Graduate Aptitude Test in Engineering

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:	MT: METALLURGICAL ENGINEERING 1st Feb shift2
Number of Questions:	65
Total Marks:	100.0

Wrong answer for MCQ will result in negative marks, (-1/3) for 1 mark Questions and (-2/3) for 2 marks Questions.

General Aptitude

Number of Questions:	10
Section Marks:	15.0

Q.1 to Q.5 carry 1 mark each & Q.6 to Q.10 carry 2 marks each.

Question Number : 1 Question Type : MCQ

Choose the appropriate word/phrase, out of the four options given below, to complete the following sentence:

Apparent lifelessness _____ dormant life.

(A) harbours   (B) leads to   (C) supports   (D) affects

Options :

1. ✔ A

2. ✖ B

3. ✖ C

4. ✖ D

Question Number : 2 Question Type : MCQ

Fill in the blank with the correct idiom/phrase.

That boy from the town was a _____ in the sleepy village.

(A) dog out of herd   (B) sheep from the heap
(C) fish out of water   (D) bird from the flock

Options :

1. ✖ A

2. ✖ B

3. ✔ C

4. ✖ D

Question Number : 3 Question Type : MCQ

Choose the statement where underlined word is used correctly.

(A) When the teacher eludes to different authors, he is being elusive.
(B) When the thief keeps eluding the police, he is being elusive.
(C) Matters that are difficult to understand, identify or remember are allusive.
(D) Mirages can be allusive, but a better way to express them is illusory.

Options :

1. ✖ A

2. ✔ B

3. ✖ C

4. ✖ D

Question Number : 4 Question Type : MCQ

Tanya is older than Eric.
Cliff is older than Tanya.
Eric is older than Cliff.

If the first two statements are true, then the third statement is:

(A) True
(B) False
(C) Uncertain
(D) Data insufficient

Options :

1. ✖ A

2. ✔ B

3. ✖ C

4. ✖ D

Question Number : 5 Question Type : MCQ

Five teams have to compete in a league, with every team playing every other team exactly once, before going to the next round. How many matches will have to be held to complete the league round of matches?

(A) 20   (B) 10   (C) 8   (D) 5

Options :

1. ✖ A

2. ✔ B

3. ✖ C

4. ✖ D

Question Number : 6 Question Type : MCQ

Select the appropriate option in place of underlined part of the sentence.

Increased productivity necessary reflects greater efforts made by the employees.

(A) Increase in productivity necessary
(B) Increase productivity is necessary
(C) Increase in productivity necessarily
(D) No improvement required

Options :

1. ✖ A

2. ✖ B

3. ✔ C

4. ✖ D

Question Number : 7 Question Type : MCQ

Given below are two statements followed by two conclusions. Assuming these statements to be true, decide which one logically follows.

Statements:
    I.   No manager is a leader.
    II.   All leaders are executives.

Conclusions:
    I.   No manager is an executive.
    II.   No executive is a manager.
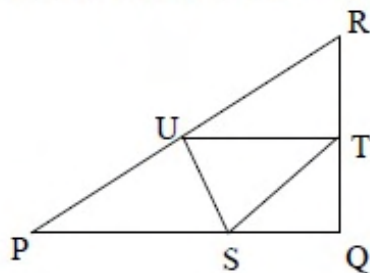
(A) Only conclusion I follows.
(B) Only conclusion II follows.
(C) Neither conclusion I nor II follows.
(D) Both conclusions I and II follow.

Options :

1. ✖ A

2. ✖ B

3. ✔ C

4. ✖ D

Question Number : 8 Question Type :NAT

In the given figure angle Q is a right angle, PS:QS = 3:1, RT:QT = 5:2 and PU:UR = 1:1. If area of triangle QTS is 20 cm^2, then the area of triangle PQR in cm^2 is _____.

Correct Answer :
280

Question Number : 9 Question Type : MCQ

Right triangle PQR is to be constructed in the xy - plane so that the right angle is at P and line PR is parallel to the x-axis. The x and y coordinates of P, Q, and R are to be integers that satisfy the inequalities: $-4 \leq x \leq 5$ and $6 \leq y \leq 16$. How many different triangles could be constructed with these properties?

(A) 110   (B) 1,100   (C) 9,900   (D) 10,000

Options :

1. ✖ A

2. ✖ B

3. ✔ C

4. ✖ D

Question Number : 10 Question Type : MCQ

A coin is tossed thrice. Let X be the event that head occurs in each of the first two tosses. Let Y be the event that a tail occurs on the third toss. Let Z be the event that two tails occur in three tosses. Based on the above information, which one of the following statements is TRUE?

(A) X and Y are not independent   (B) Y and Z are dependent
(C) Y and Z are independent   (D) X and Z are independent

Options :

1. ✖ A

2. ✔ B

3. ✖ C

4. ✖ D

Metallurgical Engineering

Number of Questions: 55
Section Marks: 85.0

Q.11 to Q.35 carry 1 mark each & Q.36 to Q.65 carry 2 marks each.

Question Number : 11 Question Type : NAT

Consider the following five readings from an experiment: 19, 17, 15, 13, 11. The standard deviation of the readings is_____.

Correct Answer :
3.1 to 3.33

Question Number : 12 Question Type : MCQ

$\frac{y(x+h)-y(x)}{h}$ is a numerical approximation for

(A) $\frac{dy}{dx}$ (B) $\frac{dy}{dh}$ (C) $\int y \, dx$ (D) $\int x \, dy$

Options :

1. ✔ A

2. ✖ B

3. ✖ C

4. ✖ D

Question Number : 13 Question Type : MCQ

If A and B are matrices, $(AB)^T$ =

(A) $A^T B$ (B) $B^T A$ (C) $A^T B^T$ (D) $B^T A^T$

Options :

1. ✖ A

2. ✖ B

3. ✖ C

4. ✔ D

Question Number : 14 Question Type : MCQ

Which of the following properties is intensive?

(A) Volume   (B) Gibbs free energy
(C) Chemical potential   (D) Entropy

Options :

1. ✖ A

2. ✖ B

3. ✔ C

4. ✖ D

Question Number : 15 Question Type : MCQ

In an Ellingham diagram, the standard free energy change ΔG^o for the oxidation reaction of a metal M given by: $xM(s) + O_2(g) \rightarrow M_x O_2(s)$, is plotted as a function of temperature. The slope of this line is positive because

(A) ΔS^0 is positive   (B) ΔS^0 is negative
(C) ΔH^0 is positive   (D) ΔH^0 is negative
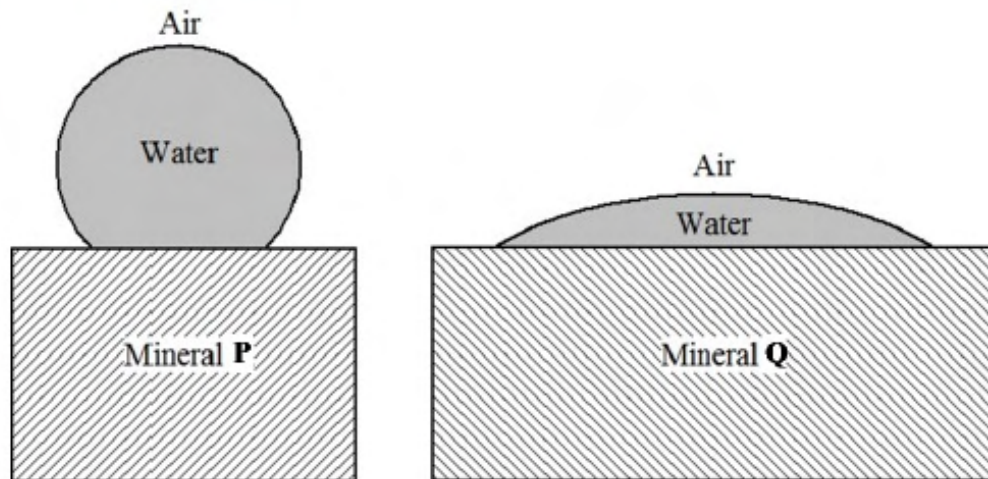
Options :

1. ✖ A

2. ✔ B

3. ✖ C

4. ✖ D

Question Number : 16 Question Type : MCQ

In froth flotation, hydrophobic mineral particles ascend with air bubbles preferentially over hydrophilic mineral particles. The figure below shows a schematic of a water droplet placed on the surfaces of two mineral P and Q.

Given this information, pick the **CORRECT** statement from the following:

(A) Mineral P ascends with air bubbles preferentially over mineral Q.
(B) Mineral Q ascends with air bubbles preferentially over mineral P.
(C) Both minerals P and Q ascend with the air bubbles without preference.
(D) Both minerals P and Q sink to the bottom.

Options :

1. ✔ A
2. ✖ B
3. ✖ C
4. ✖ D

Question Number : 17 Question Type : MCQ

Which of the following oxide addition results in polymerization (i.e., network formation) in a silicate slag?

(A) CaO　　　　　(B) MgO　　　　　(C) P_2O_5　　　　　(D) Na_2O

Options :

1. ✖ A
2. ✖ B
3. ✔ C
4. ✖ D

Question Number : 18 Question Type : MCQ

Zn is commercially extracted from which of the following minerals?

(A) Sphalerite　　　　　(B) Magnetite　　　　　(C) Chalcopyrite　　　　　(D) Galena

Options :

1. ✔ A
2. ✖ B
3. ✖ C
4. ✖ D

Question Number : 19 Question Type : MCQ

Self supporting arches for furnace roofs can be fabricated using silica bricks but not using magnesia bricks. Why?

(A) Silica has a significantly lower thermal expansion coefficient than magnesia at high temperatures.
(B) Silica has a significantly higher thermal conductivity than magnesia at high temperatures.
(C) Silica has a significantly lower melting point than magnesia.
(D) Silica is significantly more acidic than magnesia.

Options :

1. ✔ A
2. ✖ B
3. ✖ C
4. ✖ D

Question Number : 20 Question Type : MCQ

A species can diffuse through the lattice (diffusion coefficient, D_L), along grain boundaries (diffusion coefficient, D_{GB}), and along free surfaces (diffusion coefficient, D_S). Which of the following relations is **CORRECT?**
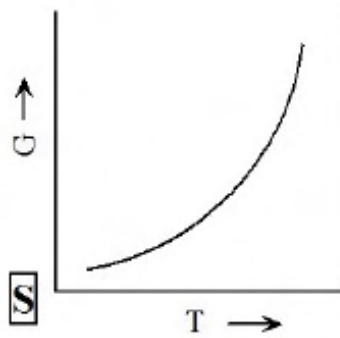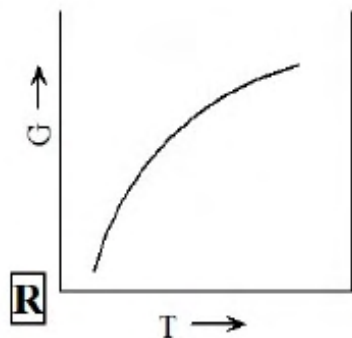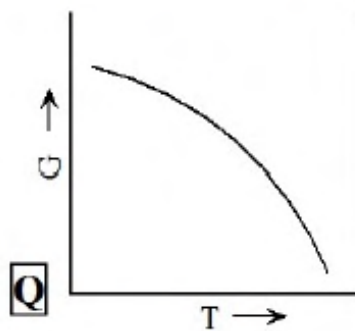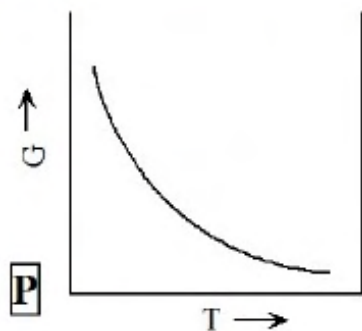
(A) $D_L > D_{GB} > D_S$

(B) $D_S > D_L > D_{GB}$

(C) $D_{GB} > D_S > D_L$

(D) $D_S > D_{GB} > D_L$

Options :

1. ✖ A
2. ✖ B
3. ✖ C
4. ✔ D

Question Number : 21 Question Type : MCQ

Select the **CORRECT** plot of Gibbs free energy (G) vs. temperature (T) for a single component system from the following:
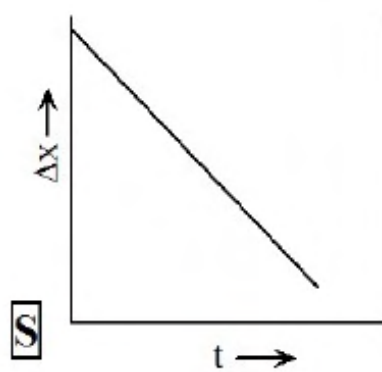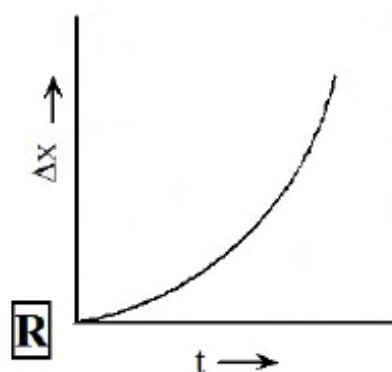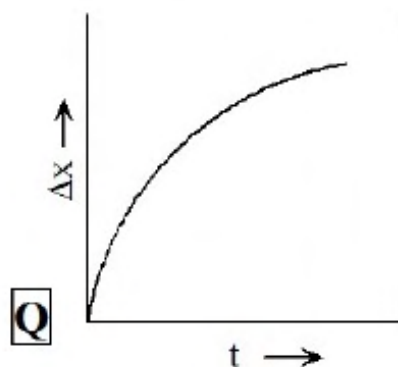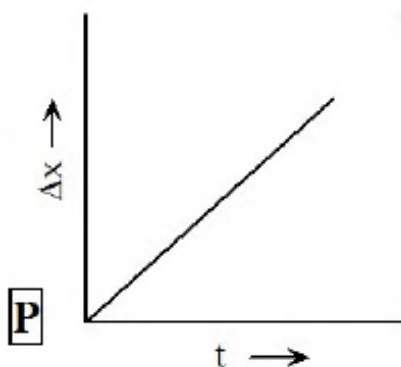

(A) P   (B) Q   (C) R   (D) S

Options :

1. ✖ A
2. ✔ B
3. ✖ C
4. ✖ D

Question Number : 22 Question Type : MCQ

If Δx represents adherent oxide layer thickness and t is time, which of the following curves represents diffusion-controlled oxidation kinetics?

(A) P   (B) Q   (C) R   (D) S

Options :
1. ✖ A
2. ✔ B
3. ✖ C
4. ✖ D

Question Number : 23 Question Type : MCQ

Based on the standard galvanic series, select the **CORRECT** *sequence of metals in the increasing order of anodic behaviour:*

(A) Zn, Fe, Pt, Cu   (B) Pt, Zn, Cu, Fe
(C) Fe, Pt, Cu, Zn   (D) Pt, Cu, Fe, Zn

Options :
1. ✖ A
2. ✖ B
3. ✖ C
4. ✔ D

Question Number : 24 Question Type : MCQ

In a conventional unit cell of a crystal, $a = b \neq c$ and $\alpha = \beta = \gamma = 90°$. This crystal belongs to which of the following systems?

(A) Cubic   (B) Tetragonal   (C) Orthorhombic   (D) Triclinic

Options :

1. ✖ A
2. ✔ B
3. ✖ C
4. ✖ D

Question Number : 25 Question Type : MCQ

In an X-Ray powder pattern of a simple cubic crystal, the 2nd peak corresponds to

(A) (111) (B) (100) (C) (200) (D) (110)

Options :
1. ✖ A
2. ✖ B
3. ✖ C
4. ✔ D

Question Number : 26 Question Type : MCQ

When boron (trivalent) is doped to silicon, the resulting material is

(A) a p-type semiconductor. (B) an n-type semiconductor.
(C) a superconductor. (D) an insulator.

Options :
1. ✔ A
2. ✖ B
3. ✖ C
4. ✖ D

Question Number : 27 Question Type : MCQ

Which of the following metal working operations can be categorized as an indirect compression process?

(A) Forging (B) Wire drawing (C) Extrusion (D) Stretch forming

Options :
1. ✖ A
2. ✖ B
3. ✔ C
4. ✖ D

Question Number : 28 Question Type : MCQ

Which of the following is a typical rolling defect?

(A) Buckling (B) Edge cracking (C) Cold shut (D) Porosity

Options :
1. ✖ A

2. ✔ B
3. ✘ C
4. ✘ D

Question Number : 29 Question Type : MCQ

Which of the following manufacturing processes is **NOT** used for producing fine grained metals?

(A) Electrodeposition
(B) Czochralski method
(C) Equi-Channel Angular Pressing (ECAP)
(D) Sintering of milled powders

Options :

1. ✘ A

2. ✔ B

3. ✘ C

4. ✘ D

Question Number : 30 Question Type : MCQ

Which of the following metal forming techniques is used to produce soft drink cans from aluminium sheets?

(A) Rolling   (B) Forging   (C) Deep drawing   (D) Extrusion

Options :

1. ✘ A

2. ✘ B

3. ✔ C

4. ✘ D

Question Number : 31 Question Type : MCQ

Which of the following is **NOT** a solid state metal joining technique?

(A) Ultrasonic welding   (B) Friction welding
(C) Diffusion bonding   (D) Electroslag welding

Options :

1. ✘ A

2. ✘ B

3. ✘ C

4. ✔ D

Question Number : 32 Question Type : NAT

The stress required for Orowan dislocation bypass is 200 MPa in an alloy when the inter-precipitate spacing is 500 nm. In the same alloy, if the inter-precipitate spacing is reduced to 200 nm, the stress required (in MPa) is _____ .

Correct Answer :

490 to 510

Question Number : 33 Question Type : MCQ

Which of the following Mohr's circles of a plane-stress condition corresponds to equi-biaxial tension?

(A) P   (B) Q   (C) R   (D) S

Options :

1. ✖ A

2. ✖ B

3. ✖ C

4. ✔ D
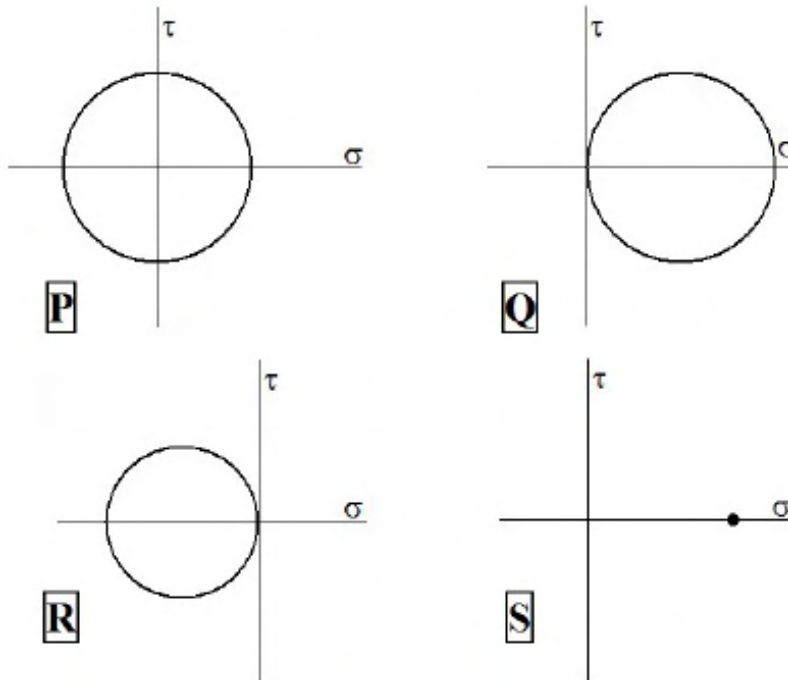
Question Number : 34 Question Type : MCQ

Select the **INCORRECT** *statement related to the effect of a small amount of carbon addition on mechanical properties of iron.*

(A) Ductile-Brittle-Transition-Temperature (DBTT) increases.
(B) Hardenability increases.
(C) Toughness increases.
(D) Yield point phenomenon occurs.

Options :

1. ✖ A

2. ✖ B

3. ✔ C

4. ✖ D

Question Number : 35 Question Type : MCQ

In polymers such as epoxies, creep resistance can be enhanced by

(A) increasing the bulkiness of side groups.
(B) increasing the cross-link density.
(C) addition of plasticizers.
(D) annealing.

Options :

1. ✖ A
2. ✔ B
3. ✖ C
4. ✖ D

Question Number : 36 Question Type : NAT

One of the eigenvalues of the matrix $\begin{bmatrix} -2 & 1 \\ 1 & -2 \end{bmatrix}$ *is* -3. *The other eigenvalue is* _____.

Correct Answer :
-1

Question Number : 37 Question Type : NAT

Consider the scalar function $f = xyz$. *The magnitude of the gradient, i.e.* $|\nabla f|$ *at the point* $(0,2,2)$ *is* _____.

Correct Answers :
4

Question Number : 38 Question Type : NAT

The determinant of the matrix $\begin{bmatrix} \cos\theta & \sin\theta & 0 \\ -\sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix}$ *is* _____

Correct Answer:
1

Question Number : 39 Question Type : MCQ

The solution of the ordinary differential equation $\frac{dy}{dx} = 5x$ for $y|_{x=0} = 0$ is

(A) 5   (B) $\frac{5x^2}{2}$ (C) $5x^2$ (D) e^{5x}

Options :

1. ✖ A
2. ✔ B
3. ✖ C
4. ✖ D

Question Number : 40 Question Type : NAT

The maximum value of the function $f(x) = -x^2 + 2x$ is _____.

Correct Answer :
1

Question Number : 41 Question Type : MCQ

$C (s) + CO_2 (g) \leftrightharpoons 2CO (g)$ is an important reaction in iron making. Given $\Delta H^0_{298} = 172000$ joules per mole of CO_2, which of the following conditions will favour the forward reaction?
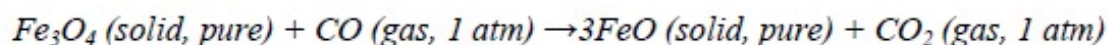
(A) Increasing both temperature and pressure.
(B) Decreasing temperature and increasing pressure.
(C) Decreasing both temperature and pressure.
(D) Increasing temperature and decreasing pressure.

Options :

1. ✖ A
2. ✖ B
3. ✖ C
4. ✔ D

Question Number : 42 Question Type : NAT

Consider the reaction:

Fe_3O_4 (solid, pure) + CO (gas, 1 atm) →3FeO (solid, pure) + CO_2 (gas, 1 atm)

For this reaction, $\Delta G^0_{1200} = -8000$ joules per mole of CO and $R = 8.314$ J mol^{-1}K^{-1}.

The equilibrium ratio, p_{CO_2}/p_{CO} for the reaction at 1200 K and 1 atm is _____

Correct Answer :
2.1 to 2.3

Question Number : 43 Question Type : NAT

An iron blast furnace produces hot metal containing 95% Fe. The iron ore charged into the furnace contains 95% Fe_2O_3 and the rest is gangue. Assume that all the iron in the ore goes to hot metal. The amount of iron ore (in kg) required for producing 1000 kg of hot metal is _____ .
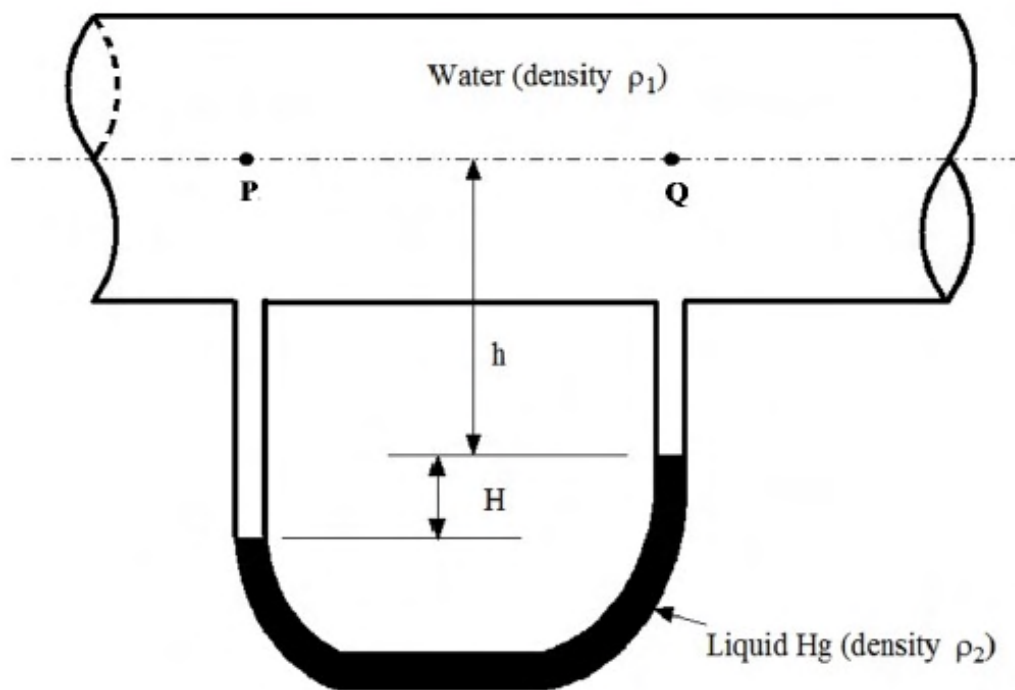
(Atomic weight of Fe = 56 g mol^{-1} and that of Fe_2O_3 = 160 g mol^{-1})

Correct Answer :
1400 to 1450

Question Number : 44 Question Type : MCQ

The figure below shows water flowing through a pipe. The pressure difference between points P and Q measured using a water-over-mercury manometer is

Water (density ρ_1)

P.

Q

h

H

Liquid Hg (density ρ_2)

(A) $\rho_2 g H$

(B) $\rho_1 g h$

(C) $(\rho_2 - \rho_1) g H$

(D) $(\rho_2 - \rho_1) g h$

Options :

1. ✖ A

2. ✖ B

3. ✔ C

4. ✖ D

Question Number : 45 Question Type : MCQ

Match the metals listed in **Group I** *with the most appropriate extraction routes listed in* **Group II.**

Group I	**Group II**
P. Al	1. Blast Furnace
Q. Ti	2. Matte Smelting
R. Cu	3. Electrolysis of Fused Salts
S. Fe	4. Halide Metallurgy

(A) P-3, Q-2, R-4, S-1   (B) P-3, Q-4, R-2, S-1

(C) P-2, Q-4, R-3, S-1   (D) P-4, Q-1, R-3, S-2
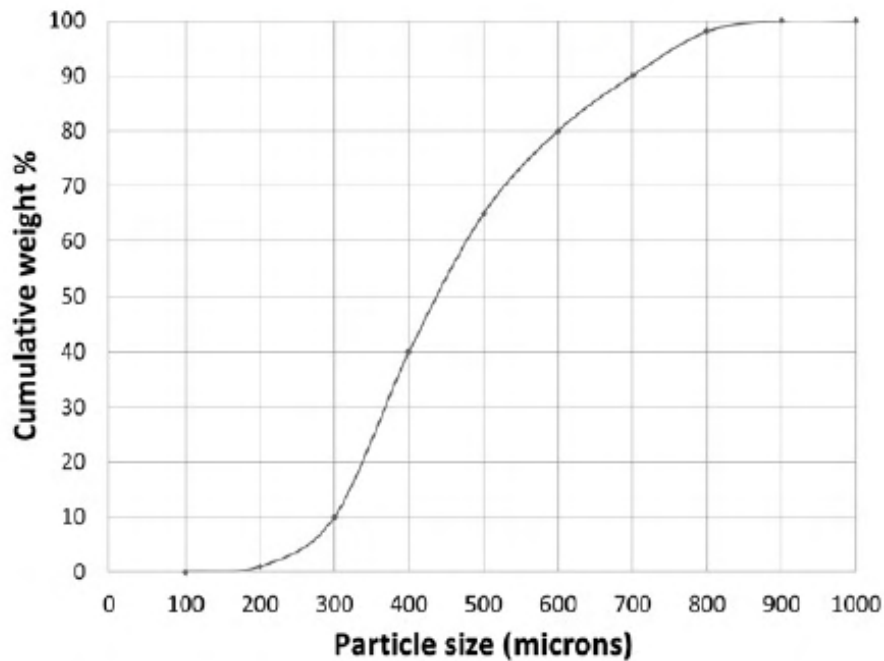
Options :

1. ✖ A

2. ✔ B

3. ✖ C

4. ✖ D

Question Number : 46 Question Type : NAT

The figure below shows the cumulative size distribution of particles of a crushed mineral. 10 kg of this material is first passed through a sieve of size 400 micron and then through a sieve of size 300 micron. The weight of mineral (in kg) that is retained on the 300 micron sieve is _____ .

Correct Answer :

2.9 to 3.1

Question Number : 47 Question Type : NAT

In electrolytic refining of Ni, the anode is Cu-10 atom % Ni and the cathode is pure Ni. Assuming the Cu-Ni solution to be ideal, the **ABSOLUTE** value of the minimum voltage (in mV) required for refining is _____ .

Given: Faraday constant = 96490 C mol^{-1}, Temperature = 300 K, R = 8.314 J mol^{-1} K^{-1}.

Correct Answer :

29.5 to 30.0

Question Number : 48 Question Type : NAT

Configurational entropy due to ideal mixing in a binary A-B system is expressed as:
$\Delta S_{mix} = -R(X_A \ln X_A + X_B \ln X_B)$, where X_A and X_B are mole fractions of A and B respectively.

ΔS_{mix} is maximum at $X_A =$_____

Correct Answer :

0.5

Question Number : 49 Question Type : NAT

Melting point of a metal is 1356 K. When the liquid metal is undercooled to 1256 K, the free energy change for solidification, $\Delta G^{L \to S} = -1000$ J mol^{-1}. On the other hand, if the liquid metal is undercooled to 1200 K, the free energy change (in J mol^{-1}) for solidification is _____.

Correct Answer :

-1600 to -1500

Question Number : 50 Question Type : MCQ

Match the names listed in **Group I** with the reactions listed in **Group II**

Group I	Group II
P. Eutectic	1. $\gamma + \beta \to \alpha$
Q. Peritectic	2. $L \to \alpha + \beta$
R. Peritectoid	3. $L_1 \to L_2 + \alpha$
S. Monotectic	4. $L + \beta \to \alpha$

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

Options :

1. ✖ A

2. ✖ B

3. ✔ C
4. ✖ D

Question Number : 51 Question Type : NAT

It takes 10 hours to homogenize an alloy at 1273 K. The time required (in hours) to achieve the same extent of homogenization at 1373 K is _____ .

Given: Diffusivity, $D_{1373\,K} = 10^{-18} m^2 s^{-1}$ and $D_{1273\,K} = 10^{-19} m^2 s^{-1}$

Correct Answer :

1

Question Number : 52 Question Type : MCQ

Match the materials listed in **Group I** with the most appropriate applications listed in **Group II**

Group I	**Group II**
P. Iron-Silicon alloy	1. Heating element
Q. GaAs	2. Ultrasonic generator
R. Nichrome	3. Transformer core
S. Quartz crystals	4. Light emitting diode

(A) P-3, Q-4, R-1, S-2 (B) P-2, Q-4, R-1, S-3
(C) P-1, Q-3, R-4, S-2 (D) P-3, Q-2, R-4, S-1
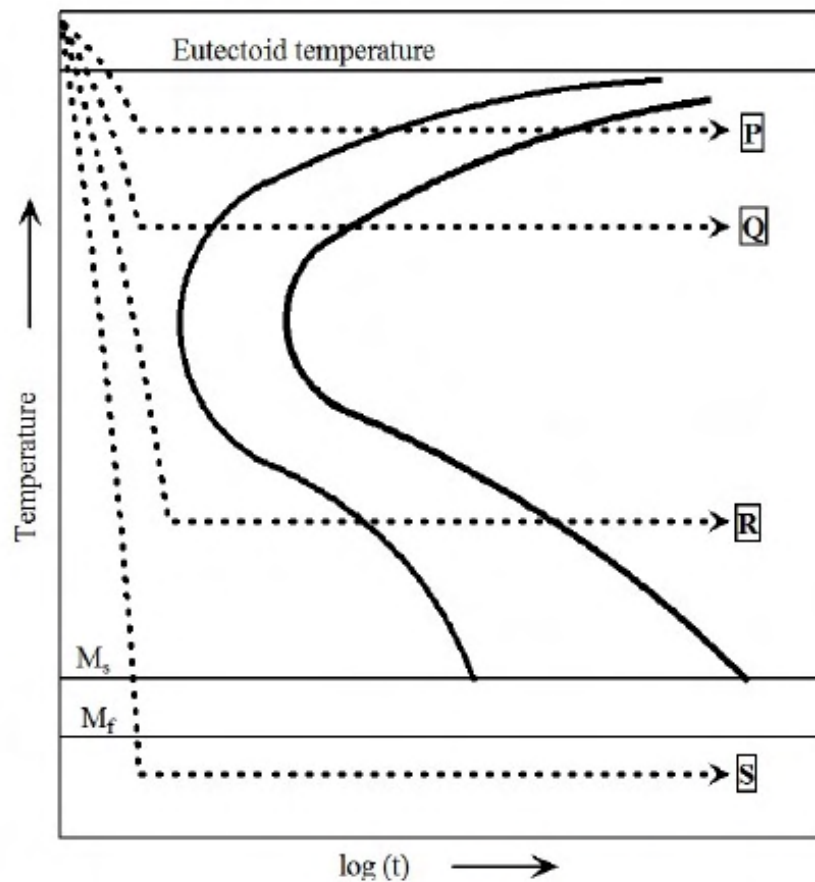
Options :

1. ✔ A

2. ✖ B

3. ✖ C

4. ✖ D

Question Number : 53 Question Type : MCQ

Match the heat treatments for an eutectoid steel shown in the TTT diagram below (as P, Q, R and S) with the resulting microstructures listed below:

1. Fine pearlite
2. Martensite
3. Bainite
4. Coarse pearlite

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

Options :

1. ✖ A

2. ✔ B

3. ✖ C

4. ✖ D

Question Number : 54 Question Type : NAT

An alloy of overall composition $X_B=0.7$ was equilibrated at temperature T_1. Microstructural analysis showed two phases, α and β, and that the phase fraction of β was 0.75. Given that the equilibrium composition of β at T_1 is 0.9 as shown in the phase diagram below, the maximum solubility of B in α (in mole fraction) at this temperature is _____ .
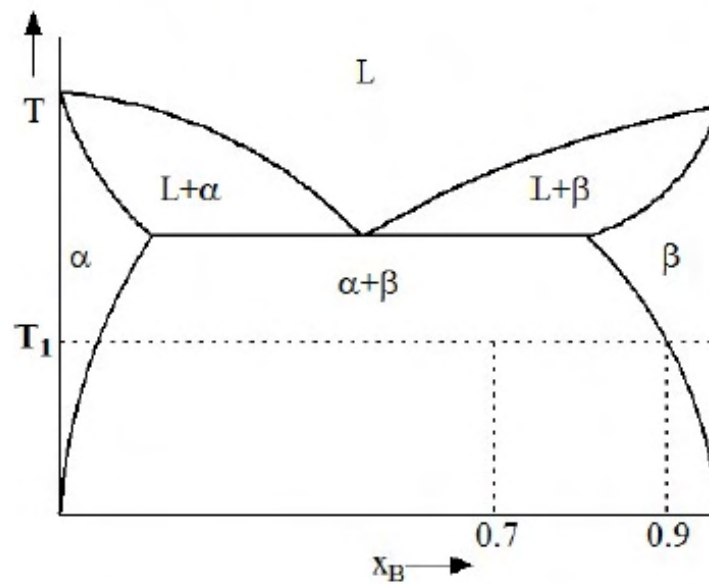
Correct Answer :

0.09 to 0.11

Question Number : 55 Question Type : NAT

If a cylindrical billet of height 1.0 m and diameter 0.5 m is upset forged to form a cylindrical pancake of height 0.25 m, the diameter of the pancake (in m) is _____ .

Correct Answer :

0.9 to 1.1

Question Number : 56 Question Type : MCQ

Determine the correctness or otherwise of the following Assertion [a] and the Reason [r]

Assertion: In a pure metal weld, elastic modulus in the heat affected zone (HAZ) is the same as that in the base metal.

Reason: Coarse grained microstructure in the HAZ results in lower hardness.

(A) Both [a] and [r] are true and [r] is the correct reason for [a]
(B) Both [a] and [r] are true and [r] is not the correct reason for [a]
(C) Both [a] and [r] are false
(D) [a] is true but [r] is false

Options :

1. ✖ A

2. ✔ B
3. ✖ C
4. ✖ D

Question Number : 57 Question Type : NAT

At the mould exit of a continuous caster, the metal consisting of a solidified shell with a liquid metal core exits at the rate of 35 kg s⁻¹. Given that the latent heat of fusion is 3×10^5 J kg⁻¹ and the total rate of heat removal by the mould is 4.2×10^6 W, the mass fraction of solid at the mould exit is _____ .

Assume that both solid and liquid remain at the melting point while they are in the mould.

Correct Answer :
0.39 to 0.41

Question Number : 58 Question Type : MCQ

*Match the features observed in castings listed in **Group I** with the most appropriate reasons listed in **Group II***

Group I
P. Macrosegregation
Q. Fine grained structure
R. Porosity
S. Dendrites

Group II
1. Inoculation
2. Gas evolution and shrinkage
3. Temperature gradients and supercooling
4. Density difference and convection currents

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

Options :
1. ✖ A
2. ✔ B
3. ✖ C
4. ✖ D

Question Number : 59 Question Type : NAT

The driving force for sintering a compact consisting of spherical particles of radius R_1 is ΔG_1. If the particle size is reduced to $R_2 = 0.1\, R_1$, the corresponding driving force $\Delta G_2 = \alpha\, \Delta G_1$, where α is _____ .

Correct Answer :
10

Question Number : 60 Question Type : MCQ

Which of the following techniques are **NOT** applicable for detecting internal flaws in a ceramic material?

1. Liquid penetration test
2. Radiography
3. Ultrasonic testing
4. Eddy current method

(A) 1 and 3   (B) 3 and 4   (C) 2 and 4   (D) 1 and 4

Options :

1. ✖ A

2. ✖ B

3. ✖ C

4. ✔ D

Question Number : 61   Question Type : MCQ

Match the following fracture surface features listed in **Group I** with the fracture mechanisms listed in **Group II**

Group I
P. Striations
Q. Dimples and microvoids
R. Flat facets and "river markings"
S. Jagged surface with grain-like features

Group II
1. Intergranular fracture
2. Cleavage fracture
3. Ductile fracture
4. Fatigue fracture

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

Options :

1. ✖ A

2. ✖ B

3. ✔ C

4. ✖ D

Question Number : 62   Question Type : MCQ

Match the scientist pairs listed in **Group I** with phenomena listed in **Group II**

Group I
P. Hall-Petch
Q. Nabarro-Herring
R. Lomer-Cottrell
S. Frank-Read

Group II
1. Dislocation reaction product
2. Diffusional creep
3. Dislocation source
4. Grain boundary strengthening

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

Options :

1. ✖ A

2. ✖ B
3. ✔ C
4. ✖ D

Question Number : 63 Question Type : NAT

In an FCC crystal, the strain energy per unit length of a dislocation with Burgers vector $\frac{a}{2}\langle 110 \rangle$ is _____ times that of a $\frac{a}{6}\langle 112 \rangle$ dislocation.

Correct Answer :
3

Question Number : 64 Question Type : MCQ

*Match the desired mechanical properties listed in **Group I** with the microstructural features listed in **Group II***

Group I
P. Creep resistance
Q. Elastic modulus enhancement
R. Superplasticity
S. Increased strength

Group II
1. Fine grained two-phase microstructure
2. Single crystal
3. Coherent precipitates
4. Glass fibres in epoxy

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

Options :
1. ✖ A
2. ✖ B
3. ✔ C
4. ✖ D

Question Number : 65 Question Type : NAT

A brittle material is mechanically tested in medium P in which it has surface energy $\gamma_s = 0.9\ J\,m^{-2}$. This material has a fracture strength of 300 MPa for a given flaw size. The same solid containing the same flaws is then tested in medium Q in which $\gamma_s = 0.1\ J\,m^{-2}$. The fracture strength (in MPa) in medium Q based on Griffith's theory is _____ .

Correct Answer :
100