

HW 5 Solution

9-3

$$r^* = \frac{(2)(204 \times 10^{-7} \text{ J/cm}^2)(1538 + 273)}{(1737 \text{ J/cm}^3)(420)} = 10.128 \times 10^{-8} \text{ cm}$$

$$V = \frac{4\pi}{3} (10.128 \times 10^{-8})^3 = 4352 \times 10^{-24} \text{ cm}^3$$

$$V_{UC} = (2.92 \text{ \AA})^3 = 24.897 \text{ \AA}^3 = 24.897 \times 10^{-24} \text{ cm}^3$$

Number of unit cells $4352/24.897 = 175$

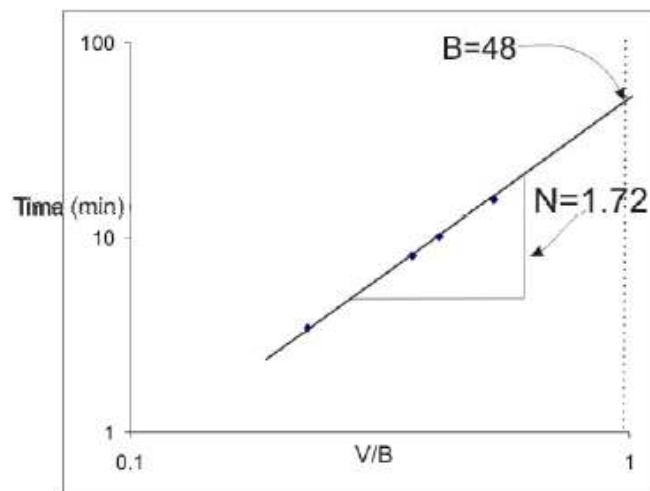
Atoms per nucleus = (175 cells)(2 atoms/cell)=350 atoms

9-12

V	A	V/A	time
48	212	0.226	3.48
60	112	0.536	15.78
15.6	37.5	0.416	10.17
36	98	0.367	8.13

$$B = 48 \text{ min/in}^2$$

$$n = 1.72$$



9-20

(a) $T_{\text{pour}} = 900 \text{ C}^\circ$

(b) $T_{\text{sol}} = 420 \text{ C}^\circ$

(c) $\Delta T_s = 900 - 420 = 480 \text{ C}^\circ$

(d) $\Delta T / \Delta t = \frac{900 - 400}{1.6 - 0} = 312 \text{ C}^\circ / \text{min}$

(e) $t_s = 9.7 \text{ min}$

(f) $\text{LST} = 9.7 - 1.6 \text{ min} = 8.1 \text{ min}$

(g) $420 - 360 = 60 \text{ C}^\circ$

(h) Zn

(i) $t_s = 9.7 = B[8/24]^2$ $B = 87.5 \text{ min/in}$

9-27

$$(V/A)_{\text{thick}} = \frac{(4)(4)(4)}{5(4)(4) + 1(2)(4)} = 0.73$$

$$(V/A)_{\text{thin}} = \frac{(2)(2)(4)}{3(2)(4) + 2(2)(2)} = 0.50$$

$$(V/A)_{\text{riser}} = \frac{(\pi/4)(4^2)(8)}{\pi(4)(8) + 2(\pi/4)4^2} = 0.80$$

The area between the thick and thin sections of the casting are not included in calculating casting area; no heat loss across this interface.

The riser will not be effective; the thin section has the smallest V/A ration and therefore freezes first. Even though the riser has the longest solidification time, the thin section isolates the thick section from the riser, preventing liquid metal from feeding from the riser to the thick section. The shrinkage will occur in the thick section.