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NPTEL

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Unit 5 - Iron Making - Week 3

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Assignment 3

The due date for submitting this assignment has passed. **Due on 2018-02-28, 23:59 IST.**

Submitted assignment

1) 1 point
The difference between direct and indirect reduction of iron oxide is:

- Direct reduction uses C and indirect reduction can use CO or H₂ or both
- Direct reduction occurs at high temperature and indirect reduction occurs in a range of temperatures
- Direct reduction uses CO or H₂ or both and indirect reduction uses C
- None of the above

No, the answer is incorrect.

Score: 0

Accepted Answers:

Direct reduction uses C and indirect reduction can use CO or H₂ or both

2) 1 point
Consider the reduction of iron oxide (hematite) to form iron in a blast furnace. Calculate the approximate equilibrium constant for the reduction of hematite to magnetite by CO at 900°C given that it attains equilibrium having $\Delta G = -110.5$ kJ.

- 1.01
- 83000
- 3.5
- 88000

No, the answer is incorrect.

Score: 0

Accepted Answers:

83000

3) 1 point
Calculate the required ratio of CO/CO₂ in the reduction of magnetite to wustite by CO at 900°C given the equilibrium constant $K=5$

- 0.2
- 0.4
- 0.6
- 0.8

No, the answer is incorrect.

Score: 0

Accepted Answers:

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0.2

4)

1 point

Determine the CO utilization for reactions in questions 2 and 3.

- 100%, 83%
- 29%, 83%
- 90%, 73%
- 19%, 45%

No, the answer is incorrect.

Score: 0

Accepted Answers:

100%, 83%

5)

3 points

Consider an indirect reduction of hematite to iron at 900°C in a co-current manner with CO in the blast furnace. Carry out a mass balance and find out how many moles of CO are required for producing 2 moles of Fe.

For $\text{Fe}_2\text{O}_3 \rightarrow \text{Fe}_3\text{O}_4$, $\text{CO}/\text{CO}_2=0.0$,

For $\text{Fe}_3\text{O}_4 \rightarrow \text{FeO}$, $\text{CO}/\text{CO}_2=0.2$, and

For $\text{FeO} \rightarrow \text{Fe}$, $\text{CO}/\text{CO}_2=2.5$

- 1.0 moles of CO
- 3.0 moles of CO
- 5.5 moles of CO
- 10.5 moles of CO

No, the answer is incorrect.

Score: 0

Accepted Answers:

10.5 moles of CO

6)

1 point

Calculate the pressure drop (approximate;y) for a laboratory scale packed bed through which air is passed, for the following conditions:

Column diameter=0.2m

Column height=2.0m

Particle diameter=0.01m

Shape factor=0.8

Void fraction=0.4

Volumetric gas flow rate= $0.04\text{m}^3/\text{s}$

Viscosity of air= $1.85 \times 10^{-5}\text{kg}/\text{m}\cdot\text{s}$

Density of air= $1.21\text{kg}/\text{m}^3$

- $7.6 \times 10^3\text{N}/\text{m}^3$
- $8.6 \times 10^3\text{N}/\text{m}^3$
- $9.6 \times 10^3\text{N}/\text{m}^3$
- $6.6 \times 10^3\text{N}/\text{m}^3$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$8.6 \times 10^3\text{N}/\text{m}^3$

7)

2 points

Estimate the minimum fluidization velocity for hematite particles 150microns in diameter, in hydrogen at 900°C and at 1atm pressure. Also estimate the elutriation velocity for the same.

Data:

$\rho_s=5.25 \times 10^3\text{kg}/\text{m}^3$

$$\mu_g = 2.2 \times 10^{-5} \text{ kg/m-s}$$

$$\rho_g = 2.05 \times 10^{-2} \text{ kg/m}^3$$

- 0.01m/s, 1.5m/s
- 0.02m/s, 2.0m/s
- 0.03m/s, 3.0m/s
- 0.04m/s, 2.5m/s

No, the answer is incorrect.

Score: 0

Accepted Answers:

0.03m/s, 3.0m/s

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