As a gentle reminder, this year’s qualifying examination for the Materials Science Ph.D. program is scheduled to take place on Wednesday, August 16, which is about six weeks from now. The following information and advice is offered to assist in your preparation for the MTSI 511 portion of the exam:

1. Format: the MTSI 511 portion of this year’s Qualifying Examination consists of five questions/problems and each of the five will be graded on a 20-point maximum basis for a total of 100 points. Some of the questions have multiple parts. Data required are provided within the problem statement and/or attached tables and figures. You would do well to review the various data tabulations and diagrams presented during the MTSI 511 lectures in fall 2022.
2. With the following exceptions, everything that was covered in the lectures, the homework, and the exams is fair game including the review of thermodynamic fundamentals, solution thermodynamics, binary and ternary phase diagrams, and vapor/condensed phase equilibria. No questions on the 2nd and 3rd Law analysis will appear on the exam this year, nor will you be asked to construct a predominance area diagram. The exam will not include formal derivations but you are expected to be able to understand, combine, and apply the fundamental thermodynamic relationships as necessary to solve problems.
3. You should thoroughly prepare to solve a series of quantitative problems. Study and practice solving the problems in the problem sets, the homework, and the examinations that were distributed during the semester.
4. No formula sheet will be provided. You are expected to know the fundamental thermodynamic relationships and equations covered in class and on the homework and exams.
5. Energy units will be calories and kilocalories; memorize the appropriate gas constant (R) value of 1.987 calories/mol-K.
6. Read every problem statement carefully and follow the instructions. The problem statement and supplemental data tables and/or figures include information necessary to determine the correct solution.
7. Although MTSI 511 questions generally require quantitative solutions, don’t neglect the theoretical aspects. Some questions may require an explanation of the theory supporting one or more key steps in the solution and/or ask you to list assumptions that are required to solve a problem. In these instances, succinctly state the relevant theory, provide appropriate equations, list assumptions, etc. Your job is to convince me that you understand thermodynamics of materials as presented during the fall 2022 semester.
8. Some solutions may require multiple steps. You must be prepared to quickly devise and execute an appropriate solution strategy. If the solution requires multiple steps and you are unable to recall how to do one of the steps, estimate the needed result, flag it as an assumption, provide a brief explanation, and continue with the next step. Although you will be penalized for the step that you did not correctly complete, the rest of the problem will be graded as if your estimate is correct.
9. Although it isn’t specifically required, you may find it helpful to outline the solution strategy and list the pertinent equations and assumptions before attempting the math on quantitative problems.

1. Make certain that your responses are complete and show your work! It is possible to pass this exam without getting exactly the right answers but it is also possible to fail if your work is incomplete – again, your job is to convince me that you have a sufficient understanding of thermodynamics.

For quantitative problems, complete means that you show the equation(s), the numerical substitutions for symbols in the equation(s), each significant mathematical step, and clearly indicate your final answer with proper units.

Be thorough and concise when responding to questions that require a written answer or description.

If a problem requires a graphical solution, show your construction lines on the diagrams provided with the exam, label key points on the diagrams, and refer to the key points in the explanation of your solution.

1. Neatness counts! Make certain that your responses are legible. Credit cannot be given for an illegible response.
2. Bring pencils, erasers, a non-programmable calculator, and a ruler or straight-edge that is graduated in millimeters to the exam.

I hope that you find this advice to be helpful. Best wishes for success on the exam!