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 29th Sep 2021 Shift2
Duration :	120
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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? (SA type of questions will be always auto saved) :	Yes
Is this Group for Examiner? :	No

Nano Technology

Section Id :	8737184
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

Question Number : 1 Question Id : 873718361 Display Question Number : Yes Is Question Mandatory : No

In comparison to macroparticles, the nanoparticles have

Options :

1. ✔ very high specific surface area

2. ✖ very high surface area

3. ✖ very low specific surface area

4. ✖ low surface area

Question Number : 2 Question Id : 873718362 Display Question Number : Yes Is Question Mandatory : No

With regards to nanoscience and nanotechnology, Prof. Richard Feynman is famous for

Options :

1. ✖ coining the word "Nanotechnology"

2. ✔ his talk entitled, "There is Plenty of Room at the Bottom"

3. ✖ his work on "Molecular Nanotechnology"

4. ✖ his invention of "Atomic Force Microscope"

Question Number : 3 Question Id : 873718363 Display Question Number : Yes Is Question Mandatory : No

If $f[x_1, x_2, \ldots\ldots x_n]$ is a function of n variables x_1 to x_n, then the total differential is written as $df = \sum_{i=1}^{n} \partial_{x_i} f \, dx_i$, where $\partial_{x_i} f$ is the

Options :

1. ✖ partial derivative of f with respect to x_i while some variables (here $x_j \neq x_i$) are held constant

2. ✖ partial derivative of f with respect to x_i while some variables (here $x_j \neq x_i$) are not held constant

3. ✖ partial derivative of f with respect to x_i while all other variables (here $x_j = x_i$) are held constant

4. ✔ partial derivative of f with respect to x_i while all other variables (here $x_j \neq x_i$) are held constant

Question Number : 4 Question Id : 873718364 Display Question Number : Yes Is Question Mandatory : No

If any change in volume (V) due to a change in temperature (T) and pressure (P) is given by $\int_l^k dV$ then l and k are the

Options :

1. ✖ initial and final values of V

2. ✖ initial and final values of V and P

3. ✔ initial and final values of T and P

4. ✖ initial and final values of P

Question Number : 5 Question Id : 873718365 Display Question Number : Yes Is Question Mandatory : No

What are the magnetic quantum numbers corresponding to $3d^{10}$ the electronic state of Zn ?

Options :

1. ✖ -2, 0, and +2

2. ✖ -3, -2, -1, 0, +1, +2, and +3

3. ✔ -2, -1, 0, +1, and +2

4. ✖ -1, 0, and +1

Question Number : 6 Question Id : 873718366 Display Question Number : Yes Is Question Mandatory : No

When connected between two conductive ports, a long (5 mm) tube with an extremely small diameter (~1 nm) exhibited unusual electron transport behavior. The tube was found to be made by a regular arrangement of atoms of the same kind. The electron mean free path in any other material made of the same kind of atoms is 10 nm. Such tubes were made in large numbers and stored in a bottle. The bottle is said to contain which class of material ?

Options :

1. ✔ 1D nanocrystalline material

2. ✖ 1D nanocrystalline macro-material

3. ✖ 1D amorphous macro-material

4. ✖ 1D amorphous nanomaterial

Question Number : 7 Question Id : 873718367 Display Question Number : Yes Is Question Mandatory : No

When a spherical body falls vertically in a fluid, the viscous friction is such that, after a certain time, the body falls with constant velocity. If L is any linear dimension in the spherical body, then the transient time scales as

Options :

1. ✖ L

2. ✖ $1/L$

3. ✖ $1/L^2$

4. ✔ L^2

Question Number : 8 Question Id : 873718368 Display Question Number : Yes Is Question Mandatory : No

Which of the following statements is correct w.r.t the stored energy in a parallel plate capacitor?

Options :

1. ✖ the stored energy increases following a cube law with the size of the capacitor

2. ✔ the stored energy decreases with the size of the capacitor

3. ✖ the stored energy is not related to the size of the capacitor

4. ✖ the stored energy increases following a square law with the size of the capacitor

Question Number : 9 Question Id : 873718369 Display Question Number : Yes Is Question Mandatory : No

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. ✖ L

2. ✖ L^2

3. ✔ L^3

4. ✖ $1/L^2$

Question Number : 10 Question Id : 873718370 Display Question Number : Yes Is Question Mandatory : No

The area of the region bounded by the curves $y = t(x)$ and $y = s(x)$ and the lines $x = l$, $x = m$, where t and s are continuous and $t(x) \geq s(x)$ ∀ x in $[l, m]$ is given by

Options :

1. ✔ $\int_l^m [t(x) - s(x)]dx$

2. ✖ $\int_l^m [t(x) + s(x)]dx$

3. ✖ $\int_l^m [t(x)s(x)]dx$

4. ✖ $\int_l^m [t(x)/s(x)]dx$

Question Number : 11 Question Id : 873718371 Display Question Number : Yes Is Question Mandatory : No

The type of atomic bonding in diamond is

Options :

1. ✖ hydrogen

2. ✖ ionic

3. ✖ metallic

4. ✔ covalent

Question Number : 12 Question Id : 873718372 Display Question Number : Yes Is Question Mandatory : No

The determinant of $\begin{pmatrix} 4 & 2 & 6 \\ 2 & 6 & 2 \\ 4 & 2 & 6 \end{pmatrix}$ is

Options :

1. ✖ 8

2. ✖ -16

3. ✖ 16

4. ✔ 0

Question Number : 13 Question Id : 873718373 Display Question Number : Yes Is Question Mandatory : No

How many residual molecules can be there in a chamber at a very high vacuum?

Options :

1. ✖ tens of residual molecules

2. ✖ hundreds of residual molecules

3. ✖ thousands of residual molecules

4. ✔ millions of residual molecules

Question Number : 14 Question Id : 873718374 Display Question Number : Yes Is Question Mandatory : No

What is the pH of an aqueous solution containing equal but low concentrations of H^+ and of OH^- ions?

Options :

1. ✖ -8

2. ✖ 0

3. ✔ 7

4. ✖ 12

Question Number : 15 Question Id : 873718375 Display Question Number : Yes Is Question Mandatory : No

Which of the following is correct w.r.t Boltzmann distribution of the speed of molecules in a gas at 300 K for a tiny sample of 20 gas molecules?

Options :

1. ✖ Boltzmann distribution will be highly uniform at any one time

2. ✔ Boltzmann distribution will be far from uniform at any one time

3. ✖ Boltzmann distribution cannot be plotted

4. ✖ Boltzmann distribution will be highly uniform at any one time

Question Number : 16 Question Id : 873718376 Display Question Number : Yes Is Question Mandatory : No

In monoclinic system, the crystal is defined by vectors of unequal lengths as in

Options :

1. ✔ orthorhombic system

2. ✖ tetragonal system

3. ✖ hexagonal system

4. ✖ triclinic system

Question Number : 17 Question Id : 873718377 Display Question Number : Yes Is Question Mandatory : No

A unit triclinic cell has

Options :

1. ✔ four crystallographic axes

2. ✖ three crystallographic axes

3. ✖ two crystallographic axes

4. ✖ only one crystallographic axis perpendicular to the basal plane

Question Number : 18 Question Id : 873718378 Display Question Number : Yes Is Question Mandatory : No

The radius of conduit is reduced by 100 times. The reduction in radius results in

Options :

1. ✖ 1000 times increase in pressure drop per unit length of the conduit

2. ✖ 1000 times decrease in pressure drop per unit length of the conduit

3. ✔ 10000 times increase in pressure drop per unit length of the conduit

4. ✖ 10000 times decrease in pressure drop per unit length of the conduit

Question Number : 19 Question Id : 873718379 Display Question Number : Yes Is Question Mandatory : No

In which of the following objects made up of the same type of constituents, the error/fluctuation in measuring an average property <P> is the highest ?

Options :

1. ✖ a solid sphere of diameter 5 nm

2. ✖ a solid sphere of diameter 10 nm

3. ✖ a solid sphere of diameter 20 A^0

4. ✔ a solid sphere of diameter 10 A^0

Question Number : 20 Question Id : 873718380 Display Question Number : Yes Is Question Mandatory : No

A body is in equilibrium in such a way that the equilibrium is independent of its displacement from its original position. What is the equilibrium called as ?

Options :

1. ✔ neutral equilibrium

2. ✖ stable equilibrium

3. ✖ unstable equilibrium

4. ✖ biased equilibrium

Question Number : 21 Question Id : 873718381 Display Question Number : Yes Is Question Mandatory : No

If the graph of $f(x)$ coincides with the line $y = x$ to the right of the y-axis and coincides with the line $y = -x$ to the left of the y-axis, then what is $f(x)$?

Options :

1. ✖ $|-x-1|$

2. ✖ $|x-1|$

3. ✔ $|x|$

4. ✖ $x-1$

Question Number : 22 Question Id : 873718382 Display Question Number : Yes Is Question Mandatory : No

Which of following is also known as Zener-Hollomon parameter ?

Options :

1. ✖ coefficient of a nonsteady flow

2. ✔ temperature compensated strain rate

3. ✖ strain rate sensitivity index

4. ✖ crystallographic index

Question Number : 23 Question Id : 873718383 Display Question Number : Yes Is Question Mandatory : No

If the Gibbs free energy of a gas, expressed as a function of Pressure P and temperature T, is given by $G(T,P) = RT\log\left(\frac{P}{P_0}\right) - KP$ (where K and P_0 are constants and R is the gas constant) then the Entropy of the gas is given by

Options :

1. ✖ $R\log\left(\frac{P}{P_0}\right)$

2. ✔ $-R\log\left(\frac{P}{P_0}\right)$

3. ✖ $RT^2\log\left(\frac{P}{P_0}\right) - KPT$

4. ✖ $RT\log\left(\frac{P}{P_0}\right) - \frac{KP}{T}$

Question Number : 24 Question Id : 873718384 Display Question Number : Yes Is Question Mandatory : No

The primary function of a cutting fluid is to

Options :

1. ✖ prevent de-coloration of the surface of the part being machined

2. ✔ decrease friction, wear and heat generation in the cutting region

3. ✖ selectively corrode the surface of the part being machined

4. ✖ quench the tool during cutting to make it hard by phase transformation

Question Number : 25 Question Id : 873718385 Display Question Number : Yes Is Question Mandatory : No

The crystal defects that are bounded by two mirror planes are known an

Options :

1. ✔ twins

2. ✖ dislocation pairs

3. ✖ stacking faults

4. ✖ misleading planes

Question Number : 26 Question Id : 873718386 Display Question Number : Yes Is Question Mandatory : No

Empirical Euler's formula in the case of buckling of columns is applicable for

Options :

1. ✖ weak columns

2. ✖ very short columns

3. ✖ short columns

4. ✔ long columns

Question Number : 27 Question Id : 873718387 Display Question Number : Yes Is Question Mandatory : No

What is the relation between elastic constants namely Youngs modulus (E), bulk modulus (K) and shear modulus (G) ?

Options :

1. ✔ $E = \frac{9KG}{G+3K}$

2. ✖ $E = \frac{9KG}{3G+3}$

3. ✖ $E = \frac{3KG}{G+9K}$

4. ✖ $E = \frac{3KG}{9G+K}$

Question Number : 28 Question Id : 873718388 Display Question Number : Yes Is Question Mandatory : No

What are units of thermal conductivity ?

Options :

1. ✔ W/m°C

2. ✖ WK/m

3. ✖ Wm/°C

4. ✖ WmK

Question Number : 29 Question Id : 873718389 Display Question Number : Yes Is Question Mandatory : No

A string is 5 mm in diameter and has an original length of 1 m. The string is pulled by a force of 100 N. If the final length of the spring is 1.02 m, then what is the strain in the string ?

Options :

1. ✖ 0.01

2. ✖ 2

3. ✔ 0.02

4. ✖ 0.002

Question Number : 30 Question Id : 873718390 Display Question Number : Yes Is Question Mandatory : No

If V is the cutting tool speed, T is tool life (mins), C is machining constant and n is Taylor's tool life exponent, then what is Taylor's tool life equation ?

Options :

1. ✖ $VC^n = T$

2. ✖ $V/T^n = C$

3. ✔ $VT^n = C$

4. ✖ $CVT^n = 1$

Question Number : 31 Question Id : 873718391 Display Question Number : Yes Is Question Mandatory : No

In a sand-casting process, if a sprue with a base diameter of d mm and height of h mm leads to a runner which fills a cubical mould cavity of size c mm then the volume flow rate is given by

Options :

1. ✖ $\frac{\pi d^2\sqrt{2gh}}{2}$ (g being acceleration due to gravity)

2. ✔ $\frac{\pi d^2\sqrt{2gh}}{4}$ (g being acceleration due to gravity)

3. ✖ $\frac{\pi d^2\sqrt{2gh}}{8c}$ (g being acceleration due to gravity)

4. ✖ $\frac{\pi d^2\sqrt{2gch}}{4}$ (g being acceleration due to gravity)

Question Number : 32 Question Id : 873718392 Display Question Number : Yes Is Question Mandatory : No

Which of the following discoveries won the Nobel prize ?

Options :

1. ✖ carbon nanotubes

2. ✖ diamond

3. ✖ carbon nanofibers

4. ✔ buckyballs

Question Number : 33 Question Id : 873718393 Display Question Number : Yes Is Question Mandatory : No

Water is flowing in a constriction with a speed V in one region with larger diameter and with a speed S in a region with smaller diameter in such a way that V is less than S, then which of the following is correct ?

Options :

1. ✖ water first flows from smaller diameter region towards larger diameter region and then reverses due to Kondo effect in a constriction

2. ✖ water is flowing from smaller diameter region towards larger diameter region

3. ✔ water is flowing from larger diameter region towards smaller diameter region

4. ✖

water first flows from larger diameter region towards smaller diameter region and then reverses due to Kondo effect in a constriction

Question Number : 34 Question Id : 873718394 Display Question Number : Yes Is Question Mandatory : No

$\int_1^{\sqrt{3}} x(6-2x^2)dx = ?$

Options :

1. ✖ 1

2. ✖ $\sqrt{3}$

3. ✔ 2

4. ✖ $\sqrt{2}$

Question Number : 35 Question Id : 873718395 Display Question Number : Yes Is Question Mandatory : No

A person walks from 0° latitude and proceeds in a westerly direction. Let T(x) denote the temperature at a point x at any given time. Which of the following is correct if T is assumed to be a continuous function of x ?

Options :

1. ✔ there are at least 2 diametrically opposite points on the equator that have precisely the same temperature

2. ✖

there are at least 2 diametrically opposite points on the equator that have different temperatures

3. ✖ there are at least 2 diametrically opposite points on the equator that have temperatures in a non-linear relationship

4. ✖ there are at least 2 diametrically opposite points on the equator that have temperatures in a linear relationship

Question Number : 36 Question Id : 873718396 Display Question Number : Yes Is Question Mandatory : No

Which of the following methods involves severe plastic deformation of a bulk material to derive nano or ultrafine grained microstructure at low homologous temperatures ?

Options :

1. ✔ equal channel angular pressing

2. ✖ nano indentation induced grain refinement

3. ✖ tampering

4. ✖ conventional extrusion

Question Number : 37 Question Id : 873718397 Display Question Number : Yes Is Question Mandatory : No

Which of the following is a layer-by-layer thin film growth mode ?

Options :

1. ✖ Volmer–Weber growth mode

2. ✔ Stranski–Krastanov growth mode

3. ✖ Frank–van der Merwe growth mode

4. ✖ Thornton growth mode

Question Number : 38 Question Id : 873718398 Display Question Number : Yes Is Question Mandatory : No

Why is that a wooden beam or other structural member made of wood can maintain mechanical strength in a fire for much longer periods than an equivalent steel beam or other steel structural member ?

Options :

1. ✔ because thermal insulation is provided by a carbon layer that forms on the surface of wooden beam as the beam burns due to fire

2. ✖ the given question is not correct

3. ✖ because the composite structure of the beam becomes highly amorphous due to the fire and therefore the strength of the beam is enhanced as it burns

4. ✖ because the composite structure of the beam becomes highly oriented due to the fire resulting in enhancement of the beam's strength as it burns

Question Number : 39 Question Id : 873718399 Display Question Number : Yes Is Question Mandatory : No

What is the parameter in Hall-Petch relation that describes the relative hardening contribution of the grain boundaries ?

Options :

1. ✖ yield stress

2. ✔ locking parameter

3. ✖ grain diameter

4. ✖ frictional stress

Question Number : 40 Question Id : 873718400 Display Question Number : Yes Is Question Mandatory : No

Which of the following ratios is the Reynolds number w.r.t to fluid flow ?

Options :

1. ✖ gravitational forces/viscous forces

2. ✖ viscous forces/inertial forces

3. ✔ inertial forces/viscous forces

4. ✖ viscous forces/gravitational forces

Question Number : 41 Question Id : 873718401 Display Question Number : Yes Is Question Mandatory : No

Heat transfer in typical boilers happens through

Options :

1. ✖ only conduction

2. ✖ conduction and convection but not radiation

3. ✖ conduction and radiation but not convection

4. ✔ conduction, convection and radiation

Question Number : 42 Question Id : 873718402 Display Question Number : Yes Is Question Mandatory : No

Which of the following statements is incorrect w.r.t the amount of heat flow through a body by conduction ?

Options :

1. ✖ it is directly proportional to the surface area of the body

2. ✖ it directly proportional to the temperature difference on the two faces of the body

3. ✖ it is dependent upon the intrinsic characteristics of the material with which the body made up of

4. ✔ it is inversely proportional to the surface area of the body

Question Number : 43 Question Id : 873718403 Display Question Number : Yes Is Question Mandatory : No

Which type of differential equation is Newton's second law of motion ?

Options :

1. ✔ second-order linear differential equation

2. ✖ first-order linear differential equation

3. ✖ second-order non-linear differential equation

4. ✖ first-order non-linear differential equation

Question Number : 44 Question Id : 873718404 Display Question Number : Yes Is Question Mandatory : No

A spring with a mass of m kg has natural length x m. A force of y N is required to maintain it stretched to a length of $x+\Delta x$. What will be the position of the mass at any time t if the spring is stretched to a length of $x+\Delta x$ and then released with an initial velocity of 0 ?

Options :

1. ✖ position will be zero

2. ✔ position will be a cosine function in t

3. ✖ position will be infinity

4. ✖ position will be an inverse cosine function in t

Question Number : 45 Question Id : 873718405 Display Question Number : Yes Is Question Mandatory : No

Which of the following is correct w.r.t $\lim_{x\to\infty} sinx$?

Options :

1. ✖ $\lim_{x\to\infty} sinx = 1$

2. ✔ $\lim_{x\to\infty} sinx$ doesn't exist

3. ✖ $\lim_{x\to\infty} sinx = 0$

4. ✖ $\lim_{x\to\infty} sinx = -1$

Question Number : 46 Question Id : 873718406 Display Question Number : Yes Is Question Mandatory : No

If $y = f(u)$ and $u = g(x)$ are two differentiable functions, then which of the following is correct ?

Options :

1. ✔ $\frac{dy}{dx} = \frac{dy}{du}\frac{du}{dx}$

2. ✖ $\frac{dy}{du} = \frac{dy}{du}\frac{du}{dx}$

3. ✖ $\frac{du}{dx} = \frac{dy}{du}\frac{du}{dx}$

4. ✖ $\frac{dx}{du} = \frac{dy}{du}\frac{du}{dx}$

Question Number : 47 Question Id : 873718407 Display Question Number : Yes Is Question Mandatory : No

If the original length of a feature is 1 nm while its length on a micrograph is 1 cm, then what is the magnification at which the micrograph was recorded ?

Options :

1. ✖ 0.1 million

2. ✖ 1 million

3. ✔ 10 million

4. ✖ 100 million

Question Number : 48 Question Id : 873718408 Display Question Number : Yes Is Question Mandatory : No

What are the solid phases containing two or more metallic elements, with optionally one or more non-metallic elements, whose crystal structure differs from that of the other constituents are called ?

Options :

1. ✖ composites

2. ✖ phase mixtures

3. ✔ intermetallic compounds

4. ✖ locally crystalline phases

Question Number : 49 Question Id : 873718409 Display Question Number : Yes Is Question Mandatory : No

A counter flow heat exchanger was designed in such a way that the heat capacities of the flowing fluids are the same. In this heat exchanger, if a hot fluid enters at t ℃ and leaves at $t - k$ ℃ while the cold fluid enters at k ℃, then what is the mean temperature difference between the two flowing fluids ?

Options :

1. ✖ $t - k^{1/2}$ ℃

2. ✖ $t - 0.2k$ ℃

3. ✖ $t - (\frac{k}{2})$ ℃

4. ✔ $t - 2k$ ℃

Question Number : 50 Question Id : 873718410 Display Question Number : Yes Is Question Mandatory : No

Into which class of levers, the Barbecue tongs are categorized ?

Options :

1. ✔ 3^{rd} order levers

2. ✖ 2^{nd} order levers

3. ✖ 1^{st} order levers

4. ✖ zero order levers

Question Number : 51 Question Id : 873718411 Display Question Number : Yes Is Question Mandatory : No

In which of the following processes the internal energy of an ideal gas remains constant?

Options :

1. ✖ reversible adiabatic process

2. ✖ reversible isomeric process

3. ✔ reversible isothermal process

4. ✖ reversible isobaric process

Question Number : 52 Question Id : 873718412 Display Question Number : Yes Is Question Mandatory : No

Which of the following is correct relation between the force of gravity on a heavy ball (f) and a lighter ball (g) ?

Options :

1. ✖ $f < 1/g$

2. ✔ $f > g$

3. ✖ $f = g$

4. ✖ $f < g$

Question Number : 53 Question Id : 873718413 Display Question Number : Yes Is Question Mandatory : No

Using which of the following, the dynamic hardness of a metal surface can be measured?

Options :

1. ✖ Rockwell C hardness test

2. ✔ Shore scleroscope

3. ✖ Mohs hardness test

4. ✖ Brinell testing

Question Number : 54 Question Id : 873718414 Display Question Number : Yes Is Question Mandatory : No

If M and N $Jmol^{-1}K^{-1}$ are the entropies of two equilibrium phases X and Y (made of same element), respectively. If T K is the transition temperature below which X transforms to Y, then what is the heat of transformation.

Options :

1. ✔ T(M-N)

2. ✖ T(N-M)

3. ✖ M-N

4. ✖ M+N

Question Number : 55 Question Id : 873718415 Display Question Number : Yes Is Question Mandatory : No

What is the ratio of surface energy to total energy in the case of nanostructures ?

Options :

1. ✖ zero

2. ✖ ~0.5

3. ✔ ~1

4. ✖ ∞

Question Number : 56 Question Id : 873718416 Display Question Number : Yes Is Question Mandatory : No

Which of the following Bravais lattices are called as self-duals ?

Options :

1. ✖ face centered cubic and body centered cubic

2. ✖ body centered cubic and hexagonal

3. ✖ hexagonal and face centered cubic

4. ✔ hexagonal and simple cubic

Question Number : 57 Question Id : 873718417 Display Question Number : Yes Is Question Mandatory : No

Hardness and yield strength of a material can be enhanced by making it

Options :

1. ✖ easy to create and move dislocations in spatially confined regions in the material

2. ✔ difficult to create and to move dislocations in spatially confined regions

3. ✖ easy to create and move twins in spatially confined regions in the material

4. ✖ difficult for the twins to move in spatially confined regions in the material

Question Number : 58 Question Id : 873718418 Display Question Number : Yes Is Question Mandatory : No

Which of the following nanomagnetic effects has won the Nobel prize ?

Options :

1. ✔ giant magnetoresistance

2. ✖ weak and electromagnetic interaction between elementary particles

3. ✖ electronic structure of magnetic and disordered systems

4. ✖ antiferromagnetism and ferrimagnetism

Question Number : 59 Question Id : 873718419 Display Question Number : Yes Is Question Mandatory : No

What should be the size a nanoparticle in order for it to exhibit unique thermal transport?

Options :

1. ✖ greater than the phonon scattering length in its bulk counterpart

2. ✔ less than or equal to the phonon scattering length in its bulk counterpart

3. ✖ less than or equal to the electron mean path in its bulk counterpart

4. ✖ equal to the length of exchange interactions in its bulk counterpart

Question Number : 60 Question Id : 873718420 Display Question Number : Yes Is Question Mandatory : No

To which of the following the units 'sccm' are related to ?

Options :

1. ✖ velocity of a fluid flowing downwards in a vertical pipe

2. ✖ acceleration of a fluid through a constriction

3. ✖ viscosity of a fluid

4. ✔ gas mass flow rate

Question Number : 61 Question Id : 873718421 Display Question Number : Yes Is Question Mandatory : No

Doped material are materials

Options :

1. ✖ that is constituted by at least 2 macroscopically identifiable/distinguishable materials, which have distinct chemical and physical (including mechanical) properties

2. ✔ that are constituted by impurities/defects as secondary constituents in addition to a primary constituent

3. ✖ that have constituents that are mixed at the atomic level

4. ✖ that have constituents that are mixed at the molecular level

Question Number : 62 Question Id : 873718422 Display Question Number : Yes Is Question

Mandatory : No

If $f(x)$ is a function defined on some interval (m, ∞), then what does $\lim_{x \to \infty} f(x) = \infty$ means?

Options :

1. ✔ it means that for every positive number n in the interval (m, ∞) there is a corresponding positive number p such that if $x > p$ then $f(x) > n$.

2. ✖ it means that for any number n there is a corresponding positive number p such that if $x > p$ then $f(x) > n$.

3. ✖ it means that for a negative number n there is a corresponding positive number p such that if $x > p$ then $f(x) > n$.

4. ✖ it means that ∀ negative numbers there are corresponding positive numbers

Question Number : 63 Question Id : 873718423 Display Question Number : Yes Is Question Mandatory : No

For an efficient combustion process in a furnace

Options :

1. ✔ the flame temperature generated by the combustion process should greater than process critical temperature

2. ✖ the flame temperature generated by the combustion process should lower than process critical temperature

3. ✖

the flame temperature generated by the combustion process should equal to the process critical temperature

4. ✖ the process critical temperature should be as high as possible

Question Number : 64 Question Id : 873718424 Display Question Number : Yes Is Question Mandatory : No

What is the shape of the solid obtained by rotating about the y-axis the region between $y = x$ and $y = x^2$?

Options :

1. ✖ semi-sphere

2. ✖ sphere

3. ✔ shell

4. ✖ U-shaped rod

Question Number : 65 Question Id : 873718425 Display Question Number : Yes Is Question Mandatory : No

Specific heats of all solids

Options :

1. ✖ rise sharply at low temperatures and approach ∞ as temperature approaches 0 K

2. ✔

drop sharply at low temperatures and approach 0 as temperature approaches 0 K

3. ✖ rise sharply at high temperatures and approach ∞ as temperature approaches 673 K

4. ✖ drop sharply at high temperatures and approach 0 as temperature approaches 673 K

Question Number : 66 Question Id : 873718426 Display Question Number : Yes Is Question Mandatory : No

In which of the following materials a non-linear behavior stress-strain behavior is observed ?

Options :

1. ✖ metals

2. ✖ ceramics

3. ✔ rubber

4. ✖ metal-matrix composites

Question Number : 67 Question Id : 873718427 Display Question Number : Yes Is Question Mandatory : No

Which of the following statements is correct w.r.t the strength of cast iron ?

Options :

1. ✖ compressive strength ≤ tensile strength

2. ✖ compressive strength = tensile strength

3. ✖ compressive strength < tensile strength

4. ✔ compressive strength > tensile strength

Question Number : 68 Question Id : 873718428 Display Question Number : Yes Is Question Mandatory : No

In linear regression analysis, what happens if there are more parameters ?

Options :

1. ✖ analysis becomes too trivial and renders no physical meaning to the solution

2. ✖ analysis typically turns out to be erroneous

3. ✖ it is very easy to calculate residual sum of squares

4. ✔ it is very difficult to calculate residual sum of squares

Question Number : 69 Question Id : 873718429 Display Question Number : Yes Is Question Mandatory : No

What is the instrument that is used to record stagnation and static pressures in a fluid flow?

Options :

1. ✖ Venturimeter

2. ✖ Orificemeter

3. ✖ static Pirani gauge

4. ✔ Pitot static tube

Question Number : 70 Question Id : 873718430 Display Question Number : Yes Is Question Mandatory : No

What is the physical meaning of the negative sign in Fourier heat conduction equation?

Options :

1. ✔ heat always flow in the direction of negative temperature gradient

2. ✖ heat always flow in the direction of positive temperature gradient

3. ✖ heat is lost to the surroundings

4. ✖ heat flow is absent

Question Number : 71 Question Id : 873718431 Display Question Number : Yes Is Question Mandatory : No

In a steady state condition, what will be the temperature distribution in a large thin plate with uniform surface temperature ?

Options :

1. ✖

hyperbolic

2. ✔ linear

3. ✖ parabolic

4. ✖ logarithmic

Question Number : 72 Question Id : 873718432 Display Question Number : Yes Is Question Mandatory : No

Which of the following is deteriorated with strain hardening ?

Options :

1. ✔ percentage elongation

2. ✖ hardness

3. ✖ Youngs modulus

4. ✖ yield strength

Question Number : 73 Question Id : 873718433 Display Question Number : Yes Is Question Mandatory : No

If the density function of a lamina occupying a region is given as $\rho(x, y)$, then how is the mass (m) of the lamina represented ?

Options :

1. ✖

$m = \int \rho(x,y)dxdy$

2. ✖ $m = \iiint \rho(x,y)dxdy$

3. ✔ $m = \iint \rho(x,y)dxdy$

4. ✖ $m = \int \rho(x)dx + \int \rho(y)dy$

Question Number : 74 Question Id : 873718434 Display Question Number : Yes Is Question Mandatory : No

In dealing with the physics of rotating bodies, and small oscillations of vibrating systems, which of the following is important ?

Options :

1. ✔ eigen values and eigen vectors

2. ✖ determinants

3. ✖ maxima and minima

4. ✖ Green's theorem

Question Number : 75 Question Id : 873718435 Display Question Number : Yes Is Question Mandatory : No

What happens to the elastic energy stored per unit volume as the loading in tension is increased?

Options :

1. ✔ increases

2. ✖ decreases

3. ✖ remains the same

4. ✖ it first decreases and then drastically increases

Question Number : 76 Question Id : 873718436 Display Question Number : Yes Is Question Mandatory : No

What is the minimum requirement w.r.t the wavelength of the x-rays to be used for Bragg's diffraction from given crystalline material ?

Options :

1. ✖ the wave length should be exactly 4 times the interplanar spacing in the material

2. ✖ the wave length should be exactly the same as the interplanar spacing in the material

3. ✖ the wave length should be greater than the interplanar spacing in the material

4. ✔ the wave length should be less than 2 times of the interplanar spacing in the material

Question Number : 77 Question Id : 873718437 Display Question Number : Yes Is Question Mandatory : No

What is the ratio of the temperature drop across two layers of a composite wall of a furnace?

The layers are of equal thickness and have thermal conductivities in the ratio 1:2.

Options :

1. ✖ 1:2

2. ✖ 1:1

3. ✔ 2:1

4. ✖ 1:0.5

Question Number : 78 Question Id : 873718438 Display Question Number : Yes Is Question Mandatory : No

The creep rate depends on which of the following ?

Options :

1. ✖ activation energy to move solute atoms

2. ✔ activation energy to move dislocations

3. ✖ activation energy to move precipitates

4. ✖ activation energy to move jogs

Question Number : 79 Question Id : 873718439 Display Question Number : Yes Is Question Mandatory : No

It is known that metals may deform by slip and twinning. In this context, which of the following is correct ?

Options :

1. ✖ Metals deform by slip and twinning independent of temperature

2. ✖ Metals deform by slip and twinning exactly at absolute melting temperature of the metal in consideration

3. ✖ Metals deform by slip and twinning at temperatures just above the melting temperature of the metal in consideration

4. ✔ Metals deform by slip and twinning at low temperatures which are about one half of the absolute melting temperature of the metal in consideration

Question Number : 80 Question Id : 873718440 Display Question Number : Yes Is Question Mandatory : No

If three liquids with vapor pressures M, N, and P (M>N>P) are kept under same pressure, then which of the following is correct ?

Options :

1. ✖ all the three liquids start boiling at the same time

2. ✔ liquid with vapor pressure M starts boiling first

3. ✖ liquid with vapor pressure N starts boiling first

4. ✖ liquid with vapor pressure P starts boiling first

Question Number : 81 Question Id : 873718441 Display Question Number : Yes Is Question Mandatory : No

If a steady state reaction namely $4M + 3N + 2O \rightarrow 2P + 3Q$ occurs in a reactor, then what is the flux ratio concerning the reactant M and the product P ?

Options :

1. ✖ -8

2. ✔ -2

3. ✖ 6

4. ✖ 2

Question Number : 82 Question Id : 873718442 Display Question Number : Yes Is Question Mandatory : No

Why is Eulerian approach (and not the Lagrangian approach) is used in fluid mechanics ?

Options :

1. ✔ because fluid mechanics deals with the state of motion at various points in the fluid system rather than the motion of each particle

2. ✖ because fluid mechanics deals with the state of the motion of each particle rather than the motion at various points in the fluid system

3. ✖ because fluid mechanics deals with neither the state of the motion of each particle nor the motion at various points in the fluid system

4. ✖ because fluid mechanics deals with both the state of the motion of each particle and the motion at various points in the fluid system

Question Number : 83 Question Id : 873718443 Display Question Number : Yes Is Question Mandatory : No

cos $2x$ equals to

Options :

1. ✔ $cos^2x - sin^2x$

2. ✖ $cos^2x + sin^2x$

3. ✖ $cos^2x \div sin^2x$

4. ✖ $sin^2x \div cos^2x$

Question Number : 84 Question Id : 873718444 Display Question Number : Yes Is Question Mandatory : No

In powder x-ray diffraction method, in addition to the diffraction angle position rules, the intensities rules also have to be considered in determining the crystal structure. In this context, what is the ratio of intensities of the diffraction lines in the order of diffraction for simple cubic lattice ?

Options :

1. ✖ 1:3:5:6:7:8:9

2. ✖ 1:2:3:4:5:6:7

3. ✖ 1:3:5:6:8:9:11

4. ✔ 1:2:3:4:5:6:8

Question Number : 85 Question Id : 873718445 Display Question Number : Yes Is Question Mandatory : No

Two pipes of diameters 10 and 5 converge to form a pipe of diameter 7.5. If the liquid flows with a velocity of 5 and 10 in the two pipes, what will be the flow velocity in the pipe formed due to the convergence ?

Options :

1. ✖ 14.66

2. ✖ 66.67

3. ✔ 13.33

4. ✖ 26.66

Question Number : 86 Question Id : 873718446 Display Question Number : Yes Is Question Mandatory : No

What does the absolute value function represent ?

Options :

1. ✖ square root of distance to the origin on a number line

2. ✔ distance to the origin on a number line

3. ✖ cube of distance to the origin on a number line

4. ✖ square of distance to the origin on a number line

Question Number : 87 Question Id : 873718447 Display Question Number : Yes Is Question Mandatory : No

What is the resultant curve if $f(x) = x^2$ is plotted with the domain consisting of all real numbers and the range consisting of all $f(x)$ values ≥ 0 ?

Options :

1. ✔ parabola

2. ✖ circle

3. ✖ a vertical asymptote

4. ✖ semi-circle

Question Number : 88 Question Id : 873718448 Display Question Number : Yes Is Question Mandatory : No

What is the aspect ratio of a simple tube of diameter (d^3) and length (l) ?

Options :

1. ✖ $\frac{d^3}{l}$

2. ✖ ld^3

3. ✔ $\frac{l}{d^3}$

4. ✖ $\frac{l}{d}$

Question Number : 89 Question Id : 873718449 Display Question Number : Yes Is Question Mandatory : No

Radiography is used to detect

Options :

1. ✖ surface defects

2. ✔ volume defects

3. ✖ both surface and volume defects

4. ✖ cracks and unfused defects

Question Number : 90 Question Id : 873718450 Display Question Number : Yes Is Question Mandatory : No

What is the magnitude of de Broglie wavelength (in m) of 1 kg body is moving with a velocity of 1 m/sec ?

Options :

1. ✔ Planck's constant

2. ✖ Boltzmann constant

3. ✖ Newtonian gravitation constant

4. ✖ Josephson constant

Question Number : 91 Question Id : 873718451 Display Question Number : Yes Is Question Mandatory : No

If L is any linear dimension in a body, then how do the heat losses by conduction and radiation scale as ?

Options :

1. ✖ mass of the body

2. ✖ volume of the body

3. ✔ area of the body

4. ✖ $L^{3/2}$

Question Number : 92 Question Id : 873718452 Display Question Number : Yes Is Question Mandatory : No

Why do the specialists of microelectronics use UV lithography when they decide to reduce the size of the electronic components on chips ?

Options :

1. ✖ UV light source is cheaper over visible light source even though visible light source gives smaller features

2. ✖ only UV can be used to remove unwanted material

3. ✖ easy to handle UV light over visible light

4. ✔ feature size scales as wavelength

Question Number : 93 Question Id : 873718453 Display Question Number : Yes Is Question Mandatory : No

Which of the following is related to only plastic regime during deformation of a ductile material ?

Options :

1. ✔ fracture

2. ✖ yield point

3. ✖ proportional limit

4. ✖ elastic limit

Question Number : 94 Question Id : 873718454 Display Question Number : Yes Is Question Mandatory : No

Based on which of the following, the continuity equation in fluid dynamics was developed ?

Options :

1. ✔

law of conservation of mass

2. ✖ law of conservation of momentum

3. ✖ law of conservation of energy

4. ✖ law of conservation of both energy and momentum

Question Number : 95 Question Id : 873718455 Display Question Number : Yes Is Question Mandatory : No

What are isobars ?

Options :

1. ✔ elements that have same number of nucleons

2. ✖ elements that differ in atomic weight

3. ✖ elements that have same number of neutrons

4. ✖ elements that have same number of protons

Question Number : 96 Question Id : 873718456 Display Question Number : Yes Is Question Mandatory : No

When do we say that the function is represented by an explicit formula ?

Options :

1. ✖ when the function is represented numerically

2. ✔ when the function is represented algebraically

3. ✖ when the function is represented visually

4. ✖ when the function is represented verbally

Question Number : 97 Question Id : 873718457 Display Question Number : Yes Is Question Mandatory : No

What is the domain of $f(x) = \sqrt{x+2}$?

Options :

1. ✖ $[0, \infty)$

2. ✖ $[2, \infty)$

3. ✔ $[-2, \infty)$

4. ✖ $(-\infty, \infty)$

Question Number : 98 Question Id : 873718458 Display Question Number : Yes Is Question Mandatory : No

If F is a fixed point (called the focus) and l is a fixed line (called the directrix) in a plane, e is a fixed positive number (called the eccentricity) and if the set of all points P in the plane are such that $\frac{|PF|}{|Pl|} = e$ in a conic section, then what is the conic section if $e < 1$?

Options :

1. ✖ circle

2. ✔ ellipse

3. ✖ parabola

4. ✖ hyperbola

Question Number : 99 Question Id : 873718459 Display Question Number : Yes Is Question Mandatory : No

What type of motion is involved when a fluid element moves from one position to another and undergoes a change in its dimensions ?

Options :

1. ✖ angular deformation

2. ✖ linear translation

3. ✖ rotation

4. ✔ linear deformation

Question Number : 100 Question Id : 873718460 Display Question Number : Yes Is Question Mandatory : No

Which of the following has the least number of atoms ?

Options :

1. ✖ 1 gram-mole of Cl gas

2. ✔ 1 gram of He gas

3. ✖ 1 gram-mole of O_2 gas

4. ✖ 1 gram of H_2 gas

Question Number : 101 Question Id : 873718461 Display Question Number : Yes Is Question Mandatory : No

At what temperature does pure iron turn into γ-iron ?

Options :

1. ✔ 910 °C

2. ✖ 810 °C

3. ✖ 710 °C

4. ✖ 900 °C

Question Number : 102 Question Id : 873718462 Display Question Number : Yes Is Question Mandatory : No

What is the flow of fluid along curvilinear or curved path called ?

Options :

1. ✖ sink flow

2. ✔ vortex flow

3. ✖ circular Flow

4. ✖ curvilinear flow

Question Number : 103 Question Id : 873718463 Display Question Number : Yes Is Question Mandatory : No

What happens when as-cut lead is exposed to air ?

Options :

1. ✖ its color changes from reddish-orange to metallic grey

2. ✖ its color changes from metallic red to metallic grey

3. ✔ its color changes from silver-blue to metallic grey

4. ✖ its color changes from yellowish-black to metallic grey

Question Number : 104 Question Id : 873718464 Display Question Number : Yes Is Question Mandatory : No

What happens to the cohesiveness of grain boundaries with increase in temperature ?

Options :

1. ✖ remains the same

2. ✖ increases

3. ✖ first increases and then decreases

4. ✔ decreases

Question Number : 105 Question Id : 873718465 Display Question Number : Yes Is Question Mandatory : No

When does a slip occur ?

Options :

1. ✖ when the shearing stress on the slip plane in the slip direction reaches 0.2% offset yield strength

2. ✖ when the shearing stress on the slip plane in the slip direction reaches a threshold value called Pierls-Nabarro stress

3. ✔ when the shearing stress on the slip plane in the slip direction reaches a threshold value called critical resolved shear stress

4. ✖ when the shearing stress on the slip plane in the slip direction reaches a threshold value called endurance limit

Question Number : 106 Question Id : 873718466 Display Question Number : Yes Is Question Mandatory : No

At what temperature is the hot working of a metallic material carried out ?

Options :

1. ✖ at the melting temperature of the metallic material

2. ✔ above the recrystallization temperature of the metallic material

3. ✖ below the recrystallization temperature of the metallic material

4. ✖ at the recrystallization temperature of the metallic material

Question Number : 107 Question Id : 873718467 Display Question Number : Yes Is Question Mandatory : No

A plot drawn between which of the following is known as Ellingham diagram ?

Options :

1. ✔ change in Gibbs free energy versus inverse of temperature

2. ✖ change in Gibbs free energy versus temperature

3. ✖ change in internal energy versus inverse of temperature

4. ✖ change in internal energy versus temperature

Question Number : 108 Question Id : 873718468 Display Question Number : Yes Is Question Mandatory : No

What is the fracture toughness of 4340 steel ?

Options :

1. ✖ $43\ \text{MPa}\sqrt{m}$

2. ✖ $40\ \text{MPa}\sqrt{m}$

3. ✖ $34\ \text{MPa}\sqrt{m}$

4. ✔ $46\ \text{MPa}\sqrt{m}$

Question Number : 109 Question Id : 873718469 Display Question Number : Yes Is Question Mandatory : No

What are the implications of precipitation hardening ?

Options :

1. ✔ ductility decreases while hardness and yield strength increase

2. ✖ hardness decreases while ductility and yield strength increase

3. ✖ yield strength decreases while hardness and ductility increase

4. ✖ ductility, hardness and yield strength increase

Question Number : 110 Question Id : 873718470 Display Question Number : Yes Is Question Mandatory : No

If Young's modulus of an uncracked material is 500 GPa, then what will be Young's modulus of a 2% porous material of the same composition and structure ?

Options :

1. ✖ 581 GPa

2. ✖ 500 GPa

3. ✔ 481 GPa

4. ✖ 400 GPa

Question Number : 111 Question Id : 873718471 Display Question Number : Yes Is Question Mandatory : No

If the characteristic equation of the differential equation $\frac{d^2y}{dx^2}+2\alpha\frac{dy}{dx}+y=0$ has two equal roots, then the values of α are

Options :

1. ✖ $\pm\frac{1}{2}$

2. ✖ $\pm\frac{1}{3}$

3. ✖ $0, \frac{1}{2}$

4. ✔ ± 1

Question Number : 112 Question Id : 873718472 Display Question Number : Yes Is Question Mandatory : No

The particular integral of $\frac{d^3y}{dx^3}+4\frac{dy}{dx}=\sin 2x$ is

Options :

1. ✖ $-\frac{x}{8}\cos 2x$

2. ✖ $\frac{x}{8}\cos 2x$

3. ✔ $-\frac{x}{8}\sin 2x$

4. ✖ $\frac{x}{8}\sin 2x$

Question Number : 113 Question Id : 873718473 Display Question Number : Yes Is Question Mandatory : No

If $\bar{F} = 3xy\bar{i} - y^2\bar{j}$ and C is the curve $y = 2x^2$ in the XY- plane form (0, 0) to (1, 2), then $\int_C \bar{F}.d\bar{r} =$

Options :

1. ✖ $-\frac{2}{3}$

2. ✔ $-\frac{7}{6}$

3. ✖ $-\frac{5}{6}$

4. ✖ $-\frac{7}{2}$

Question Number : 114 Question Id : 873718474 Display Question Number : Yes Is Question Mandatory : No

If $z=\sin^{-1}\left(\frac{x^2+y^2}{x+y}\right)$, then $x\frac{\partial z}{\partial x}+y\frac{\partial z}{\partial y}$ is

Options :

1. ✖ $\sin z$

2. ✖ $\cos z$

3. ✖ $2z$

4. ✔ $\tan z$

Question Number : 115 Question Id : 873718475 Display Question Number : Yes Is Question Mandatory : No

Given $y'=\left(x^3+xy^2\right)e^{-x}$, $y(0)=1$ using Euler's method $y(0.1)$ is

Options :

1. ✖ 1.01

2. ✖ 1.1

3. ✔ 1

4. ✖ 1.009

Question Number : 116 Question Id : 873718476 Display Question Number : Yes Is Question Mandatory : No

Suppose that the probabilities are 0.4, 0.3, 0.2 and 0.1 that there will be 0, 1, 2 and 3 power failure in a certain city during the month of May. Then the variance of this probability distribution is

Options :

1. ✔ 1

2. ✖ 0.5

3. ✖ 0.3

4. ✖ 0.2

Question Number : 117 Question Id : 873718477 Display Question Number : Yes Is Question Mandatory : No

The mean and poisson distribution are

Options :

1. ✖ $m, \frac{1}{m}$

2. ✔

$m, \sqrt{m}$

3. ✖ $\frac{m}{2}, \sqrt{\frac{m}{2}}$

4. ✖ $\frac{m}{3}, \sqrt{\frac{m}{3}}$

Question Number : 118 Question Id : 873718478 Display Question Number : Yes Is Question Mandatory : No

Matrix A has m rows and m+5 columns. Matrix B has n rows and 11-n columns. Both AB and BA exist. Then m, n are

Options :

1. ✖ 2, 3

2. ✖ 8, 1

3. ✔ 3, 8

4. ✖ 3, 1

Question Number : 119 Question Id : 873718479 Display Question Number : Yes Is Question Mandatory : No

The characteristic roots of $A=\begin{bmatrix}1 & 4\\ 3 & 2\end{bmatrix}$ is

Options :

1. ✖ -1, 2

2. ✔ -2, 5

3. ✖ 1, 5

4. ✖ 1, -2

Question Number : 120 Question Id : 873718480 Display Question Number : Yes Is Question Mandatory : No

The value of the integral $\int_0^{1+i}\left(x-y+ix^2\right)dz$ along the straight line $z=0$ to $z=1+i$ is

Options :

1. ✖ $\frac{i+1}{3}$

2. ✔ $\frac{i-1}{3}$

3. ✖ $\frac{i}{3}$

4. ✖

$$-\frac{i}{3}$$