Formal Lab Report (40 pts)

1. **Title page (2 pts)**
   a. Make a title page: This page should be the entire page with the title displayed prominently. Underneath the title, put your name; and underneath your name, the name of your partner; then the date the report is due, and the class period. Everything must be there on one page to get full points. It is OK to add relevant pictures.
   b. **Good titles**:
   "Variations of time spent hand washing and its effectiveness at removal of microbes from hands"
   "Comparison of Ivory Soap and Citrus II Soap in their effectiveness at removing microbes from hands during handwashing"
   c. **Bad titles**:
   "Does the type of soap you use really matter?" (Matter for what? Not at all helpful to a potential reader as to the contents
   "What lives on your hands?" (We were not determining which microbes inhabit your hands – you were trying to see if a product or procedure removed more microbes from your hands, regardless of what types they were.)

2. **Abstract (2 pts):** An abstract is a **brief** description of the experiment. In 2 or 3 sentences, without going into details, summarize your experiment.
   a. What are you trying to show?
   b. How are you going to show it?
   c. What products or procedures are you comparing?
   d. What was your result?

3. **Introduction (2 pts):** An introduction provides some background for the experiment, and addresses why you chose the products and procedures that you did.

4. **Hypothesis (3 pts):** Which product or procedure do you predict will lead to the greatest reduction in number and type of microbes on the hands? Why do you think one product or procedure will work better than the other? Be sure to give a reason for your hypothesis!

5. **Variables: (2 pts)**
   a. **Independent (experimental) variable:** An experimental variable is what **differs** between the two tests.
   b. **Controlled variables:** Controlled variables are all the things that are the same between the two tests. Define as many controlled variables as possible.
   c. **Dependent variable:** The dependent variable is what you measure. How did you determine how contaminated your and your partner's hands were before and after washing?

6. **Supplies and equipment: (2 pts)** Provide a complete list; for example, brand name of products, including active ingredients, and all lab supplies you used. There are more things used than you may think of initially. **Be complete.**

7. **Steps in detail: (4 pts)** This should be complete enough that a person in a different research lab could replicate exactly what you did. For this section of the report, a numbered list format is very useful. Make sure you list the steps used by **both** students, and don't forget to discuss what you did on the second lab day.

8. **Results: (9 pts)** Report results for **both partners**, not just yours. You are trying to compare products or procedures, so both sets of data are needed to make a comparison and decide which product or procedure you will recommend. The results section must include:
   a. **A brief written statement.** This is NOT the place to draw conclusions about your results – just report the results here. You may include pictures, but they must be clearly labeled with the name of the product or procedure and which side is "before" and which is "after".
      i. Which product or procedure showed the greatest percent reduction in total number of colonies?
      ii. Which product or procedure showed the greatest percent reduction in types of colonies?
      iii. Describe the colony types on the before and after sides of both plates.
   b. **Calculations** for both partners' data. Remember, if you had an increase in number on the "after" side, the number will be negative. Show your work!
   c. **Tables.** Use the names of the products or procedures in your data reporting table. DO NOT use "Plate A" and "Plate B" or the names of you and your partner. Doing so annoys your reader. In a real publication they would not bother to read your work, and in a class situation they will deduct points. Examples:

Good example

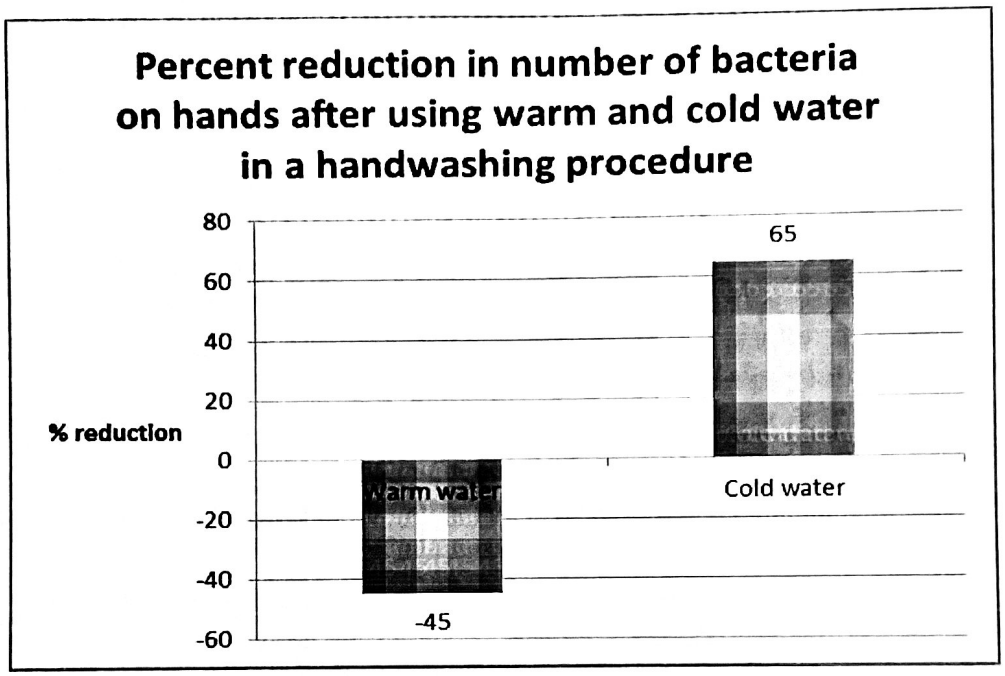
Product	# of colonies		% reduction
	Before	After	
Avagard D gel	100	20	80%
Softcide	100	25	75%

Bad examples

Product	# of colonies		% reduction
	Before	After	
Plate A	100	20	80%
Plate B	100	25	75%

Product	# of types of colonies		% reduction
	Before	After	
Mary	100	20	80%
George	100	25	75%

d. **Graphs** of the % reduction for both plates. It is important to learn to display your data in a visual format.
   i. Use a bar graph. (See below for an example).
   ii. Include a title that is descriptive of your experiment, put "percent reduction" on the Y axis, and label the two bars with either the name of the product or procedure.



9. Discussion: (4 pts)

a. Did the results support your hypothesis or not? **Explain**.
   i. If they did, why do you think your product or procedure really is better at reducing microbes from hands? OR:
   ii. If the results were not what you expected, what do you think this means? What possible explanation might there be for these results?
   iii. If you saw an increase in numbers of bacteria after the procedure, explain why that might have happened.
   iv. How did the number of types of organisms change on before and after plates? How does this relate to how effective the product or procedure was?

10. Flaws, limitations, and improvements: (3 pts)

a. Were there flaws in your experimental design or execution of the experiment? What were they?
b. What are some of the limitations of your experiment?
c. What would you do next time to improve the quality of your data? Hint: this is just one experiment you and your partner are doing – can you claim the results as FACT? How would you improve the believability of the results? How would you redesign the experiment to get better data?

11. **Recommendation: (2 pts)** Based on your and your partner's data, which product or procedure would you recommend to others? In other words, which product or procedure actually showed the greatest percent reduction in your experiment? Do not tell me that you recommend a product or procedure that did not perform as well in your experiment – this recommendation is based on your actual data only.

    However, if your data are contrary to common sense, you might explain why you might not actually recommend this product or procedure. This is your chance to give an opinion, but don't forget the first part – the data.

12. **Worksheet: (5 pts)** Turn in the worksheet from your lab packet, but please do NOT staple it to your report.

13. **Penalties: (-1 to -5)** Points may be deducted if your report is late, or if your use of language is particularly difficult to understand. This is not a writing class, but your report should still be written in an academic style using proper grammar and correct spelling.

Lab 10: Hand washing

Name: _____ Date: _____

1. What independent variable did you use in your experiment? For example, method of drying (air vs. paper towel), or type of soap (no antimicrobial agent vs. antimicrobial).

Drying hands with paper towel vs air drying

hypothesis: Drying hands with paper towel is more effective than air drying

Student A: Name: JO

Student A: Product (and active ingredient) or procedure: water, antimicrobial shampoo, washed for 60 min approximately then air dry until dry.

Student B: Name: SAM

Student B: Product (and active ingredient) or procedure: used water, antimicrobial shampoo, washed for 60 min then used paper towel to dry.

2. Indicate the number of colonies you counted on the before and after sides of each plate in the table below, then calculate the percent reduction for each plate. Remember that if you had an increase in numbers on the after side, this means you will have a negative percent reduction.
Show your calculations here and in your report. Be sure to show your work!

A. $\frac{108-214}{108} \times 100 = -98.14$

B. $\frac{82-19}{82} \times 100 = \frac{63}{82} \times 100$

	# of colonies before	# of colonies after	% reduction
Product or Procedure A	108	214	-98.14
Product or Procedure B	82	19	76.82

Due 4/3.

Hand Washing Report Grading Rubric

Make sure you include <u>every</u> section, and that each section contains the required information.

Section	Approximate length/format	Most important points	points
Title page	Separate page, nicely laid out	Title/student's name/partner's name/due date/class	2
Abstract	2 or 3 sentences	<u>Brief</u> explanation of your experiment, without details of methods; what you tested and what you learned	2
Intro/purpose	1 medium paragraph	Why are we doing this experiment? What do you hope to learn? Why does it matter?	2
Hypothesis	1 or 2 sentences	What method do you predict will remove the most microbes? Why did you make that prediction?	3
Variables	List, table, or paragraph	Identify controlled, independent (experimental), and dependent variables.	2
Equipment/supplies	List format is preferred	Make sure your list of equipment and supplies is complete.	2
Steps in detail	Numbered list format is preferred	You should include enough detail to enable someone else to repeat your experiment exactly.	4
Results statement	1 paragraph	Report your results without commentary. You may include pictures, but they <u>must</u> be clearly labeled.	2
Results table #1	See the examples in your lab manual	Table with number of colonies before and after, and % reduction for each method	1
Results table #2	See the examples in your lab manual	Table with number of types of colonies before and after, and % reduction for each method	1
Results calculations	Formula below	Show your calculations for both total number of colonies, and numbers of types of colonies.	2
Results bar graph	See the example in your lab manual	Be sure to include a title, put % reduction on the y-axis, and label your graph.	3
Discussion	1 or 2 paragraphs	Was your hypothesis supported by your data?	4
Flaws/improvements	1 paragraph	Were there any problems with your experiment? How could you improve this experiment?	3
Recommendation	1 short paragraph	Based on your data, what method of hand washing would you recommend?	2

Calculations:

$$\frac{\text{(\# of colonies before - \# of colonies after)}}{\text{\# of colonies before}} \times 100 = \%\text{ reduction in number of colonies}$$

$$\frac{\text{(\# of types of colonies before - \# of type of colonies after)}}{\text{\# of types of colonies before}} \times 100 = \%\text{ reduction in number of types of colonies}$$