

PGCET-2022

Seat No. _____

SUB:METALLURGICAL ENGINEERING (MT)

Time:1 Hour 30 minutes

Instructions:

1. Ensure that all pages are printed.
2. Use Black ball pen only
3. Change in option is not allowed
4. There is no negative marking
5. Use of non-programmable scientific calculator is allowed

1.	Which of the following is the correct Gibbs equation?			
	A	a) $\Delta G = \Delta H + T\Delta S$	B	$\Delta G = \Delta H - T\Delta S$
	C	$\Delta G = \Delta H - 2T\Delta S$	D	$\Delta G = \Delta H - 3T\Delta S$
2.	What does the Ellingham diagram consist of?			
	A	Plots of $\Delta_f G^\circ$ vs T	B	Plots of T vs $\Delta_f G^\circ$
	C	Plots of $\Delta_f G^\circ$ vs ΔS	D	Plots of ΔS vs $\Delta_f G^\circ$
3.	What is the term given to the extraction of aluminium from bauxite by using electrochemical process?			
	A	Baeyer's process	B	Hall-Heroult process
	C	Mc-Arthur process	D	Blasts process
4.	Which of the following is an example of steady-state heat transfer?			
	A	Electric bulb cools down by the surrounding atmosphere	B	Chilling effect of cold wind on a warm body
	C	Boilers and turbines	D	Cooling of I.C engine
5.	Which of the following is the rate of heat transfer unit?			
	A	Watt	B	Pascal
	C	Joule	D	Newton
6.	On which of the following does convective heat transfer coefficient doesn't depend?			
	A	Orientation of solid surface	B	Time
	C	Surface area	D	Space
7.	In liquids and gases, heat transmission is primarily caused by			
	A	Convection	B	Radiation
	C	Conduction	D	Conduction as well as convection

8.	In which of the following cases provision of fins on a given heat transfer surface will be more effective?			
	A	Fewer but thin fins	B	Large number of thin fins
	C	Large number of thick fins	D	Fewer but thick fins
9.	Which of the following is the unit of coefficient of radiant heat transfer?			
	A	W/m^2	B	$W/m\ K$
	C	$W/m^2\ K$	D	W/K
10.	What is the unit of diffusion coefficient?			
	A	m^2	B	S
	C	m^2s	D	m^2/s
11.	Which corrosion occurs when two different metals have physical or electrical contact with each other and are immersed in a common electrolyte?			
	A	Intergranular	B	Crevice
	C	Galvanic	D	Erosion
12.	How much percentage of chromium is minimally required to ensure passivation?			
	A	8	B	10
	C	12	D	18
13.	cathodic polarization always _____ the corrosion rate.			
	A	increases	B	reduces
	C	Remain same	D	None of the above
14.	Which of the following ores are concentrated by froth flotation?			
	A	Haematite	B	Zinc
	C	Copper Pyrites	D	Magnetite
15.	How is ore dressing of iron is done?			
	A	Froth flotation	B	Magnetic Separation
	C	Hand ickling	D	By wetting
16.	A mineral is called an ore if			
	A	Metal present in mineral is precious	B	Metal can be extracted from it
	C	Metal can be extracted profitably from it	D	Metal can not be extracted from it
17.	Copper can be extracted from			
	A	Kupfernickel	B	Dolomite

	C	Galena	D	Malachite
18.	Cast iron is a _____ alloy.			
	A	Eutectic	B	Eutectoid
	C	Peritectic	D	Peritectoid
19.	Which among the following is an essential chemical reaction for the manufacture of pig iron?			
	A	$\text{Fe}_2\text{O}_3 + 3\text{C} \rightarrow 2\text{Fe} + 3\text{CO}$	B	$\text{FeS} + \text{C} \rightarrow \text{Fe} + \text{CS}$
	C	$\text{Fe}_3\text{O}_4 + \text{S} \rightarrow 3\text{Fe} + \text{SO}_4$	D	$\text{Fe}_2\text{O}_3 + \text{S} \rightarrow 2\text{Fe} + \text{SO}_3$
20.	What are the raw materials needed for the manufacture of pig iron?			
	A	Iron ore-Calcium-Coke	B	Iron ore-Coke
	C	Iron ore-Calcium	D	Iron ore-Coke-Limestone
21.	What are the raw materials needed for the manufacture of steel?			
	A	Pig iron	B	Nickel + oxygen
	C	Pig iron + oxygen	D	Pig iron + nitrogen
22.	What is the temperature of the blast furnace in steel plants?			
	A	100 °C	B	1000 °C
	C	500 °C	D	2200 °C
23.	What are the steps involved in purifying copper? (In order of precedence)			
	A	Smelting-Roasting-Converting	B	Smelting-Converting-Roasting
	C	Converting-Roasting-Smelting	D	Roasting-Smelting-Converting
24.	How is much amount of chromium (in percent) normally added in steel to be called as stainless steel?			
	A	1-2 %	B	2-5 %
	C	5-10%	D	10-30 %
25.	Which of the following types of stainless steels contain maximum amount of chromium in it?			
	A	Duplex stainless steels	B	Martensitic stainless steels
	C	Austenitic stainless steels	D	Precipitation hardenable stainless steels
26.	VOD process is preferred over AOD process for making extra low carbon stainless steels because:			

	A	Pco can be lowered to a much lower level in the VOD than in AOD.	B	AOD does not have adequate stirring
	C	free-board needed for such operation is not available in the AOD	D	refractory is not stable in contact with extra low carbon steel
27	Which of the following material is required in a technique of decarburizing the molten metal?			
	A	Calcium Carbonate	B	Sodium Chloride
	C	Carbon ferrochrome	D	Soldium ferrochrome
28	Which of the following properties is not associated with refractory metals?			
	A	High fusion temperature	B	High heat resistance
	C	Good Corrosion resistance	D	High thermal coefficient of expansion
29	What kind of refractory can bauxite be grouped as?			
	A	Acid refractory	B	Basic refractory
	C	Neutral refractory	D	Silica refractory
30	Which of the following neutral elements neither form carbides nor cause graphitization			
	A	Aluminium	B	Chromium
	C	Cobalt	D	Copper
31	The rule used to determine composition of various phases in a phase diagram is _____			
	A	Gibb's Phase rule	B	Lever rule
	C	Hume -Rothary Rule	D	Henry's Law
32	Which of the following elements increase/s chilled depth for chilled cast irons?			
	A	Silicon	B	Manganese
	C	Manganese Sulphide	D	All of the above
33	Why is gray cast iron annealed?			
	A	Graphitize Carbide	B	Decrease Ductility
	C	Decrease Machinability	D	Increase the colour of gray
34	Knife Line Attack is a type of _____			

	A	Intergranular Corrosion	B	Bimetal Corrosion
	C	Localized Corrosion	D	Uniform Corrosion
35	Magnesium & Zinc have _____ structure.			
	A	BCC	B	FCC
	C	HCP	D	None of these
36	The Cementite is:			
	A	Iron Carbide	B	A mixture of ferrite and iron carbide
	C	A mixture of pearlite and iron carbide	D	Hypo-eutectoid pearlite
37	In ausforming of Steel _____ operation is also involved			
	A	Strain-hardening	B	Tempering
	C	Age hardening	D	Solution hardening
38	When a pair of cation and anion is absent from crystal, it is called:			
	A	Vacancy defect	B	Line imperfection
	C	Schottky's defect	D	Frenkel defect
39	Heat treatment that requires heating a part below A1 temperature, i.e. between 550°C and 650° is called as:			
	A	Hardening	B	Normalising
	C	Process annealing	D	Full annealing
40	Mild steel is an alloy of iron and carbon with percentage of carbon ranging from:			
	A	up to 0.2%	B	0.15–0.3%
	C	0.3–0.5%	D	above 0.5%
41	Nickel addition in alloys:			
	A	Increases toughness	B	Increases hardenability and impact resistance
	C	Limit grain growth during heat treatment process	D	All of the mentioned
42	Which of the following etching solution is used for medium and high carbon steel, pearlite steel and cast iron?			
	A	Nital	B	Picral
	C	50% NH ₂ OH and water	D	None of these

43	Under microscope ferrite appears as:			
	A	Dark	B	White
	C	Light	D	Finger print
44	Line Acm on iron carbon diagram indicate:			
	A	The beginning of transition from austenite to ferrite	B	Limit of carbon solubility in Austenite
	C	Both a and b	D	None of the above
45	Annealing improves:			
	A	Grain size	B	Mechanical properties
	C	Electrical properties	D	All of above
46	A dislocation with a Burgers vector that is perpendicular to the dislocation line:			
	A	an edge dislocation	B	a screw dislocation
	C	a mixed dislocation	D	can be either a or b
47	The crystal structure of Cementite is:			
	A	Triclinic	B	Orthorhombic
	C	Hexagonal	D	Cubic
48	Blue Brittleness is a result of:			
	A	Dynamic strain ageing	B	Strain ageing
	C	Dynamic recovery	D	Martensitic transformation
49	Which of the following constituents of steel is the softest and least strong:			
	A	Banite	B	Ferrite
	C	Austenite	D	Pearlite
50	In Martempering of steel_____			
	A	Cementite is decomposed into alpha iron and carbon	B	austenite is transformed into pearlite
	C	austenite is transformed into martensite	D	austenite is transformed into banite
51	The eaching reagent for Al and it's alloys is:			
	A	Nital	B	Picral
	C	Aqua-regia	D	Hydrofluoric acid

52	Two component are completely soluble in the liquid state and completely soluble in solid state is:			
	A	Isomorphous system	B	Eutectic system
	C	Peritectic system	D	Peritectoid system
53	Tempering is generally done to _____ steel.			
	A	Annealed	B	Normalised
	C	Quenched	D	Plastically deformed
54	Martempering is also called:			
	A	Secondary hardening	B	Stepped quenching
	C	Isothermal annealing	D	Sub- critical annealing
55	What is the unit of G from Griffith's energy criterion?			
	A	J-m ²	B	J-m
	C	J/m ²	D	J/m
56	Which of the followings is not a type of fracture in brittle materials?			
	A	Bright granular	B	Flat type
	C	Neck	D	Chevron patterns
57	Brittle fracture is more dangerous than ductile fracture because _____.			
	A	it gives warning sign before fracture	B	crack propagates at slow speeds
	C	it needs more extra stress during crack propagation	D	Crack propagates at very high speeds without warning.
58	What causes a brittle fracture?			
	A	dislocations	B	Hole
	C	Vacancy	D	Notch
59	Fracture stress (σ_f) is proportional to			
	A	crack length	B	1/crack length
	C	(crack length) ^{1/2}	D	(crack length) ^{-1/2}
60	Automobile crankshaft is likely to undergo _____ fracture.			
	A	Ductile	B	Brittle
	C	Intergranular	D	Fatigue

61	Fracture toughness, K_{IC} , decreases with			
	A) increasing temperature	B	increasing strain rate
	C	increase in yield strength	D	increase in grain size
62	Which of the following is a point defect in crystals?			
	A	Edge dislocation	B	Interstitialcies
	C	Grain boundaries	D	Cracks
63	_____ forms a seat in mold on which the sand core rests during pouring.			
	A	Pattern	B	Sand
	C	Core	D	Core Print
64	In order to get a smooth casting, the size of the sand particles should be _____			
	A	Coarse	B	Fine
	C	Moderate	D	Large
65	The _____ property ensures the removal of excess sand in the mould box.			
	A	Adhesiveness	B	Cohesiveness
	C	Green strength	D	Compressive strength
66	Which of the following is the most important property of the molding sand in cores?			
	A	Dry Strength	B	Green strength
	C	Collapsibility	D	Cohesiveness
67	Which of the following fill the flask uniformly with sand under a high-pressure stream?			
	A	Sands lingers	B	Patterns
	C	Cores	D	Chills
68	Which of the following components is mainly manufactured by performing metal forging?			
	A	Piston	B	Engine block
	C	Connecting rod	D	Crankcase
69	Which of the following processes is not the type of bulk forming process in the metal forming?			
	A	Bending	B	Rolling
	C	Forging	D	Extrusion

70	Which of the following manufacturing processes is mainly considered for producing the components of very high strength?			
	A	Casting	B	Forging
	C	Extrusion	D	Rolling
71	Which of the following components are manufactured by the sheet metal forming process?			
	A	Engine blocks	B	Connecting rods
	C	Electric wires	D	Car bodies
72	Up to what percent of carbon content in steel, it is not required to preheat it?			
	A	0.25% – 0.3%	B	0.3% – 0.35%
	C	0.35% – 0.4%	D	0.4% – 0.45%
73	Which one of the following is non-consumable welding process?			
	A	Plasma arc welding	B	Submerged arc welding
	C	Gas metal arc welding	D	Shielded metal arc welding
74	Which one of the following does not affect the heat input of gas tungsten arc welding process?			
	A	Electrode diameter	B	Welding speed
	C	Welding current	D	Voltage
75	In arc welding process			
	A	low voltage and high current is used	B	high voltage and low current is used
	C	high voltage and high current is used	D	voltage is always kept at zero
76	Which one of the following arc welding process has high process efficiency than others?			
	A	Gas metal arc welding	B	Submerged arc welding
	C	Gas tungsten arc welding	D	Flux cored arc weld
77	Dye penetrant method is generally used to locate			
	A	core defects	B	surface defects
	C	superficial defects	D	temporary defects

78	Non-destructive testing is used to determine			
	A	location of defects	B	chemical composition
	C	corrosion of metal	D	All of these
79	During radiography test, which region absorbs less radiation and transmits more?			
	A	Low and high density regions absorb and transmit same amount of radiation	B	High density region
	C	Low density region	D	None of the above
80	Which among the following is the last step in magnetic particle test method?			
	A	observation and inspection	B	Circular magnetization
	C	demagnetization	D	magnetization
81	Which of the following matrix is in reduced row echelon form?			
	A	$\begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & 2 \\ 0 & 0 & 0 \end{bmatrix}$	B	$\begin{bmatrix} 1 & 4 & 5 \\ 0 & 1 & 2 \\ 0 & 0 & 1 \end{bmatrix}$
	C	$\begin{bmatrix} 1 & 0 & 2 \\ 0 & 1 & 3 \\ 0 & 0 & 0 \end{bmatrix}$	D	none of these
82	The system of linear equations $x + y + 2z = 9$, $2x + 4y - 3z = 1$, $3x + 6y - 5z = 0$ has			
	A	a unique solution	B	infinitely many solutions
	C	No solution	D	None of above
83	What is an integrating factor of $(e^x + 3xy)dx + 3x^2dy = 0$			
	A	$-\frac{1}{x}$	B	$\log\left(\frac{1}{x}\right)$
	C	$\frac{1}{x}$	D	none of these
84	The general solution of $(xp - y)^2 = p^2 - 1$, where $p = \frac{dy}{dx}$ is.....			
	A	$y = cx - \sqrt{c^2 + 1}$	B	$(cx - y)^2 = 1$
	C	$y = cx - \sqrt{c^2 - 1}$	D	$(cx - y)^2 = c^2 - 1$
85	If $y = e^{-x}$ is one of the solutions of $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + y = 0$, then the second solution is given by			
	A	xe^{-x}	B	x^2e^{-x}
	C	xe^x	D	e^x
86	The differential equation $(2x + 1)^2 \frac{d^2y}{dx^2} - 2(2x + 1) \frac{dy}{dx} - 12y = 6x$ can be solved by the substitution			
	A	$x = e^z$	B	$2x + 1 = e^z$
	C	$2x + 1 = y$	D	None of these

87	If $\vec{F} = \text{grad } f$, where $f = x^3 + y^3 + z^3 - 3xyz$ then $\text{curl } \vec{F}$ is		
	A	$\vec{0}$	B $\text{grad } f$ itself
	C	0	D not defined
88	Statement: If $M(x, y)$, $N(x, y)$, $\frac{\partial M}{\partial y}$ and $\frac{\partial N}{\partial x}$ be continuous everywhere in a region R of XY-plane bounded by a closed curve C , then		
	$\oint_C (Mdx + Ndy) = \iint_R \left(\frac{\partial N}{\partial x} - \frac{\partial M}{\partial y} \right) dxdy.$		
	The above statement represents.....		
	A	Stokes theorem	B Gauss' theorem
89	C	Green's theorem	D none of these
	$\int_0^\infty t e^{-2t} \cos t dt$ equals		
	A	$\frac{s^2 - 1}{(s + 1)^2}$	B $\frac{3}{25}$
	C	$\frac{s^2 - 1}{s^2 + 1}$	D $\frac{5}{9}$
90	In Gauss-Jordan method to solve a system of simultaneous linear equations, the coefficient matrix A of the system $AX=B$ is brought into ____.		
	A	an upper triangular	B a lower triangular
	C	a zero	D an identity matrix
91	Which of the following methods does not require prior information about the approximate values?		
	A	bisection method	B False position method
	C	Newton-Raphson method	D Root squaring method
92	To apply Simpson's 3/8 rule, the number of intervals must be		
	A	multiple of 3	B multiple of 2
	C	odd	D even
93	Which of the following is one of the predictor-corrector methods to solve first order linear differential equation numerically?		
	A	Picard's method	B Milne's method
	C	Taylor's series method	D Runge-Kutta fourth order method
94	The singular point of the complex function $f(z) = \frac{z+1}{z^2+4}$ is/are		
	A	$z = \pm 2i$	B $z = \pm i$
	C	$z = \pm 2$	D $z = -1$
95	Statement: A bounded entire function is constant. This statement is of _____ theorem.		
	A	Cauchy-Goursat	B Cauchy residue
	C	Liouville's	D Morera's

96	If the number of terms of negative powers is infinite in the Laurent's expansion about the point $z = z_0$ then $z = z_0$ is called a/ansingularity.			
	A	isolated	B	removable
	C	essential	D	all of above
97	The function $f(x, y) = x^3 - 3x^2 - 3y^2 + 3xy^2 + 4$ has saddle point at			
	A	(0, 0)	B	(1, -1)
	C	(2, 0)	D	none of these
98	In usual notation, if the mean of the Poisson distribution is 4 then $P(\lambda - 2\sigma < X < \lambda + 2\sigma)$ is equal to.....			
	A	0.0694	B	0.9306
	C	not defined	D	2
99	Two cards are drawn successively with replacement from a well-shuffled pack of 52 cards. If X denotes the number of kings in a draw of two cards then the mean of the distribution is.....			
	A	$\frac{34}{221}$	B	$\frac{188}{221}$
	C	$\frac{32}{221}$	D	$\frac{220}{221}$
100	For a normal distribution, if the mean is zero then what is $P(X > 0)$?			
	A	$\frac{1}{4}$	B	$\frac{1}{2}$
	C	1	D	$\frac{1}{3}$