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NPTEL

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Courses » Heat Treatment and Surface Hardening-I

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Unit 9 - Week-8



Course outline

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- Diffusion in Solids-II
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Assignment 8

The due date for submitting this assignment has passed. **Due on 2018-04-04, 23:59 IST**
As per our records you have not submitted this assignment.

1) A 0.7% carbon steel is decarburized for 5 hours at 1223 K in a gaseous medium **1 point** containing no carbon. Determine the minimum depth up to which post-machining is to be done, if the carbon content at the surface after machining should not be below 0.53%. [D_0 of carbon in Fe (γ) = $0.7 \times 10^{-4} \text{ m}^2\text{s}^{-1}$ and $Q = 157 \text{ kJ mol}^{-1}$]

z	$erf(z)$	z	$erf(z)$	z	$erf(z)$
0	0	0.55	0.5633	1.3	0.9340
0.025	0.0282	0.60	0.6039	1.4	0.9523
0.05	0.0564	0.65	0.6420	1.5	0.9661
0.10	0.1125	0.70	0.6778	1.6	0.9763
0.15	0.1680	0.75	0.7112	1.7	0.9838
0.20	0.2227	0.80	0.7421	1.8	0.9891
0.25	0.2763	0.85	0.7707	1.9	0.9928
0.30	0.3286	0.90	0.7970	2.0	0.9953
0.35	0.3794	0.95	0.8209	2.2	0.9981
0.40	0.4284	1.0	0.8427	2.4	0.9993
0.45	0.4755	1.1	0.8802	2.6	0.9998
0.50	0.5205	1.2	0.9103	2.8	0.9999

- 62 mm
- 43 mm
- 82 mm
- 98 mm

No, the answer is incorrect.**Score: 0****Accepted Answers:**

82 mm

2) The diffusion distance varies with time (t) during solid state diffusion as **1 point**

- $t^{1/3}$
- $t^{1/4}$
- $\log t$
- $t^{1/2}$

No, the answer is incorrect.**Score: 0****Accepted Answers:** $t^{1/2}$

3) Hari wanted to diffuse nitrogen from a gaseous phase in to pure iron at 948 K. If **1 point** the surface concentration is maintained at 0.2 wt% N, then concentration of nitrogen at 2

mm from the surface after 25 h will be _____ $\times 10^{-2}$ wt%. (given that diffusion coefficient of nitrogen in iron at 948 K is $1.9 \times 10^{-11} \text{ m}^2/\text{s}$)

- 4.6
 5.7
 6.5
 7.3

No, the answer is incorrect.

Score: 0

Accepted Answers:

5.7

4) If the diffusion coefficient of oxygen ion in a metal oxide is $5 \times 10^{-14} \text{ m}^2/\text{s}$ at 1423 K and $8 \times 10^{-10} \text{ m}^2/\text{s}$ at 1448 K, then activation energy required for diffusion is _____ KJ/mol.

- 6651.4
 5362.6
 4234.7
 3169.2

No, the answer is incorrect.

Score: 0

Accepted Answers:

6651.4

5) Interstitial diffusion is faster than the vacancy diffusion in solid state diffusion due to **1 point**

- Small probability of finding a free interstitial site around interstitial atom in case of interstitial diffusion
 High probability of finding a free interstitial site around interstitial atom in case of interstitial diffusion
 Small activation energy required for vacancy diffusion
 Large activation energy required for interstitial diffusion

No, the answer is incorrect.

Score: 0

Accepted Answers:

High probability of finding a free interstitial site around interstitial atom in case of interstitial diffusion

6) Two rods P and Q containing A-40 wt% B and A-10wt% B, respectively, are joined together to form a diffusion couple. After 300 hours of annealing at 1000°C , the concentration of B (in wt%) in rod Q at a distance 0.4mm from the interface will be _____. (Take, diffusion coefficient, $D = 5 \times 10^{-13} \text{ m}^2\text{s}^{-1}$). **1 point**

- 32.1 %
 21.3 %
 17.3 %
 11.2 %

No, the answer is incorrect.

Score: 0

Accepted Answers:

21.3 %

7) In question no.6. the distance (in mm) at which the concentration of B reaches 20 wt% in the rod Q will be **1 point**

- 0.45
 0.55



- 0.65
 0.75

No, the answer is incorrect.

Score: 0

Accepted Answers:

0.45

8) Which of the following element will diffuse at a fastest rate in Fe

1 point

- Cr
 Ni
 H
 W

No, the answer is incorrect.

Score: 0

Accepted Answers:

H

9) 10 hrs was required to fully carburize a steel gear at 1173 K. If activation energy required for diffusion of carbon in FCC iron is 137.85 KJ/mol, then the time required to carburize similar steel gear at 1173 K will be _____hrs

- 3.3
 5.2
 6.3
 7.1

No, the answer is incorrect.

Score: 0

Accepted Answers:

3.3

10) The error function of 0 is

1 point

- 1
 -1
 0
 Not defined

No, the answer is incorrect.

Score: 0

Accepted Answers:

0

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