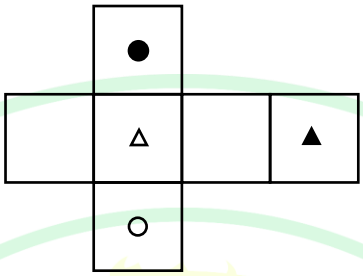
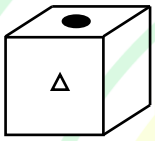
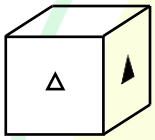
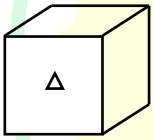
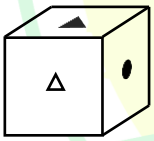
General Aptitude

Q.1 – Q.5 Carry ONE mark Each

Q.1	Despite his initial hesitation, Rehman's _____ to contribute to the success of the project never wavered. Select the most appropriate option to complete the above sentence.
(A)	ambivalence
(B)	satisfaction
(C)	resolve
(D)	revolve

Q.2	Bird : Nest :: Bee : _____ Select the correct option to complete the analogy.
(A)	Kennel
(B)	Hammock
(C)	Hive
(D)	Lair

Q.3	If $Pe^{x} = Qe^{-x}$ for all real values of x, which one of the following statements is true?
(A)	$P = Q = 0$
(B)	$P = Q = 1$
(C)	$P = 1;\ Q = -1$
(D)	$\frac{P}{Q} = 0$

Q.4	The paper as shown in the figure is folded to make a cube where each square corresponds to a particular face of the cube. Which one of the following options correctly represents the cube? Note: The figures shown are representative.
	
(A)	
(B)	
(C)	
(D)	

Q.5	Let p_1 and p_2 denote two arbitrary prime numbers. Which one of the following statements is correct for all values of p_1 and p_2?
(A)	$p_1 + p_2$ is not a prime number.
(B)	$p_1 p_2$ is not a prime number.
(C)	$p_1 + p_2 + 1$ is a prime number.
(D)	$p_1 p_2 + 1$ is a prime number.

Q.6 – Q.10 Carry TWO marks Each

Q.6	Based only on the conversation below, identify the logically correct inference: "Even if I had known that you were in the hospital, I would not have gone there to see you", Ramya told Josephine.
(A)	Ramya knew that Josephine was in the hospital.
(B)	Ramya did not know that Josephine was in the hospital.
(C)	Ramya and Josephine were once close friends; but now, they are not.
(D)	Josephine was in the hospital due to an injury to her leg.

Q.7	If IMAGE and FIELD are coded as FHBNJ and EMFJG respectively then, which one among the given options is the most appropriate code for BEACH ?
(A)	CEADP
(B)	IDBFC
(C)	JGIBC
(D)	IBCEC

Q.8 Which one of the following options is correct for the given data in the table?

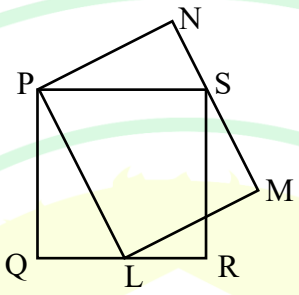
Iteration (i)	0	1	2	3
Input (I)	20	-4	10	15
Output (X)	20	16	26	41
Output (Y)	20	-80	-800	-12000

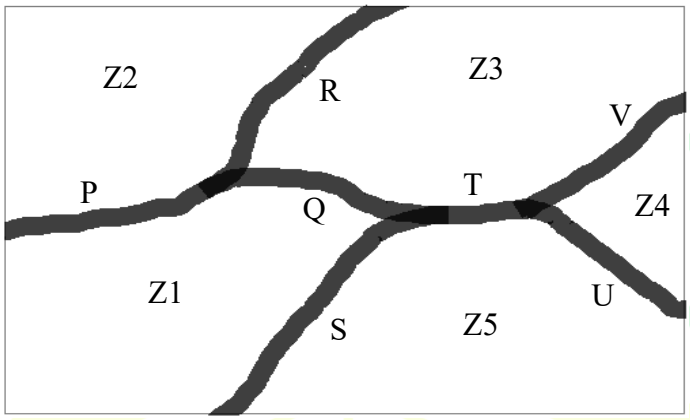
(A) $X(i) = X(i-1) + I(i); \quad Y(i) = Y(i-1)I(i); \quad i > 0$

(B) $X(i) = X(i-1)I(i); \quad Y(i) = Y(i-1) + I(i); \quad i > 0$

(C) $X(i) = X(i-1)I(i); \quad Y(i) = Y(i-1)I(i); \quad i > 0$

(D) $X(i) = X(i-1) + I(i); \quad Y(i) = Y(i-1)I(i-1); \quad i > 0$

Q.9	In the given figure, PQRS is a square of side 2 cm and PLMN is a rectangle. The corner L of the rectangle is on the side QR. Side MN of the rectangle passes through the corner S of the square. What is the area (in cm^2) of the rectangle PLMN? Note: The figure shown is representative.
	
(A)	$2\sqrt{2}$
(B)	2
(C)	8
(D)	4

Q.10	The diagram below shows a river system consisting of 7 segments, marked P, Q, R, S, T, U, and V. It splits the land into 5 zones, marked Z1, Z2, Z3, Z4, and Z5. We need to connect these zones using the least number of bridges. Out of the following options, which one is correct? Note: The figure shown is representative.
	
(A)	Bridges on P, Q, and T
(B)	Bridges on P, Q, S, and T
(C)	Bridges on Q, R, T, and V
(D)	Bridges on P, Q, S, U, and V

Q.11 – Q.35 Carry ONE mark Each

Q.11	Which one of the following matrices has eigenvalues 1 and 6?
(A)	$\begin{bmatrix} 5 & -2 \\ -2 & 2 \end{bmatrix}$
(B)	$\begin{bmatrix} 3 & -1 \\ -2 & 2 \end{bmatrix}$
(C)	$\begin{bmatrix} 3 & -1 \\ -1 & 2 \end{bmatrix}$
(D)	$\begin{bmatrix} 2 & -1 \\ -1 & 3 \end{bmatrix}$

Q.12	For an isobaric process, the heat transferred is equal to the change in _____ of the system.
(A)	enthalpy
(B)	entropy
(C)	Helmholtz free energy
(D)	Gibbs free energy

Q.13	Match each crystal defect in **Column I** with the corresponding type in **Column II**
	Column I — **Column II** P. Edge dislocation — 1. Zero-dimensional defect Q. Stacking fault — 2. One-dimensional defect R. Frenkel defect — 3. Two-dimensional defect S. Porosity — 4. Three-dimensional defect
(A)	P – 3, Q – 4, R – 2, S – 1
(B)	P – 3, Q – 4, R – 1, S – 2
(C)	P – 2, Q – 3, R – 1, S – 4
(D)	P – 2, Q – 4, R – 3, S – 1

Q.14	At high temperatures, which one of the following empirical expressions correctly describes the variation of dynamic viscosity μ of a Newtonian liquid with absolute temperature T? Given: A and B are positive constants.
(A)	$\mu = A + BT$
(B)	$\mu = A \exp\left(-\frac{B}{T}\right)$
(C)	$\mu = A \exp(BT)$
(D)	$\mu = A \exp\left(\frac{B}{T}\right)$

Q.15	Which one of the following is an intensive property?
(A)	Chemical potential
(B)	Volume
(C)	Mass
(D)	Entropy

Q.16	Hot metal from a blast furnace is treated with mill scale prior to oxygen steelmaking for _____.
(A)	dephosphorization
(B)	decarburization
(C)	desulphurization
(D)	desiliconization

Q.17	In optical microscopy, which one of the following combinations of wavelength (λ) and numerical aperture (NA) provides the best spatial resolution?
(A)	λ = 400 nm and NA = 1.0
(B)	λ = 600 nm and NA = 1.2
(C)	λ = 400 nm and NA = 1.2
(D)	λ = 600 nm and NA = 1.0

Q.18	The coordination number for an octahedral site in pure copper is _____.
(A)	4
(B)	6
(C)	8
(D)	12

Q.19	Consider the following gas-phase reaction: $2SO_2 + O_2 \rightleftharpoons 2SO_3$ If the enthalpy of reaction is negative, which one of the following conditions promotes a higher equilibrium concentration of SO_3?
(A)	Higher pressure and higher temperature
(B)	Higher pressure and lower temperature
(C)	Lower pressure and higher temperature
(D)	Lower pressure and lower temperature

Q.20	Which one of the following slag components is responsible for the oxidizing power of steelmaking slags?
(A)	SiO_2
(B)	CaO
(C)	MgO
(D)	FeO

Q.21	Two randomly oriented polycrystalline copper samples with average grain sizes of 10 µm (Sample A) and 100 µm (Sample B) were tested at room temperature. Given: E_A = Young's modulus of Sample A E_B = Young's modulus of Sample B YS_A = Yield strength of Sample A YS_B = Yield strength of Sample B Which one of the following statements is CORRECT?
(A)	$E_A > E_B$ and $YS_A > YS_B$
(B)	$E_A = E_B$ and $YS_A < YS_B$
(C)	$E_A > E_B$ and $YS_A = YS_B$
(D)	$E_A = E_B$ and $YS_A > YS_B$

Q.22	In metal casting, which one of the following gating ratios (sprue-runner-gate area ratio) represents a non-pressurized gating system?
(A)	1 : 2 : 3
(B)	3 : 2 : 1
(C)	4 : 3 : 1
(D)	5 : 4 : 1

Q.23	In the Fe-C system, the invariant reaction Liquid + $\delta \rightleftharpoons \gamma$ takes place at 1493 ℃. This type of reaction is called _____.
(A)	eutectic
(B)	eutectoid
(C)	peritectic
(D)	monotectic

Q.24	Match the following elements in **Column I** with their respective ores in **Column II**.
	Column I — **Column II** P. Al — 1. Rutile Q. Fe — 2. Hematite R. Ti — 3. Chalcopyrite S. Cu — 4. Bauxite
(A)	P – 4, Q – 2, R – 3, S – 1
(B)	P – 2, Q – 4, R – 1, S – 3
(C)	P – 3, Q – 1, R – 4, S – 2
(D)	P – 4, Q – 2, R – 1, S – 3

Q.25	Which of the following functions is/are expandable using Maclaurin series?
(A)	$\ln(1+z)$
(B)	$\ln z$
(C)	$\frac{1}{z^2}$
(D)	$\exp(z)$

Q.26	With reference to edge and screw dislocations, which of the following statements is/are CORRECT?
(A)	Both edge and screw dislocations can leave the slip plane by climb.
(B)	Burgers vector of a screw dislocation is parallel to its line vector.
(C)	Both edge and screw dislocations can leave the slip plane by cross-slip.
(D)	Strain energy per unit length of an edge dislocation is higher than that of a screw dislocation.

Q.27	Which of the following conditions is/are favorable for producing low-silicon hot metal in blast furnace ironmaking?
(A)	Reduced raceway adiabatic flame temperature
(B)	Oxygen-enriched blast
(C)	Lime injection through tuyeres
(D)	Increased hearth temperature

Q.28	Which of the following statements is/are CORRECT with respect to the initial stage of GP zone formation in a precipitation hardenable Al - 4.5 wt.% Cu alloy?
(A)	GP zones are Cu-rich clusters.
(B)	GP zones are $CuAl_2$ precipitates.
(C)	GP zones are incoherent with the matrix.
(D)	GP zones are coherent with the matrix.

Q.29	Which of the following techniques can be used to detect an internal defect in a metal casting?
(A)	Ultrasonic inspection
(B)	Liquid (or dye) penetrant inspection
(C)	Gamma-ray radiography
(D)	X-ray radiography

Q.30	Standard Gibbs free energies of formation of some solid oxides per mole of O_2 at 1000 K are given below. SiO_2: −728 kJ, TiO_2: −737 kJ, VO: −712 kJ, MnO: −624 kJ Regarding thermodynamic feasibility of oxide reduction, which of the following statements is/are CORRECT under standard conditions at 1000 K?
(A)	Si can reduce TiO_2.
(B)	Mn can reduce VO.
(C)	Ti can reduce MnO.
(D)	V can reduce SiO_2.

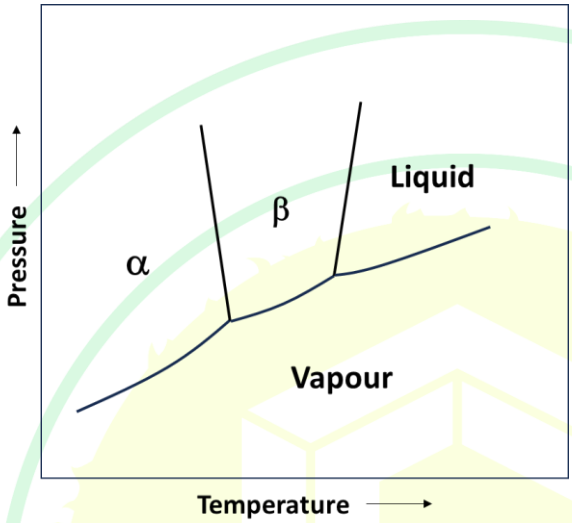
Q.31	Consider a fully developed, steady, one-dimensional, laminar flow of a Newtonian liquid through a pipe. The maximum velocity in the pipe is proportional to which of the following quantities? Given: ΔP is the difference between the outlet and inlet pressure, μ is the dynamic viscosity of the liquid, and R and L are radius and length of the pipe, respectively.
(A)	ΔP
(B)	$1/R^2$
(C)	$1/\mu$
(D)	$1/L$

Q.32	The hydrostatic stress for the stress tensor provided below is _____ MPa (*in integer*).
	$\begin{bmatrix} 150 & 0 & 0 \\ 0 & -100 & 100 \\ 0 & 100 & 250 \end{bmatrix}$ MPa
Q.33	For an application where the Reynolds number is to be kept constant, a liquid with a density of 1 g cm^{-3} and viscosity 0.01 Poise results in a characteristic speed of 1 cm s^{-1}. If this liquid is replaced by another with a density of 1.25 g cm^{-3} and viscosity of 0.015 Poise, the characteristic velocity will be _____ cm s^{-1} (*rounded off to one decimal place*). Assume the characteristic length of the flow to be the same in both cases.
Q.34	Consider the gas phase reaction: $CO + \frac{1}{2} O_2 \rightleftharpoons CO_2$ At equilibrium for a particular temperature, the partial pressures of CO, O_2, and CO_2 are found to be 10^{-6} atm, 10^{-6} atm, and 16 atm, respectively. The equilibrium constant for the reaction is _____ $\times 10^{10}$ (*rounded off to one decimal place*).

Q.35	A linear regression model was fitted to a set of (x, y) data. The total sum of squares and sum of squares of error are 1200 and 120, respectively. The coefficient of determination (R^2) of the fit is _____ (*rounded off to one decimal place*).

Q.36 – Q.65 Carry TWO marks Each

Q.36	For two continuous functions $M(x, y)$ and $N(x, y)$, the relation $M\ dx + N\ dy = 0$ describes an exact differential equation if
(A)	$\frac{\partial M}{\partial x} = \frac{\partial N}{\partial y}$
(B)	$\frac{\partial M}{\partial x} = -\frac{\partial N}{\partial y}$
(C)	$\frac{\partial M}{\partial y} = \frac{\partial N}{\partial x}$
(D)	$\frac{\partial M}{\partial y} = -\frac{\partial N}{\partial x}$

Q.37	Consider the phase diagram of a one component system given below. V_α, V_β, and V_{Liquid} are the molar volumes of α, β, and liquid phases, respectively. Which one of the following statements is TRUE? Given: The change in molar enthalpies, $\Delta H^{\alpha \rightarrow \beta}$ and $\Delta H^{\beta \rightarrow \text{Liquid}}$, are positive.
	
(A)	$V_\alpha < V_\beta$ and $V_\beta < V_{\text{Liquid}}$
(B)	$V_\alpha > V_\beta$ and $V_\beta < V_{\text{Liquid}}$
(C)	$V_\alpha < V_\beta$ and $V_\beta > V_{\text{Liquid}}$
(D)	$V_\alpha > V_\beta$ and $V_\beta > V_{\text{Liquid}}$

Q.38	Match the steel plant related processes in **Column I** with the associated information in **Column II**.
	Column I — **Column II** P. Corex — 1. Melter-gasifier Q. Electric Arc Furnace — 2. Natural gas reformer R. Midrex — 3. Electromagnetic stirrer S. Continuous Casting — 4. Hot heel
(A)	P – 1, Q – 4, R – 2, S – 3
(B)	P – 1, Q – 4, R – 3, S – 2
(C)	P – 2, Q – 4, R – 1, S – 3
(D)	P – 1, Q – 3, R – 2, S – 4

Q.39	Radiative heat flux $\dot{q}$ at a hot surface at a temperature T_s can be expressed as $\dot{q} = A\, f(T_s, T_\infty)\, (T_s - T_\infty)$ where A is a constant and T_∞ is the temperature of the surroundings (temperatures are expressed in K). The function $f(T_s, T_\infty)$ is given by _____.
(A)	$(T_s + T_\infty)^2 (T_s - T_\infty)$
(B)	$(T_s^2 + T_\infty^2)(T_s + T_\infty)$
(C)	$(T_s^2 - T_\infty^2)\, (T_s + T_\infty)$
(D)	$(T_s - T_\infty)^2 (T_s + T_\infty)$

Q.40	Match the phenomena in **Column I** with the typical observations in **Column II**.

Column I	**Column II**
P. Dynamic strain aging	1. Grain boundary sliding
Q. Recrystallization	2. Decrease in yield stress with a reversal of loading direction
R. Bauschinger effect	3. Decrease in dislocation density
S. Superplasticity	4. Serrations in stress-strain curve

(A)	P – 4, Q – 1, R – 2, S – 3
(B)	P – 4, Q – 3, R – 2, S – 1
(C)	P – 3, Q – 4, R – 2, S – 1
(D)	P – 1, Q – 4, R – 2, S – 3

Q.41	Which one of the following matrices is orthogonal?
(A)	$\begin{bmatrix} 1/2 & -\sqrt{3}/2 \\ -\sqrt{3}/2 & 1/2 \end{bmatrix}$
(B)	$\begin{bmatrix} 1/2 & -\sqrt{3}/2 \\ \sqrt{3}/2 & 1/2 \end{bmatrix}$
(C)	$\begin{bmatrix} 1/\sqrt{2} & -\sqrt{3}/2 \\ -\sqrt{3}/2 & 1/2 \end{bmatrix}$
(D)	$\begin{bmatrix} 1/\sqrt{2} & -\sqrt{3}/2 \\ \sqrt{3}/2 & -1/\sqrt{2} \end{bmatrix}$

Q. 42	Match the casting defects in **Column I** with the characteristic features in **Column II**.

Column I	**Column II**
P. Misrun	1. Penetration of liquid metal behind surface layer of sand moulds
Q. Expansion scab	2. Metal solidifies prematurely in the mould and some sections of the casting are not filled
R. Pin holes	3. Cracking because of restraint to contraction in certain areas of the casting during solidification and cooling to room temperature
S. Hot tearing	4. Evolution of gases during solidification resulting in porosity

(A)	P – 2, Q – 4, R – 3, S – 1
(B)	P – 1, Q – 3, R – 2, S – 4
(C)	P – 1, Q – 2, R – 4, S – 3
(D)	P – 2, Q – 1, R – 4, S – 3

Q.43	The following are the activation energies for diffusion of carbon and iron at 773 K in polycrystalline BCC iron: P = Activation energy for diffusion of carbon in BCC iron through the lattice Q = Activation energy for diffusion of iron in BCC iron through the lattice R = Activation energy for diffusion of iron in BCC iron along the grain boundary Which one of the following statements is CORRECT?
(A)	R < P < Q
(B)	R < Q < P
(C)	Q < P < R
(D)	P < R < Q

Q.44	Front tension is applied during cold rolling of a thin metal sheet. Which of the following statements is/are TRUE?
(A)	The neutral point shifts towards the roll entrance.
(B)	The rolling load is decreased.
(C)	The neutral point shifts towards the roll exit.
(D)	The rolling load is increased.
Q.45	Which of the following statements is/are CORRECT when Ni is added as an alloying element to a low alloy steel?
(A)	Hardenability is increased AND the M_s temperature is lowered.
(B)	Hardenability is decreased AND the M_s temperature is lowered.
(C)	Hardenability is increased AND the M_s temperature is raised.
(D)	Hardenability is decreased AND the M_s temperature is raised.

Q.46	Which of the following statements is/are CORRECT with respect to fusion welding and solid-state welding of metals and alloys?
(A)	Thermomechanically affected zone is found in the fusion welding of pure metals.
(B)	Partially melted zone is NOT found in the fusion welding of pure metal.
(C)	Diffusion bonding is one type of solid-state welding process.
(D)	Partially melted zone is found in the fusion welding of alloys with a large freezing range.
Q.47	Which of the following welding processes does NOT / do NOT utilize consumable electrode?
(A)	Plasma arc welding
(B)	Gas metal arc welding
(C)	Shielded metal arc welding
(D)	Electron beam welding

Q.48	For a two-dimensional field described by $T(x,y) = \frac{1}{3}xy(x+y)$, the magnitude of its gradient at the point (1,1) is _____ (*rounded off to two decimal places*).
Q. 49	X-ray diffraction using a monochromatic radiation of wavelength 0.154 nm is performed on powder samples of metal A (with FCC crystal structure) and metal B (with BCC crystal structure). If the first peak in both the cases occurs at a Bragg angle $\theta = 20^{o}$, then the value of $\frac{\text{lattice parameter of metal A}}{\text{lattice parameter of metal B}}$ = _____ (*rounded off to two decimal places*).

Q.50	The excess molar Gibbs free energy of a solution of element A and B at 1000 K is given by $G^{XS} = -3000\ X_A X_B$ J mol^{-1}, where X_A and X_B are mole fractions of A and B, respectively. The activity of B in a solution of A and B containing 40 mol% of B at 1000 K is _____ (*rounded off to two decimal places*). Given: Ideal gas constant R = 8.314 J mol^{-1} K^{-1}
Q.51	Molten steel at 1900 K having dissolved hydrogen needs to be vacuum degassed. The equilibrium partial pressure of hydrogen to be maintained to achieve 1 ppm (mass basis) of dissolved hydrogen is _____Torr (*rounded off to two decimal places*). Given: For the hydrogen dissolution reaction in molten steel (½ H_2(g) = [H]), the equilibrium constant (expressed in terms of ppm of dissolved H) is: $\log_{10} K_{eq} = -\frac{1900}{T} + 2.4$ 1 atm = 760 Torr
Q.52	The value of $\lim_{x\to 0} \frac{6(x-\sin x)}{x^3}$ is _____(*in integer*).

Q.53	Consider the following reactions and their standard Gibbs free energies (in J): $Fe(s) + \frac{1}{2} O_2(g) \rightleftharpoons FeO(s)$ $\quad \Delta G^\circ = -264900 + 65T$ $2\ H_2(g) + O_2(g) \rightleftharpoons 2\ H_2O(g)$ $\quad \Delta G^\circ = -492900 + 109T$ Assuming Fe and FeO to be pure and no solubility of gases in the solids, the value of $\frac{p_{H_2O}}{p_{H_2}}$ required to reduce solid FeO to solid Fe at 1000 K is _____ (*rounded off to two decimal places*). Given: Ideal gas constant R = 8.314 J mol^{-1} K^{-1}
Q.54	The diameter of spherical galena particles that have the same settling velocity as spherical quartz particles of diameter 25 μm (both settling in water) is _____ μm (*rounded off to one decimal place*). Assume Stokes law of settling to be valid. Given: Density of galena = 7400 kg m^{-3}, density of quartz = 2600 kg m^{-3}, density of water = 1000 kg m^{-3}.

Q.55	Consider the following cell reaction: $Mg + Cd^{2+} \rightleftharpoons Mg^{2+} + Cd$ The standard Gibbs free energy change for the reaction is _____ kJ (*rounded off to an integer*). Given: Standard oxidation potentials for the reactions with respect to standard hydrogen electrode are: $Mg \rightleftharpoons Mg^{2+} + 2e^{-}$ $E^{\circ} = 2.37$ V $Cd \rightleftharpoons Cd^{2+} + 2e^{-}$ $E^{\circ} = 0.403$ V Faraday's constant = 96500 C mol^{-1}
Q.56	Copper is being electrodeposited from a $CuSO_4$ bath onto a stainless steel cathode of total surface area of 2 m^2 in an electrolytic cell operated at a current density of 200 A m^{-2} with a current efficiency of 90%. The mass of copper deposited in 24 h is_____ kg (*rounded off to two decimal places*). Given: Faraday's constant = 96500 C mol^{-1}, atomic mass of copper = 63.5 g mol^{-1}

Q.57	An intrinsic semiconductor has conductivity of 100 Ω^{-1} m^{-1} at 300 K and 300 Ω^{-1} m^{-1} at 500 K. The band gap of the semiconductor is _____ eV (*rounded off to two decimal places*). Given: Boltzmann constant k_B = 8.6× 10^{-5} eV K^{-1}
Q.58	For a component fabricated from an alloy A with plane strain fracture toughness, K_{IC} = 50 MPa $m^{1/2}$, fracture was observed to take place at a crack length of 0.4 mm at a tensile service stress of σ. If the same component is instead fabricated from alloy B with K_{IC} = 75 MPa $m^{1/2}$, the crack length at which a similar crack geometry will result in fracture (under identical tensile service stress of σ) is _____ mm (*rounded off to one decimal place*).

Q.59	Temperatures at two sides of a 0.4 m thick copper plate are 1000 and 500 °C. Assuming steady state, one-dimensional conductive heat transfer through the wall and ignoring end-effects, the magnitude of the heat flux through the wall is _____ $\times 10^5$ W m^{-2} (*in integer*). Given: Thermal conductivity of copper is 400 W m^{-1} K^{-1}
Q.60	In polycrystalline Ni, Nabarro-Herring diffusion creep was found to be the rate controlling creep mechanism at a certain temperature. At that temperature, if the steady state strain rate is 10^{-8} s^{-1} at a stress of 10 MPa, the steady state strain rate of 10^{-9} s^{-1} will be obtained at a stress value of _____ MPa (*in integer*). Assume that the same creep mechanism is rate controlling during the creep deformation.

Q.61	A single crystal BCC metal with a lattice parameter a = 0.4 nm is subjected to deformation at a shear strain rate of 0.001 s^{-1}. If the average mobile dislocation density in the single crystal is 10^{10} m^{-2}, the average dislocation velocity is _____ $\times 10^{-3}$ m s^{-1} (*rounded off to two decimal places*). Given: Burgers vector $\mathbf{b} = \frac{a}{2}\langle 111 \rangle$
Q.62	A cylindrical specimen is subjected to plastic deformation in tension up to a uniform elongation of 10%. The final cross-sectional area of the gage section is found to be 20 mm^2. The initial cross-sectional area of the gage section is _____mm^2 (*rounded off to an integer*).
Q.63	The reaction represented by $A \rightarrow B$ follows first order kinetics. At a given temperature, 20% of the reaction is completed in 223 s. The time taken to complete 50% of the reaction at the same temperature is _____ s (*rounded off to the nearest integer*).

Q.64	A cylindrical Al alloy billet of 300 mm diameter is hot extruded to produce a cylindrical rod of 75 mm diameter at a constant true strain rate ($\dot{\varepsilon}$) of 10 s^{-1}. The flow stress (σ) of the alloy at the extrusion temperature is given by $\sigma = 10\ (\dot{\varepsilon})^{0.3}$ MPa. Assume the alloy is perfectly plastic and there is no temperature rise during the extrusion process. The ideal plastic work of deformation per unit volume is _____ $\times 10^6$ J m^{-3} (*rounded off to one decimal place*).
Q.65	Two consecutive estimates of the root of a function $f(x)$ obtained using the Newton-Raphson method are $x_i = 8.5$ and $x_{i+1} = 13.5$, and the value of the function at x_i is 15. The numerical value of first derivative of the function evaluated at x_i is _____ (*in integer*).

Answer Key for Metallurgical Engineering (MT)

Q. No.	Session	Q. Type	Section	Key/Range	Marks
1	2	MCQ	GA	C	1
2	2	MCQ	GA	C	1
3	2	MCQ	GA	A	1
4	2	MCQ	GA	A	1
5	2	MCQ	GA	B	1
6	2	MCQ	GA	B	2
7	2	MCQ	GA	B	2
8	2	MCQ	GA	A	2
9	2	MCQ	GA	D	2
10	2	MCQ	GA	C	2
11	2	MCQ	MT	A	1
12	2	MCQ	MT	A	1
13	2	MCQ	MT	C	1
14	2	MCQ	MT	D	1
15	2	MCQ	MT	A	1
16	2	MCQ	MT	D	1
17	2	MCQ	MT	C	1
18	2	MCQ	MT	B	1
19	2	MCQ	MT	B	1
20	2	MCQ	MT	D	1
21	2	MCQ	MT	D	1
22	2	MCQ	MT	A	1
23	2	MCQ	MT	C	1
24	2	MCQ	MT	D	1
25	2	MSQ	MT	A;D	1
26	2	MSQ	MT	B;D	1
27	2	MSQ	MT	A;C	1
28	2	MSQ	MT	A;D	1
29	2	MSQ	MT	A;C;D	1
30	2	MSQ	MT	C	1

31	2	MSQ	MT	A;C;D	1
32	2	NAT	MT	100 to 100	1
33	2	NAT	MT	1.2 to 1.2	1
34	2	NAT	MT	1.6 to 1.6	1
35	2	NAT	MT	0.9 to 0.9	1
36	2	MCQ	MT	C	2
37	2	MCQ	MT	B	2
38	2	MCQ	MT	A	2
39	2	MCQ	MT	B	2
40	2	MCQ	MT	B	2
41	2	MCQ	MT	B	2
42	2	MCQ	MT	D	2
43	2	MCQ	MT	D	2
44	2	MSQ	MT	A;B	2
45	2	MSQ	MT	A	2
46	2	MSQ	MT	B;C;D	2
47	2	MSQ	MT	A;D	2
48	2	NAT	MT	1.40 to 1.42	2
49	2	NAT	MT	1.20 to 1.25	2
50	2	NAT	MT	0.34 to 0.36	2
51	2	NAT	MT	1.19 to 1.22	2
52	2	NAT	MT	1 to 1	2
53	2	NAT	MT	0.37 to 0.39	2
54	2	NAT	MT	12.5 to 12.5	2
55	2	NAT	MT	-381 to -379	2
56	2	NAT	MT	10.20 to 10.30	2
57	2	NAT	MT	0.13 to 0.15	2
58	2	NAT	MT	0.9 to 0.9	2
59	2	NAT	MT	5 to 5	2
60	2	NAT	MT	1 to 1	2
61	2	NAT	MT	0.27 to 0.30	2
62	2	NAT	MT	22 to 22	2
63	2	NAT	MT	685 to 705	2
64	2	NAT	MT	53.3 to 57.3	2
65	2	NAT	MT	-3 to -3	2