PU Ph D Nano Science and Technology

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106 PU_2015_160

Group I contains elementary excitations in solids. Group II gives the associated field with these exciations. MATCH the excitations with their associated field and select your answer as per codes given below.

Group I	Group II
(P) phonon	(i) photon + lattice vibration
(Q) plasmon	(ii) electron +elastic deformation
(R) polaron	(iii) collective electron oscillations
(S) polariton	(iv) elastic wave

- (P - iv), (Q - iii), (R - ii), (S - i)
- (P - iv), (Q - iii), (R - i), (S - ii)
- (P - i), (Q - iii), (R - ii), (S - iv)
- (P - iii), (Q - iv), (R - ii), (S - i)

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118 PU_2015_160

A live music broadcast consists of a radio-wave of frequency 7 MHz, amplitude - modulated by a microphone output consisting of signals with a maximum frequency of 10 kHz. The spectrum of modulated output will be zero outside the frequency band:-

- 6.99 MHz to 7.00 MHz
- 6.995 MHz to 7.005 MHz
- 7.00 MHz to 7.01 MHz
- 6.99 MHz to 7.01 MHz

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101 PU_2015_160

For an ideal Fermi gas in three dimensions, the electron velocity V_F at the Fermi surface is related to electron concentration n as:-

- $V_F \alpha n^{1/2}$
- $V_F \alpha n^{1/3}$
- $V_F \alpha n$
- $V_F \alpha n^{2/3}$

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116 PU_2015_160

A charged particle is at a distance d from an infinite conducting plane maintained at zero potential. When released from rest, the particle reaches a speed u at a distance d/2 from the plane. At what distance from the plane will the particle reach the speed 2u:-

- d / 4
- d / 5
- d / 6
- d / 3

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112 PU_2015_160

The number of degrees of freedom of a rigid body in d space-dimensions is:-

- 2d
- d(d +1)/ 2
- d!
- 6

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110 PU_2015_160

Two bodies of equal mass m are connected by a massless rigid rod of length l lying in the xy-plane with the centre of the rod at the origin. If this system is rotating about the z-axis with a frequency ω, its angular momentum is:-

- $ml^2\omega/ 4$
- $ml^2\omega/ 2$
- $ml^2\omega$
- $2ml^2\omega$

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113 PU_2015_160

The recently-discovered Higgs boson at the LHC experiment has a decay mode into a photon and a Z boson. If the rest masses of the Higgs and Z boson are 125 GeV/c^2 and 90 GeV/c^2 respectively, and the decaying Higgs particle is at rest, the energy of the photon will approximately be:-

- $35(3)^{1/2}$ GeV
- 15 GeV
- 35 GeV
- 30 GeV

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115 PU_2015_160

A beam of light of frequency ω is reflected from a dielectric-metal interface at normal incidence. The refractive index of the dielectric medium is n and that of the metal is $n_2= n(1+ i\rho)$. If the beam is polarised parallel to the interface, then the phase change experienced by the light upon reflection is:-

- $\tan^{-1}(2\rho)$
- $\tan^{-1}(2 /\rho)$
- $\tan(2 /\rho)$

- $\tan^{-1}(1/\rho)$

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121 PU_2015_160

An RC network produces a phase-shift of 30°. How many such RC networks should be cascaded together and connected to a Common Emitter amplifier so that the final circuit behaves as an oscillator?

- 13
- 9
- 6
- 12

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108 PU_2015_160

A horizontal circular platform mutes with a constant angular velocity Ω directed vertically upwards. A person seated at the centre shoots a bullet of mass m horizontally with speed v. The acceleration of the bullet, in the reference frame of the shooter, is:-

- v Ω to his right
- v Ω to his left
- 2v Ω to his right
- 2v Ω to his left

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102 PU_2015_160

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

- Thermal expansion
- Optical branches in lattices
- DulongPetit's law
- Deby's T^3 law

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103 PU_2015_160

The acceleration due to gravity (g) on the surface of Earth is approximately 2.6 times that on the surface of Mars. Given that the radius of Mars is about one half the radius of Earth, the ratio of the escape velocity on Earth to that on Mars is approximately:-

- 1.1
- 1.3
- 5.2
- 2.3

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224 PU_2015_160

Which of the following atoms cannot exhibit Bose-Einstein condensation, even in principle?

- $^{30}K_{19}$
- $^{23}Na_{11}$
- $^{4}H_{2}$
- $^{1}H_{1}$

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221 PU_2015_160

A spectral line due to a transition from an electronic state *p* to an *s* state splits into three Zeeman lines in the presence of a strong magnetic field. At intermediate field strengths the number of spectral lines is:-

- 6
- 3
- 9
- 10

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227 PU_2015_160

If Planck's constant were zero, then the total energy contained in a box filled with radiation of all frequencies at temperature would be (k is the Boltzmann constant and T is nonzero):-

- kT
- Infinite
- (3/2)kT
- zero

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220 PU_2015_160

The electronic energy levels in a hydrogen atom are given by E_n = -13.6 /n^2eV. If aselective excitation to the n = 100 level is to be made using a laser, the maximum allowed frequency line-width of the laser is:-

- 6.5 kHz
- 6.5 MHz
- 6.5 GHz
- 6.5 Hz

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261 PU_2015_160

Two gases separated by an impermeable but movable partition are allowed to freely exchange energy. At equilibrium, the two sides will have the same:-

- volume and temperature
- pressure and volume
- pressure and temperature
- volume and energy

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265 PU_2015_160

Far away from any of the resonance frequencies of a medium, the real part of the dielectric permittivity is:-

- Monotonically decreasing with frequency
- A non-monotonic function of frequency
- Monotonically increasing with frequency
- Always independent of frequency

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262 PU_2015_160

The entropy function of a system is given by $S(E) = aE(E_0 - E)$ where a and E_0 are positive constants. The temperature of the system is:-

- decreases monotonically with energy
- negative for some energies
- increases monotonically with energy
- Zero

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263 PU_2015_160

Consider *X*-ray diffraction from a crystal with a face-centered-cubic (*fcc*) lattice. The lattice plane for which there is NO diffraction peak is:-

- (2, 0, 0)
- (3, 1, 1)
- (1, 1, 1)
- (2, 1, 2)

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142 PU_2015_160

A culture vessel in which physical, physiochemical and physiological conditions, as well as cell concentration, are kept constant is known as:-

- Biostat
- Batch bioreactor
- Incubator
- Cell concentration

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136 PU_2015_160

Multiplication of genetically identical copies of a cultivar by asexual reproduction is known as:-

- polyclonal propagation
- Vegetative propagation

- Clonal propagation
- aclonal propagation

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127 PU_2015_160
Si RNA(s) interfere at:-

- Post-transcriptional level
- Translational level
- Transcriptional level
- DNA replication level

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140 PU_2015_160
Caspases are involved in the process of:-

- DNA replication
- Antibody synthesis
- Aposptosis
- Mutation and recombination

25 of 100
133 PU_2015_160
Parthenogenetic embryos in plants are those which are formed by:-

- Unfertilized eggs
- Fertilized eggs
- male gametophyte
- Sporophytic cells

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129 PU_2015_160
A protein binds to phosphocellulose column at pH 7.0 and elutes at pH 8.0. If the protein has to be further purified on a DEAE Sephacel column, the binding buffer should have a pH of:-

- 7
- 5
- 6
- 8

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126 PU_2015_160
Protein binding regions of DNA are identified by one of the following techniques:-

- Western blotting

- Finger printing
- Foot printing
- Southern blotting

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135 PU_2015_160

Which one of the following techniques is best suited for immobilizing an affinity ligand?

- Cross-linking with a polymer
- Physical absorption
- Gel entrapment
- Covalent linkage to a spacer arm

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130 PU_2015_160

A bioremedial solution to reduce oxides of nitrogen and carbon in flue gases is to integrate flue gas emission to:-

- micro-algal culture
- Seri culture
- Fish culture
- mushroom culture

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146 PU_2015_160

Program used for essentially local similarity search is:-

- BLAST
- SWISS-PROT
- RasMol
- Ex PASY

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138 PU_2015_160

To produce plants that are homozygous for all traits, the best choice is:-

- Cell suspension culture
- Apical meristem culture
- Protoplast culture
- Anther and pollen culture

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145 PU_2015_160

Antibiotic resistance marker that CANNOT be used in cloning vector in Gram negative bacteria is:-

- Vancomycin
- Ampicillin
- Kanamycin
- Streptomycin

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230 PU_2015_160

A culture of bacteria is infected with bacteriophage at a multiplicity of 0.3. The probability of a single cell infected with 3 phages is:-

- 0.027
- 0.27
- 0.9
- 0.009

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229 PU_2015_160

Which of the following DOES NOT belong to the domain of bacteria?

- Methano bacteria
- Cyanobacteria
- Bacteroids
- Proteo bacteria

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233 PU_2015_160

During lactic acid fermentation, net yield of ATP and NADH per mole of glucose is:-

- 4 ATP and 2 NADH
- 2 ATP and 2 NADH
- 2 ATP and 0 NADH
- 4 ATP and 0 NADH

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232 PU_2015_160

Lymphocytes interact with foreign antigens in:-

- Bone marrow
- Lymph nodes
- Peripheral blood
- Thymus

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271 PU_2015_160

What product will result from complete hydrolysis of soluble dextran?

- Fructose only
- Glucose and Fructose only
- Glucose only
- Sucrose only

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274 PU_2015_160

Which of the following fluorescent probes is used to monitor the progress of amplification in Real time PCR ?

- Rhodamine
- Cyan blue
- SYBR green
- FITC

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272 PU_2015_160

Aeration in a bioreactor is provided by:-

- charger
- impeller
- sparger
- baffles

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269 PU_2015_160

Ultrafiltration process cannot be used for:-

- harvesting of cells
- selective removal of solvents
- Fractionation of proteins
- desalting

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162 PU_2015_160

The number of atoms in hexagonal close packed unit cell is:-

- 4
- 6
- 3
- 2

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160 PU_2015_160
Heat of sublimation at standard condition is high for:-

- FeO
- Mg
- Al
- TiO_2

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152 PU_2015_160
A steel body is moving against the following materials - in which case the friction will be maximum:-

- aluminum
- copper
- wood
- steel

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151 PU_2015_160
Which among the following has body centered cubic structure?

- copper
- sodium
- carbon
- cobalt

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148 PU_2015_160
Hardness of a material refers to the:-

- ability to drawn into wires
- opposition to the corrosion
- opposition to the plastic deformation
- ease of malleability

46 of 100

166 PU_2015_160
Which one of the following is not a composite?

- bone
- sand
- fiberglass
- polymer

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154 PU_2015_160
Glass fibers are examples for:-

- photonic material
- semiconductor material
- conducting material
- protonic conductor material

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150 PU_2015_160
For a material to be used as spring, it should possess:-

- plasticity
- ductility
- hardness
- resilience

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153 PU_2015_160
A metal body during a process forms a few nanometer thick oxide. What technique would be preferred to quantify the oxide formation and nature of oxide:-

- X-ray diffraction
- Infrared spectroscopy
- X-ray photoelectron spectroscopy
- UV-Visible spectroscopy

50 of 100

149 PU_2015_160
From the following statements pick up the TRUE one about brittle fracture:-

- Noise precedes before brittle fracture
- Generally materials with hexagonal close packed structure shows brittle fracture
- Brittle facture is characterized by cup and cone formation
- High temperature always favour brittle fracture.

51 of 100

168 PU_2015_160
Burgers vector is related to:-

- vacancy
- dislocation
- fatigue
- creep

52 of 100

156 PU_2015_160

Artificial hip joint materials require:-

- high ultimate strength parallel to bone axis
- high friction coefficient
- high elongation perpendicular to bone axis
- low ultimate strength parallel to bone axis

53 of 100

239 PU_2015_160

Identify the statement which is NOT true among the following regarding the formation of substitutional solid solution:-

- Similar electronegativity favours substitutional solid solution
- Atomic radii should be less than 15%
- For solid solubility the atoms need not have to have the same crystal structure
- The metal with higher valency dissolves in lower valency

54 of 100

237 PU_2015_160

Fracture toughness (K_c) is proportional to crack length (a) by:-

- a
- a^2
- a^3
- $\sqrt{a}$

55 of 100

238 PU_2015_160

Fatigue life cannot be improved by:-

- carburizing and nitriding process
- surface finishing by better polishing
- introducing tensile stress along the surface
- reducing the mean stress

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241 PU_2015_160

Thermal conductivity of polymers and ceramics are poor due to:-

- high free electron concentration
- high electrical conductivity
- high phonon conduction
- high electron scattering

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280 PU_2015_160
Wiedemann-Franz law is related to:-

- deformation in plastics
- optical properties of thin films
- thermal conductivity of metals
- mobility of charge carriers

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276 PU_2015_160
Hardness cannot be improved by:-

- normalizing
- nitriding
- annealing
- alloying

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278 PU_2015_160
On heating one solid phase transforming to one solid and another liquid phase is known as ;-

- hypoeutectic reaction
- peritectic reaction
- eutectic reaction
- hypereutectic reaction

60 of 100
283 PU_2015_160
MnO exhibits:-

- paramagnetism
- ferromagnetism
- ferrimagnetism
- antiferromagnetism

61 of 100
187 PU_2015_160
If the first term minus third term of a G. P. = 768 and the third term minus seventh term of the same G. P. = 240, then the product of first 21 terms =

- 3
- 2
- 1

- 4

62 of 100

195 PU_2015_160

Laplace transform of sin*at* is:-

- $\frac{1}{s^2+a^2}$
- $\frac{1}{s^2-a^2}$
- $\frac{a}{s^2+a^2}$
- $\frac{a}{s^2-a^2}$

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183 PU_2015_160

An unbiased die with faces marked 1, 2, 3, 4, 5 and 6 is rolled four times. Out of four face values obtained, the probability that the minimum face value is not less than 2 and the maximum face value is not greater than 5 is then:-

- 65/81
- 80/81
- 16/81
- 1/81

64 of 100

172 PU_2015_160

Which of the following is the Highest Common Factor of 18, 24 and 36?

- 72
- 6
- 36
- 18

65 of 100

185 PU_2015_160

The number of real solutions of the equation x2 - 3 |x| + 2 = 0 is:-

- 1
- 3
- 2
- 4

66 of 100

173 PU_2015_160

How many subsets does the set {a, b, c, d, e} have?

- 10
- 5
- 2
- 32

67 of 100

178 PU_2015_160

The period of |sin (3x)| is:-

- 2π
- 3π
- $2\pi/3$
- $\pi/3$

68 of 100

175 PU_2015_160

A hollow iron pipe is 21 cm long and its external diameter is 8 cm. If the thickness of the pipe is 1 cm and iron weighs 8 g/cm^3, then the weight of the pipe is:-

- 36.9 kg
- 36 kg
- 3.6 kg
- 3.696 kg

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190 PU_2015_160

If the order of matrix A is m x p. And the order of B is p x n. Then the order of AB is ?

- m x p
- m x n
- n x p
- n x m

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176 PU_2015_160

The population of a country increased by an average of 2% per year from 2000 to 2003. If the population of this country was 2 000 000 on December 31, 2003, then the population of this country on January 1, 2000, to the nearest thousand would have been:-

- 1 852 000
- 1 500 000
- 1 846 000
- 1 000 000

71 of 100
191 PU_2015_160

What is *a*, if $B = \begin{bmatrix} 1 & 4 \\ 2 & a \end{bmatrix}$ is a singular matrix?

- 7
- 8
- 5
- 6

72 of 100
177 PU_2015_160
The exam scores of all 500 students were recorded and it was determined that these scores were normally distributed. If Jane's score is 0.8 standard deviation above the mean, then how many, to the nearest unit, students scored above Jane:-

- 106
- 394
- 250
- 400

73 of 100
246 PU_2015_160
If $(2/3)^{x+2} = (3/2)^{2-2x}$ then *x* =

- 4
- 0
- 3
- 1

74 of 100
245 PU_2015_160
How many numbers of five digits can be formed from the numbers 2, 0, 4, 3, 8 when repetition of digits is not allowed:-

- 14
- 114
- 120
- 96

75 of 100
247 PU_2015_160
The equation of the straight line passing through the point (3, 2) and perpendicular to the line y = x is:-

- x - y = 1
- x + y = 5
- x + y = 1
- x - y = 5

76 of 100

249 PU_2015_160

If 2a + 3b + 6c = 0, then at least one root of the equation ax2 + bx + c = 0 lies in the interval:-

- (2, 3)
- (0, 1)
- (1, 3)
- (1, 2)

77 of 100

284 PU_2015_160

The magnitudes of mutually perpendicular forces a, b and c are 2, 10 and 11 respectively. Then the magnitude of its resultant is:-

- 9
- 15
- 12
- None

78 of 100

290 PU_2015_160

If a = cos α + i sin α and b = cos β + i sin β, then the value of $\frac{1}{2}\left(ab+\frac{1}{ab}\right)$ is

- sin (α - β)
- cos (α - β)
- cos (α + β)
- sin (α + β)

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287 PU_2015_160

If two distinct chords drawn from the point (p, q) on the circle $x^2 + y^2 = px + qy$ (where $pq \neq 0$) are bisected by the X-axis, then:-

- $p^2 < 8q^2$
- $p^2 > 8q^2$
- $p^2 = 8q^2$

- $p^2 = q^2$

80 of 100

291 PU_2015_160

For all complex numbers z1, z2 satisfying |z1| = 12 and |z2 - 3 - 4i| = 5, the minimum value of |z1 - z2| is:-

- 7
- 2
- 17
- 0

81 of 100

218 PU_2015_160

Which of the following units represents largest amount of energy?

- Calorie
- Erg
- Joule
- Electron volt

82 of 100

205 PU_2015_160

The lightest particle is:-

- Neutron
- α - particles
- Proton
- Positron

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197 PU_2015_160

Halogen belongs to the:-

- s-block of the periodic table
- d-block of the periodic table
- p-block of the periodic table
- f- block of the periodic table

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206 PU_2015_160

The shape of a orbital is:-

- Spherical
- Pyramidal
- Dum-bell shaped

- Tetrahedral

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196 PU_2015_160

The elements with atomic number 10, 18, 36, 54 and 86 are all:-

- Rare earth metals
- Halogen
- Light metals
- Inert gases

86 of 100

201 PU_2015_160

Which is buffer solution among the following?

- $CH_3COOH + CH_3COONa$
- NaOH + NaCl
- $CH_3COOH + CH_3COONH_4$
- $CH_3COOH + NH_4Cl$

87 of 100

217 PU_2015_160

In the following reaction the conjucate pair is:-

$$CH_3COOH + H_2O \Leftrightarrow H_2O + \cdots CH_3COO^-$$

- CH_3COOH and CH_3COO^-
- H_2O and CH_3COO^-
- CH_3COO- and H_3O^+
- CH_3COOH and H_3O^+

88 of 100

202 PU_2015_160

CH_3COOH is a weak acid because:-

- It decomposes easily
- It reacts very mildly
- It is very heavy
- It ionizes slightly

89 of 100

200 PU_2015_160

The theory of ionization was given by:-

- Faraday
- Arrhenius
- Rutherford
- Graham

90 of 100

209 PU_2015_160

Which of the following has more unpaired electron?

- Zn^{2+}
- Fe^{2+}
- Cu^{+}
- N^{3+}

91 of 100

213 PU_2015_160

Rate of reaction:-

- Does not depend on boiling point
- Does not depend on temperature
- Decrease with increase in temperature
- Increase with increase in temperature

92 of 100

198 PU_2015_160

Which is not a colligative property?

- Osmotic pressure
- Depression in freezing point
- Optical activity
- Elevation in boiling point

93 of 100

258 PU_2015_160

Which of the following undergoes the Grignard like reaction?

- Reformatsky reaction
- Perkin reaction
- Witting reaction
- Hydroboration

94 of 100

257 PU_2015_160

Porphyrins are:-

- Tetradentate
- Ambidentate
- Tridentate
- Bidentate

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255 PU_2015_160
Which of the following nuclei is unstable?

- $^{14}_{7}N$
- $^{16}_{8}O$
- $^{10}_{5}B$
- $^{10}_{4}Be$

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253 PU_2015_160
For an ideal gas Joule-Thomson coefficient is:-

- Dependent on molecular weight
- Zero
- Negative
- Positive

97 of 100
292 PU_2015_160
Which solvent is employed in hydrothermal reaction?

- Oil
- Methanol
- Ethylene glycol
- Water

98 of 100
294 PU_2015_160
How we can find the particle size of the nanoparticle?

- TGA
- XPS
- FTIR
- TEM

99 of 100
297 PU_2015_160

Ball milling is working in which technique?

- Electrical
- Optical
- Soft chemical
- Mechanical

100 of 100

293 PU_2015_160

How many types of electronic transition are possible in visible and UV regions?

- Two types
- Three types
- Four types
- One type