## ENGR161 - ASSIGNMENTS - FALL 2020

Callister and Rethwisch's Materials Science and Engineering, 8th ed.
The 9th edition is also on reserve in the MESA Center, the STEM Center and the AHC Library Reserve.

## CAUTION: Problems SUBJECT TO CHANGE

## Submitting Assignments

## For face-to-face classes:

- Do your homework (HW) on engineering paper (you will get a pack of 200 sheets at the start of the term). Follow the guidelines for HW in the syllabus.
- Staple each assignment as a separate packet.
- Turn in your HW in class or in the HW Box in M-208, depending on instructions, by the due date.

For ERT classes (Fall 2020, until further notice):

- Do your homework (HW) on engineering paper (you will get a pack of 200 sheets at the start of the term). Follow the guidelines for HW in the syllabus.
- Scan your pages for the assignment and collate them into a single PDF.
- Upload the PDF into Canvas by the due date listed.

Here are a few smartphone apps that let you scan documents and convert them into PDFs:

- Adobe Scan
- CamScanner


## Solutions

- Numerical answers to all $8^{\text {th }}$ ed. problems are in the back of the text.
- Brief solutions will be posted/distributed after the assignment has been turned in.

Homework Assignments begin on Page 2

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CAUTION: Problems SUBJECT TO CHANGE - Double-check the assignment on Canvas.

| No. | Date <br> Assigned/ Updated | [Chapter <br> /Section] | Assignment, Callister, 9th Edition | Due |
| :---: | :---: | :---: | :---: | :---: |
| 1 | 07/04/20 | 2 | 1, 2, 6, 16, 18, 19*, 22(a), 25 (MgO, GaP \& CsF only), 27 <br> (problems available as PDF on Canvas and website) <br> *Notes <br> *Prob 2.19: Use Microsoft EXCEL to make the plot. The increment of $r$ should made small enough so that the curve is smooth... do not plot markers (data points), but a smooth curve through many points. <br> In general, when plotting by hand or by Excel, make all plots to scale, label axes correctly, title plots. <br> Note: HW \#1 may be the only HW I post. Please refer to the textbook. |  |
| 2 | 07/04/20 | 3, 12 | Chapt 3: 2, 4*, 7, 9, 15, 22 <br> Chapt 12: 1, 5*, 17 <br> *Notes <br> *Prob 3.4: Do not just copy a (the book's) solution. Use 3D geometry/trig. to find the half-height $c / 2$ of the HCP cell. Hint: Consider a stack of 4 touching spheres - three on the base and the fourth in the divot. Their centers are at the corners of a tetrahedron, each side of the tetrahedron being $2 R$. The height of the tetrahedron is $c / 2$. The apex of the tetrahedron is directly above the centroid of the tetrahedron's base triangle. Note that the centroid of a triangle is $2 / 3$ of the way from a corner to the opposite side. <br> *Prob 12.5: use the Structure Names in the LEFT column of Table 12.4, e.g., "Rock Salt", "Cesium Chloride", "Zinc Blend", "Flourite", "Perovskite", "Spinel". |  |
| 3 | 07/04/20 | 3 | 29, 34(bcfg), 36, 46(acfg), 47, 50(ab), 52(ab)*, 59, 60, 63 <br> *Notes: <br> *Prob. 3.28 is an orthorhombic unit cell. Draw it that way. <br> *Prob. 3.52 is an orthogonal system. Also, for \#52, explain your answer ... why are the planes equivalent or not. Just listing equivalent planes does not tell me your thought process (what does it mean for two planes to be "equivalent"). <br> *Prob. 3.63 explain in your own words why polycrystalline materials are isotropic. What is it about many grains randomly oriented that makes the material isotropic? |  |

Homework Assignments \#4 onward are on Page 3

| No. | Date <br> Assigned/ <br> Updated | [Chapter /Section] | Assignment, Callister, 9th Edition | Due |
| :---: | :---: | :---: | :---: | :---: |
| 4 | 07/04/20 | 4 | $3,5^{*}, 6^{*}, 8 \mathrm{a}, 16,24,31,40^{*}, 42,47 \mathrm{a}, 51 \mathrm{a}$ <br> *Notes <br> *Prob 4.5: Hint: use the density equation to determine the number of atoms $/ \mathrm{m}^{3}$. <br> *Prob 4.6: All elements in table should be characterized as one of the following: <br> (a) substitutional solid lution (s.s.s) with complete solubility; <br> (b) s.s.s. with incomplete solubility; or <br> (c) interstitial solid sol'n. <br> You are not just finding one element for each category. <br> *Prob 4.40: Do not think of a single unit cell (where (110) is not on the surface), but a material of many cells. Various planes may be exposed to the free surface. Thus, plane (110) can be on the surface of a material (any plane could be). You are comparing plane (100) and (110), both of which are exposed to the air. <br> *Prob 4.51: here is a pdf with images for Prob 50 and 51. |  |
| 5 | 07/04/20 | 5 | $=3,7,9,20^{*}, 24,27$ <br> *Notes <br> *Prob 5.20 Hint: Use Table 5.2. |  |
| 6 | 07/04/20 | 6 | $6,7,15,19,24,26^{*}, 30^{*}, 39,52,6 . \mathrm{D} 1$ <br> *Notes <br> *Prob 6.26: Copy the stress-strain curve so you can show how you determined the various properties. <br> *Prob 6.30: Use EXCEL to plot the stress vs. strain curve. Only use S.I. units. This problem is worth more than the others. Follow rules for graphing as in the lab manual. |  |
| 7 | 07/04/20 | 7 | $1,5,6 b, 7,12,21,23,25,37,42,7 . \mathrm{D} 4$ <br> *Note: Use your own words in the descriptions. |  |
| 8 | 07/04/20 | 8 | $4,7,8,11,20^{*}, 24,30,42$ <br> *Prob 20 Hint: for the rotating beam, the maximum bending stress is sigma $=16 F L /\left(\mathrm{pi}^{*} d^{3}\right)$ |  |
| 9 | 07/04/20 | 9 | $\text { 2, 10a-d, 14, 17a-d, 21, 29a-d, 30, } 39$ <br> *Note: 9.10, 9.17 and 9.29 are linked problems <br> Phase diagrams (Word): $\mathrm{Pb}-\mathrm{Sn} ; \mathrm{Cu}-\mathrm{Ag} ; \mathrm{Mb}-\mathrm{Pb} ; \mathrm{Cu}-\mathrm{Zn} ; \mathrm{Fe}-\mathrm{C}$ |  |
| 10 | 07/04/20 | 9 | $43,57,58,59,61^{*}, 62^{*}, 63$ <br> *Note: For Prob. 6.61 and $\mathbf{6 . 6 2}$ take Temperature just below eutectoid for drawing the microstructure. <br> Phase diagrams (Word): $\mathrm{Pb}-\mathrm{Sn} ; \mathrm{Cu}-\mathrm{Ag} ; \mathrm{Mb}-\mathrm{Pb} ; \mathrm{Cu}-\mathrm{Zn} ; \mathrm{Fe}-\mathrm{C}$ |  |
| 11 | 07/04/20 | 17 | 1, 4, 7, 9, 22, 23 |  |
| 12 | 07/04/20 | 18 | 1, 3, 7, 11, 15, 26, 43, 45, 49 |  |
| 13 | 07/04/20 | 10 | $6,8,9,14,18,19,20,21,30,34$ <br> Only turn in problems associated with the TTT curve |  |

