapled
2. doubled
3. unchanged
4. halved

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=14461]

2[Option ID=14462]

3[Option ID=14463]

4[Option ID=14464]

Sl. No.17

QBID:1042117

If the current flowing through a wire of a circular current loop is doubled, the magnetic moment is

1. quadrapled
2. doubled
3. unchanged
4. halved

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=14465]

2[Option ID=14466]

3[Option ID=14467]

4[Option ID=14468]

Sl. No.18

QBID:1042118

Electromagnetic waves are produced by

1. a static charge
2. a moving charge
3. an accelerating charge
4. chargeless particle

(1) 1

(2) 2

(3) 3

(4) 4

- 1[Option ID=14469]
 2[Option ID=14470]
 3[Option ID=14471]
 4[Option ID=14472]

Sl. No.19
QBID:1042119

If the current flowing through a small infinitesimal wire of length dl placed at the origin is doubled, the Magnetic field at position r is

1. quadrapled
2. halved
3. unchanged
4. doubled

- (1) 1
 (2) 2
 (3) 3
 (4) 4

- 1[Option ID=14473]
 2[Option ID=14474]
 3[Option ID=14475]
 4[Option ID=14476]

Sl. No.20
QBID:1042120

Consider a hollow tube carrying a current along its length, distributed uniformly over its cross section. The magnitude of the magnetic field

1. is zero inside the hollow tube
2. is zero just outside the hollow tube
3. increases linearly as one goes away from axis
4. is constant outside the tube

- (1) 1
 (2) 2
 (3) 3
 (4) 4

- 1[Option ID=14477]
 2[Option ID=14478]
 3[Option ID=14479]
 4[Option ID=14480]

Sl. No.21
QBID:1042121

The effective number of lattice points in the unit cell of end-centred monoclinic lattice is

1. 1
2. 2
3. 3
4. 4

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=14481]

2[Option ID=14482]

3[Option ID=14483]

4[Option ID=14484]

Sl. No.22

QBID:1042122

Which of the following crystal structure has least atomic packing factor?

1. Simple cubic
2. Body centred cubic
3. Face centred cubic
4. Hexagonal close packed

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=14485]

2[Option ID=14486]

3[Option ID=14487]

4[Option ID=14488]

Sl. No.23

QBID:1042123

A plane cuts intercepts $2a$, $3b$ and c along the crystallographic axes in a crystal. The

Miller indices of plane are

1. (231)
2. (632)
3. (326)
4. (111)

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=14489]
 2[Option ID=14490]
 3[Option ID=14491]
 4[Option ID=14492]

Sl. No.24
QBID:1042124

. If the misorientation angle (in radians) of a low angle boundary formed by an array of edge dislocations with Burgers vector b , is halved, then the spacing between the dislocations is

1. quadrapled
2. halved
3. unchanged
4. doubled

- (1) 1
 (2) 2
 (3) 3
 (4) 4

1[Option ID=14493]
 2[Option ID=14494]
 3[Option ID=14495]
 4[Option ID=14496]

Sl. No.25
QBID:1042125

. If r is the interionic distance in KCl structure, the lattice parameter is :

1. $2r$
2. r
3. $r/2$
4. $4r$

- (1) 1
 (2) 2
 (3) 3
 (4) 4

1[Option ID=14497]
 2[Option ID=14498]
 3[Option ID=14499]
 4[Option ID=14500]

Sl. No.26
QBID:1042126

Which of the following reflections are absent in the x-ray diffraction pattern of bcc crystal:

1. (2, 0, 0)
2. (2, 2, 0)
3. (1, 1, 1)
4. (2, 1, 1)

- (1) 1
(2) 2
(3) 3
(4) 4

1[Option ID=14501]

2[Option ID=14502]

3[Option ID=14503]

4[Option ID=14504]

Sl. No.27

QBID:1042127

A vector in reciprocal space is

1. Perpendicular to the corresponding plane in real space
2. Perpendicular to the corresponding plane in reciprocal space
3. Perpendicular to the corresponding vector in real space
4. Parallel to the corresponding vector in real space

- (1) 1
(2) 2
(3) 3
(4) 4

1[Option ID=14505]

2[Option ID=14506]

3[Option ID=14507]

4[Option ID=14508]

Sl. No.28

QBID:1042128

Diamond structure may be viewed as

1. two fcc structures displaced from each other by one quarter of body diagonal
2. two fcc structures displaced from each other by one half of body diagonal
3. two bcc structures displaced from each other by one quarter of body diagonal
4. two bcc structures displaced from each other by one half of body diagonal

- (1) 1
(2) 2
(3) 3
(4) 4

1[Option ID=14509]

2[Option ID=14510]

3[Option ID=14511]
4[Option ID=14512]

Sl. No.29

QBID:1042129

At temperatures much below the Fermi temperature, electronic specific heat of metals is

1. inversely proportional to temperature
2. proportional to temperature
3. inversely proportional to square of temperature
4. proportional to square of temperature

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=14513]

2[Option ID=14514]

3[Option ID=14515]

4[Option ID=14516]

Sl. No.30

QBID:1042130

The magnetic susceptibility of a diamagnetic material is

1. Small and positive
2. Large and positive
3. Small and negative
4. Large and negative

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=14517]

2[Option ID=14518]

3[Option ID=14519]

4[Option ID=14520]

Sl. No.31

QBID:1042131

Thermal expansion of materials arises from

1. asymmetry of potential energy curve
2. strong bonds
3. weak bonds
4. thermal vibrations

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=14521]

2[Option ID=14522]
 3[Option ID=14523]
 4[Option ID=14524]

Sl. No.32
 QBID:1042132

. Dielectric constant of a material,

1. depends on Temperature only
2. depends on frequency of the alternating field applied only
3. depends on temperature and frequency of the alternating field applied
4. is independent of temperature and frequency of the alternating field applied

- (1) 1
 (2) 2
 (3) 3
 (4) 4

1[Option ID=14525]
 2[Option ID=14526]
 3[Option ID=14527]
 4[Option ID=14528]

Sl. No.33
 QBID:1042133

On application of an electric field of frequency 50 Hz, which of the following polarization processes will be present?

1. electronic, ionic, orientation and space-charge
2. electronic, ionic and orientation only
3. electronic and ionic only
4. electronic only

- (1) 1
 (2) 2
 (3) 3
 (4) 4

1[Option ID=14529]
 2[Option ID=14530]
 3[Option ID=14531]
 4[Option ID=14532]

Sl. No.34
 QBID:1042134

The unit of magnetic permeability is

1. Wb m^{-2}
2. $\text{Wb A}^{-1} \text{m}^{-1}$
3. A m^{-1}
4. A m^{-2}

- (1) 1
 (2) 2
 (3) 3

(4) 4

1[Option ID=14533]
 2[Option ID=14534]
 3[Option ID=14535]
 4[Option ID=14536]

Sl. No.35

QBID:1042135

Which of the following phenomenon tells about the transverse nature of light waves?

1. interference
2. diffraction
3. polarization
4. photoelectric effect

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=14537]
 2[Option ID=14538]
 3[Option ID=14539]
 4[Option ID=14540]

Sl. No.36

QBID:1042136

The majority charge carriers in n-type Si are

1. electrons
2. ions
3. holes
4. conduction holes

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=14541]
 2[Option ID=14542]
 3[Option ID=14543]
 4[Option ID=14544]

Sl. No.37

QBID:1042137

The grown single crystal generally contains

1. tilt boundaries
2. twin boundaries
3. grain boundaries
4. dislocation loops due to vacancy condensation

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=14545]
 2[Option ID=14546]
 3[Option ID=14547]
 4[Option ID=14548]

Sl. No.38

QBID:1042138

Quantum mechanical behavior is prominent when

1. Size scale of objects involved is huge
2. Size scale of objects is in the "visible to unaided eye" regime
3. The objects are hidden from view
4. Size scale of the objects is in the subatomic particle range

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=14549]
 2[Option ID=14550]
 3[Option ID=14551]
 4[Option ID=14552]

Sl. No.39

QBID:1042139

The entire information of a system can be gathered with the help of

1. eigen value
2. wave function
3. momentum operator
4. position

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=14553]
 2[Option ID=14554]
 3[Option ID=14555]
 4[Option ID=14556]

Sl. No.40

QBID:1042140

Potential energy term used in the time independent Schrodinger equation of the hydrogen atom has the following dependence on r , (r is the distance between proton and electron of the hydrogen atom)

1. $1/r$
2. r
3. r^2
4. $1/r^2$

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=14557]

2[Option ID=14558]

3[Option ID=14559]

4[Option ID=14560]

Sl. No.41

QBID:1042141

Ground state energy of the harmonic oscillator is

1. $\hbar\omega/(4\pi)$ 2. $\hbar\omega/(2\pi)$

3. 0

4. $\hbar\omega$

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=14561]

2[Option ID=14562]

3[Option ID=14563]

4[Option ID=14564]

Sl. No.42

QBID:1042142

If the mass of the tunneling particles is quadrupled and width of the tunneling barrier is halved, transmission probability is

1. doubled

2. quadrupled

3. not changed

4. halved

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=14565]

2[Option ID=14566]

3[Option ID=14567]

4[Option ID=14568]

Sl. No.43

QBID:1042143

An eigenfunction of the operator d^2/dx^2 is $\psi=e^{3x}$. Find the corresponding eigenvalue of the operator.

1. 3

2. 9

3. 0

4. 6

- (1) 1
(2) 2
(3) 3
(4) 4

1[Option ID=14569]
2[Option ID=14570]
3[Option ID=14571]
4[Option ID=14572]

Sl. No.44
QBID:1042144

The average period that elapses between the excitation of an atom and the time it radiates is 10 ns. The inherent quantum mechanical uncertainty in the frequency of the emitted photon is

1. ≥ 8 MHz
2. ≥ 4 MHz
3. ≥ 2 MHz
4. ≥ 1 MHz

- (1) 1
(2) 2
(3) 3
(4) 4

1[Option ID=14573]
2[Option ID=14574]
3[Option ID=14575]
4[Option ID=14576]

Sl. No.45
QBID:1042145

Time independent Schrodinger equation is not suitable for potential which is.

1. independent of time
2. dependent on x
3. independent of x
4. dependent on time

- (1) 1
(2) 2
(3) 3
(4) 4

1[Option ID=14577]
2[Option ID=14578]
3[Option ID=14579]
4[Option ID=14580]

Sl. No.46
QBID:1042146

Which one of the followings is false?

1. $[x, x] = i\hbar/(2\pi)$
2. $[P_x, P_y] = 0$
3. $[x, P_y] = 0$
4. $[P_x, x] = -i\hbar/(2\pi)$

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=14581]

2[Option ID=14582]

3[Option ID=14583]

4[Option ID=14584]

Sl. No.47

QBID:1042147

Constructive interference in real space is represented by:

1. Path difference being an integral multiple of $\lambda/2$
2. Phase difference being π
3. Path difference being an integral multiple of λ
4. Phase difference being π

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=14585]

2[Option ID=14586]

3[Option ID=14587]

4[Option ID=14588]

Sl. No.48

QBID:1042148

Wavefront of light coming from a distant source are nearly:

1. spherical
2. elliptical
3. plane
4. cylindrical

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=14589]

2[Option ID=14590]

3[Option ID=14591]

4[Option ID=14592]

Sl. No.49

QBID:1042149

Four light waves are represented by (i) $y = a_1 \sin \omega t$, (ii) $y = a_2 \sin(\omega t + \epsilon)$, (iii) $y = a_3 \sin 2\omega t$, (iv) $y = a_3 \sin 3\omega t$. Interference fringes may be observed due to superposition of

1. (i) and (ii)
2. (i) and (iii)
3. (ii) and (iv)
4. (iii) and (iv)

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=14593]

2[Option ID=14594]

3[Option ID=14595]

4[Option ID=14596]

Sl. No.50

QBID:1042150

Which of the following equations represents a wave travelling along Y-axis ?

$$y = A \sin (kx - \omega t)$$

$$y = A \sin ky \cos \omega t$$

$$x = A \sin (ky - \omega t)$$

$$y = A \cos ky \sin \omega t.$$

(1) 1

(2) 2

(3) 3

(4) 4

1[Option ID=14597]

2[Option ID=14598]

3[Option ID=14599]

4[Option ID=14600]