

CHEM 1062: Reviewing for the American Chemical Society (ACS) Standardized Final Exam

The CHEM 1062 Final Exam will be a one semester standardized exam written by the ACS. The goal is to see how well students know and understand chemistry, and to see how well the students compare to other students across the country. There is not a huge emphasis on math problems, but more so than the standardized exam administered at the end of CHEM 1061. While the exam covers only second semester material, many topics covered in your first semester of chemistry have been used throughout your second semester.

Because the exam covers what you know and understand, the best way to review and study for the exam may be to go over previous exams in this course and end-of-the chapter questions. As with the exams in this course, there are no direct questions on definitions or terms. However, you are expected to know chemistry vocabulary. There will, of course, be things which we emphasized a lot which will only show up briefly on the final exam and vice versa. However, if you understand the material, you should be able to reason through things which you don't remember as well.

The exam has 70 multiple choice questions, each with four choices. You will be given 110 minutes – the exam is timed. Programmable calculators are not permitted on the exam. Please remember to bring a non programmable calculator to use on the exam. If you don't have one and cannot borrow one from a friend, let me know ASAP and I'll see what I can do.

What is provided for you?

- A comprehensive list of abbreviations and symbols
- The values of numerous constants used throughout the course
- Periodic Table (just like the ones you have received in class)
- Arrhenius Equation, Graham's Law of Effusion, Nernst Equation, Integrated Rate Law Equations

Directions

- You may NOT make marks in the exam booklet.
- Answers will be placed onto an answer sheet using a soft #2 pencil.
- All calculations must be done on the scratch paper provided.
- Each question has only one correct answer and has four choices.
- Your score is based solely on the number of questions answered correctly. **It is to your advantage to answer every question.**

Strategies

- **Don't allow yourself to get stuck on a single problem.** If you don't know how to do it, move along and go back to it later.
- Remember, your score on the final depends on your percentile ranking – there will be several students across the nation that were unable to perform the same problems.
- Consider writing answers onto scratch paper and transferring several onto answer sheet at one time.
- Spend the least time studying what you know well and the most time studying what you DON'T know well.

Things you are expected to know (*items in italics are first-semester topics*):

- basic chemistry vocabulary/terminology (Look at the end of each chapter for Important Terms given in **bold**)
- intermolecular forces, lattice energy, phase transitions, relation of b.p. and m.p. to intermolecular forces, phase diagrams, types of solids, unit cell calculations
- types of solutions, solution concentrations (molarity, molality, %, mole fraction), solubility curves, colligative properties, colloids, solubility curves for gases vs. curves for solids
- kinetics, instantaneous rates, experimental determination of rate, determining the rate law using the initial rate method, rate constants, elementary reactions, catalysis, reaction mechanisms, collision & transition state theory, activation energy, concentration-time calculations, temperature and rate, half-lives, graphical determinations of reaction order and rate constant, potential energy diagrams
- chemical equilibrium, equilibrium constant, reaction quotient, LeChatlier's Principle, predicting reaction direction, calculating equilibrium concentrations, ICE tables
- acid-base theories: Arrhenius and Bronsted-Lowry, acid-base strength and relation to molecular structure, self-ionization of water, and pH, *strong and weak acids and bases*
- acid & base ionization equilibria, polyprotic acids, salt solutions, common ion effect, buffers, titration curves
- solubility product constant, common ion effect, pH and solubility, precipitation calculations
- 2nd & 3rd laws or thermodynamics, entropy and ΔS , free energy and ΔG , spontaneity, relation to the equilibrium constant, work, *enthalpy and ΔH*
- balancing redox reactions, voltaic and electrolytic cells, cell notation, emf, E_{cell} , electrode potentials, *oxidation numbers (know your rules)*, *oxidizing and reducing agents*, strength of these agents, applications of electrochemistry, electrolysis
- fission, fusion, radioactivity, nuclear bombardment reactions, radioactive decay, half-lives, mass-energy calculations, *isotopes and nuclide symbols*, *mass numbers and atomic weights*, *subatomic particles*
- g/cm^3 may be written as $\text{g}\cdot\text{cm}^{-3}$ and $\frac{\text{L}\cdot\text{atm}}{\text{mol}\cdot\text{K}}$ may be written as $\text{L}\cdot\text{atm}\cdot\text{mol}^{-1}\cdot\text{K}^{-1}$

Know the following equations:

| | |
|---|---|
| $d = \frac{m}{V}$ | $\Delta S^\circ = \sum n\Delta S^\circ(\text{products}) - \sum n\Delta S^\circ(\text{reactants})$ |
| $M_1V_1 = M_2V_2$ | $\Delta T_f = K_f c_m$ and $\Delta T_b = K_b c_m$ |
| Calculating Molarity, molality, %, mole fraction | Formulas for equilibrium constant and reaction quotient |
| $\Delta G^\circ = \Delta H^\circ + T\Delta S^\circ$ | $[\text{H}_3\text{O}^+][\text{OH}^-] = K_w = 1.0 \times 10^{-14}$ |
| $\Delta G^\circ = -RT \ln K$ | $\text{pH} = -\log[\text{H}_3\text{O}^+]$ |
| $\Delta G^\circ = -nFE^\circ_{cell}$ | $\text{pOH} = -\log[\text{OH}^-]$ |
| $E^\circ_{cell} = \frac{0.0592}{n} \log K$ | $\text{pH} = \text{p}K_a + \log \frac{[\text{base}]}{[\text{acid}]}$ |
| $\text{pH} + \text{pOH} = 14.00$ | $K_a K_b = K_w$ |
| $\ln \frac{N_t}{N_0} = -kt$ | $t_{1/2} = \frac{0.693}{k}$ |
| $\Delta H^\circ = \sum n\Delta H^\circ_f(\text{products}) - \sum n\Delta H^\circ_f(\text{reactants})$ | $\text{Rate} = kN_t$ |
| $\Delta G^\circ = \sum n\Delta G^\circ_f(\text{products}) - \sum n\Delta G^\circ_f(\text{reactants})$ | $\Delta E = (\Delta m)c^2$ |

How Your Final Exam Score Will Be Determined

The table below shows how raw scores on the ACS exam will be converted to scaled final exam scores. The ACS standardized exam has 70 questions.

In the event you are unfamiliar with how percentiles work, an 84th percentile means that you scored higher than 84% of the students on the national norms and a 25th percentile means that you scored higher than 25% of the students taking the same exam on the national norms. Students scoring in the 80th to 100th percentile will be assigned an "A" score on the final, the 60th to 79th percentile will be assigned a "B", the 40th to 59th percentile will be assigned a "C", the 20th to 39th percentile will be assigned a "D", and the 0th to 19th percentile will be assigned an "F".

| Raw Score | Percentile Ranking | Scaled Percentage | Scaled Final Exam Score |
|-----------|--------------------|-------------------|-------------------------|
| 70 | 100 | 100 | 200 |
| 69 | 100 | 100 | 200 |
| 68 | 100 | 100 | 200 |
| 67 | 100 | 100 | 200 |
| 66 | 100 | 100 | 200 |
| 65 | 100 | 100 | 200 |
| 64 | 100 | 100 | 200 |
| 63 | 100 | 100 | 200 |
| 62 | 99 | 99.5 | 199 |
| 61 | 99 | 99.5 | 199 |
| 60 | 99 | 99.5 | 199 |
| 59 | 98 | 99 | 198 |
| 58 | 97 | 98.5 | 197 |
| 57 | 96 | 98 | 196 |
| 56 | 95 | 97.5 | 195 |
| 55 | 94 | 97 | 194 |
| 54 | 93 | 96.5 | 193 |
| 53 | 91 | 95.5 | 191 |
| 52 | 89 | 94.5 | 189 |
| 51 | 87 | 93.5 | 187 |
| 50 | 85 | 92.5 | 185 |
| 49 | 82 | 91 | 182 |
| 48 | 80 | 90 | 180 |
| 47 | 77 | 88.5 | 177 |
| 46 | 74 | 87 | 174 |
| 45 | 71 | 85.5 | 171 |
| 44 | 68 | 84 | 168 |
| 43 | 65 | 82.5 | 165 |
| 42 | 62 | 81 | 162 |
| 41 | 60 | 80 | 160 |
| 40 | 57 | 78.5 | 157 |
| 39 | 54 | 77 | 154 |
| 38 | 51 | 75.5 | 151 |
| 37 | 47 | 73.5 | 147 |
| 36 | 44 | 72 | 144 |
| 35 | 41 | 70.5 | 141 |

| Raw Score | Percentile Ranking | Scaled Percentage | Scaled Final Exam Score |
|-----------|--------------------|-------------------|-------------------------|
| 34 | 38 | 69 | 138 |
| 33 | 35 | 67.5 | 135 |
| 32 | 32 | 66 | 132 |
| 31 | 30 | 65 | 130 |
| 30 | 27 | 63.5 | 127 |
| 29 | 24 | 62 | 124 |
| 28 | 22 | 61 | 122 |
| 27 | 19 | 59.5 | 119 |
| 26 | 17 | 58 | 116 |
| 25 | 14 | 55 | 110 |
| 24 | 11 | 53 | 106 |
| 23 | 9 | 50 | 100 |
| 22 | 7 | 48 | 96 |
| 21 | 6 | 47 | 94 |
| 20 | 5 | 46 | 92 |
| 19 | 3 | 45 | 90 |
| 18 | 2 | 44 | 88 |
| 17 | 2 | 43 | 86 |
| 16 | 1 | 42 | 84 |
| 15 | 1 | 41 | 82 |
| 14 | 0 | 38 | 76 |
| 13 | 0 | 36 | 72 |
| 12 | 0 | 34 | 68 |
| 11 | 0 | 31 | 62 |
| 10 | 0 | 28 | 56 |
| 9 | 0 | 25 | 50 |
| 8 | 0 | 23 | 46 |
| 7 | 0 | 20 | 40 |
| 6 | 0 | 17 | 34 |
| 5 | 0 | 14 | 28 |
| 4 | 0 | 11 | 22 |
| 3 | 0 | 8 | 16 |
| 2 | 0 | 5 | 10 |
| 1 | 0 | 2 | 4 |
| 0 | 0 | 0 | 0 |