

Notations :

- Options shown in green color and with ✓ icon are correct.
- Options shown in red color and with ✖ icon are incorrect.

|                                        |                           |
|----------------------------------------|---------------------------|
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Question Shuffling Allowed : Yes

Question Number : 1 Question Id : 2310981951 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

In Ellingham diagram for oxides, the  $C + O_2 = CO_2$  is nearly horizontal because

Options :

- ✓ The slope is equal to Entropy change in standard state, and it is very small in this case
- ✖ The slope is equal to Enthalpy change in standard state, and it is zero in this case
- ✖  $CO_2$  is gaseous oxide

4. ✖  $\text{CO}_2$  shows non-ideal behavior

Question Number : 2 Question Id : 2310981952 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

Activation energy of a heterogeneous chemical reaction is estimated from the following plot:

Options :

1. ✖  $k$  versus  $\ln T$

2. ✖  $1/k$  versus  $T$

3. ✖  $1/k$  versus  $\ln T$

4. ✔  $\ln k$  versus  $1/T$

Question Number : 3 Question Id : 2310981953 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

The heat of reaction at any arbitrary temperature  $T_2$  can be easily calculated from the value of the same available at another temperature by using which of the following reactions?

Options :

1. ✖ Hess' Law

2. ✔ Kirchoff's Equation

3. ✖ First Law of Thermodynamics

4. ✖ Law of Conservation of Energy

Question Number : 4 Question Id : 2310981954 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

As per Ellingham diagram  $2\text{Fe} + \text{O}_2 = 2\text{FeO}$ ;  $\Delta G^\circ = -364 \text{ kJ/mol}$  and  $2\text{Pb} + \text{O}_2 = 2\text{PbO}$ ;  $\Delta G^\circ = -184 \text{ kJ/mol}$ . The value of standard free energy as calculated from of the reaction  $\text{PbO} + \text{Fe} = \text{Pb} + \text{FeO}$  at  $1000^\circ\text{C}$  is:

Options :

1. ✓  $-90 \text{ kJ/mol}$
2. ✗  $-180 \text{ kJ/mol}$
3. ✗  $-45 \text{ kJ/mol}$
4. ✗  $-548 \text{ kJ/mol}$

Question Number : 5 Question Id : 2310981955 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

In an Ellingham diagram, the standard free energy change  $\Delta G^\circ$  for the oxidation reaction of a metal M given by  $xM(s) + O_2(g) = M_xO_2(s)$ , is plotted as a function of temperature. The slope of this line is positive because:

Options :

1. ✗  $\Delta S^\circ$  is positive
2. ✓  $\Delta S^\circ$  is negative
3. ✗  $\Delta H^\circ$  is positive
4. ✗  $\Delta H^\circ$  is negative

Question Number : 6 Question Id : 2310981956 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

One mole of element P is mixed with one mole of element Q. The entropy of mixing at 0 K temperature is:

Options :

1. ✗ 0
2. ✓  $-R \ln 0.5$

3. ✖  $\infty$

4. ✖  $-R \ln 2$

Question Number : 7 Question Id : 2310981957 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

Intensive thermodynamic variables are;

Options :

1. ✔ independent of the number of mass of the system

2. ✖ Dependent on the mass of the system

3. ✖ Independent of the volume of the system

4. ✖ Dependent on the volume of the system

Question Number : 8 Question Id : 2310981958 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

For a closed system of fixed internal energy and volume, at equilibrium:

Options :

1. ✖ Gibbs' free energy is minimum

2. ✔ entropy is maximum

3. ✖ Helmholtz' free energy is minimum

4. ✖ Enthalpy is maximum

Question Number : 9 Question Id : 2310981959 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

The reaction between X and Y results in an intermediate complex  $XY^*$  which leads to the final product XY as  $X + Y \rightarrow XY^* \rightarrow XY$ . Collision theory views the rate as dependent on:

Options :

1. ✖ frequency of breakdown of intermediate to form  $XY^*$
2. ✔ frequency of energetic interaction to form  $XY^*$
3. ✖ frequency of formation of XY from  $XY^*$
4. ✖ frequency of breakdown of XY

Question Number : 10 Question Id : 2310981960 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

In laminar flow, the fraction factor:

Options :

1. ✖ increases with Reynolds number
2. ✔ decreases with Reynolds number
3. ✖ depends upon the velocity of the fluid only and increases with the velocity of the fluid
4. ✖ depends upon the density of the fluid only and increases with the density of the fluid

Question Number : 11 Question Id : 2310981961 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

An atmosphere containing a mixture of  $CO_2$ , CO and  $N_2$  will cause oxidation of nickel at 1000 K, if the following condition is satisfied:

Options :

1. ✔  $(p_{CO_2}/p_{CO})_{actual} > (p_{CO_2}/p_{CO})_{equilibrium}$



2. ✖  $(p_{\text{CO}_2}/p_{\text{CO}})_{\text{actual}} < (p_{\text{CO}_2}/p_{\text{CO}})_{\text{equilibrium}}$

3. ✖  $(p_{\text{CO}_2}/p_{\text{CO}})_{\text{actual}} = (p_{\text{CO}_2}/p_{\text{CO}})_{\text{equilibrium}}$

4. ✖ Activity of nickel = 1

Question Number : 12 Question Id : 2310981962 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

The Henrian's activity coefficient of oxygen in liquid iron at 1560°C is reduced by addition of:

Options :

1. ✖ nickel

2. ✖ molybdenum

3. ✔ chromium

4. ✖ cobalt

Question Number : 13 Question Id : 2310981963 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

When an element 'i' is to be transferred from phase I to phase II, the transfer will be feasible thermodynamically if the following condition of chemical potential is satisfied:

Options :

1. ✔  $\mu_i(\text{I}) > \mu_i(\text{II})$

2. ✖  $\mu_i(\text{I}) < \mu_i(\text{II})$

3. ✖  $\mu_i(\text{I}) = \mu_i(\text{II})$

4. ✖  $\mu_i(I) = G_i(II)$

Question Number : 14 Question Id : 2310981964 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

The weight percentage of nitrogen ( $N_2$ ) in liquid iron can be expressed as:

Options :

1. ✔  $K \sqrt{pN_2}$

2. ✖  $\sqrt{K} (pN_2)$

3. ✖  $\sqrt{K pN_2}$

4. ✖  $K (pN_2)$

Question Number : 15 Question Id : 2310981965 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

$2Cu(S) + 0.5O_2(g) = Cu_2O(s)$ ,  $\Delta G^\circ = (-162200 + 69.24 T) J$ ;  $2Cu(l) + 0.5O_2(g) = Cu_2O(s)$ ,  $\Delta G^\circ = (-188300 + 88.48 T) J$ . The molar free energy change at 1300 K for the transformation of solid Cu to liquid Cu will be:

Options :

1. ✖ 1050 J

2. ✖ 960 J

3. ✔ 544 J

4. ✖ 445 J

Question Number : 16 Question Id : 2310981966 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

During fully developed laminar flow in a circular pipe, the velocity profile is parabolic and symmetric around the axis. The velocity at the tube wall is zero. The ratio of average to the maximum velocity is:

Options :

1. ✖ 1/3

2. ✔ 1/2

3. ✖ 2/3

4. ✖ 3/4

Question Number : 17 Question Id : 2310981967 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

The vapour pressure of pure liquid Y at temperature  $T_0$  is 0.5 atm. The partial pressure of Y in the vapour pressure that is in equilibrium with the liquid solution consisting of 30 mol of % X and 70 mol of % Y at temperature  $T_0$  is (assume that both liquid and vapour phases behave ideally):

Options :

1. ✔ 0.35 atm

2. ✖ 0.50 atm

3. ✖ 0.70 atm

4. ✖ 1.00 atm

Question Number : 18 Question Id : 2310981968 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

At constant temperature and pressure, two phases  $\alpha$  and  $\beta$  will be in equilibrium when:

Options :

1. ✔ chemical potential of each component is the same as in  $\alpha$  and  $\beta$

2. ✖ partial molar free energy of each component is not the same in  $\alpha$  and  $\beta$



3. ✖ Gibbs free energy of mixing is minimum

4. ✖ Enthalpy of mixing is zero

Question Number : 19 Question Id : 2310981969 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

The activation energy for a reaction is 100 kJ/mol. The approximate increase in temperature required for doubling the rate of reaction from that at 25°C is:

Options :

1. ✖ 5°C

2. ✔ 10°C

3. ✖ 15°C

4. ✖ 20°C

Question Number : 20 Question Id : 2310981970 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

In multicomponent heterogeneous system at thermodynamic equilibrium, identify the option that need NOT be true.

Options :

1. ✔ Uniform pressure

2. ✖ Uniform temperature

3. ✖ Uniform chemical potential

4. ✖ Uniform composition

Question Number : 21 Question Id : 2310981971 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

For the following reaction, the standard free energy change is given at 1773 K as follows:  $\frac{2}{3} \text{Cr}_2\text{O}_3 (\text{s}) = \frac{4}{3} \text{Cr}(\text{s}) + \text{O}_2(\text{g})$ ,  $\Delta G^\circ = 447800 \text{ J}$ ;  $2 \text{H}_2 (\text{g}) + \text{O}_2(\text{g}) = \text{H}_2\text{O}(\text{g})$ ,  $\Delta G^\circ = -297000 \text{ J}$ . If chromium oxide powder has to be reduced by hydrogen in a fluidised bed the minimum  $p\text{H}_2 / p\text{H}_2\text{O}$  ratio that has to be maintained at the exit of the reactor is:

Options :

1. ✖ 8.5

2. ✖ 10.6

3. ✖ 100.2

4. ✔ 166.5

Question Number : 22 Question Id : 2310981972 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3 Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

A furnace wall consists of two layers. The inside layer of 450 mm is made of light weight bricks of thermal conductivity  $1 \text{ W m}^{-1} \text{ K}^{-1}$  and the outside layer of 900 mm is made of refractory of thermal conductivity  $2 \text{ W m}^{-1} \text{ K}^{-1}$ . The hot face of the inside layer is at temperature 1300 K and the cold face of the outer layer is at 400 K. The temperature at the interface between the two layers is:

Options :

1. ✖ 1000 K

2. ✔ 850 K

3. ✖ 700 K

4. ✖ 600 K

Question Number : 23 Question Id : 2310981973 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3 Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

At 1330 K, the emf of the given cell  $[\text{Pb} (\text{pure liquid}) \mid \text{PbO-SiO}_2 \text{ Liquid Electrolyte } (X_{\text{PbO}}=0.5) \mid \text{Pt}(\text{s}), \text{O}_2 (\text{g}), p_{\text{O}_2}=1 \text{ atm}]$  is 0.60 V. Given that  $\Delta G^\circ = -88800 \text{ J mol}^{-1}$  at 1300 K for the reaction  $\text{Pb}(\text{l}) + \frac{1}{2} \text{O}_2 (\text{g}) = (\text{PbO})$ . The electrochemical potential of the cell is:

Options :

1. ✓ + 0.460 V

2. ✗ -0.460 V

3. ✗ + 0.60 V

4. ✗ -0.60 V

Question Number : 24 Question Id : 2310981974 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

The entropy of a pure solid at  $T = 0$  is:

Options :

1. ✓ 0

2. ✗  $\infty$

3. ✗ 1

4. ✗ 0.5

Question Number : 25 Question Id : 2310981975 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

A  $H_2$ - $H_2S$  gas mixture with  $H_2/H_2S$  gas ratio of 10 was equilibrated with pure liquid iron at 1850 K. The quenched iron sample contains 0.8 wt. % Sulphur. The free energy change for the reaction  $\{1/2 S_2 (g, 1 \text{ atm}) = [S] 1 \text{ wt.}\% \text{ SS in liquid Fe}\}$ . Given at 1850 K  $\log h_S = 0.76$  and  $\Delta G^\circ = 690 \text{ J mol}^{-1}$  at 1850 K for the reaction  $H_2 (g) + 1/2 S_2 (g) = H_2S (g)$ .

Options :

1. ✗  $-20,500 \text{ J mol}^{-1}$

2. ✗  $-40,500 \text{ J mol}^{-1}$

3. ✓  $-30,500 \text{ J mol}^{-1}$

4. ✗  $-10,500 \text{ J mol}^{-1}$

Question Number : 26 Question Id : 2310981976 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

In order to remove copper from the molten lead, solid PbS is added. The reaction is  $\{ 2[\text{Cu}] (\text{in liquid Pb}) + \text{PbS}(\text{s}) = \text{Cu}_2\text{S}(\text{s}) + \text{Pb}(\text{l}) \}$ . At  $1073 \text{ K}$   $\Delta G^\circ = -27126 \text{ J mol}^{-1}$ , the solubility of Cu in liquid lead,  $X_{\text{Cu}} = 0.10$  and the activities of  $\text{Cu}_2\text{S}$ ,  $\text{PbS}$ ,  $\text{Pb}$  can be assumed equal to 1. Copper Sulphide is separated as pure compound. What will be the minimum attainable copper concentration at  $1073 \text{ K}$ ?

Options :

1. ✗ 0.05

2. ✓ 0.0216

3. ✗ 0.0912

4. ✗ 0.0325

Question Number : 27 Question Id : 2310981977 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

Consider a reaction  $[\text{Fe}] + \text{H}_2\text{O}(\text{g}) = \text{FeO}(\text{s}) + \text{H}_2(\text{g})$ , at  $910^\circ\text{C}$  and at  $1 \text{ atm}$  total pressure. When the iron is pure, the gas mixture at equilibrium contains  $60.2\% \text{ H}_2$  and  $39.8\% \text{ H}_2\text{O}$  by volume, (as per standard convention for gases). If Fe is present as a solid solution of Fe and Ni ( $X_{\text{Fe}} = 0.721$ ), the equilibrium gas composition is  $51.9\% \text{ H}_2$  and  $48.1\% \text{ H}_2\text{O}$ . The activity of Fe in alloy is (assume FeO to be pure):

Options :

1. ✗ 0.317

2. ✗ 0.173

3. ✓ 0.713

4. ✖ 0.513

Question Number : 28 Question Id : 2310981978 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

Lithium melts at 453 K. Solubility of iron in Lithium is minimum and it increases with increase in temperature. If the solubility of iron in lithium is  $4.36 \times 10^{-4}$  at 1473 K and  $4.97 \times 10^{-6}$  at 673 K, then the minimum solubility of iron in lithium is: (Given: enthalpy of mixing  $H = 46143 \text{ J mol}^{-1}$ .)

Options :

1. ✖  $9 \times 10^{-6}$

2. ✔  $9 \times 10^{-8}$

3. ✖  $9 \times 10^{-9}$

4. ✖  $9 \times 10^{-7}$

Question Number : 29 Question Id : 2310981979 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

Liquid lead-tin solution exhibits regular solution behaviour. At 746 K, it is given that  $\ln \gamma_{\text{Pb}} = -0.737(1-X_{\text{Pb}})^2$ . The corresponding expression of Sn is:

Options :

1. ✔  $\ln \gamma_{\text{Sn}} = -0.737(1-X_{\text{Sn}})^2$

2. ✖  $\ln \gamma_{\text{Sn}} = -(1-X_{\text{Sn}})^2$

3. ✖  $\ln \gamma_{\text{Sn}} = -0.737(1-X_{\text{Sn}})^3$

4. ✖  $\ln \gamma_{\text{Sn}} = -0.737(1-X_{\text{Sn}})$

Question Number : 30 Question Id : 2310981980 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66



After the Parkes process of de-silverisation, an appreciable amount of zinc is left in molten Lead. The gas that bubbles through the molten lead to remove zinc is:

Options :

1. ✖ oxygen
2. ✔ chlorine
3. ✖ hydrogen
4. ✖ CO

Question Number : 31 Question Id : 2310981981 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

Higher value of which of the following characters indicates low value of coke as Blast furnace fuel?

Options :

1. ✖ Fixed carbon
2. ✖ Reactivity
3. ✔ Sulphur content
4. ✖ Strength and abrasion resistance

Question Number : 32 Question Id : 2310981982 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

Zirconia sensor is used to measure the properties of a Heat-treatment atmosphere in a furnace of:

Options :

1. ✔ Oxygen
2. ✖ Carbon

3. ✖ Nitrogen

4. ✖ Hydrogen

Question Number : 33 Question Id : 2310981983 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

Wustite is an ionic solid. The chemical formula of Wustite is:

Options :

1. ✖  $\text{FeS}_2$

2. ✖  $\text{Fe}_2\text{O}_3$

3. ✖  $\text{Fe}_3\text{O}_4$

4. ✔  $\text{Fe}_{1-x}\text{O}$

Question Number : 34 Question Id : 2310981984 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

Match the metallurgical processes in Group I with their corresponding reactor types in Group II.

**Group I**

- P) Roasting of sulphide concentrate
- Q) LD steel making
- R) Dwight-Lloyd sintering
- S) Zinc extraction

**Group II**

- 1) Pneumatic reactor
- 2) Retort
- 3) Travelling grate reactor
- 4) Fluidised bed reactor

Options :

1. ✖ P – 3; Q – 2; R – 4; S – 1

2. ✔ P – 4; Q – 1; R – 3; S – 2

3. ✖ P – 3; Q – 4; R – 2; S – 1

4. ✖ P – 4; Q – 1; R – 2; S – 3

Question Number : 35 Question Id : 2310981985 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

Match the extraction method in Group I with the metals in Group II.

**Group I**

- P) Roasting followed by carbothermic reduction
- Q) Electrolysis of fused salt
- R) Roasting followed by controlled oxidation
- S) Zinc extraction Group

**Group II**

- 1) Pneumatic reactor
- 2) Retort
- 3) Travelling grate reactor
- 4) Fluidised bed reactor

Options :

1. ✔ P – 2; Q – 3; R – 4; S – 1

2. ✖ P – 5; Q – 4; R – 3; S – 1

3. ✖ P – 2; Q – 5; R – 1; S – 4

4. ✖ P – 3; Q – 2; R – 5; S – 1

Question Number : 36 Question Id : 2310981986 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

Group I gives the practices and Group II gives the reactors. Match the items from Group I with the items from Group II.

**Group I**

- P) Layered charging of coke and ore
- Q) Oxygen injection through supersonic nozzle
- R) Aluminium wire feeding
- S) Foamy slag practice

**Group II**

- 1) Laddle Furnace
- 2) Electric Arc Furnace
- 3) Blast Furnace
- 4) LD converter

Options :

1. ✖ P – 3; Q – 1; R – 2; S – 4

2. ✖ P – 2; Q – 4; R – 3; S – 1

3. ✖ P – 4; Q – 3; R – 2; S – 1

4. ✔ P – 3; Q – 4; R – 1; S – 2

Question Number : 37 Question Id : 2310981987 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

Which of the following processes is performed for inclusion modification in ladle metallurgy of steel making?

Options :

1. ✖ Aluminium wire feeding

2. ✔ Calcium wire feeding

3. ✖ Oxygen top blowing

4. ✖ Oxygen bottom blowing

Question Number : 38 Question Id : 2310981988 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

Which of the following factors is NOT desirable for effective phosphorus removal in BOF steelmaking processes?

Options :

1. ✖ Higher FeO level in slag

2. ✖ Higher basicity

3. ✔ Higher temperature

4. ✖ Lower temperature

Question Number : 39 Question Id : 2310981989 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

Which of the following oxide addition results in polymerisation in a silicate slag?

Options :

1. ✓ CaO

2. ✗ MgO

3. ✗ P<sub>2</sub>O<sub>5</sub>

4. ✗ Na<sub>2</sub>O

Question Number : 40 Question Id : 2310981990 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

The rate of a chemical reaction at a slag-metal interface is:

Options :

1. ✓ proportional to interfacial area

2. ✗ proportional to volume of slag

3. ✗ inversely proportional to interfacial area

4. ✗ inversely proportional to volume of slag

Question Number : 41 Question Id : 2310981991 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

Deoxidation of liquid steel with ferrosilicon produces spherical silica particles. The particles of 5 μm diameter take 1000 minutes to float up through a 2 meters height of liquid steel. For particles of 50 μm diameter to float up through the same height, the time required in minutes is:

Options :



1. ✓ 10

2. ✗ 100

3. ✗ 50

4. ✗ 1000

Question Number : 42 Question Id : 2310981992 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

Match the processes in Group I with the physical principles in Group II.

**Group I**

P) Leaching

Q) cementation

R) roasting

S) Converting

**Group II**

1) Precipitation of metal in aqueous solution

2) Selective dissolution of metal

3) Conversion of matte to metal

4) Conversion of sulphide to oxide

5) Separation of metal from slag

Options :

1. ✗ P – 2; Q – 1; R – 3; S – 5

2. ✓ P – 2; Q – 1; R – 4; S – 3

3. ✗ P – 3; Q – 4; R – 5; S – 2

4. ✗ P – 4; Q – 3; R – 2; S – 1

Question Number : 43 Question Id : 2310981993 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

In Kroll process for producing titanium, what is the right combination of the following conditions:

- P) inert atmosphere;
- Q) stoichiometric amount of magnesium;
- R) metal at the top and slag at the bottom;
- S) no external heating

Options :

1. ✓ P, Q, R

2. ✗ Q, S

3. ✗ P, R

4. ✗ P, R, S

Question Number : 44 Question Id : 2310981994 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

Match the processes in Group I with the physical principles in Group II.

**Group I**

- P) Electric Arc Furnace
- Q) LD Converter
- R) Continuous Caster
- S) Blast Furnace

**Group II**

- 1) High Top Pressure
- 2) Dummy Bar
- 3) Slag splashing
- 4) Eccentric bottom tapping

Options :

1. ✗ P – 4; Q – 1; R – 2; S – 3

2. ✗ P – 2; Q – 4; R – 1; S – 3

3. ✓ P – 4; Q – 3; R – 2; S – 1

4. ✖ P – 1; Q – 3; R – 2; S – 4

Question Number : 45 Question Id : 2310981995 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

Identify the condition that is NOT beneficial for dephosphorisation of hot metal in an LD converter.

Options :

1. ✖ High slag basicity

2. ✖ Low temperature

3. ✔ High silicon in hot metal

4. ✖ Highly oxidizing slag

Question Number : 46 Question Id : 2310981996 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

In an iron making blast furnace, the sinter is added in preference to iron ore lumps because sinter:

Options :

1. ✔ has better reducibility than ore

2. ✖ increases the raceway adiabatic flame temperature

3. ✖ decreases the carbon content of hot metal

4. ✖ helps in reducing the manganese content of hot metal

Question Number : 47 Question Id : 2310981997 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

The purpose of injection of calcium into liquid steel is to:

- P) replace alumina inclusions by calcium oxide inclusions
- Q) modify alumina inclusions into calcium aluminate inclusions
- R) reduce sulphur content of steel
- S) reduce nitrogen content of steel

Options :

1. ✖ P, Q

2. ✖ P, R

3. ✔ Q, R

4. ✖ Q, S

Question Number : 48 Question Id : 2310981998 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

Liquid metal contains initially 0.05 mass % of P and this has to be reduced to 0.02 mass % using a basic slag. The equilibrium distribution ratio of P between slag and metal is  $L_p = (\% \text{ P slag}) / [\% \text{ P metal}] = 60$ . Assuming that initially the slag does NOT contain any phosphorus, then the minimum weight of slag (ton) required per ton of steel is:

Options :

1. ✔ 0.025

2. ✖ 0.05

3. ✖ 0.075

4. ✖ 0.10

Question Number : 49 Question Id : 2310981999 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66



A  $200\text{mm} \times 200\text{mm}$  cross section bloom is continuously cast at a casting speed of  $0.05\text{ m/s}$ . The amount of heat extracted from  $0.7\text{ m}$  long mould is  $1.28\text{MW}$ . Assume that the temperature of the steel is at its melting point while entering and leaving the mould. Latent heat of fusion for the steel is  $278\text{ kJ/kg}$  and density of steel is  $7800\text{ kg/m}^3$ . The thickness of solidified shell emerging from the mould will be:

Options :

1. ✓  $0.147\text{ mm}$

2. ✗  $1.47\text{ mm}$

3. ✗  $14.7\text{ mm}$

4. ✗  $147\text{ mm}$

Question Number : 50 Question Id : 2310982000 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

In BOF steel melting, 5 metric tons of lime containing 90 wt % CaO is used to refine 100 metric ton of hot metal containing 93.2 wt % Fe. The slag produced during refining contains 40 wt % CaO and 22 wt % FeO neglecting material losses, the yield of Fe (in %) is:

Options :

1. ✓ 97.9

2. ✗ 99.7

3. ✗ 79.9

4. ✗ 97.7

Question Number : 51 Question Id : 2310982001 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

150 tonnes of liquid steel at a temperature of  $1900\text{ K}$  is contained in a refractory-lined cylindrical ladle which is open at the top. Consequently  $4.91\text{m}^2$  area of steel is exposed. (Given: specific heat of molten steel,  $C = 788\text{J/Kg-K}$ , emissivity of steel surface = 0.5, Fraction of total radiation is 0.437; Stefan Boltzman constant =  $5.667 \times 10^{-8}\text{ Watts m}^{-2}\text{ K}^{-4}$ ). The rate of temperature drop of steel is:

Options :



1. ✓ 0.0133 K/s

2. ✗ 0.0103 K/s

3. ✗ 0.0313 K/s

4. ✗ 0.133 K/s

Question Number : 52 Question Id : 2310982002 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

The minimum pH required for precipitation of  $\text{Ni}^{2+}$  ions from an aqueous solution at  $25^\circ\text{C}$  is: (Standard electrode potential is 0.241 V,  $\text{Ni}^{2+}$  ions concentration in the solution is 0.01;  $p\text{H}_2 = 1 \text{ atm.}$ )

Options :

1. ✓ 5.1

2. ✗ 4.22

3. ✗ -4.7

4. ✗ 3.92

Question Number : 53 Question Id : 2310982003 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

A volume of aqueous phase with solute concentration  $C^\circ$  is treated with a given volume of organic solvent (with zero initial solute concentration). The maximum extraction efficiency can be maximised by which of the following methods?

Options :

1. ✓ Multiple contacting

2. ✗ Single contacting

3. ✖ Increasing volume of organic solvent

4. ✖ Maximising solute concentration in the aqueous phase

Question Number : 54 Question Id : 2310982004 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

The unit cell with three lattice parameters is:

Options :

1. ✖ tetragonal

2. ✔ orthorhombic

3. ✖ monoclinic

4. ✖ triclinic

Question Number : 55 Question Id : 2310982005 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

Which of the following alloy systems exhibits complete solid solubility?

Options :

1. ✖ Fe – Cu

2. ✔ Cu – Ni

3. ✖ Al – Si

4. ✖ Cu – Zn

Question Number : 56 Question Id : 2310982006 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

The peritectic reaction in the Binary system is given by:

Options :

1. ✖  $L = \alpha + \beta$

2. ✖  $\alpha = L + \beta$

3. ✖  $\gamma = \alpha + \beta$

4. ✔  $L + \alpha = \beta$

Question Number : 57 Question Id : 2310982007 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

Which of the following microstructures of eutectic is NOT observed in binary alloys?

Options :

1. ✖ Lamellar

2. ✖ Acicular

3. ✔ Widmanstätten

4. ✖ Nodular

Question Number : 58 Question Id : 2310982008 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

The fraction of pearlite in an annealed 0.55 % carbon steel is approximately:

Options :

1. ✖ 0.55

2. ✖ 0.31

3. ✓ 0.69

4. ✗ 0

Question Number : 59 Question Id : 2310982009 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

Which element of the following is a ferrite stabiliser in steels?

Options :

1. ✗ Ni

2. ✗ Cu

3. ✓ Cr

4. ✗ Mn

Question Number : 60 Question Id : 2310982010 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

Which of the following techniques does NOT require quenching to obtain final case hardness?

Options :

1. ✗ Induction Hardening

2. ✗ Flame Hardening

3. ✗ Carburizing

4. ✓ Nitriding

Question Number : 61 Question Id : 2310982011 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

The carbon atom in BCC iron occupies the following position for which of the following reasons?

Options :

1. ✓ Octahedral: most easily accommodated elastic distortion
2. ✗ Octahedral: largest site in BCC unit cell
3. ✗ Tetrahedral: Largest site in BCC unit cell
4. ✗ Substitutional : Similar atomic size of Fe and Carbon

Question Number : 62 Question Id : 2310982012 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

Fine grain size in materials lead to:

Options :

1. ✗ increase in percentage elongation
2. ✗ increase in creep strength
3. ✓ increase in yield strength
4. ✗ decrease in impact strength

Question Number : 63 Question Id : 2310982013 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

The atomic diameter of an FCC crystal (lattice parameter is a) is:

Options :

1. ✓  $a\sqrt{2}/2$
2. ✗  $a\sqrt{2}/4$



3. ✖  $a\sqrt{3/4}$

4. ✖  $a/2$

Question Number : 64 Question Id : 2310982014 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

As compared to the nucleation rate maximum, the growth rate maximum is at:

Options :

1. ✔ a higher temperature

2. ✖ a lower temperature

3. ✖ the same temperature

4. ✖ the temperature of maximum transformation rate

Question Number : 65 Question Id : 2310982015 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

A copper sample is observed microscopically for its average grain size of ASTM grain size number of 5. The number of grains per  $\text{mm}^2$  in the sample will be:

Options :

1. ✖ 72

2. ✖ 124

3. ✔ 248

4. ✖ 496

Question Number : 66 Question Id : 2310982016 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

The c/a ratio of martensite depends on the concentration of:

Options :

1. ✖ nickel
2. ✖ manganese
3. ✔ carbon
4. ✖ nitrogen

Question Number : 67 Question Id : 2310982017 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

From the following, which element makes the most effective contribution in improving hardenability of steel?

Options :

1. ✖ Nickel
2. ✖ Cobalt
3. ✖ Chromium
4. ✔ Vanadium

Question Number : 68 Question Id : 2310982018 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

Martensitic transformations:

Options :

1. ✖ are diffusion-controlled
2. ✔ are shear processes

3. ✖ yield two products of different compositions

4. ✖ yield ultrafine microstructure

Question Number : 69 Question Id : 2310982019 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

Overaging refers to:

Options :

1. ✖ aging above room temperature

2. ✖ ultrafine precipitate size

3. ✖ long aging times

4. ✔ coarsening of precipitate particles

Question Number : 70 Question Id : 2310982020 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

In steel, during carburisation at  $937^{\circ}\text{C}$ , 0.6 % carbon is obtained at a depth of 0.2 mm after 1 hr. How long will it take to obtain same amount of carbon at a depth of 0.4 mm?

Options :

1. ✖ 60 seconds

2. ✖ 1.414 hours

3. ✖ 2 hours

4. ✔ 4 hours

Question Number : 71 Question Id : 2310982021 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

The ratio of the number of octahedral holes to tetrahedral holes per atom in BCC structure is:

Options :

1. ✖ 1 : 1

2. ✔ 1 : 2

3. ✖ 2 : 1

4. ✖ 2 : 6

Question Number : 72 Question Id : 2310982022 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

If the interplanar spacing obtained from the second reflection of a Diamond Cubic crystal is  $1.81\text{\AA}$ , then the lattice parameter is:

Options :

1. ✖  $0.905\text{\AA}$

2. ✖  $2.56\text{\AA}$

3. ✖  $3.62\text{\AA}$

4. ✔  $5.12\text{\AA}$

Question Number : 73 Question Id : 2310982023 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

The fraction of octahedral voids filled by Al ions in  $\text{Al}_2\text{O}_3$  is (ratio of radius of Al ion to the radius of oxygen ion is equal to 0.43):

Options :

1. ✖ 0.43

2. ✖ 0.287

3. ✔ 0.667

4. ✖ 1

Question Number : 74 Question Id : 2310982024 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

In case of homogeneous nucleation, the critical edge length for a cube shaped nucleus is ( $\gamma$  = energy per unit area of the interface between the product and the parent phase,  $\Delta G_v$  = Gibbs free energy change per unit volume):

Options :

1. ✔  $-4\gamma / \Delta G_v$

2. ✖  $-2\gamma / \Delta G_v$

3. ✖  $\gamma / \Delta G_v$

4. ✖  $-3\gamma / \Delta G_v$

Question Number : 75 Question Id : 2310982025 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

Following factor promotes coring in cast alloy results :

Options :

1. ✖ small difference between the liquidus and the solidus temperature

2. ✔ large difference between the liquidus and the solidus temperature

3. ✖ rapid cooling during solidification



4. ✖ quenching in water

Question Number : 76 Question Id : 2310982026 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

At 910°C,  $\gamma$ -Fe transforms to  $\alpha$ -Fe resulting in a percentage volume expansion of:

Options :

1. ✖ 5.6

2. ✖ 7.1

3. ✖ 7.6

4. ✔ 8.8

Question Number : 77 Question Id : 2310982027 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

The maximum amount of proeutectic austenite that can form in Fe-C alloy containing 3.5% carbon is (given that the maximum solubility of carbon in austenite is 2.11 %):

Options :

1. ✖ 24.80%

2. ✔ 36.53%

3. ✖ 67.87%

4. ✖ 72.52%

Question Number : 78 Question Id : 2310982028 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

Steadite phase is:

Options :

1. ✓ a three component eutectic of iron, iron carbide, iron phosphate found in cast iron
2. ✗ an embrittling compound found in stainless steel
3. ✗ obtained on tempering of hardened steel
4. ✗ responsible for causing the weld deposit on austenitic stainless steels to be slightly magnetic

Question Number : 79 Question Id : 2310982029 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

A Fe-3 wt. % Si alloys is cooled very slowly from liquid state to a temperature of 1023 K, thereafter, it is cooled in air.  
The microstructure at room temperature will consist of:

Options :

1. ✓ ferrite + graphite
2. ✗ pearlite + graphite
3. ✗ martensite + graphite
4. ✗ ferrite + pearlite

Question Number : 80 Question Id : 2310982030 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

If the volume of a material does not change during deformation, then the Poisson's ratio should be:

Options :

1. ✗ 0.25
2. ✗ 0.50

3. ✖ 0.67

4. ✔ 1.00

Question Number : 81 Question Id : 2310982031 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

Which combination of three items given in options — scale-load in kgf-indenter— is incorrect for the measurement of hardness?

Options :

1. ✖ A-60-120° diamond cone

2. ✖ C-150-120° diamond cone

3. ✖ B-100-1/8" diamond ball

4. ✔ D-100-1/16" steel sphere

Question Number : 82 Question Id : 2310982032 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

The largest size of an immobilised segment of dislocation in a Frank Read (FR) source in a polycrystalline material is of the order of grain size. In a metal of 10  $\mu\text{m}$  grain size, the shear stress required to operate such an FR source is 100 MPa. If the grain size in the same metal is reduced to 10 nm, the shear stress required to operate such FR source would be:

Options :

1. ✖  $10^2$  MPa

2. ✖  $10^3$  MPa

3. ✔  $10^5$  MPa

4. ✖  $10^6$  MPa

Question Number : 83 Question Id : 2310982033 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

The magnitude of the burger's vector in nickel (FCC) in the  $[112]$  direction is ( lattice parameter of nickel is  $3.52 \text{ \AA}$ ):

Options :

1. ✔  $4.31 \text{ \AA}$

2. ✖  $3.39 \text{ \AA}$

3. ✖  $5.31 \text{ \AA}$

4. ✖  $4.18 \text{ \AA}$

Question Number : 84 Question Id : 2310982034 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

The elastic strain energy per-unit length of a screw dislocation for iron is (shear modulus of iron is  $70 \text{ GPa}$ ; burger's vector of iron  $= 3.00 \text{ \AA}$ ):

Options :

1. ✖  $5.15 \times 10^{-9} \text{ J/m}$

2. ✔  $3.15 \times 10^{-9} \text{ J/m}$

3. ✖  $6.30 \times 10^{-9} \text{ J/m}$

4. ✖  $14.0 \times 10^{-9} \text{ J/m}$

Question Number : 85 Question Id : 2310982035 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

A pure screw dislocation can:

Options :

1. ✖ climb up
2. ✖ climb down
3. ✔ cross-slip
4. ✖ interact with vacancy

Question Number : 86 Question Id : 2310982036 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

The Nabarro-Herring creep and the Coble creep are governed:

Options :

1. ✖ by the grain boundary diffusion and the volume diffusion, respectively
2. ✖ only by the grain boundary diffusion
3. ✖ equally by the volume diffusion and the grain boundary diffusion
4. ✔ by the volume diffusion and the grain boundary diffusion, respectively

Question Number : 87 Question Id : 2310982037 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

The hydrogen-embrittled steel samples can exhibit:

Options :

1. ✖ only cleavage fracture
2. ✖ cleavage, dimple and intergranular fracture



3. ✓ both cleavage and dimple fracture

4. ✗ only intergranular fracture

Question Number : 88 Question Id : 2310982038 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

An aluminum alloy rod of diameter 15 mm and length 120 mm is subjected to a tensile load of 35 kN along its axis. The Young's modulus and Poisson's ratio for aluminum are 70 GPa and 0.33, respectively. The reduction in diameter on the application of tensile load is:

Options :

1. ✗ 0.011 mm

2. ✓ 0.014 mm

3. ✗ 0.018 mm

4. ✗ 0.021 mm

Question Number : 89 Question Id : 2310982039 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

Which of the following are the structure-sensitive properties:

P) Elastic modulus; Q) Yield strength; R) Melting point; S) Fracture strength

Options :

1. ✗ P,S

2. ✓ Q,S

3. ✗ Q,R

4. ✖ P,R

Question Number : 90 Question Id : 2310982040 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

Which of the following are the conditions necessary for the superplastic deformation in an alloy:

P) extremely fine and uniform grain size; Q) high homologous temperature; R) high strain rate; S) coarse non-uniform grains

Options :

1. ✔ P,Q

2. ✖ Q,R,S

3. ✖ P,Q,R

4. ✖ Q,R

Question Number : 91 Question Id : 2310982041 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

Which of the following is true for metals?

Options :

1. ✖ twin boundary energy > grain boundary energy > surface energy

2. ✔ grain boundary energy > twin boundary energy > surface energy

3. ✖ twin boundary energy > surface energy > grain boundary energy

4. ✖ surface energy > grain boundary energy > twin boundary energy

Question Number : 92 Question Id : 2310982042 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

Copper shows an array of edge dislocation on (110) plane of atoms. If the angle of tilt is  $1^\circ$ , the lattice constant of copper is  $3.62\text{\AA}$ , then the spacing of dislocations is:

Options :

1. ✓  $146.70\text{\AA}$

2. ✗  $3.62\text{\AA}$

3. ✗  $2.56\text{\AA}$

4. ✗  $170.50\text{\AA}$

Question Number : 93 Question Id : 2310982043 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

A thermal groove was observed on the surface of iron, where the grain boundary intercepted it perpendicularly making a dihedral angle of  $147^\circ$ . The surface energy of iron is  $1.49\text{ J/m}^2$ . The grain boundary energy of iron is:

Options :

1. ✗  $0.745\text{ J/m}^2$

2. ✗  $0.37\text{ J/m}^2$

3. ✓  $0.85\text{ J/m}^2$

4. ✗  $1.7\text{ J/m}^2$

Question Number : 94 Question Id : 2310982044 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

A straight dislocation in copper has Burgers vector parallel to  $[110]$  direction, and the dislocation line is parallel to  $[011]$  direction. If the lattice parameter is  $0.362\text{ nm}$ , the character of the dislocation is:

Options :

1. ✗ edge dislocation

2. ✖ screw dislocation

3. ✖ prismatic dislocation

4. ✔ mixed dislocation

Question Number : 95 Question Id : 2310982045 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

The direction of  $[01\bar{1}]$  in cubic crystal:

Options :

1. ✖ is perpendicular to the (111) plane

2. ✔ lies within the (111) plane

3. ✖ makes an angle  $30^\circ$  with the normal to (111) plane

4. ✖ makes an angle  $45^\circ$  with the normal to (111) plane

Question Number : 96 Question Id : 2310982046 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

The resilience of strong metals can be increased by using them in the shapes of:

Options :

1. ✔ slender

2. ✖ spherical

3. ✖ cubical

4. ✖ plates

Question Number : 97 Question Id : 2310982047 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

For an isotropic material subjected to a three-dimensional stressing, which of the following relationships exists?

Options :

1. ✔  $K = E/3(1-\nu)$

2. ✖  $K = E/3(1+\nu)$

3. ✖  $K = E/(3-\nu)$

4. ✖  $K = E/2(3+\nu)$

Question Number : 98 Question Id : 2310982048 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

The stress concentration factor for a large thin plate with a small circular hole is:

Options :

1. ✖ 1

2. ✖ 2

3. ✔ 3

4. ✖ approaching infinity

Question Number : 99 Question Id : 2310982049 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66



Match the number of independent elastic constants given in Group I with crystal structures given in Group II.

**Group I**

1) 21

2) 9

3) 13

4) 6

**Group II**

P) Triclinic

Q) Monoclinic

R) Orthorhombic

S) Tetragonal

Options :

1. ✓ P-1, Q-3, R-2, S-4

2. ✗ P-3, Q-1, R-2, S-4

3. ✗ P-1, Q-3, R-4, S-2

4. ✗ P-1, Q-2, R-3, S-4

Question Number : 100 Question Id : 2310982050 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

The strain gauge measurements made on the free surface of a steel plate ( $E=200\text{GPa}$ ,  $\nu=0.33$ ) indicate that the principal strains are 0.004 and 0.001. The principal stresses are:

Options :

1. ✓ 965 MPa and 516 MPa

2. ✗ 800 MPa and 200 MPa

3. ✗ 400 MPa and 100 MPa

4. ✗ 900 MPa and 500 MPa

Question Number : 101 Question Id : 2310982051 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

Match the items in Group I to their description in Group II.

**Group I**

- P) Hall-Petch relation
- Q) Orowan mechanism
- R) Nabarro-Herring creep
- S) Griffith Criterion

**Group II**

- 1) Bulk diffusion between grain boundaries
- 2) Fracture of brittle materials
- 3) Grain boundary strengthening
- 4) dispersion strengthening

Options :

1. ✖ P-1, Q-2, R-3, S-4

2. ✖ P-2, Q-3, R-4, S-1

3. ✖ P-4, Q-1, R-2, S-3

4. ✔ P-3, Q-4, R-1, S-2

Question Number : 102 Question Id : 2310982052 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

The true strain at fracture of a tensile specimen is 0.75. The percentage reduction in the cross-section area is about:

Options :

1. ✖ 29.41 %

2. ✖ 52.76 %

3. ✔ 68.31 %

4. ✖ 75.0 %

Question Number : 103 Question Id : 2310982053 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

Perfect dislocations can act as nucleation centres for precipitation primarily because they:

Options :

1. ✖ locally reproduce the atomic structure of the precipitate
2. ✔ provide fast diffusion paths for solutes
3. ✖ provide additional driving force due to elimination of their own strain energy
4. ✖ reduce the interfacial energy

Question Number : 104 Question Id : 2310982054 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

The yield stresses of both Au and Ag single crystals are 0.7 MPa. The yield stress of a 50 : 50 solid solution is:

Options :

1. ✖ 0.7 MPa
2. ✔ greater than 0.7 MPa
3. ✖ lesser than 0.7 MPa
4. ✖ zero

Question Number : 105 Question Id : 2310982055 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

The resolved shear stress for the plastic deformation to start in an iron crystal is ( $G$  = shear stress):

Options :

1. ✖  $G$
2. ✖  $G/6$
3. ✖  $G/30$

4. ✓ G/4700

Question Number : 106 Question Id : 2310982056 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

Match the items in Group I to their description in Group II.

**Group I**

P) Dislocation intersections

Q) Fracture toughness

R) Viscoelastic

S) Strain aging

**Group II**

1) Kinks

2) MPa

3) Time dependent

4) Jogs

5) MPa/√m

6) Yield point phenomenon

Options :

1. ✗ P-3, Q-4, R-6, S-2

2. ✓ P-1, Q-5, R-2, S-3

3. ✗ P-2, Q-3, R-4, S-1

4. ✗ P-4, Q-6, R-3, S-5

Question Number : 107 Question Id : 2310982057 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

Match the phenomenon in Group I with associate primary change in Group II:

**Group I**

P) Change in dislocation density

Q) Change in the shape of a phase

R) Change in vacancy concentration

S) Change in grain orientation

**Group II**

1) Recovery

2) Recrystallisation

3) Malleabilising

4) Texture

Options :

1. ✖ P-3,Q-4,R-1, S-2

2. ✖ P-3, Q-1, R-4, S-2

3. ✔ P-2, Q-3, R-1, S-4

4. ✖ P-3, Q-4, R-2, S-1

Question Number : 108 Question Id : 2310982058 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

Perfect dislocations can act as nucleation centres for precipitation primarily because they:

Options :

1. ✖ locally reproduce the atomic structure of the precipitate

2. ✖ reduce the interfacial energy

3. ✖ provide additional driving force due to elimination of their own strain energy

4. ✔ provide fast diffusion paths for solutes

Question Number : 109 Question Id : 2310982059 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

A tensile load of 100 N is applied to an aluminum-boron composite of 1 mm<sup>2</sup> cross-sectional area. The volume of the parallel fibres is 30%. When the load axis is parallel to the fibres, then the stress in the fibres is:

Options :

1. ✖ 484 MN/m<sup>2</sup>

2. ✖ 100 MN/m<sup>2</sup>



3. ✖ 200 MN/m<sup>2</sup>

4. ✔ 242 MN/m<sup>2</sup>

Question Number : 110 Question Id : 2310982060 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

A spacecraft structural member is subjected to a state of stress where  $\sigma$  in X-axis, Y-axis and Z-axis direction is 200 MPa, 100 MPa and -50 MPa respectively. If the part is made from 7075-T<sub>6</sub> aluminum alloy with  $\sigma_o = 500$  MPa, it does not exhibit yielding. The factor of safety is:

Options :

1. ✔ 2.2

2. ✖ 1.2

3. ✖ 3.2

4. ✖ 2.0

Question Number : 111 Question Id : 2310982061 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

For a good quality brazing, the molten filler alloy should have:

Options :

1. ✔ low contact angle with the base metal

2. ✖ low density

3. ✖ high surface tension

4. ✖ high viscosity

Question Number : 112 Question Id : 2310982062 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

A piece of copper has a measured density of  $8910 \text{ kg/m}^3$ . The lattice parameter of copper is  $0.362 \text{ nm}$  and its atomic mass is  $0.06351 \text{ kg/mol}$ . The percentage of vacancies in the pure copper is:

Options :

1. ✓ 0.23%

2. ✗ 0.32%

3. ✗ 0.42%

4. ✗ 0.52%

Question Number : 113 Question Id : 2310982063 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

The dissociation a perfect dislocation  $a/2 [10\bar{1}]$  into  $a/6[2\bar{1}\bar{1}] + a/6[11\bar{2}]$  in a crystal is:

Options :

1. ✗ energetically unfavourable

2. ✓ energetically favourable

3. ✗ vactorially imbalanced

4. ✗ likely to occur in Zinc metal

Question Number : 114 Question Id : 2310982064 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

The surface energy of a highly brittle material is doubled without changing its elastic modulus. The approximate percent increase in fracture strength is:

Options :

1. ✗ 100

2. ✖ 73

3. ✖ 50

4. ✔ 41

Question Number : 115 Question Id : 2310982065 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

A single crystal of aluminum, when free of dislocation, has a theoretical strength of about (shear modulus  $G = 28 \text{ GPa}$ ):

Options :

1. ✖ 28.0 GPa

2. ✔ 4.5 GPa

3. ✖ 0.56 GPa

4. ✖ 0.07 GPa

Question Number : 116 Question Id : 2310982066 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

Identify the correct statements from the following:

P) The Von-Mises criterion depends upon the coordinate system as the individual stress components change with the coordinate system for the same externally applied load.

Q) Both Tresca and Von-Mises criteria are independent of the hydrostatic stress.

S) According to Von-Mises criterion, yielding commences when the maximum shear stress reaches a critical value.

R) According to Tresca yield criterion, yielding commences on plane equally inclined to the external principle stress directions.

Options :

1. ✖ P,Q

2. ✖ R,S

3. ✓ Q,S

4. ✗ P,S

Question Number : 117 Question Id : 2310982067 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

A rope is attached to a glass sheet 10 cm wide and 0.127 cm thick. The rope contains a central crack with a total length of 1.62 cm that is oriented parallel to the ground. The fracture toughness of the glass is 0.83 MPa/m<sup>2</sup>. The limiting load that can be hung from the rope is:

Options :

1. ✗ 243 N

2. ✗ 544 N

3. ✓ 661 N

4. ✗ 732 N

Question Number : 118 Question Id : 2310982068 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

According to Von-Mises criterion of yielding, the approximate minimum roll pressure at which rolling may be carried out is:

Options :

1. ✓ 10.7 MPa

2. ✗ 108.6 MPa

3. ✗ 231.2 MPa

4. ✗ 301.5 MPa

Question Number : 119 Question Id : 2310982069 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

A component is expected to last for a minimum of 5 years at 850°C. Assuming Larson-Millar constant to be 46, the magnitude of the Larson-Miller parameter is:

Options :

1. ✖  $40.46 \times 10^3$

2. ✔  $63.66 \times 10^3$

3. ✖  $48.18 \times 10^3$

4. ✖  $53.46 \times 10^3$

Question Number : 120 Question Id : 2310982070 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

A single-phase aluminum alloy with grain size 5  $\mu\text{m}$  and yield strength of 400 MPa is annealed at 500 °C. The grain size increases to 15  $\mu\text{m}$  and the yield strength drops to 300 MPa. The further annealing time required to increase the grain size to 25  $\mu\text{m}$  will be (assume time exponent of 0.5):

Options :

1. ✖ 15 min

2. ✖ 30 min

3. ✔ 60 min

4. ✖ 90 min

Question Number : 121 Question Id : 2310982071 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

For a good quality brazing, the molten filler alloy should have:

Options :



1. ✓ low contact angle with the base metal

2. ✗ low density

3. ✗ high surface tension

4. ✗ high viscosity

Question Number : 122 Question Id : 2310982072 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

The most fundamental relationship for plastic deformation is given by:

Options :

1. ✓  $\epsilon_1 + \epsilon_2 + \epsilon_3 = 0$

2. ✗  $\sigma_1 + \sigma_2 + \sigma_3 = 3\sigma$

3. ✗  $\tau_1 + \tau_2 + \tau_3 = 3\tau$

4. ✗  $\epsilon_1 + \epsilon_2 + \epsilon_3 = 3\epsilon$

Question Number : 123 Question Id : 2310982073 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

The strain rate does not have which of the following types of effect in metalworking?

Options :

1. ✓ The flow stress of the metal increases with the strain rate

2. ✗ The temperature of the work piece increases because of adiabatic heating

3. ✖ There is improved lubrication at the tool-metal interface

4. ✖ There is an extremely high strain hardening of work piece

Question Number : 124 Question Id : 2310982074 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

The typical value of velocity (in m/sec) encountered in explosive forming operation is:

Options :

1. ✖ 0.1 to 1.0

2. ✖ 3 to 6

3. ✔ 30 to 120

4. ✖ 300 to 500

Question Number : 125 Question Id : 2310982075 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

For the manufacturing of thin films of aluminum, which of the following rolling mills is used?

Options :

1. ✖ Three-high rolling mill

2. ✔ Sendzimir mill

3. ✖ Four-stand continuous mill

4. ✖ Planetary mill

Question Number : 126 Question Id : 2310982076 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

The residual stress on a rolled plate:

Options :

1. ✖ varies monotonically from one surface to the other
2. ✖ is compressive on the surface and tensile at the centre
3. ✔ is tensile on the surface and compressive at the centre
4. ✖ continuously decreases from the surface to the centre of the plate

Question Number : 127 Question Id : 2310982077 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

A suitable technique for monitoring a growing crack in an alloy is:

Options :

1. ✔ acoustic emission
2. ✖ radiography
3. ✖ magnetic particle technique
4. ✖ liquid penetration test

Question Number : 128 Question Id : 2310982078 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

For obtaining a bright finish, aluminum alloys are extruded using which of the following types of die geometry?

Options :

1. ✖ Conical dies
2. ✖ Shear dies

3. ✓ Parabolic dies

4. ✗ Porthole dies

Question Number : 129 Question Id : 2310982079 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

In which of the following materials used for sheet making is the spring-back effect significant?

Options :

1. ✓ Aluminum alloys

2. ✗ Stainless steel

3. ✗ Magnesium

4. ✗ Lead

Question Number : 130 Question Id : 2310982080 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

For obtaining 100% theoretical density, which of the following compaction processes is used in powder metallurgy?

Options :

1. ✗ Double-ended compaction

2. ✓ Hot isostatic pressing

3. ✗ Cold isostatic pressing

4. ✗ Powder extrusion

Question Number : 131 Question Id : 2310982081 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

Match the following manufacturing process of Group I to be used for producing the product of Group II.

| Group I            | Group II             |
|--------------------|----------------------|
| P) Drawing         | 1) Large curved disc |
| Q) Forging         | 2) Tube              |
| R) Rolling         | 3) Crank shaft       |
| S) Stretch forming | 4) Plate             |

Options :

1. ✓ P-2,Q-3,R-4, S-1

2. ✗ P-1, Q-4, R-3, S-2

3. ✗ P-3, Q-2, R-1, S-4

4. ✗ P-4, Q-1, R-2, S-3

Question Number : 132 Question Id : 2310982082 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

Match the following joining process of Group I with filler materials of Group II.

| Group I      | Group II                 |
|--------------|--------------------------|
| P) Soldering | 1) Silver-titanium alloy |
| Q) Welding   | 2) Silver-tin alloy      |
| R) Brazing   | 3) Mild steel            |
|              | 4) Lead fluoride         |

Options :

1. ✓ P-2,Q-3,R-1

2. ✗ P-1, Q-2, R-3

3. ✗ P-3, Q-1, R-2

4. ✗ P-2, Q-4, R-1



Question Number : 133 Question Id : 2310982083 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

Match the defects given in Group I with the suitable non-destructive evaluation technique from Group II.

**Group I**

P) Cracks in a flat aluminum slab

Q) subsurface porosity in a bronze casting

R) surface cracks in a steel tool

S) Internal porosity in a ceramic block

**Group II**

1) Radiography

2) Eddy current technique

3) Ultrasonic technique

4) Magnetic particle technique

Options :

1. ✖ P-3, Q-4, R-1, S-2

2. ✖ P-2, Q-4, R-1, S-3

3. ✖ P-4, Q-2, R-1, S-3

4. ✔ P-3, Q-2, R-4, S-1

Question Number : 134 Question Id : 2310982084 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

Match the 'additions to the flux cover in the welding rod' in Group I with their functions in Group II.

**Group I**

P) Boron, niobium

Q) Aluminum, silicon

R) Sodium oxide, potassium oxide

**Group II**

1) De-oxidiser

2) Grain refiner

3) Arc stabilisation

4) Protection of weld metal

Options :

1. ✖ P- 1, Q-2, R-3

2. ✔ P-2, Q-1, R-3

3. ✖ P-3, Q-1, R-4

4. ✖ P-1, Q-3, R-4

Question Number : 135 Question Id : 2310982085 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

The existence of stretcher strains or worms in steel sheets is directly associated with the:

Options :

1. ✔ presence of yield point elongation

2. ✖ high deformation temperature

3. ✖ high deformation load

4. ✖ coarse grained steel

Question Number : 136 Question Id : 2310982086 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

How long should a pattern maker's ruler be for making patterns for 300 mm long aluminum casting if the shrinkage allowance is 1.3%?

Options :

1. ✔ 303.9 mm

2. ✖ 301.3 mm

3. ✖ 296.1 mm

4. ✖ 298.7 mm

Question Number : 137 Question Id : 2310982087 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

Match the items in Group I with the manufacturing processes in Group II.

**Group I**

- P) I-section for structural work
- Q) Base plate for heavy machines
- R) Self-lubricating bearings
- S) Rotor for turbine

**Group II**

- 1) Forging
- 2) Rolling
- 3) Casting
- 4) Powder metallurgy
- 5) Extrusion

Options :

1. ✓ P-2, Q-3, R-4, S-1

2. ✗ P-5, Q-4, R-2, S-3

3. ✗ P-1, Q-3, R-4 S-2

4. ✗ P-4, Q-1, R-3, S-5

Question Number : 138 Question Id : 2310982088 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

In arc welding of a butt joint, the welding speed is to be selected such that the highest cooling rate is achieved. Melting and heat transfer efficiency are 0.5 and 0.7 respectively. The area of the weld cross-section is  $5 \text{ mm}^2$  and unit energy required to melt is  $10 \text{ Jmm}^{-3}$ . If the welding power is 2 KW, the welding speed is:

Options :

1. ✗ 7 mm/sec

2. ✓ 14 mm/sec

3. ✗ 40 mm/sec

4. ✗ 28 mm/sec

Question Number : 139 Question Id : 2310982089 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

An acceleration of 120 g is necessary to produce a part in true centrifugal casting. The part is 6-metre-long and has inner and outer diameter of 200 mm and 350 mm respectively. The necessary rotational speed is:

Options :

1. ✖ 783 rad/sec

2. ✖ 78.3 rad/sec

3. ✔ 82 rad/sec

4. ✖ 6.283 rad/sec

Question Number : 140 Question Id : 2310982090 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

The force required in extruding 70-30 brass at 700 °C is (the billet dia is 150 mm and extrusion ratio is 30; yield strength of brass is 200 MPa):

Options :

1. ✖ 20 MN

2. ✔ 12 MN

3. ✖ 10 MN

4. ✖ 21 MN

Question Number : 141 Question Id : 2310982091 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

Which option represents the requirement(s) to reduce or prevent the flattening of rolls during the rolling?

Options :

1. ✔ Increase in elastic modulus of rolls and decrease in friction at the roll-sheet interface

- 2. ✖ Increase in elastic modulus of rolls and increase in friction at the roll-sheet interface
- 3. ✖ Increase in compressive strength of rolls and decrease in friction at the roll-sheet interface
- 4. ✖ Increase in compressive strength of rolls and increase in friction at the roll-sheet interface

Question Number : 142 Question Id : 2310982092 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

A deep drawn steel exhibits 20% reduction in width and 10% reduction in thickness under a tensile loading. The normal anisotropy of steel is:

Options :

- 1. ✖ -0.0870
- 2. ✖ +0.0953
- 3. ✖ +0.1823
- 4. ✔ +2.110

Question Number : 143 Question Id : 2310982093 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

The solidification time of a thin plate casting in a sand mold increases by approximately 4 times with the:

Options :

- 1. ✔ doubling of thickness
- 2. ✖ doubling of length
- 3. ✖ doubling of both width and length



4. ✖ doubling of length, width and thickness

Question Number : 144 Question Id : 2310982094 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

A 30 mm diameter bar is drawn to 15 mm in a single step using tapered cylindrical dies. The equivalent strain  $\epsilon$  in the drawn bar is:

Options :

1. ✔ 0.6931

2. ✖ 1.3862

3. ✖ 0.3466

4. ✖ 1.0986

Question Number : 145 Question Id : 2310982095 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

If the current is increased 4 times and the duration is reduced by half (while other parameters are kept constant), then the order of change in the heat generated in a welding process is:

Options :

1. ✖ 2 times

2. ✖ 4 times

3. ✔ 8 times

4. ✖ No change

Question Number : 146 Question Id : 2310982096 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

A vertically tapered sprue of 16 cm length is kept full during pouring. To avoid any aspiration, the cross-sectional areas at the centre and at the bottom of the sprue must be in the ratio:

Options :

1. ✖ 1:1

2. ✔  $\sqrt{2} : 1$

3. ✖ 2 : 1

4. ✖ 4 : 1

Question Number : 147 Question Id : 2310982097 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

A steel plate of 10 mm thickness is to be cold-rolled. The mill has rolls of diameter 72 mm. If the coefficient of friction  $\mu$  is 0.3, the maximum possible thickness reduction in the first pass will approximately be:

Options :

1. ✖ 10%

2. ✖ 20%

3. ✔ 30%

4. ✖ 40%

Question Number : 148 Question Id : 2310982098 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

Two copper alloys A and B display freezing ranges of 1070°C-1050° C and 1000°C-900° C respectively. Then which of the following two statements correctly reflect the observations made during their castings.

Statements:

P) Alloy A exhibits coring, segregation and hot tearing.

Q) Alloy A exhibits sound castings with reasonably uniform composition.

R) Alloy B exhibits coring, segregation and hot tearing.

S) Alloy B exhibits sound castings with reasonably uniform composition.

Options :

1. ✓ Q and R

2. ✗ P and S

3. ✗ P and R

4. ✗ Q and S

Question Number : 149 Question Id : 2310982099 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

Which option represents the correct order of decreasing weldability among the steels: P) Fe-0.6%C; Q) Fe-0.4%C; R) HSLA

Options :

1. ✓  $R \rightarrow Q \rightarrow P$

2. ✗  $P \rightarrow Q \rightarrow R$

3. ✗  $Q \rightarrow P \rightarrow R$

4. ✗  $Q \rightarrow R \rightarrow P$

Question Number : 150 Question Id : 2310982100 Question Type : MCQ Option Shuffling : Yes Negative Marks Display Text : 2/3  
Option Orientation : Vertical

Correct Marks : 2 Wrong Marks : 0.66

For ingot breakdown by hot rolling, the rolls are generally grooved parallel to the roll axis in order to : P) increase the angle of bite; Q) decrease the rolling load; R) achieve larger reduction; S) decrease rolls flattening

Select the appropriate option.

Options :

1. ✗ P,Q

2. ✗ Q,R

3. ✖ P,R

4. ✔ Q,S