PU Ph D Green Energy Technology

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If $A = \begin{bmatrix} 2 & 1-i \\ 1+i & 6 \end{bmatrix}$ then A is:-

- Symmetric
- skew symmetric
- hermitian
- skew hermitian

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The straight lines L_1: x=0, L_2:y=0 and L_3: x+y=1 are mapped by the transformation $w=z^2$ into the curves C_1, C_2 and C_3 respectively. The angle of intersection between the curves at w=0 is:-

- $\pi/4$
- π
- $\pi/3$
- 0

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The first order differential equation M(x,y) dx+N(x,y) dy=0 is exact if:-

- $\frac{\partial M}{\partial x} = \frac{\partial N}{\partial y}$
- $\frac{\partial M}{\partial x} \neq \frac{\partial N}{\partial y}$
- $\frac{\partial M}{\partial y} = \frac{\partial N}{\partial x}$
- $\frac{\partial M}{\partial y} = \frac{\partial M}{\partial x}$

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$\int_a^b x^{-1+\varepsilon} dx$ where $\varepsilon \to 0$ is

- 1/ ε
- ln(b/a)

- $b^{\varepsilon}-a^{\varepsilon}$
- 0

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The singularity of $e^{\sin Z}$ at Z= ∞ is:-

- A pole
- non isolated essential singularity
- a removable singularity
- isolated essential singularity

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complex conjugate of $\frac{i\sqrt{-9}+5i}{1+\sqrt{-1}}$ is:-

- i-5
- 1+5i
- i+5
- 1-5i

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The possible set of eigen values of a 4x4 skew-symmestric orthogonal real matrix is:-

- $\{\pm i, \pm 1\}$
- $\{\pm 1\}$
- $\{\pm i\}$
- $\{0, \pm i\}$

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If $y = \sum_{m=0}^{\infty} C_m x^{r+m}$ is assumed to be a solution of the differential equation $x^2y'' - xy' - 3(1+x^2)y = 0$ then the values of r are:-

- -1 and 3
- 1 and 3
- -1 and -3

- 1 and -3

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If a transformation y=uv transforms the given differential equation $f(x)y'' - 4f'(x)y' + g(x)y = 0$ into the equation of the form $v'' + h(x)v = 0$ then u must be:-

- f^2
- xf
- 1/2f
- $1/f^2$

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If there exist a non-zero minor of order r, then rank of A is:-

- less than r
- greater than or equal to r
- Equal to r
- less than or equal to r

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If A is an nxn non-singular matrix then which of the following is true?

- $adj(adj\ A) = |A|^{(n-1)}$
- $|adj(adj\ A)| = |A|^{2(n-1)}$
- $|adj(adj\ A)| = |A|^{(n-1)^2}$
- $adj(adj\ A) = |A|^{(n-1)^2}$

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The residue of $\frac{sinZ}{Z^8}$ at Z=0 is:-

- 0
- $-\frac{1}{7!}$

- $-\frac{1}{5!}$
- none of these

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If $x > 1$ and $\frac{\sqrt{x}}{x^3} = x^m$, what is the value of m?

- 2
- $-\frac{5}{2}$
- -2
- $-\frac{3}{2}$

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The determinant $\begin{vmatrix} a1 & a2 & a3 \\ b1 & b2 & b3 \\ c1 & c2 & c3 \end{vmatrix} \times \begin{vmatrix} a1 & a2 & a3 \\ b1 & b2 & b3 \\ c1 & c2 & c3 \end{vmatrix}$ is a determinant of order:-

- 6
- 9
- 3
- 27

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For XOR operator $\oplus$ which one is not correct?

- $0 \oplus 0 = 1$
- $1 \oplus 0 = 1$
- $0 \oplus 1 = 1$
- $1 \oplus 1 = 0$

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When Cos Θ=-1/2, then Θ is in:-

- quadrant II
- quadrant I
- quadrant IV
- quadrant III

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$\int_0^1 \frac{x}{1+x^2} dx$ is:-

- π/4
- 1
- log2
- log√2

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All the diagonal elements of a skew symmetric matrix are:-

- one
- Zero
- real
- pure imaginary

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The maximum value of $\frac{\log(x)}{x}$ in (0,∞) is:-

- 1/e
- 1
- e
- none of these

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Let $f(x) = \sum_{n=1}^{\infty} \frac{\sin(nx)}{n^2}$ then:-

- $lim_{x \to 0} f(x) = 0$
- $lim_{x \to 0} f(x) doesnot\ exist$
- $lim_{x \to 0} f(x) = 1$
- $lim_{x \to 0} f(x) = \pi^6/2$

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The sum of the natural numbers between 100 and 1000 which are multiples of 5:-

- 100000
- 98450
- 94850
- none of these

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The equation of a straight line that passes through point A(1,-1) and has a slope equa to -1 is:-

- y=1/x
- y=-x
- y=x+1
- y=x

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The value of $\begin{vmatrix} 265 & 240 & 219 \\ 240 & 225 & 198 \\ 219 & 198 & 181 \end{vmatrix}$ is:-

- 1161
- 251
- 2151
- 0

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If $A = \begin{bmatrix} cos\alpha & -sin\alpha \\ sin\alpha & cos\alpha \end{bmatrix}$ then A-1 is:-

- $\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$
- Not existing
- $\begin{bmatrix} cos\alpha & sin\alpha \\ -sin\alpha & cos\alpha \end{bmatrix}$
- $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

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If $A = \begin{bmatrix} x & y \\ z & w \end{bmatrix}$ then Adj(Adj(A)) is equal to:-

- $\begin{bmatrix} x & z \\ y & w \end{bmatrix}$
- $\begin{bmatrix} z & w \\ x & y \end{bmatrix}$
- $\begin{bmatrix} z & x \\ w & y \end{bmatrix}$
- $\begin{bmatrix} x & y \\ z & w \end{bmatrix}$

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An element 'X' emits successively two α particles. The mass and atomic numbers of the element are decreased by, respectively.

- 4 and 8
- 2 and 4
- 4 and 6
- 4 and 4

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When an atom/ion is missing from its normal lattice position creating vacancy, it is known as:-

- Frenkel defect
- Line defect
- Schotky defect

- None

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The electrolyte used in lead-acid battery is:-

- HCl
- H_2SO_4
- HNO_3
- H_2O

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The point group of NH_3 molecule is:-

- C_{1v}
- C_{2v}
- C_{3v}
- $C_{v\alpha}$

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The bond order of C_2 molecule is:-

- 1
- 2
- 0
- 3

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The number of peaks in the EPR spectrum of $CH_3^{\bullet}$ radical is:-

- 2
- 3
- 1
- 4

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According to Arrhenius equation, $k = A \cdot e\text{-}(E_a/RT)$, as 'T' approaches infinity, 'k' will approach:-

- A
- 0
- 1

- Infinity

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A Carnot engine operates between 600 and 800K, and observes 2000 calories heat from the source. The work done (in cal) is:-

- 1000
- 666
- 2000
- 500

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As we move from bulk materials to nanostructured materials, the density of states (DOS):-

- Remains same
- Not applicable
- Increases
- Decreases

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The intense color of $KMnO_4$ is due to:-

- MLCT
- LMCT
- None
- d-d transition

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The number of normal modes of vibration for H_2O molecule is:-

- 3
- 1
- 4
- 2

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One of the following molecules used as food preservatives is:-

- Sodium benzoate
- Ethylene glycol

- Sodium alkyl benzene sulphonate
- None

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The Bayer's angle strain is expected to be maximum in:-

- Cyclopentane
- Cyclodecane
- Cyclooctane
- Cyclohexane

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An example for the species having quadruple bond is:-

- $Mn_2(CO)_{10}$
- $Hg_2(CH_3COO)_2$
- $Cr_2O_7^{2-}$
- $Re_2Cl_8^{2-}$

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An example for spinel compound is:-

- $CaTiO_3$
- Co_3O_4
- $MgAl_2O_4$
- None

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Lead acid battery uses _____ as anode.

- PbO_2
- $PbSO_4$
- $PbCl_2$
- Pb

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The molar entropy of crystalline CO at absolute zero is:-

- Zero
- Rln2

- 2Rln2
- –Rln2

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The point group symmetry of H_2O molecule is:-

- C_{2v}
- C_{1v}
- D_{3h}
- C_{3v}

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The most symmetrical crystal system is:-

- Trigonal
- Cubic
- Triclinic
- Monoclinic

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Optical isomerism is exhibited by:-

- $K_4[Fe(CN)_6]$
- $K_3[Fe(CN)_6]$
- $[Co(H2O)_6]^{3+}$
- $[Co(en)_3]^{3+}$

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The absorption maximum of CdS is 470 nm. The approximate band gap in eV is:-

- 4.63
- 2.63
- 3.63
- 1.63

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A solution of sodium in liquid ammonia is blue in color due to the presence of:-

- Sodamine
- Solvated electrons

- Solvated sodium ions
- Solvated sodium atoms

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Cathode of lead-acid battery is:-

- PbO_2
- Cd
- Pb
- $PbSO_4$

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All radioactive reactions are:-

- First order reactions
- Second order reactions
- Third order reactions
- Zero order reactions

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Picric acid is:-

- Trinitrobenzene
- Trinitrophenol
- Tribromobenzene
- Trinitrotoluene

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In gluconeogenesis, Glucose is synthesized from two molecules of pyruvate and:-

- Two molecule of ATP
- Four molecules of ATP
- Six molecules of ATP
- Eight molecules of ATP

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Enzyme that are used to hydrolyse fats into diglycerides, monoglycerides, fatty acids and glycerol is:-

- Protease
- Zymase

- Cellulase
- Lipase

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The residue which has least conformational hindrance and thus can covers most of the area of Ramachandran plot is:-

- Alanine
- Lysine
- Glycine
- Proline

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A true breeding tall plant is crossed with a true breeding short plant and the F_1 generation produced is self-pollinated to produce F_2 generation. Ratio of true breeding tall and true breeding short plant in F_2 generation will be:-

- 2 : 1
- 1 : 2
- 1 : 3
- 1 : 1

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Breakdown of pyruvate to give carbon dioxide, water and energy takes places in:-

- Cytoplasm
- Nucleus
- Chloroplast
- Mitochondria

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What happen when wheat field is inoculated with *Rhizobium*?

- Fertility of the soil decreases
- No increase in production / nitrogen content of the soil
- Fertility of the soil increases
- Increase in production/ nitrogen content of the soil

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Specific group of atoms that is needed to mount the immune response of the antigen is called:-

- Antigenic determinant
- Fab Fragment
- Antigen molecule
- Fc Fragment

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For an ecosystem, which of the following is incorrect?

- Energy movement is non-cyclic
- Energy is lost irretrievably
- Energy movement is unidirectional
- Energy movement is from higher to lower trophic level

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Which of the following is not an Antigen Presenting Cell?

- Monocytes
- thymus epithelial cells
- macrophage
- T cell

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Which of the following can be classified as second messenger molecule?

- G protein
- adenylecyclase
- cyclic adenosine monophophate
- phospholipase

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A frog that feeds on insects is as:-

- Tertiary consumer
- Primary consumer
- Decomposures
- Secondary consumer

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Which of the following chemicals that can be related to biological magnification?

- Phospholipids
- Organophosphates
- Cholesterol
- Fatty acids

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Example of a light-driven proton pump is:-

- Bacteriorhodopsin
- ATP Synthase
- Na Channel
- Connexin

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How many genes a child receives from its father?

- 25%
- 75%
- 50%
- 100%

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A method of purification of proteins according to their specificity to particular antibody/ substrate/ cofactor is called:-

- Electrophoresis
- Affinity Chromatography
- Gel filtration Chromatography
- Ion exchange Chromatography

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The viscosity of gas is directly proportional to:-

- characteristic gas constant
- density of gas
- square root of temperature
- temperature

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A semiconductor with equal concentration of acceptor and donor type of impurities is termed as:-

- Compensated
- Intrinsic
- Amphoteric
- None of these

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An insulator is really a semiconductor which melts:-

- At low temperature
- At high temperature
- At very high temperature
- None of these

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The sun release energy by:-

- Nuclear fusion
- Hydro-thermal process
- Spontaneous combustion
- Nuclear fission

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A constant volume gas thermometer works on:-

- Archimede's law
- Charle's law
- Boyle's law
- Pascal's law

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What is the average binding energy of a nucleon in the nucleus of an atom?

- 7.8 eV
- 7.8 KeV
- 7.8 MeV
- 7.8 BeV

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The expression for Fourier level in a metal is:-

- $E_f = \frac{h^2}{8\pi m}\left[\frac{3L}{N^3}\right]^{1/3}$
- $E_f = \frac{h^2}{8m}\left[\frac{3N}{\pi L^3}\right]^{2/3}$
- $E_f = \frac{h^2}{8m}\left[\frac{3\pi N}{L^3}\right]^{3/2}$
- None of these

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Nuclear fission required high temperature because:-

- The mass deficit must be supplied
- All nuclear reactions absorb heat
- The particles cannot come closer unless they are moving rapidly
- The binding energy must be supplied from an external source

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Which type of crystals are generally good optical reflectors?

- Metals
- Ionic crystals
- Covalent crystals
- All of the above

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Electronic contribution to the specific heat of a metal at low temperature is:-

- An exponential function of T
- A linear function of T
- Zero
- None of these

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The mean life time of one of the atoms of a radioactive sample is:-

- λ
- $2 \ln \lambda$
- $(1/\lambda)$
- $\lambda \ln 2$

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The angular velocity of the body:-

- $\omega = \theta/t$
- $\omega = \theta/t\sin\theta$
- $\omega = 2\Pi r/t$
- $\omega = 2\Pi r/ t\sin\theta$

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In case of single core cable if the inner radius and outer radius of the insulation are doubled, the capacity of the cable will:-

- become half
- remain same
- become four times
- Become double

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The susceptibility of a superconductor is:-

- Negative and unity
- Positive and small
- Positive and unity
- Negative and small

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Isotopes of given elements must have the same:-

- number of proton in the nucleus
- molecular weight
- number of neutrons in the nucleus
- Atomic weight

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Which of the following wavelength falls in X-ray region?

- 10-4 Å
- 1000 Å
- 10000 Å
- 1 Å

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The one which is not compatible with crystal symmetry is:-

- Three-fold symmetry
- One-fold symmetry
- Six-fold symmetry
- Five-fold symmetry

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The profile of advancing liquid through a tube is:-

- straight line
- hyperbola
- semicircle
- parabola

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Germanium and silicon have diamond structure for which the molecules per unit cell are equal to:-

- 2
- 8
- 4
- 1

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The Centre of Gravity of triangular lamina lies at:-

- in centre
- orthocenter
- circum centre
- centroid

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The total current density through the reverse biased depletion region under study state is:-

- $J_{tot} = \log J + J_{diff}$
- $J_{tot} = J_{dr} + J_{diff}$
- $J_{tot} = J_n + J_p$
- $J_{tot} = \log J + V$

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Which of the following can be deflected by a magnet?

- radio waves
- Ultra-violet rays
- beta rays
- X-rays

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The classical electron radius is of the order of:-

- 10^{-8} cm
- 10^{-13} cm
- 10^{-15} cm
- 10^{-11} cm

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When viewed in white light, a soap bubbles show colour because of:-

- Dispersion
- Diffraction
- Scattering
- Interference

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What type of waves carry sound in air?

- Longitudinal wave
- Electromagnetic wave
- Transverse wave
- Transverse and longitudinal wave

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What is the purpose of supercharging an engine?

- To improve cooling of cylinders
- To reduce the noise of the engine
- To reduce specific fuel consumption
- To increase the power output of engine

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The Rockwell number refers to a material's:-

- Plasticity
- Hardness
- Toughness
- Malleability

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288 PU_2015_159
Which one of the following statements is correct? In a boiler, the air preheater is invariably:-

- Condenser and feed pump
- Forced draft fan and furnace
- Forced draft fan and chimney
- Economizer and feed pump

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In diesel cycle:-

- Compression ratio is greater than the expansion ratio
- Compression ratio is less than the expansion ratio
- Compression ratio and expansion ratio are the same
- Compression ratio + expansion ratio= 1

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Stefan Boltzmann law is applicable for heat transfer by:-

- Conduction
- Radiation
- Convection
- Conduction and radiation

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In heat exchangers, degree of approach is defined as the difference between temperatures of:-

- Hot medium outlet and cold water outlet
- Hot medium outlet and cold water inlet
- Cold water inlet and outlet
- Hot medium inlet and outlet

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Two plates spaced 150mm apart are maintained at 1000°C and 70°C.The heat transfer will take place mainly by:-

- Convection
- Radiation
- Forced convection
- Free convection

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Thermal conductivity of air with rise in temperature:-

- Remains constant
- Increases
- May increase or decrease depending on temperature
- Decreases

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295 PU_2015_159
When a liquid flows through a tube with sub-cooled or saturated boiling, what is the process known?

- Pool boiling
- Bulk boiling
- Forced convection boiling
- Convection boiling

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277 PU_2015_159
Critical pressure of a liquid is the pressure:-

- Above which liquid becomes solid
- Above which liquid becomes gas
- Above which liquid becomes vapour
- Above which liquid will remain liquid