

Grading Rubric for Formal, Synthetic Experiment Reports

Heading – 5 Points: Student name, report submission date, experiment title, section day/time (make-up information if applicable), and TA's name.

1 Point deduction for each missing or wrong piece of data.

Lab Technique – 5 Points: TA's use discretion and take note of behavior such as failure to use protective equipment (goggles, lab coat, or fume hood), messiness, or repeatedly asking the same question.

Purpose – 5 points:

Full Credit – What reaction is going to be done, what are the starting materials/reagents and what is the expected product, in one complete sentence (only aspect that should be future tense). Not wordy, not an explanation of a mechanism or a procedure. Minute details left out.

3 – 4 Points – Overly wordy. Unnecessary aspects (1-2) included.

2 Points – Should be rare, but is possible. Completely verbose and student has missed the idea of what a 'purpose' should be. Lowest score possible on a purpose.

Pre-lab Outline – 10 points:

Full credit – All aspects are included – title of experiment, a short purpose, TOR, and an in-their-own-words procedural outline. Purpose is clear and to the point. **TOR has all pertinent physical properties** – MW, MP, BP, density, *known hazards*, etc. Procedure is clear and could be used in the absence of the handout, but not a direct copy of handout.

8 – 9 Points – Something is wrong. One or more of the following: Missing title, unfit or missing purpose, 1-2 missing pieces of data in TOR, procedure either lacks a step or two or is wordy, but not a direct copy.

5 – 7 Points – More is wrong. 3-4 missing pieces of data in TOR, procedure lacks a few steps or is becoming very wordy, or a verbatim copy of handout.

4 Points – Student sent away for inadequacies. Earns points by fixing their prelab before returning to perform the experiment.

2 Points – Student arrived completely unprepared. Earns points by completing a prelab before returning to perform the experiment.

In Lab Observations and Recordings – 10 Points:

Full Credit – Includes weighings, MPs, and BPs with correct units (if applicable). Observations are clearly noted along with any relevant calculations. Experiment and any work done in limited use hours dated. Organized, neat, and easy to read. Symbols and shorthand are ok (@, etc.).

8 – 9 Points – Missing units on BP/MPs. Masses of things still included. Somewhat unorganized.

6 – 7 Points – Missing some BPs, MPs, masses of items, or observations. Even more unorganized.

3 – 5 Points – Most data/observations left out, but still some present.

1 – 2 Points – Missing data and observations. Missing dates of performed experiments or MPs in limited-use hours. Completely unorganized.

0 points – Nothing present. Should be a rare case.

Reaction Scheme – 5 Points:

Full Credit – Correct graphical representation (drawn with ChemDraw, NOT copy and pasted from elsewhere or hand drawn) that shows starting material(s), reagents/reactants, reaction conditions and expected organic products(s). Structures drawn correctly (bond angles, etc). Reaction conditions, catalysts, etc. written above (and below if needed) reaction arrow and centered with arrow. Scheme centered within the margins of the paper. Organics drawn as skeletal structures. *Inorganics can be omitted for clarity*, although including them as formulas (e.g., H₂SO₄) is fine too.

4 Points – One piece of pertinent information is missing or incorrectly written. This includes but not limited to: wrong number of carbons, bond angles are incorrect, scheme as a whole is not centered within margins, unnecessary hydrogens shown with their symbol (organics should be a skeletal structure).

3 Points – Two things missing or incorrectly written (see above for examples).

2 Points – Three things missing or incorrectly written (see above for examples).

0 Points – > 3 Three things missing or incorrectly written and/or is copy/pasted from another source (structures become pixelated, choppy when copy/pasted from a pdf).

Experimental Procedure – 25 Points: **10 points automatically deducted for not following example format** (i.e., bulleted procedure and/or first/second person narrative).

Full Credit – Follows format of example (see under general handouts “The Formal Report”) to the fullest extent (i.e., written in a past tense, passive voice and not a bulleted procedure). Procedure is accurate, phrased originally (student’s own work), and uses correct vocabulary. Well-written with very good sentence structure. Free of major grammatical errors (GE) such as use of 1st or 2nd person, command form, and present tense, or a lack of tense agreement or subject-verb agreement. Free of minor GE such as spelling, punctuation, capitalization (i.e., names of chemicals are all lower case unless leading a sentence), spacing between numbers and units (i.e., 1.23 mmol is correct, while 1.23mmol is not), or leading zeros (i.e., 0.23 mmol is correct, while .23 mmol is not). Exact amounts used in lab are reported *in parentheses*, not amounts given in the lab handout. Any physical observations/changes are noted. Easy to read and clearly **could be performed by a scientist**. **No unnecessary details** (see the “not-so-well-written-procedure” on the general handouts page, the graded version, and the note below).

*What not to include: Anything to do with the hot plate. Any use of common equipment, e.g., “The balance was used to . . .”. How to perform a known technique, etc.

22 – 24 Points – Still follows format of example to the fullest extent (i.e., not a bulleted procedure), and completely past tense. Only shows minor GE. All other aspects listed in ‘full credit’ followed. Unnecessary details (<=3) make a presence. Leading zeroes may be missing.

19 – 21 Points – Still follows format of example to the fullest extent (i.e., not a bulleted procedure) and completely past tense. Showing more minor (4-6) and major (1 only) GE, e.g, chemical names capitalized, spelling. Unnecessary details (4-8) starting to make even more of a presence. Decent sentence structure. **Still no first/second person**.

16 – 18 Points – Procedure format still being followed (i.e., not a bulleted procedure). Present tense now major, past tense is almost completely omitted. **Still no first/second person**. Procedural “commands” may be taking notice (e.g., now add compound x to the flask). Unnecessary details throughout.

14 – 17 Points – Present tense only, past tense is completely absent. Procedural commands have taken over. Riddled with unnecessary details.

10 – 13 Points – Has completely missed the point of a correctly formatted, written experimental procedure that a scientist could follow. Bulleted procedure written in the first person with present tense. Spelling is an issue. Embarrassing, random font size/style changes. Incorrect abbreviations (e.g., rt is room temperature whereas RT is not).

5 Points – Procedure is a verbatim copy and paste of the handout (i.e., not the student's own work).

0 Points – No procedure written at all.

Results – 10 Points:

Full Credit – All experimentally necessary results (product mass, mp/bp, percent recoveries/yields, characterization methods (not actual data yet) simply restated in tabular form with appropriate column headings.

2 Point deduction for each missing piece of physical data, including not putting results into a table, no matter how small the table is.

Discussion – 20 Points:

Full Credit – Reaction is discussed using correct chemical terminology. For example, "In this lab, 2-methyl-1-butene was synthesized via the elimination reaction of 1-bromo-2-methylbutane in the presence of potassium tert-butoxide." **Results summarized and interpreted well. Discussion is thorough yet easy to read.** For example, "Product identified to be 2-methyl-1-butene via $^1\text{H-NMR}$. The signal at 4.7 ppm is a singlet as expected as the terminal alkene protons are equivalent and do not experience spin-spin coupling. The chemical shift of these protons is also indicative of a typical alkene. The starting material, 1-bromo-2-methylbutane, would not show any signal this far downfield (halide-bearing carbon protons generally 3 ppm)." Spectra interpreted and discussed appropriately (how do they know they have what they think they do). Any printouts included with report and referenced. No use of first person. Challenges procedural assumptions, offers appropriate suggestions to increase yield or purity.

15 – 19 Points – Reaction discussion is not present. For example, "2-methyl-1-butene was synthesized" is not adequate. Some use of first person (I, me, etc.). Purity, yields, recoveries, etc. less than adequately discussed and interpreted. Spectra from results portion interpreted, but some interpretation is incorrect or not fully discussed. For Example, "Product identified to be 2-methyl-1-butene via $^1\text{H-NMR}$. The signal at 4.7 ppm is a singlet as expected," while interpreted, is inadequate.

10 – 14 Points – A lot is missing. Results not completely restated/summarized with very little discussion. Some interpretation of spectra but way inadequate. For Example, "Product identified to be 2-methyl-1-butene via $^1\text{H-NMR}$," is very inadequate. First person may predominate.

5 – 9 Points – Extremely inadequate. No, or very little discussion/interpretation of results. For example, "Product identified to be 2-methyl-1-butene," is completely inadequate.

4 Points – No post lab turned in at all.

Post-Lab Questions – 5 Points equally distributed.

Late Penalty – **1 Point deduction** for each day (or part of a day) that the report is submitted past the due date.