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Unit 7 - Iron Making - Week 5

Assignment 5

The due date for submitting this assignment has passed. **Due on 2018-03-14, 23:59 IST.**

Submitted assignment

1) In a laboratory scale model to replicate the lower part of the blast furnace, plastic beads of equivalent diameter 4mm and shape factor 0.87 are used to represent the coke matrix. An experiment is conducted at air flow rate of 900lpm, with air injected laterally into the bed. Other parameters are: ***2.5 points***

Density of plastic beads: 940 kg/m^3

Density of air=1.177 kg/m^3

Void fraction=0.4

Particle wall friction = 0.22

Bed height=80cm

Bed width=50cm

Tuyere opening=5mm

Depth of apparatus=6cm

The approximate ratio of raceway diameter for decreasing gas flow rate case to raceway diameter for increasing gas flow rate is closer to:

For effective density, take: $\rho_{eff}=\varepsilon\rho_g+(1-\varepsilon)\,\rho_s$

- 4.0
- 0.2
- 1.0
- 2.5

No, the answer is incorrect.
Score: 0

Accepted Answers:
2.5

2) The aerodynamics of the blast furnace depends on: ***0.5 points***

- Raceway size and shape
- Raw material property
- Cohesive Zone shape
- Height of the blast furnace

No, the answer is incorrect.
Score: 0

Accepted Answers:
Raceway size and shape

3) The high 'S' content in coal affects the blast furnace operation mostly by: ***0.5 points***

- Reducing permeability of coke matrix
- Increasing requirement of slag volume to remove it as sulphur-bearing compound
- Reducing the strength of the coke

Interactive Session with Students

- Increasing the coke rate

No, the answer is incorrect.
Score: 0

Accepted Answers:
Increasing requirement of slag volume to remove it as sulphur-bearing compound

4) Which portion of the blast furnace is known as the deadman zone? ***0.5 points***

- Preheating of raw material zone
- Molten metal formation zone
- Combustion of coke zone
- Lower central portion of the blast furnace in the shape of an inverted cone

No, the answer is incorrect.
Score: 0

Accepted Answers:
Lower central portion of the blast furnace in the shape of an inverted cone

5) Which zone(s) of the blast furnace has high Si pickup? ***0.5 points***

- Stack zone
- Dropping zone
- Hearth zone
- Deadman zone

No, the answer is incorrect.
Score: 0

Accepted Answers:
Dropping zone

6) The coal particle size in pulverized coal injection in a blast furnace is very small. The main reason(s) is/are: ***0.5 points***

- To burn all particles in milliseconds
- To increase the combustibility of coal
- To reduce the amount of unburnt coal in the blast furnace
- All of the above

No, the answer is incorrect.
Score: 0

Accepted Answers:
All of the above

7) Which region of the blast furnace has predominantly cross-current gas and liquid flow? ***0.5 points***

- Stack region
- Belly region
- Raceway region
- Hearth region

No, the answer is incorrect.
Score: 0

Accepted Answers:
Raceway region

8) Which of the following represents the dropping zone of the blast furnace? ***0.5 points***

- Gas and powder continuous and downwards; coke and liquid discrete and upwards
- Gas and powder discrete and upwards; coke and liquid discrete and downwards
- Gas and powder continuous and upwards; coke and liquid discrete and downwards
- Gas and powder upwards; coke and liquid downwards; all continuous

No, the answer is incorrect.
Score: 0

Accepted Answers:
Gas and powder continuous and upwards; coke and liquid discrete and downwards

9) The ability of the liquid slag to absorb sulphides in the blast furnace is known as sulphide capacity and is expressed as: ***0.5 points***

- $C_S = \%S \times (p_O/p_{S_2})^{(1/2)}$
- $C_S = \%S \times (p_{O_2}/p_{S_2})^{(1/2)}$
- $C_S = \%S \times (p_{O_2}/p_S)^{(1/2)}$
- $C_S = \%S \times (p_{S_2}/p_{O_2})^{(1/2)}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$C_S = \%S \times (p_{O_2}/p_{S_2})^{(1/2)}$

10) Fill in the blank with a one word answer:
The cavity formed due to the introduction of hot blast inside the blast furnace is known as ____.

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: String) Raceway
(Type: String) race way

0.5 points

11) The chemistry of sulphur in the liquid iron/slag system is important because in iron and steelmaking, slags are used to remove sulphur from metal. Express the sulphur distribution ratio ((%S)/[%S]) as a function of the sulphide capacity (C_S) and the oxygen activity for the ironmaking and steelmaking conditions respectively. ***3 points***

Given:

(1/2) $O_{2(g)}$=O(%);logK=5136/T+0.152

(1/2) $S_{2(g)}$=S(%);logK=6288/T-1.109

Ironmaking:

Temperature: 1400^0C
Composition: C=5.5%, Si=0.4%, Mn=0.3%, P=0.2%, S=0.04%
Interaction coefficients: e_S^C=0.116, e_S^{Si}=0.095, e_S^{Mn}=-0.035, e_S^P=0.033, e_S^S=-0.031

Steelmaking:

Temperature: 1500^0C
Composition: C=0.14%, Si=0.30%, Mn=0.65%, P=0.03%, S=0.01%
Interaction coefficients: e_S^C=0.112, e_S^{Si}=0.075, e_S^{Mn}=-0.015, e_S^P=0.053, e_S^S=-0.030

- Ironmaking: $(\%S)/[\%S] = 17.5\ C_S/a_O$
  Steelmaking: $(\%S)/[\%S] = 4.4\ C_S/a_O$
- Ironmaking: $(\%S)/[\%S] = 11.2\ C_S/a_O$
  Steelmaking: $(\%S)/[\%S] = 9.9\ C_S/a_O$
- Ironmaking: $(\%S)/[\%S] = 25.3\ C_S/a_O$
  Steelmaking: $(\%S)/[\%S] = 1.9\ C_S/a_O$
- Ironmaking: $(\%S)/[\%S] = 5.3\ C_S/a_O$
  Steelmaking: $(\%S)/[\%S] = 20.1\ C_S/a_O$

No, the answer is incorrect.
Score: 0

Accepted Answers:

Ironmaking: (%S)/[%S] =17.5 C_S/a_O

Steelmaking: (%S)/[%S] =4.4 C_S/a_O

Previous Page End