

Laboratory Report and Grading Guidelines

This is a group assignment consisting of a lab report with data and calculations, results, and discussion. One group assignment consisting of these parts should be submitted for each group.

1. Title and Authors (2 pts)

The top of your report, include the i) title; ii) group number (day of week and number); iii) list of authors; iv) date(s) of experiment(s). The title of the report should provide insight to the research; please be more creative than copying the title used on the handout.

2. Data or calculation sheets (15 pts)

Include any handwritten or typed summaries of raw data (unprocessed data), along with calculations (written by hand, typed or displays of equations in excel) you used to arrive at your results.

3. Results (45 pts)

Integrate tables and figures that show your results along with text. One way to think about writing a results section is to make your relevant tables and figures (showing your calculated results, not just raw data), and then write about what those tables or figures show and why. Think about the results as telling a story by referring to the tables and figure you've put together, described both as visuals and in text. Include any specific requested tables and figures from the lab handout in this section.

If there are any additional analysis requested in the laboratory handout, include these here as well under a different sub-heading.

4. Discussion (20 pts)

The discussion section interprets the overall results, draws significant conclusions from the data collected, and includes the answers to relevant questions often provided in the specific laboratory guidance document. Your discussion should have three sub-headings:

- *Conclusions.* What conclusions can you logically and defensibly draw from the results? How do your results compare to your objectives and what you expected to achieve? Include here answers to questions listed in the laboratory handout.
- *Limitations.* What were the limitations of your study and how do these impact the conclusions you can draw from the study?
- *Future Research.* If you were to repeat the experiment or design a new experiment to address the same question, what would you propose?

A. Author contributions and References (3 pt)

Author contributions: In one sentence, list the specific contributions of each group member. For example:

Data collection (EK, LD, BL), abstract (EK, LD, BL), calculations (EK, LD), results tables (EK), results figures (LD), results writing (BL), discussion (BL).

While different students may focus on preparing different sections of the report, all students should review the full report. Exams may include content from any part of the lab, so students must be familiar with all the laboratory procedures and analysis.

References: The references section includes a bibliography of any sources referenced in the report. The purpose of the references section is to give credit to the researchers who provided the knowledge for the basis of your work. Only reliable sources should be referenced in the report; these include peer-reviewed journal articles, academic works, and “trusted” websites including government and academic sources. You may use a software to manage your references (e.g. Zotero, Mendeley).

References in text should be cited with the format of the author(s) last name followed by a comma and the year. The following is an example of in-line citation (note the difference for references with one author, two authors, or multiple authors, respectively) and, for each in-line citation in the text, the full citation should appear in the Reference section listed alphabetically by last name; examples below

Deficiencies in piped water distribution systems have been linked to outbreaks of water-borne illnesses (Geldreich, 1996; Lee and Schwab, 2005; Semenza et al., 1998;).

References

- Geldreich, E., 1996. *Microbial Quality of Water Supply in Distribution Systems*. CRC Lewis Publishers, Boca Raton.
- Lee, E.J., Schwab, K.J., 2005. Deficiencies in drinking water distribution systems in developing countries. *Journal of Water and Health* 3 (2), 109e127.
- Semenza, J.C., Roberts, L., Henderson, A., Bogan, J., Rubin, C.H., 1998. Water distribution system and diarrheal disease transmission: a case study in Uzbekistan. *American Journal of Tropical Medicine and Hygiene* 59 (6), 941e946.

Overall presentation (15 pts)

Points will also be allocated to the following questions:

- Was the lab report well written? Were there many grammatical errors? Was the formatting logical and consistent throughout the document?
- Did the lab demonstrate clear and thoughtful scientific inquiry?

Specific formatting guidance

- Use Times New Roman 11pt font; one inch margins; single spacing; page numbers
- When writing about experimental work, use the past tense when describing what you did and the results. Instead of “The turbidity of the river water is 3.6 NTU,” say “The turbidity of the river water was 3.6 NTU.” While you may have measured 3.6 NTU of turbidity in river last week, there’s no guarantee it still is today.
- Make sure all numbers, calculations and figure axis titles have appropriate labels and units.
- If you use symbols (e.g., α , ω , E) or acronyms (e.g., BOD, EC, GPM), define them the first time you use them in the text.
- Use only the number of significant figures that are appropriate.
- Equations, figures, and tables should be numbered sequentially and have a title and caption. Figure captions are written below the figure and table captions are written above the table. Examples below:

Combined Chlorine (mg/L) = Total Chlorine (mg/L) – Free Chlorine (mg/L) (Equation 1)

Table 1. Total, free, and combined chlorine concentrations by dose added, accounting for dilution.

Chlorine Dose (mg/L)	Free Chlorine (mg/L)	Combined Chlorine (mg/L)	Total Chlorine (mg/L)
1	0.33	0.64	0.97
2	0.28	2.34	2.62
3	0.47	2.85	3.32
4	0.85	2.92	3.77

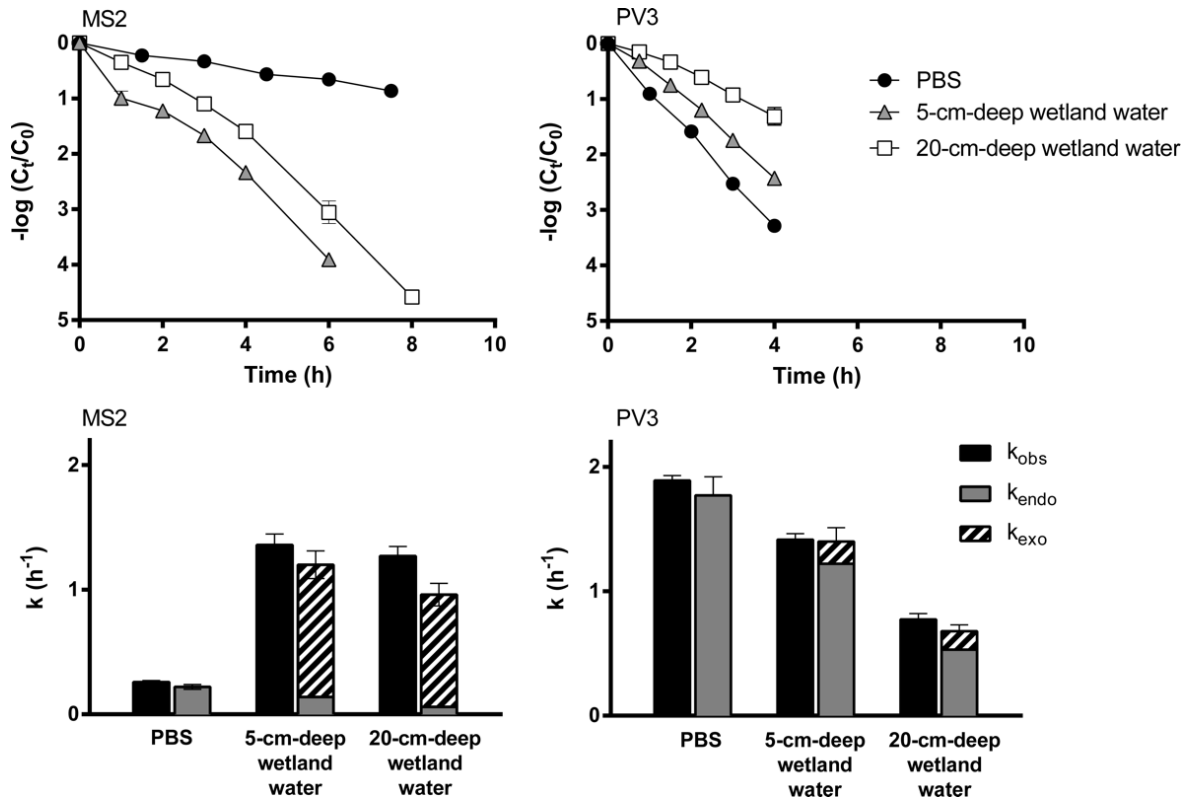


Figure 1. MS2 and PV3 inactivation curves (top row) and inactivation rates (bottom row) during laboratory experiments in clear, sensitizer-free solution (PBS) and 5 and 20 cm deep wetland water ($n = 2$ for each time point). Measured (k_{obs}) and modeled (k_{endo} and k_{exo}) inactivation rates are presented. Error bars report the standard error; some error bars are smaller than the symbols.

From: Silverman, A. I., Nguyen, M. T., Schilling, I. E., Wenk, J. & Nelson, K. L. 2015. Sunlight Inactivation of Viruses in Open-Water Unit Process Treatment Wetlands: Modeling Endogenous and Exogenous Inactivation Rates. *Environ. Sci. Technol.* 49, 2757–2766.)

Grading rubric

	Points
Group Assignment	
Title	2
Describes lab content concisely, adequately, appropriately	
Data or calculation sheets (10 pts)	15
Are relevant raw data sheets provided and interpretable	
Were calculations performed correctly	
Results	45
Presents tables and figures clearly and accurately (e.g. shows relevant data, axes labeled, appropriate significant figures used)?	
Presents findings clearly and with sufficient support?	
Successfully integrates verbal and visual representations?	
Were additional analysis required in the lab handout performed thoughtfully?	
Discussion	20
<i>Conclusions.</i> Were the links between theory and objectives clear? Were conclusions logically and defensibly drawn from the results?	
Were thoughtful and appropriate answers to questions listed in the laboratory handout provided?	
<i>Limitations.</i> Adequately addresses the limitations of the study (in the experimental design, data collection and measurements, or subsequent analyses)? What did you not measure that you could include were you to do this again?	
<i>Future research.</i> What would you do differently if you had to do this over? What would be a follow-on experiment that you could add?	
Author Contributions and References	3
Author contributions clearly stated	
Adequate references	
Overall Presentation	15
Was the report well written? Were there many grammatical errors? Was the formatting logical and consistent throughout the document?	