

## Grading Rubric for Formal, Synthetic Experiment Reports

### Prelab – 5 points

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

**4 points** – Something is wrong. One or more of the following: Missing title, purpose does not fit or is missing, 1-2 missing pieces of data in TOR, procedure either lacks a step or two or is wordy, but not a direct copy.

**3 points** – More is wrong. 3-4 missing pieces of data in TOR, procedure lacks a few steps or is becoming very wordy, but still not a direct copy of the handout.

**2 Points** – Even more is wrong. >4 missing pieces of data in TOR, procedure becoming a direct copy of handout

**1 Point** – Procedure is a direct copy of the handout or very close to it.

**0 Points** – Missing prelab entirely before lab begins. Give 1/5 for doing it and then returning.

### In and Out of Lab Notebook Entries – 5 Points

**Full Credit** – Organized and neat, easy to read. Entries are clear and anything with the procedure is done while working (before you sign). Includes UK #, weighings, MPs, BPs with units (if applicable). Observations are clearly noted. Symbols and shorthand are ok (@, etc.). Experiment dated and any out-of-lab things dated or morning hours dates are included.

**8 – 9 Points:** Somewhat unorganized or not as easy to read. Missing units on BP/MP. Masses of things still included.

**6 – 7 Points:** Even more unorganized, becoming harder to read. Missing BP, MP or masses of items.

**4 -5 Points:** Almost undecipherable. Observations minimal, but still some present.

**1 – 3 Points:** Undecipherable. No observations. Can't read at all. Completely unorganized. Missing dates of performed experiments or      MPs in morning hours.

**0 points:** Nothing present. should be a rare case unless the report is not turned in.

### Lab Technique – 5 Points

Keep a note of this. Messiness, asking the same question over and over again, has to constantly be asked to put on goggles or to work in the hood.

### Start of Formal (Typed) Portion

**All typed portions MUST be double spaced for ease of reading.** Automatic 5 point deduction.

### Heading – 5 Points

**Full Credit** – All aspects (title of the experiment, students name, the name of the TA responsible for grading the report, and the *submission date*) included.

**4 – 0 Points** - Minus one point for each missing piece.

### Purpose – 5 points

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

**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.

### Reaction Scheme – 5 Points

**Full Credit** – Correct graphical representation (drawn with ChemDraw NOT copy and pasted from somewhere, lab handout included, or hand drawn) that shows starting material(s), reagents/reactants, reaction conditions and expected organic products(s). *Inorganics can be omitted for clarity*, although including them is fine, too. Structures drawn correctly (bond angles, etc). Reaction conditions, catalysts, etc. written above (and below if needed) reaction arrow and centered with arrow. Scheme centered with the margins of the paper. Organics drawn as skeletal structures, inorganics shown with formulas (e.g., H<sub>2</sub>SO<sub>4</sub>).

**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 with 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 – 40 Points

**Full Credit** - Follows format of example to the fullest extent (i.e., not a bulleted procedure, parenthetical amounts of materials used, etc.). Procedure and steps are correct and not in a “command” form. Free of minor and major grammatical errors (GE): use of 3<sup>rd</sup> person throughout (1<sup>st</sup> or 2<sup>nd</sup> person are major errors) as well as past tense, tense agreement, subject-verb agreement, correct spelling (minor), punctuation (minor) and passive voice (major), names of chemicals are all lower case (minor), unless leading a sentence. Correct use of vocabulary and is original phrasing (student’s own work). Well-written and very good sentence structure. Exact amounts used in lab are reported, not amounts in lab handout. Any physical observations/changes, if any, are noted. Spaces between numbers and units (e.g., 1.23 mmol and not 1.23mmol). Uses leading zeroes (e.g., 0.23 mmol and not .23 mmol). **No unnecessary details** (see next page for what should never be included). Easy to read and clearly **could be performed by a scientist**.

**35 – 39 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.

**30 – 34 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 a presence. Decent sentence structure. **Still no first/second person.**

**25 – 29 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.

**20 – 24 Points** - **Half credit (20 points) automatically for not following example format** (i.e., bulleted procedure) **and/or first/second person narrative.** Present tense only (past tense is completely absent). Procedural commands have taken over.

**11 – 19 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).

**10 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 and Discussion – 20 Points (10 points for results portion and 10 points for discussion portion)

Results Portion:

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

**Minus two points for each missing piece of physical data, including not putting results into a table, no matter how small the table is.**

Discussion portion:

**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 interpreted well and are 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 any printouts included with report and referenced) and discussed appropriately and what the results mean (how do they know they have what they think they do). No use of first person. Results are discussed and what they mean is clear to the reader. Challenges procedural assumptions, offers appropriate suggestions to increase yield or purity.

Discussion portion (continued):

**7 - 9 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. First person some of the time.

**4 – 6 Points** – A lot missing. Very little discussion of results. Very little mentioned or discussion on purity, yields, recoveries. Incomplete physical data of products. Some interpretation of spectra but way inadequate. For Example, "Product identified to be 2-methyl-1-butene via  $^1\text{H-NMR}$ ," is still inadequate. First person may predominate.

**2 – 3 Points** - Extremely inadequate. No, or very little discussion of results or purity, or discussion/interpretation of results. For Example, "Product identified to be 2-methyl-1-butene," is completely inadequate

**1 Point** – No post lab turned in at all.

What not to include: Anything to do with a sand bath. Any use of common equipment, e.g., "The balance was used to . . ."

Most importantly, see the "not-so-well-written-procedure" on the general handouts page and the graded version as well.

Answers to Post-Lab Questions – 10 Points equally distributed.