Andhra Pradesh State Council of Higher Education

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 :	Nano Technology 20th July 2022 Shift 2
Duration :	120
Total Marks :	120
Display Marks:	No
Share Answer Key With Delivery Engine :	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
Is this Group for Examiner? :	No
Examiner permission :	Cant View
Show Progress Bar? :	No

Nano Technology

Section Id :	90030020
Section Number :	1
Mandatory or Optional :	Mandatory
Number of Questions :	120
Section Marks :	120
Enable Mark as Answered Mark for Review and Clear Response :	Yes
Maximum Instruction Time :	0

Question Number : 1 Question Id : 9003002281 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The adhesion between two contacting rough surfaces scales as the

Options :

1. ✓ actual contact area

2. ✗ square of the actual contact area

3. ✗ contact volume

4. ✗ square of the contact volume

Question Number : 2 Question Id : 9003002282 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Which law of thermodynamics describes both the quality and quantity of energy?

Options :

1. ✗ third law of thermodynamics

2. ✓ second law of thermodynamics

3. ✗ first law of thermodynamics

4. ✗ zeroth law of thermodynamics

Question Number : 3 Question Id : 9003002283 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

In a belt and pulley system, which of the following is not transmitted to the axels?

Options :

1. ✗ power

2. ✗ torque

3. ✓ lagging force

4. ✗ speed

Question Number : 4 Question Id : 9003002284 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Which of the following is not an acceptor when used as an impurity in Germanium (Ge)?

Options :

1. ✗ Boron

2. ✗ Galium

3. ✗ Aluminum

4. ✓ Phosphorus

Question Number : 5 Question Id : 9003002285 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

With regards to fluid properties, which of the following is true for a steady flow process within the control volume?

Options :

1. ✗ properties change with time and position

2. ✓ properties change with position but not with time

3. ✗ properties change with time but not with position

4. ✗ properties do not change with both time and position

Question Number : 6 Question Id : 9003002286 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

If x is the radius of spheres that can form tetrahedral voids in a hexagonal closed-packed structure, what is the size of the largest sphere that can fit into the tetrahedral void?

Options :

1. ✓ $(\frac{\sqrt{3}}{\sqrt{2}} - 1)x$

2. ✗ $\frac{\sqrt{3}}{\sqrt{2}}x$

3. ✗ $(\frac{\sqrt{2}}{\sqrt{3}} - 1)x$

4. ✗ $\frac{\sqrt{2}}{\sqrt{3}}x$

Question Number : 7 Question Id : 9003002287 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

What is 10.404 m of water pressure in mm of Hg at a given point (given, the density of water = 1000 kg/m^3 and density of Hg = 13600 kg/m^3)

Options :

1. ✓ 765 mm of Hg

2. ✗ 0.765 mm of Hg

3. ✗ 10.404 mm of Hg

4. ✗ 136 mm of Hg

Question Number : 8 Question Id : 9003002288 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A cuboidal casting of dimensions 140 mm x 120 mm with 55 mm diameter (⌀) through-hole is to be cast with a machine allowance of 3 mm. What are the dimensions of the cross-section and diameter of the casting, respectively?

Options :

1. ✗ 134 mm x 114 mm, 61 mm

2. ✗ 146 mm x 126 mm, 55 mm

3. ✓ 146 mm x 126 mm, 49 mm

4. ✗ 146 mm x 126 mm, 61 mm

Question Number : 9 Question Id : 9003002289 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

If L is a typical linear dimension in a body and if any other linear dimension in the body varies proportionally to L, then the volume of the body scales as

Options :

1. ✗ $1/L^3$

2. ✗ $1/L$

3. ✗ L^2

4. ✓ L^3

Question Number : 10 Question Id : 9003002290 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The solid solution of Cu and Zn forms

Options :

1. ✗ a disordered FCC structure at temperatures above 470 °C

2. ✓ a disordered BCC structure at temperatures above 470 °C

3. ✗ a disordered HCP structure at temperatures above 470 °C

4. ✗ a disordered DC structure at temperatures above 470 °C

Question Number : 11 Question Id : 9003002291 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Why can atoms in pure Ge be continuously replaced by Si atoms till pure Si is obtained?

Options :

1. ✓ Ge and Si have the same crystal structure and satisfy the Hume-Rothery conditions very well

2. ✗ Ge and Si have the same crystal structure but do not satisfy the Hume-Rothery conditions very well

3. ✗ Ge and Si satisfy the Hume-Rothery conditions very well but do not have the same crystal structure

4. ✗ Ge and Si neither have the same crystal structure nor satisfy the Hume- Rothery conditions very well

Question Number : 12 Question Id : 9003002292 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Which of the following statements is true?

Options :

1. ✗ both path and point functions have partial differentials

2. ✗ path functions have exact differentials

3. ✓ point functions have exact differentials

4. ✗ both path and point functions have exact differentials

Question Number : 13 Question Id : 9003002293 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

How many moles of C-C bonds are broken when one mole of a diamond is converted into gaseous carbon atoms?

Options :

1. ✓ 2 moles

2. ✗ 4 moles

3. ✗ 3 moles

4. ✗ 2.5 moles

Question Number : 14 Question Id : 9003002294 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Why does solid methane melt at -182 °C even when the C-H bond energy is 413 kJ/mole?

Options :

1. ✗ in solid methane, molecules are held by ionic bonds

2. ✓ in solid methane, molecules are held by van der Waals bonds

3. ✗ in solid methane, molecules are held by metallic bonds

4. ✗ in solid methane, molecules are held by covalent bonds

Question Number : 15 Question Id : 9003002295 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The construction of a 2-dimensional pentagonal lattice is not possible because the pentagon has an interior angle of

Options :

1. ✓ 108°

2. ✗ 120°

3. ✗ 90°

4. ✗ 112°

Question Number : 16 Question Id : 9003002296 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

How do the number of highly energetic atoms in a solid increase with an increase in temperature?

Options :

1. ✗ linearly

2. ✓ exponentially

3. ✗ parabolically

4. ✗ hyperbolically

Question Number : 17 Question Id : 9003002297 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The concept of temperature is given by

Options :

1. ✓ zeroth law of thermodynamics

2. ✗ first law of thermodynamics

3. ✗ second law of thermodynamics

4. ✗ third law of thermodynamics

Question Number : 18 Question Id : 9003002298 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

What is the Gibbs free energy change for an endothermic reaction?

Options :

1. ✗ 0

2. ✗ > 0

3. ✓ < 0

4. ✗ ∞

Question Number : 19 Question Id : 9003002299 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

1 inch is equal to

Options :

1. ✗ 2.54×10^9 nm

2. ✗ 2.54×10^6 nm

3. ✗ 25.4×10^9 nm

4. ✓ 25.4×10^6 nm

Question Number : 20 Question Id : 9003002300 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The ratio of the surface energy of the free surface to that of the grain boundary energy in a metal is 2:1. What is the angle (θ) at the bottom of the groove of a grain boundary making an angle of 90° with the external surface of the metal at elevated temperatures?

Options :

1. ✗ $\cos(\theta/2) = 1/2$

2. ✓ $\cos(\theta/2) = 1/4$

3. ✗ $\cos(\theta/2) = 4$

4. ✗ $\cos(\theta/2) = 2$

Question Number : 21 Question Id : 9003002301 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Extremely fast phase transformations

Options :

1. ✗ cannot be suppressed both theoretically and experimentally

2. ✓ can be suppressed by very fast cooling (cooling rates exceeding a million degrees per second)

3. ✗ can be suppressed by very slow cooling (cooling rates lower than one degree per second)

4. ✗ can be suppressed only theoretically but not experimentally because it is impossible to have cooling rates exceeding a million degrees per second in practice

Question Number : 22 Question Id : 9003002302 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

What is the critical radius of the nucleus of ice when it tries to nucleate from water at 0°C?

Options :

1. ✓ 0 Å

2. ✗ 30 Å

3. ✗ 3 Å

4. ✗ 1 Å

Question Number : 23 Question Id : 9003002303 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The strain energy difference between the cold worked and the strain-free material acts as the driving force for

Options :

1. ✗ glass transition

2. ✗ nucleation

3. ✗ cluster formation

4. ✓ recrystallization

Question Number : 24 Question Id : 9003002304 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

What does the grain size number ASTM 2 correspond to?

Options :

1. ✗ 1 grain

2. ✓ 2 grains

3. ✗ 4 grains

4. ✗ 8 grains

Question Number : 25 Question Id : 9003002305 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

What is the stress in the boron fibers if a tensile load of 200 N is applied on a 1 mm^2 cross-section of boron fibers reinforced aluminum composite?

Options :

1. ✗ 2 MN/m^2

2. ✗ 20 MN/m^2

3. ✓ 200 MN/m^2

4. ✗ 2000 MN/m^2

Question Number : 26 Question Id : 9003002306 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The free energy of formation at room temperature for which of the following materials is positive?

Options :

1. ✓ Au_2O_3

2. ✗ Ag_2O

3. ✗ NiO

4. ✗ MgO

Question Number : 27 Question Id : 9003002307 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

With regards to cutting tool life, if X is the cutting speed in m/min, Y is the time taken to form certain flank wear, m is an exponent related to the cutting tool material, and k is a constant that depends on the cutting tool, cutting conditions, and workpiece material, then which of the following represents Taylor's relation?

Options :

1. ✗ $XY = k/m$

2. ✗ $X^mY^m=k$

3. ✓ $XY^m=k$

4. ✗ $YX^m=k$

Question Number : 28 Question Id : 9003002308 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

What is the time average of random directed force?

Options :

1. ✓ 0

2. ✗ ∞

3. ✗ always 0.5 N/sec

4. ✗ always $\frac{\sqrt{3}}{2}$ N/sec

Question Number : 29 Question Id : 9003002309 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Active tints in eyeglasses are

Options :

1. ✗ photophytic

2. ✗ photobaric

3. ✗ photoelectric

4. ✓ photochromic

Question Number : 30 Question Id : 9003002310 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

In the case of a Brownian motion, the force is

Options :

1. ✓ finite only over the duration of a single effective collision

2. ✗ finite only over the duration of multiple effective collisions

3. ✗ zero over the duration of a single effective collision

4. ✗ infinite over the duration of a single effective collision

Question Number : 31 Question Id : 9003002311 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Hot-working of a metal results in

Options :

1. ✗ annihilation of dislocations

2. ✗ increase in porosity in the metal

3. ✗ grain growth

4. ✓ grain refinement

Question Number : 32 Question Id : 9003002312 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Under which of the following conditions continuous chips are formed?

Options :

1. ✗ when the workpiece is brittle, and the cutting speed is low

2. ✗ when the workpiece is brittle, and the cutting speed is high

3. ✓ when the workpiece is ductile, and the cutting speed is low

4. ✗ when the workpiece is ductile, and the cutting speed is high

Question Number : 33 Question Id : 9003002313 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

What is the entropy change in an ideal adiabatic and reversible thermodynamic process?

Options :

1. ✓ 0

2. ✗ < 0

3. ✗ > 0

4. ✗ ∞

Question Number : 34 Question Id : 9003002314 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A heat engine operating between 600 K and 300 K has a thermal efficiency of 30%.
What is second law efficiency?

Options :

1. ✓ 60%

2. ✗ 50%

3. ✗ 40%

4. ✗ 30%

Question Number : 35 Question Id : 9003002315 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Which of the following can be used to measure the work function of surfaces exhibiting even very low electrically conductivity?

Options :

1. ✗ piezo force microscopy

2. ✗ Einstein force microscopy

3. ✗ scanning tunneling microscopy

4. ✓ scanning Kelvin force microscopy

Question Number : 36 Question Id : 9003002316 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Copper sulphate crystal is dropped to the bottom of a test tube filled with water to a depth of 6 cm. If the diffusion constant of the crystal in water is 2000 $(\mu m)^2$/sec, how long will it take for the top of the solution to appear blue if the sample is not stirred?

Options :

1. ✓ 10^6 sec (almost a month)

2. ✗ 10 days

3. ✗ 10^5 sec (one day or so)

4. ✗ 10 min

Question Number : 37 Question Id : 9003002317 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Probability amplitudes of wave packet in quantum mechanics

Options :

1. ✗ is equivalent to momentum of a particle in classical mechanics

is equivalent to rate of change of momentum of a particle in classical mechanics

2. ✓

3. ✗ is equivalent to quantity of reaction

4. ✗ cannot be equated to any measurable in classical mechanics

Question Number : 38 Question Id : 9003002318 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

At reasonable temperatures (such as room temperature), the mean free path of electrons in typical metals will be

Options :

1. ✗ few nm

2. ✓ tens of nm

3. ✗ few μm

4. ✗ few tens of μm

Question Number : 39 Question Id : 9003002319 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Ohm's law may not be applicable when

Options :

1. ✗ the dimensions of the electron conducting structure are far greater than the mean free path of an electron in its bulk counterpart

2. ✗ the dimensions of the electron conducting structure are of the same scale as the square of mean free path of an electron in its bulk counterpart

3. ✓ the dimensions of the electron conducting structure are of the same scale as the mean free path of an electron in its bulk counterpart

4. ✗ the dimensions of the electron conducting structure are of the same scale as the square root of mean free path of an electron in its bulk counterpart

Question Number : 40 Question Id : 9003002320 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

At low temperature (T), the heat capacity varies as

Options :

1. ✗ T

2. ✗ T^2

3. ✗ $T^{3/2}$

4. ✓ T^3

Question Number : 41 Question Id : 9003002321 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

When the size of a thermodynamic system is at the nanoscale, what is the relation between the thermodynamic properties and the size of a system?

Options :

1. ✗ thermodynamic properties are proportional to the size of a system

2. ✗ thermodynamic properties strictly follow a cube law in relation to the size of a system

3. ✗ thermodynamic properties strictly follow an inverse cube law in relation to the size of a system

4. ✓ thermodynamic properties are not strictly proportional to the size of a system

Question Number : 42 Question Id : 9003002322 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The steam temperature in a boiler is 700 °C, and the pressure is 250 atm. The steam is ejected from a Laval nozzle. As the steam leaves the nozzle, its temperature should be

Options :

1. ✓ > 100 °C but not necessarily the steam tempearture

2. ✗ < 100 °C but not close to 0 °C

3. ✗ 0 °C

4. ✗ same as the steam temperature

Question Number : 43 Question Id : 9003002323 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

How many nearest neighbours does a carbon atom in diamond have?

Options :

1. ✖ 3

2. ✔ 4

3. ✖ 6

4. ✖ 2

Question Number : 44 Question Id : 9003002324 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

If the original length of a feature is 10 nm while its length on a micrograph is 5 cm, then what is the resolution at which the micrograph was recorded?

Options :

1. ✔ atomic resolution

2. ✖ micron-level resolution

3. ✖ nuclear resolution

4. ✖ sub-micron resolution

Question Number : 45 Question Id : 9003002325 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

In intrinsic Si at 300 K,

Options :

1. ✔ the electron mobility > the hole mobility

2. ✖ the hole mobility > the electron mobility

3. ✖ electron mobility = 0, anomalous behavior of Si

4. ✗ hole mobility = 0, anomalous behavior of Si

Question Number : 46 Question Id : 9003002326 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A methyl group on an alkane is oxidized to a carboxylate group to produce alkanethiol, which is

Options :

1. ✗ neutral to water

2. ✓ hydrophilic

3. ✗ hydrophobic

4. ✗ super hydrophobic

Question Number : 47 Question Id : 9003002327 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Peierls distortion in 1D conducting polymers is related to

Options :

1. ✗ distorted grain boundaries in crystalline polymers

2. ✗ change is electrical resistivity

3. ✗ change is electrical conductivity

4. ✓ lattice distortion

Question Number : 48 Question Id : 9003002328 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

One dimensional wave function $\Psi(x) = M\exp(-k|x|)$ then

Options :

1. ✓ $M = \sqrt{k}$

2. ✗ $M = k$

3. ✗ $M = 1/k$

4. ✗ $M = 1/\sqrt{k}$

Question Number : 49 Question Id : 9003002329 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

What is the Fermi energy level for all temperatures > 0 K?

Options :

1. ✗ the energy level at which the Fermi function is 0.05

2. ✗ the energy level at which the Fermi function is 0.38

3. ✓ the energy level at which the Fermi function is 0.5

4. ✗ the energy level at which the Fermi function is 1

Question Number : 50 Question Id : 9003002330 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

How much of proeutectoid ferrite is there in a slowly cooled 0.6% carbon steel?

Options :

1. ✓ 0.25

2. ✗ 0.75

3. ✗ 0.88

4. ✗ 0.66

Question Number : 51 Question Id : 9003002331 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

What happens when a thin layer of Ag is dispersed atlong the grain boundaries of Fe?

Options :

1. ✗ Fe becomes brittle (from being ductile) at -196°C

2. ✓ Fe becomes ductile (from being brittle) at -196°C

3. ✗ Fe retains its ductility irrespective of Ag addition and temperature

4. ✗ Fe retains its brittleness irrespective of Ag addition and temperature

Question Number : 52 Question Id : 9003002332 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Entropy of a pure crystalline substance at 0 K

Options :

1. ✓ is 0

2. ✗ is positive

3. ✗ cannot be defined

4. ✗ is negative

Question Number : 53 Question Id : 9003002333 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Two objects X and Y (of same mass and at same temperature) have specific heats of 10 and 5 kJ/kg-K, respectively then which of the following is correct?

Options :

1. ✗ Y has higher internal energy than X

2. ✓ X has higher internal energy than Y

3. ✗ X and Y have the same internal energy

4. ✗ given data is insufficient to calculate the internal energy

Question Number : 54 Question Id : 9003002334 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

One atom goes from its ground state into its excited state across 4 eV for a short time at 0 K. If 4.14×10^{-15} eV-sec is the value of Planck's constant, what is the lifetime of the spontaneous excitation of the atom in consideration?

Options :

1. ✓ $\sim 10^{-15}$ sec

2. ✗ ~1 sec

3. ✗ ~10 sec

4. ✗ ~10 nano sec

Question Number : 55 Question Id : 9003002335 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

If m is the mass of each carbon atom in the unit cell of diamond of volume V, what is the density of the diamond?

Options :

1. ✗ 1m/V

2. ✗ 4m/V

3. ✓ 8m/V

4. ✗ 12m/V

Question Number : 56 Question Id : 9003002336 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

What happens to the effective mass of an electron near the energy bandgap as the energy bandgap becomes narrower?

Options :

1. ✗ the effective mass of the electron becomes larger in comparison to the mass of a free electron

2. ✓ the effective mass of the electron becomes smaller in comparison to the mass of a free electron

3. ✗ the effective mass of the electron becomes zero

4. ✗ the effective mass of the electron equals the mass of a free electron

Question Number : 57 Question Id : 9003002337 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

What is the stress required to move a dislocation having zero width?

Options :

1. ✗ negligibly small

2. ✓ very high stress, equivalent to stress required to deform a perfect crystal

3. ✗ zero

4. ✗ half of the stress required to deform a perfect crystal

Question Number : 58 Question Id : 9003002338 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

What ratios of $h^2+k^2+l^2$ values are allowed for x-ray diffraction lines for a diamond cubic crystal? (h, k, l are Miller indices)

Options :

1. ✗ 3:4:8:11

2. ✗ 3:4:8:12

3. ✗ 3:8:12:16

4. ✓ 3:8:11:16

Question Number : 59 Question Id : 9003002339 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Fluctuations relative to the mean property of a system constituted by N^2 particles scales as

Options :

1. ✗ N^2

2. ✗ $\frac{-1}{N^2}$

3. ✗ N^{-2}

4. ✓ $\frac{1}{N}$

Question Number : 60 Question Id : 9003002340 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

If the plot of the logarithm of electrical conductivity versus the reciprocal of temperature (in Kelvin) of an intrinsic semiconductor is a straight line, then the plot of the number of charge carriers versus temperature (in Kelvin) is

Options :

1. ✗ an elliptical curve

2. ✗ a parabola

3. ✗ also, a straight line

4. ✓ exponential

Question Number : 61 Question Id : 9003002341 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

For nano-sized thermodynamic systems, the free energy

Options :

1. ✓ is no longer an extensive but depends on the size of the system

2. ✗ is no longer an intensive but depends on the size of the system

3. ✗ continues to be extensive while other properties change

4. ✗ continues to be intensive while other properties change

Question Number : 62 Question Id : 9003002342 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

What is the equilibrium concentration of vacancies in Al at 0 K?

Options :

1. ✓ 0

2. ✗ 10^{11}

3. ✖ 10^{24}

4. ✖ 10^{12}

Question Number : 63 Question Id : 9003002343 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Heating stochiometric ZnO in Zn vapor (such that Zn enters ZnO lattice) produces

Options :

1. ✖ Zn_xO_y, where $x > 1$ and $y > 1$

2. ✖ ZnO_x, where $x > 1$

3. ✔ Zn_xO, where $x > 1$

4. ✖ Zn_xO_y, where $x < 1$ and $y < 1$

Question Number : 64 Question Id : 9003002344 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

What are the units of specific capacitance?

Options :

1. ✖ Farad

2. ✔ Farad/meter

3. ✖ Farad-meter

4. ✖ Farad/Coulomb

Question Number : 65 Question Id : 9003002345 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

If μ is the shear modulus of a crystal, the first approximation of elastic strain energy per unit length of a dislocation of Burgers vector b is

Options :

1. ✓ $\mu b^2/2$

2. ✗ $\mu^2 b/2$

3. ✗ $\mu b^2/4$

4. ✗ $2\mu b$

Question Number : 66 Question Id : 9003002346 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The points at which dislocations intersect a random cross-section of the crystal are called as

Options :

1. ✗ Burgers vector points

2. ✓ etch pits

3. ✗ nodal points

4. ✗ antinodes

Question Number : 67 Question Id : 9003002347 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

For a statistically sound linear regression analysis with a high confidence level, the total number of independent variables should always be

Options :

1. ✗ equal to the number of residual sum of squares

2. ✗ equal to the total number of parameters involved in the problem

3. ✓ greater than the total number of parameters involved in the problem

4. ✗ lesser than the total number of parameters involved in the problem

Question Number : 68 Question Id : 9003002348 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

On cooling down $BaTiO_3$ below 120 °C (Curie temperature)

Options :

1. ✗ its crystal structure changes from tetragonal to cubic and, therefore, large polarization is observed in the solid

2. ✗ its crystal structure remains cubic, but large polarization is observed in the solid

3. ✗ its crystal structure changes from cubic to tetragonal and, therefore, polarization in the solid is considerably reduced

4. ✓ its crystal structure changes from cubic to tetragonal and, therefore, large polarization is observed in the solid

Question Number : 69 Question Id : 9003002349 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The saturation magnetization of a simple magnetic BCC solid with a unit cell volume of V m^3 is X kA/m. What is the net magnetic moment per atom?

Options :

1. ✗ XV Am^2

2. ✗ 1000XV Am^2

3. ✓ $500XV\ Am^2$

4. ✗ $250XV\ Am^2$

Question Number : 70 Question Id : 9003002350 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

If V is the volume per mole of a gas, what is the internal pressure for the gas as per the van der Waals gas equation?

Options :

1. ✗ $\frac{V^2}{k}$ where k is a gas constant

2. ✗ kV where k is a gas constant

3. ✓ $\frac{k}{V^2}$ where k is a gas constant

4. ✗ $\frac{k}{V}$ where k is a gas constant

Question Number : 71 Question Id : 9003002351 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

What is the electron concentration for an alloy $Cu_{1-x}Zn_x$

Options :

1. ✗ x

2. ✗ $1-x$

3. ✓ $1+x$

4. ✗ $x-1$

Question Number : 72 Question Id : 9003002352 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Entropy transfers to or from a system through

Options :

1. ✓ heat and mass transfer

2. ✗ mass transfer and work

3. ✗ heat transfer and work

4. ✗ heat and mass transfer and also work

Question Number : 73 Question Id : 9003002353 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

What is the uncertainty in the velocity of moving particles if the position of the particles can be determined accurately?

Options :

1. ✗ ∞, non-physical

2. ✗ 0, non-physical

3. ✗ 99.9%

4. ✓ 50%

Question Number : 74 Question Id : 9003002354 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A closed system undergoes a process M $\rightarrow$ N for which the heat ($Q_{M \rightarrow N}$) and the work ($W_{M \rightarrow N}$) are 10 kJ and 40 kJ, respectively. If the system has returned to state M from state N due to a work corresponding to -50 kJ, what is the value of heat?

Options :

1. ✗ 20 kJ

2. ✓ -20 kJ

3. ✗ 10 kJ

4. ✗ -10 kJ

Question Number : 75 Question Id : 9003002355 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

What is the total change in internal energy of the system undergoing a cyclic process?

Options :

1. ✗ theoretically ∞

2. ✓ zero

3. ✗ > 0 but not ∞

4. ✗ < 0

Question Number : 76 Question Id : 9003002356 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

If a heat pump's coefficient of performance (CoP) is 5, then what is the CoP of the associated refrigerator?

Options :

1. ✗ 7

2. ✗ 6

3. ✓ 4

4. ✗ 3

Question Number : 77 Question Id : 9003002357 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Which of the following is typically produced using zone refining, Czochralski, and float zone methods?

Options :

1. ✗ diamond

2. ✗ SiC

3. ✓ Si

4. ✗ W

Question Number : 78 Question Id : 9003002358 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Which of the following is correct with regards to Kelvin-Planck and Clausius statements?

Options :

1. ✓ violation of Kelvin-Planck statement results in violation of Clausius statement and vice-versa

2. ✗ violation of Kelvin-Planck statement results in violation of Clausius statement but not vice-versa

3. ✗ violation of Kelvin-Planck statement does not result in violation of Clausius statement and vice-versa

4. ✗ violation of Kelvin-Planck statement does not result in violation of Clausius statement but not vice-versa

Question Number : 79 Question Id : 9003002359 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The system is said to have undergone a reversible process when

Options :

1. ✓ the system returns to its initial state but not the surroundings

2. ✗ the surroundings of the system return to their initial state but not the system

3. ✗ both the system and its surroundings return to their respective initial states

4. ✗ neither the system nor its surroundings return to their respective initial states

Question Number : 80 Question Id : 9003002360 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The area enclosed by a cycle on the temperature (T)-entropy(S) diagram is

Options :

1. ✗ entropy

2. ✗ internal energy

3. ✓ heat transfer

4. ✗ total work done

Question Number : 81 Question Id : 9003002361 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A heat pump operates on a Carnot cycle with a coefficient of performance (CoP) of 12.
If the pump maintains a space at 24 °C by consuming 2 kW of power, then what heating load is provided by the pump?

Options :

1. ✗ 2.4 kW

2. ✖ 24 kW

3. ✖ 2.69 kW

4. ✔ 26.9 kW

Question Number : 82 Question Id : 9003002362 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

What is the probability of finding an electron in the Fermi level of an intrinsic semiconductor?

Options :

1. ✖ 0

2. ✔ 2/3

3. ✖ 0.5

4. ✖ 1

Question Number : 83 Question Id : 9003002363 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Nichrome or Kanthal is preferred over Cu as heating coils because they exhibit

Options :

1. ✖ low elastic modulus and low thermal expansion

2. ✖ high elastic modulus and low thermal expansion

3. ✔ high thermal expansion and low elastic modulus

4. ✖ low thermal expansion and high elastic modulus

Question Number : 84 Question Id : 9003002364 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Mg is often used as a sacrificial anode in the cathodic protection of a ship hull. How many moles of Mg will be sacrificed for every 2F of charge?

Options :

1. ✓ 1

2. ✗ 2

3. ✗ 4

4. ✗ 0.5

Question Number : 85 Question Id : 9003002365 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

For an oxide layer to informally cover a metal surface and act as a protective layer, the following should be satisfied?

Options :

1. ✓ The Pilling-Bedworth ratio is < 1 (tensile testing)

2. ✗ The Pilling-Bedworth ratio is just > 1

3. ✗ The Pilling-Bedworth ratio is much greater than 1 (compression)

4. ✗ The Pilling-Bedworth ratio is just < 1

Question Number : 86 Question Id : 9003002366 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The electrical resistivity of a pure metal X is 2×10^{-8} Ωm while that of an alloy X-4%Y is 6×10^{-8} Ωm. What is the resistivity due to impurities scattering per % of Y in the lattice of X? Consider the resistivities of X and X-4%Y to be negligible at 0 K.

Options :

1. ✗ 2×10^{-8} Ωm

2. ✓ 10^{-8} Ωm

3. ✗ 4×10^{-8} Ωm

4. ✗ 1.6×10^{-7} Ωm

Question Number : 87 Question Id : 9003002367 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Triple point of water on Pressure (P)-Temperature (T) diagram is a

Options :

1. ✗ exponential curve

2. ✗ triangle

3. ✗ line

4. ✓ point

Question Number : 88 Question Id : 9003002368 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Which of the following has the highest thermal conductivity at room temperature?

Options :

1. ✗ steel

2. ✗ Cu

3. ✗ Al

4. ✓ diamond

Question Number : 89 Question Id : 9003002369 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Experimentally measurable coefficient of thermal expansion is equivalent to which of the following? The partial derivative of volume with the temperature at constant pressure is related to experimentally measurable

Options :

1. ✗ partial derivative of temperature with the volume at constant pressure

2. ✗ partial derivative of pressure with the temperature at constant volume

3. ✓ partial derivative of volume with the temperature at constant pressure

4. ✗ partial derivative of temperature with the pressure at constant volume

Question Number : 90 Question Id : 9003002370 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Which of the following help Fe stabilize its BCC structure above the Curie temperature and below 912 °C?

Options :

1. ✓ both vibrational entropy and short-range magnetic ordering

2. ✗ vibrational entropy but not short-range magnetic ordering

3. ✗ short-range magnetic ordering but not vibrational entropy

4. ✗ configurational entropy and short-range magnetic ordering

Question Number : 91 Question Id : 9003002371 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

As per Newton's law of viscosity

Options :

1. ✓ viscosity is the linear proportionality constant

2. ✗ viscosity is inverse proportionality constant

3. ✗ viscosity is directly proportional to the shear strain

shear stress and shear strain are related through square law in dynamic viscosity

4. ✗

Question Number : 92 Question Id : 9003002372 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

R32 is a low global warming potential refrigerant which is chemically known as

Options :

1. ✗ difluoroethane

2. ✓ difluoromethane

3. ✗ chloro di-fluoro ethane

4. ✗ chloro di-fluoro methane

Question Number : 93 Question Id : 9003002373 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

If the temperature of a fluid is raised from T_1 to T_2 at a constant volume by heating in one case and by mechanical friction in another case, then the internal energy of the fluid at T_2 will be the same in both cases as per

Options :

1. ✗ zeroth law of thermodynamics

2. ✓ first law of thermodynamics

3. ✗ second law of thermodynamics

4. ✗ third law of thermodynamics

Question Number : 94 Question Id : 9003002374 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

At 0 K, all atoms in a solid will be in the lowest allowed energy level as per

Options :

1. ✗ the atomic approach to enthalpy

2. ✗ the atomic approach to free energy

3. ✗ the atomic approach to heat capacity

4. ✓ the atomic approach to entropy

Question Number : 95 Question Id : 9003002375 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

What is the entropy change when ice melts?

Options :

1. ✗ > 0

2. ✗ < 0

3. ✓ $= 0$

4. ✗ < 0 but close to -1 kJ/kg-K

Question Number : 96 Question Id : 9003002376 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A material that is constituted by at least 2 macroscopically distinguishable constituent materials, which have distinct chemical and physical properties is called as

Options :

1. ✗ a doped material

2. ✗ an alloy

3. ✗ a mixture

4. ✓ a composite

Question Number : 97 Question Id : 9003002377 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

If $\Psi = \sqrt{N}e^{-ikt}$, what is $\Psi\Psi^*$?

Options :

1. ✗ 1

2. ✗ N^2

3. ✗ $-N$

4. ✓ N

Question Number : 98 Question Id : 9003002378 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A combination turbine receives saturated Hg vapor from a boiler at 800 K and exhausts it to heat a steam boiler at 600 K. The steam turbine exhausts the steam to a condenser at 300 K. What is the maximum efficiency of the combination turbine?

Options :

1. ✖ 100%

2. ✔ 62.5%

3. ✖ 50%

4. ✖ 25%

Question Number : 99 Question Id : 9003002379 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

In the case of a monoatomic gas, what is heat given: change in internal energy: work done for an isochoric process =

Options :

1. ✖ 3:2:5

2. ✖ 5:3:1

3. ✔ 5:3:2

4. ✖ 5:2:3

Question Number : 100 Question Id : 9003002380 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

What is the crystal structure of 2D SiO_2?

Options :

1. ✔ hexagonal closed pack

2. ✖ body centered cubic

3. ✖ face centered cubic

4. ✗ orthorhombic

Question Number : 101 Question Id : 9003002381 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Mobility of an electron is

Options :

1. ✗ flow of electron per unit electric field strength

2. ✓ average electron drift velocity per unit electric field strength

3. ✗ reciprocal of conductivity per unit charge

4. ✗ resistivity per unit charge per unit electric field strength

Question Number : 102 Question Id : 9003002382 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Which of the following molding method is not used for fabricating thermoplastic components?

Options :

1. ✗ extrusion

2. ✗ injection molding

3. ✓ calendaring

4. ✗ casting

Question Number : 103 Question Id : 9003002383 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Thermocouple works on

Options :

1. ✗ Thomson effect

2. ✗ Peltier effect

3. ✓ Seebeck effect

4. ✗ Joule-Thomson effect

Question Number : 104 Question Id : 9003002384 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The bond between atoms which results from the sharing of pairs of valence electrons by two or more atoms is called as

Options :

1. ✓ covalent bond

2. ✗ metallic bond

3. ✗ ionic bond

4. ✗ hydrogen bond

Question Number : 105 Question Id : 9003002385 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Indentation modulus of a material is related to the

Options :

1. ✓ bulk modulus of the material

2. ✗ shear modulus of the material

3. ✗ elastic modulus of the material

4. ✗ ratio between the bulk modulus and elastic modulus

Question Number : 106 Question Id : 9003002386 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Electron affinity of diamond is

Options :

1. ✗ > 0

2. ✓ < 0

3. ✗ $= 0$

4. ✗ ∞

Question Number : 107 Question Id : 9003002387 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The mass of an electron varies with the variation in

Options :

1. ✗ gravitational field acting on it

2. ✗ magnetic field applied on it

3. ✗ electrostatic field applied on it

4. ✓ its velocity

Question Number : 108 Question Id : 9003002388 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Pure metals such as Ni is used as a cathode material in photo emissive cells concerning

Options :

1. ✗ visible light

2. ✗ IR light

3. ✗ near IR light

4. ✓ UV light

Question Number : 109 Question Id : 9003002389 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Which of the following super conductive properties is structure sensitive?

Options :

1. ✗ critical magnetic field strength

2. ✗ critical temperature

3. ✓ critical current density

4. ✗ critical permeability

Question Number : 110 Question Id : 9003002390 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Which type of electron pairs exists in a typical semiconductor?

Options :

1. ✗ heteropolar pairs

2. ✓ homopolar pairs

3. ✗ ionic pairs

4. ✗ non-ionic pairs

Question Number : 111 Question Id : 9003002391 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

If $f(x,y)=\begin{cases}\frac{xy(x^2-y^2)}{x^2+y^2} & (x,y)\neq(0,0)\\ 0 & (x,y)=(0,0)\end{cases}$, then $\frac{\partial}{\partial y}\left(\frac{\partial f}{\partial x}\right)(0,0)$ is

Options :

1. ✗ 1

2. ✗ 0

3. ✓ -1

4. ✗ Do not exists

Question Number : 112 Question Id : 9003002392 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Which of the following is true

Options :

1. ✓ If $\sum_{n=1}^{\infty} a_n$ converges, then $a_n \to 0$

2. ✗ If $a_n \to 0$ then $\sum_{n=0}^{\infty} a_n$ converges

3. ✗ $\sum_{n=1}^{\infty} a_n$ converges if and only if $a_n \to 0$

4. ✗ If $\lim_{n\to\infty} a_n$ is different from zero then $\sum_{n=1}^{\infty} a_n$ converges

Question Number : 113 Question Id : 9003002393 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The value of the integral $\oint xy\,dy - y^2\,dx$ (where C is the square cut from the first quadrant by the lines $x = 1$ and $y = 1$) is

Options :

1. ✓ $\frac{3}{2}$

2. ✗ 0

3. ✗ $\frac{1}{2}$

4. ✗ $\frac{5}{2}$

Question Number : 114 Question Id : 9003002394 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

If A and B are two independent events such that $P(A^c \cap B) = \frac{2}{15}$ and $P(A \cap B^c) = \frac{1}{6}$, then $P(B)$ is

Options :

1. ✓ $\frac{1}{6}$

2. ✗ $\frac{1}{8}$

3. ✗ $\frac{1}{2}$

4. ✗ $\frac{1}{4}$

Question Number : 115 Question Id : 9003002395 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Let X be a normal random variable with unknown mean μ and variance σ^2.
If $P[X \leq 49] = 0.6915$ and $P[X > 51] = 0.2266$, then μ and σ are
(use $\Phi(0.5) = 0.6915$ and $\Phi(0.75) = 0.7734$ from standard normal table)

Options :

1. ✓ $45,\ 8$

2. ✗ $42,\ 10$

3. ✗ $51,\ 8$

4. ✗ $45,\ 12$

Question Number : 116 Question Id : 9003002396 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Let $A = \begin{bmatrix} 4 & -1 & 0 \\ -1 & 4 & -1 \\ 0 & -1 & 4 \end{bmatrix}$. The upper triangular matrix U in LU decomposition of $A = \begin{bmatrix} 1 & 0 & 0 \\ l_{21} & 1 & 0 \\ l_{31} & l_{32} & 1 \end{bmatrix}\begin{bmatrix} u_{11} & u_{12} & u_{13} \\ 0 & u_{22} & u_{23} \\ 0 & 0 & u_{33} \end{bmatrix}$ is

Options :

1. ✗ $\begin{bmatrix} 4 & -1 & 0 \\ 0 & \frac{15}{4} & -1 \\ 0 & 0 & -\frac{56}{15} \end{bmatrix}$

2. ✗ $\begin{bmatrix} 4 & -1 & 0 \\ 0 & -1 & \frac{15}{4} \\ 0 & 0 & -\frac{56}{15} \end{bmatrix}$

3. ✗ $\begin{bmatrix} 4 & -1 & 0 \\ 0 & -1 & \frac{15}{4} \\ 0 & 0 & \frac{56}{15} \end{bmatrix}$

4. ✓ $\begin{bmatrix} 4 & -1 & 0 \\ 0 & \frac{15}{4} & -1 \\ 0 & 0 & \frac{56}{15} \end{bmatrix}$

Question Number : 117 Question Id : 9003002397 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The approximate value of $\int_0^{\pi} e^x \cos 4x \, dx$ using Simpson's $\frac{1}{3}$ rule with $h = \frac{\pi}{2}$ is

Options :

1. ✗ 25.143

2. ✓ 22.724

3. ✗ 20.137

4. ✗ 27.156

Question Number : 118 Question Id : 9003002398 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Solution of the initial value problem $4x^2\frac{d^2y}{dx^2} + 24x\frac{dy}{dx} + 25y = 0, y(1) = 2, \frac{dy}{dx}(1) = -6$ at $x = 4$ is

Options :

1. ✗ 0.1895

2. ✖ 0.2534

3. ✔ 0.019

4. ✖ 0.065

Question Number : 119 Question Id : 9003002399 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Let A be a $m \times n$ matrix, where $m < n$. Consider the system of linear equations $Ax = b$, where b is a $m \times 1$ column vector and $b \neq 0$. Which of the following is always true?

Options :

1. ✖ The system of equations has no solution.

2. ✔ The system of equations has a solution if and only if it has infinitely many solutions.

3. ✖ The system of equations has a unique solution.

4. ✖ The system of equations has at least one solution.

Question Number : 120 Question Id : 9003002400 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The system of equations $x + y + z = 0,\ 3x + 6y + z = 0,\ \alpha x + 2y + z = 0$ has infinitely many solutions if α is equal to:

Options :

1. ✖ 7

2. ✔ $\frac{7}{5}$

3. ✖ $\frac{5}{7}$

4. ✖ 4