Supporting Laboratories, Metacognition, and Active Learning

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Gradescope User Summit

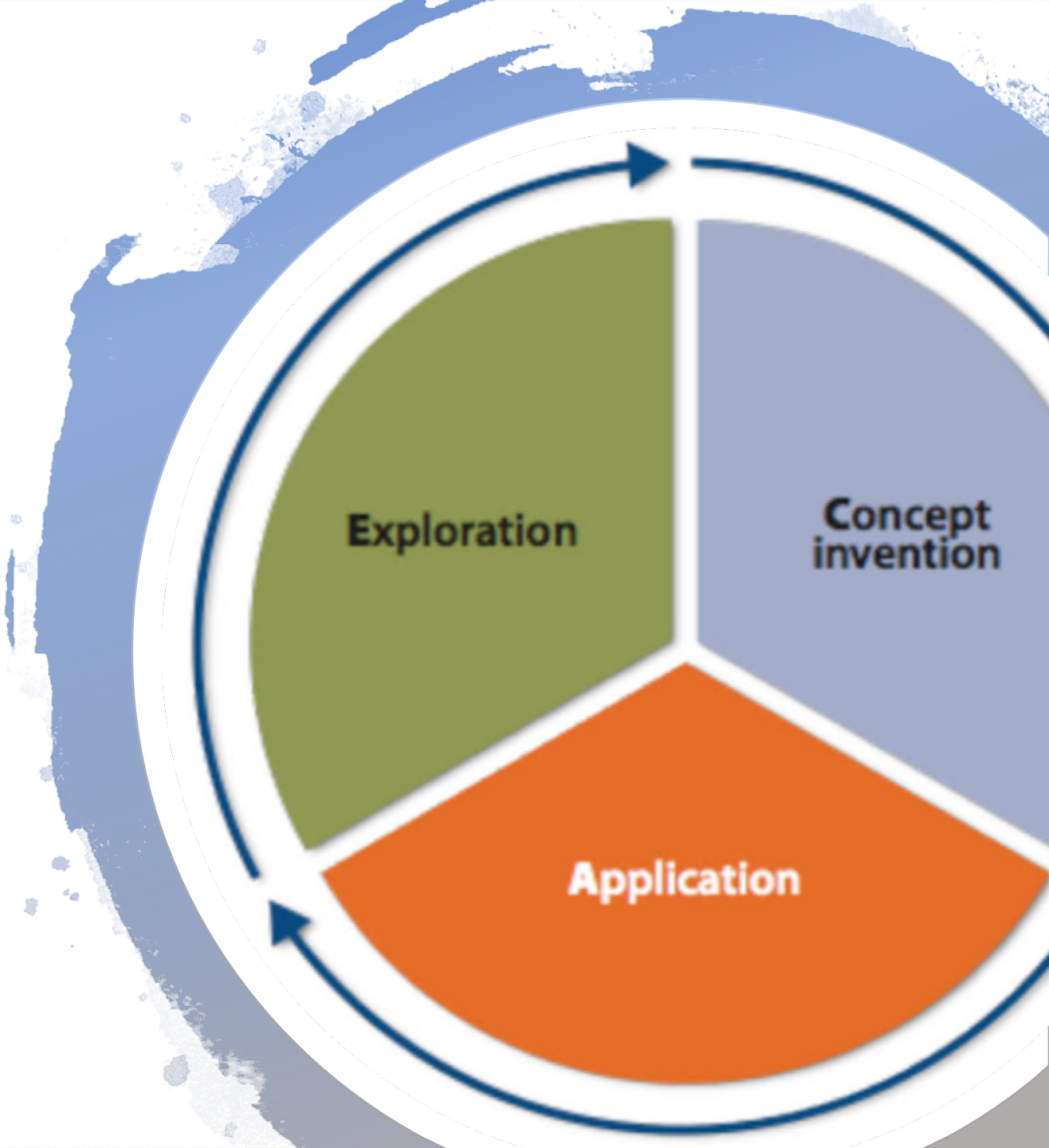
March 16, 2021

My General Chemistry Classes:

- 2 Classes of 30-40, active learning classroom
- Class assignments:
    - Reading Checks (daily, pre-class, online)
    - Active learning/HW (daily, in-and-post-class, paper)
    - Weekly quiz (paper)
    - Optional requiz
- Weekly labs: taught by faculty
    - Prelab (safety and procedure-oriented, online)
    - Lab activities (scaffolded inquiry, worksheet-style)
    - Lab quiz the next week (paper)
- No/minimal TA support

Active Learning: POGIL (Process-Oriented Guided Inquiry Learning)

www.pogil.org



Active Learning Activity (Exploration Phase):

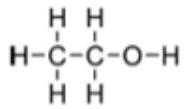
Name: _____

Collaborators: _____

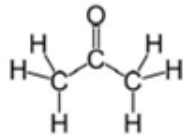
HW25 – Solubility

Part I. The ten vials you've been given contain these ten compounds, plus a few mL of water.

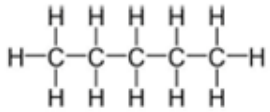
KI $CaCO_3$ $Co(NO_3)_2$ $CuCl_2$ MgO MnO_2



(ethanol)



(acetone)



(pentane)

Based on…

- your observations of how and whether these compounds mix with water in the vials,
- what the types of compounds these are, and
- the intermolecular forces present in the original compounds,

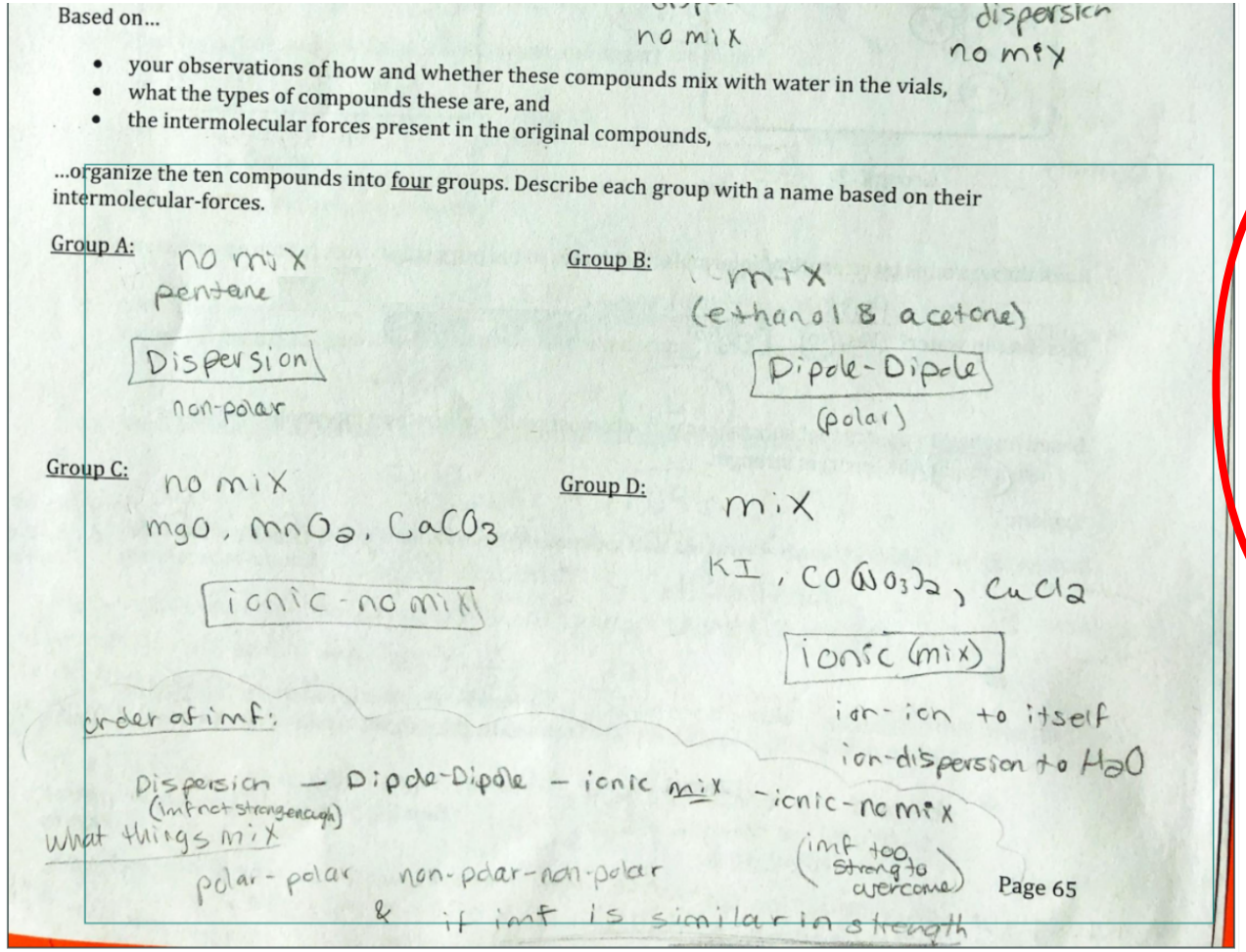
…organize the ten compounds into four groups. Describe each group with a name based on their intermolecular-forces.

Group A:

Group B:

Grading Active Learning Activities:

(All student work used with permission.)



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- your observations of how and whether these compounds mix with water in the vials,
- what the types of compounds these are, and
- the intermolecular forces present in the original compounds,

...organize the ten compounds into four groups. Describe each group with a name based on their intermolecular-forces.

Group A: no mix
pentane
Dispersion
non-polar

Group B: mix
(ethanol & acetone)
Dipole-Dipole
(polar)

Group C: no mix
MgO, MnO_2, $CaCO_3$
ionic - no mix

Group D: mix
KI, $CO(NO_3)_2$, $CuCl_2$
ionic (mix)

order of imf:
Dispersion (imf not strong enough) — Dipole-Dipole — ionic mix — ionic-no mix
ion-ion to itself
ion-dispersion to H_2O
(imf too strong to overcome)

What things mix
polar - polar non-polar - non-polar
& if imf is similar in strength

Page 65

1.1: Identity of Four Groups

0 OF 43 GRADED

TOTAL POINTS
0.08 / 0.08 pts

Rubric Settings

Collapse View

1 -0.0
Correct: reasonable groups and names

2 -0.04
Non-optimal grouping (groups dispersion and strong ionics together)

3 -0.08
Answer missing/blank

Add Rubric Item | Create Group | Import...

SUBMISSION SPECIFIC ADJUSTMENTS

Point Adjustment 0

Provide comments specific to this submission

APPLY PREVIOUSLY USED COMMENTS

Submission: 20 of 43

Previous Ungraded | Previous | Next | Next Ungraded

Active Learning over Zoom (in Gradescope):

Group collaboration in 3-4 person breakout rooms.

Identifying “facilitator” role helped keep groups on track.

Paper activities translated well to online format!

Q1.1 Collaborators
0 Points

In science, we acknowledge our collaborators. If you worked with anyone else on this assignment, identify them by name here. (If you had no collaborators, that's OK, too.)

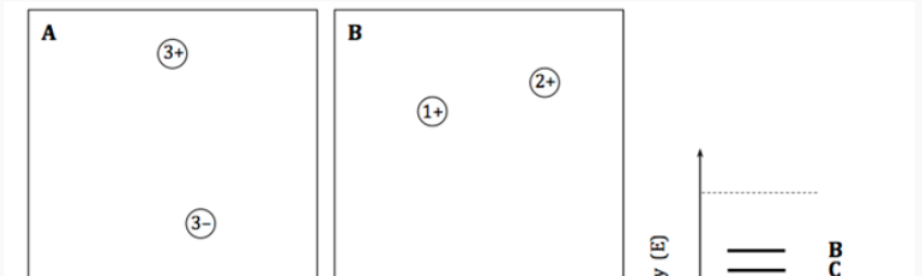
Q1.2 Facilitator
0 Points

As you work together today in Zoom breakout rooms, the person whose **first** name comes **first** alphabetically will be your group's "facilitator" -- helping to keep the group on track (reading questions aloud, asking if everyone agrees on the answer). Is that you?

- (•) Yes
- ( ) No

Q2 Point Charges
0.28 Points

The questions below refer to our systems of point charges and the relative potential energies. (Based on Rickey, Dysleski, et al. “Recitation Worksheet 1” Copyright © Colorado State University)



Metacognition

- Awareness of one's own thinking, knowledge, and performance ("Do you know what you do and don't know?")

- Exam wrappers:
  - For pre-quiz assessment
  - For post-exam reflection

Q1 Quiz 4 Objectives
0.1 Points

For every weekly unit, I have posted a page on Canvas that summarizes the weekly objectives and points at potentially useful practice problems from the online text.

For Unit 4, this page is at:
https://oit.instructure.com/courses/9134/pages/unit-4-objectives

So: Take a look at the Unit 4 Objectives on Canvas (which is what Friday's Quiz 4 will be over). Rate your confidence on your ability to answer questions based on these unit objectives; there is no "right" or "wrong" answer - my purpose is to make sure you reflect on how well you've mastered these outcomes in preparation for your quiz.

Q1.1
0 Points

Draw Lewis structures for ionic compounds, covalent molecules, and polyatomic ions.

- I feel fantastic about this skill; total confidence that I can do it perfectly.
- I feel really good about this skill, although some practice never hurts.
- I feel OK about this skill; maybe I need some more practice and to test myself to see where I really stand
- I definitely need more practice at this skill and may want to find other resources to help me.
- I don't feel good about this skill at all and I know that need to dig into resources (instructor, peers, textbook)

Q1.2
0 Points

Calculate formal charge and oxidation state based on Lewis structures, and use formal charge as a basis for determining preferred Lewis structures.

- I feel fantastic about this skill; total confidence that I can do it perfectly.
- I feel really good about this skill, although some practice never hurts.
- I feel OK about this skill; maybe I need some more practice and to test myself to see where I really stand

Pre-Quiz Reflection

Used multiple-choice (+ “dummy” question) as a survey.

Puts that week’s objectives in front of students.

Asks students’ to reflect on their confidence
(and even suggests some approaches.)

Post-Quiz Analysis

Q2 Quiz 4 Analysis

0.1 Points

Take a look at your grades and feedback on Gradescope for Quiz 4, as well as the Quiz 4 Answer Key posted on Canvas. (https://oit.instructure.com/courses/9134/files/1691393?module_item_id=557129)

Note that, in Gradescope, my feedback is viewable when you click on each question, so you can see my notes on why points were deducted!

Identify:

1) A question where you made a mistake.

2) Describe the mistake that you made.

3) What the correct answer should have been.

For example:

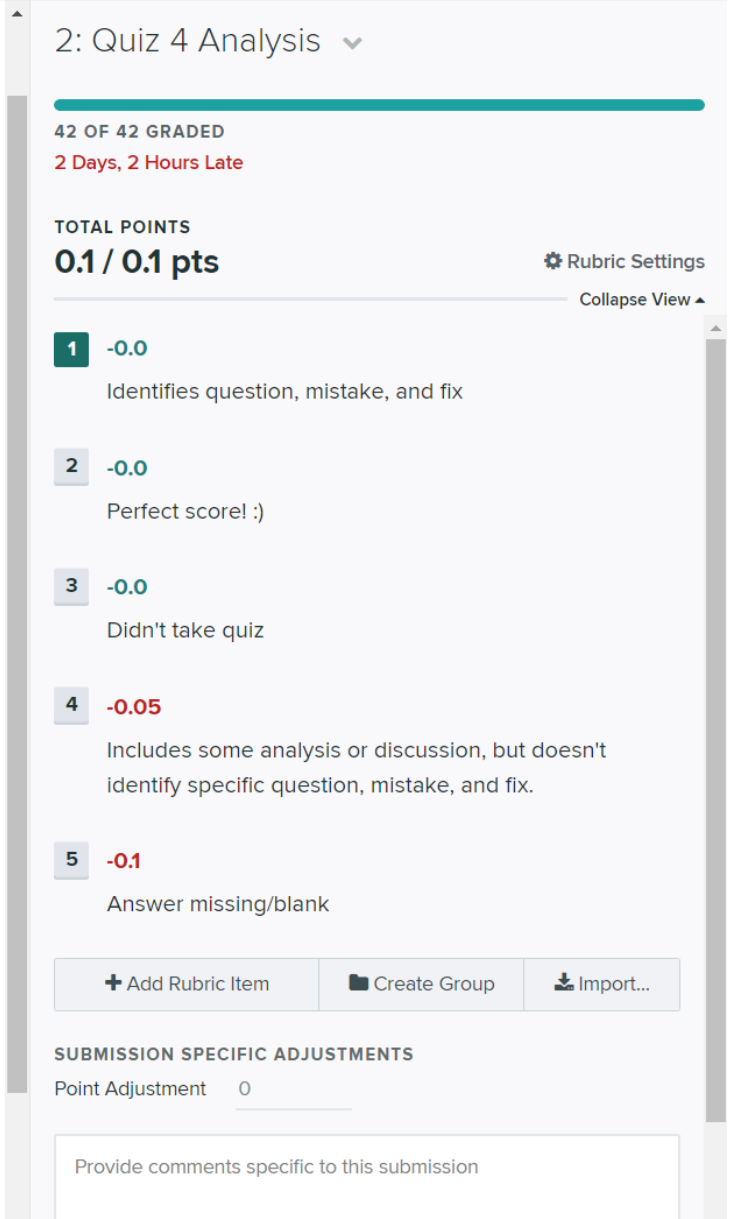
"1) I missed question 7a.

2) I didn't divide by the number of liters of solution.

3) The correct answer should have been 0.300 mol / 2 L = 0.150 L"

If you had a perfect score on the quiz, or didn't take it for a legitimate reason, indicate that below.

1) 1.2
2) The element Si, i used two bars, instead of putting 4 electrons surrounding the element.
3) The right answer would of been showing the 4 electrons spread out on four edges of the atom.



Laboratories

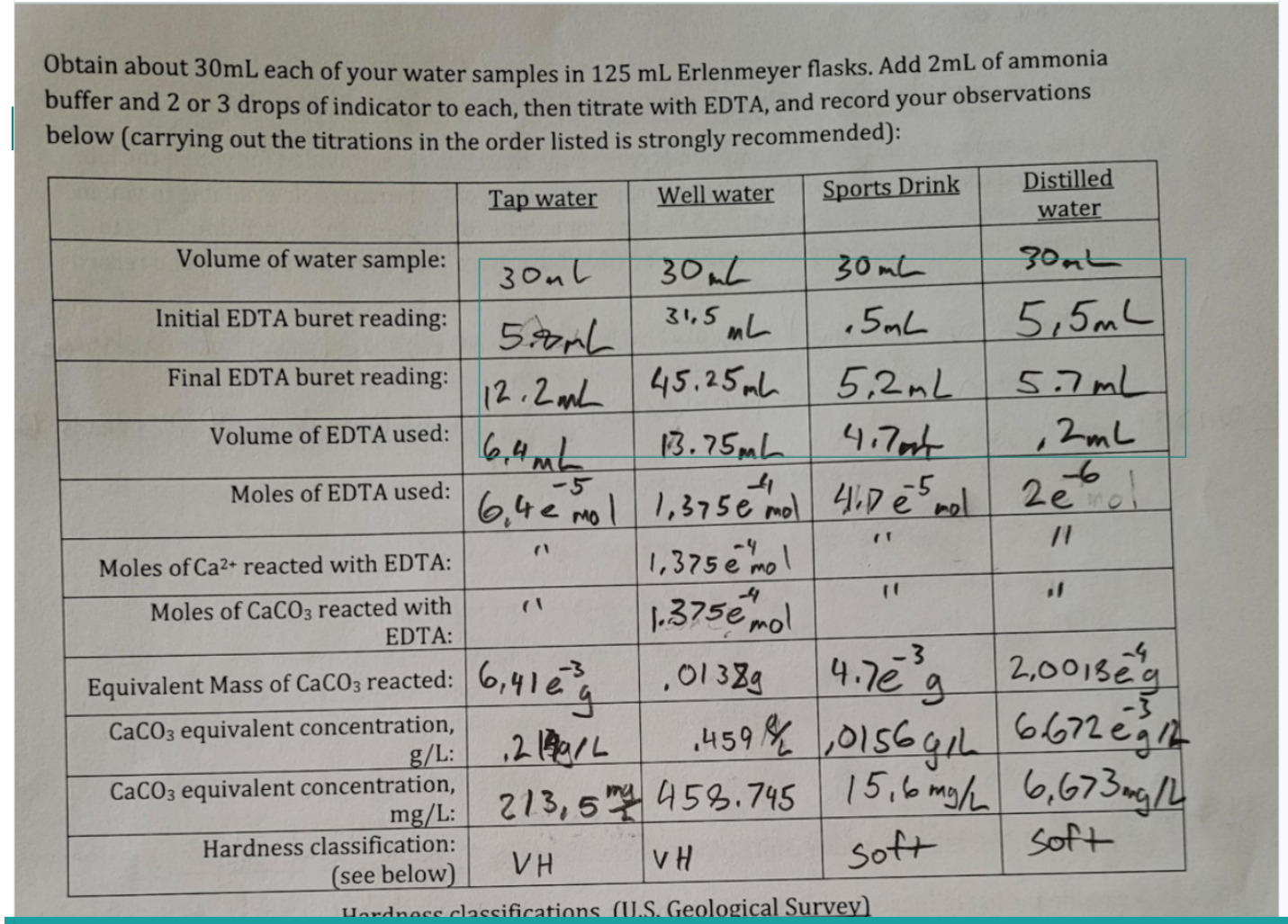
- “Standard” worksheet labs
- Remote labs
- Rubric-based lab writeups

In-Person Labs

Grading by Submission

You are grading one of 48 submissions in **Group volumes with units**

Grade the whole group instead >



Obtain about 30mL each of your water samples in 125 mL Erlenmeyer flasks. Add 2mL of ammonia buffer and 2 or 3 drops of indicator to each, then titrate with EDTA, and record your observations below (carrying out the titrations in the order listed is strongly recommended):

	Tap water	Well water	Sports Drink	Distilled water
Volume of water sample:	30mL	30mL	30mL	30mL
Initial EDTA buret reading:	5.8mL	31.5 mL	.5mL	5,5mL
Final EDTA buret reading:	12.2mL	45.25mL	5,2mL	5.7mL
Volume of EDTA used:	6,4mL	13.75mL	4.7mL	,2mL
Moles of EDTA used:	$6,4e^{-5}$ mol	$1,375e^{-4}$ mol	$4.7e^{-5}$ mol	$2e^{-6}$ mol
Moles of Ca^{2+} reacted with EDTA:	"	$1,375e^{-4}$ mol	"	"
Moles of $CaCO_3$ reacted with EDTA:	"	$1.375e^{-4}$ mol	"	"
Equivalent Mass of $CaCO_3$ reacted:	$6,41e^{-3}$ g	.0138g	$4.7e^{-3}$ g	$2,0018e^{-4}$ g
$CaCO_3$ equivalent concentration, g/L:	.21g/L	.459g/L	,0156g/L	$6672e^{-3}$ g/L
$CaCO_3$ equivalent concentration, mg/L:	213,5mg/L	458.745	15,6 mg/L	6,673mg/L
Hardness classification: (see below)	VH	VH	Soft	Soft

Hardness classifications (U.S. Geological Survey)

3.2: Buret Readings

Part of Group volumes with units

55 / 55 GRADED — GRADING 1 SUBMISSION

TOTAL POINTS

0.6 / 0.6 pts

Rubric Settings | Pop Out

Collapse View

1 **-0.0**

Correct: Buret readings and total volume reported, with (at least some) units

2 **-0.1**

Units missing from all titration volume data

+ Add Rubric Item | Create Group | Import...

SUBMISSION SPECIFIC ADJUSTMENTS

Point Adjustment 0

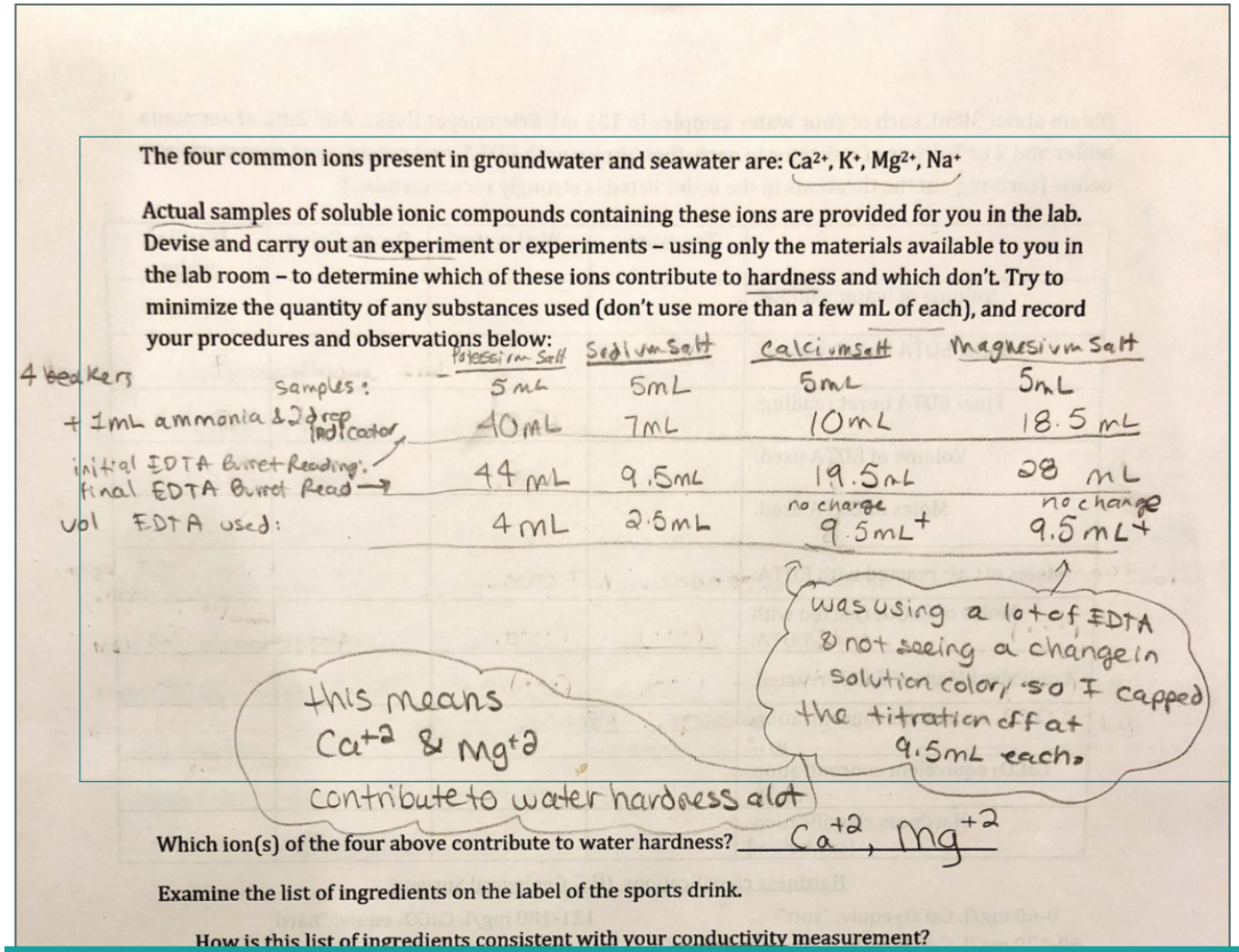
Provide comments specific to this submission

APPLY PREVIOUSLY USED COMMENTS

Submission: 11 of 55 (part of Group volumes with units)

< Previous Ungraded | << Previous | Next >> | **Next Ungraded >**

In-Person Labs



The four common ions present in groundwater and seawater are: Ca^{2+}, K^{+}, Mg^{2+}, Na^{+}

Actual samples of soluble ionic compounds containing these ions are provided for you in the lab. Devise and carry out an experiment or experiments – using only the materials available to you in the lab room – to determine which of these ions contribute to hardness and which don't. Try to minimize the quantity of any substances used (don't use more than a few mL of each), and record your procedures and observations below:

4 beakers	Potassium Salt	Sodium salt	calcium salt	magnesium salt
samples:	5 mL	5mL	5mL	5mL
+ 1mL ammonia & 2 drop indicator	40mL	7mL	10mL	18.5 mL
initial EDTA Buret Reading:	44 mL	9.5mL	19.5mL	28 mL
final EDTA Buret Read →			no change	no change
vol EDTA used:	4mL	2.5mL	9.5mL+	9.5mL+

this means Ca^{+2} & Mg^{+2} contribute to water hardness a lot

was using a lot of EDTA & not seeing a change in solution color, so I capped the titration off at 9.5mL each.

Which ion(s) of the four above contribute to water hardness? Ca^{+2}, Mg^{+2}

Examine the list of ingredients on the label of the sports drink.

How is this list of ingredients consistent with your conductivity measurement?

4.1: Experiments with Water Hardness

55 OF 55 GRADED

TOTAL POINTS

0.8 / 0.8 pts

Rubric Settings | Pop Out

Collapse View

1 -0.0
Records observations in a manner that can be generally followed and reproduced

2 -0.4
Records some notes on experiment, but not in a manner that is clear enough to be readily reproduced

3 -0.8
Answer missing/blank

+ Add Rubric Item | Create Group | Import...

SUBMISSION SPECIFIC ADJUSTMENTS

Point Adjustment 0

Provide comments specific to this submission

APPLY PREVIOUSLY USED COMMENTS

Submission: 10 of 55

Previous Ungraded | Previous | Next | Next Ungraded

Remote Labs

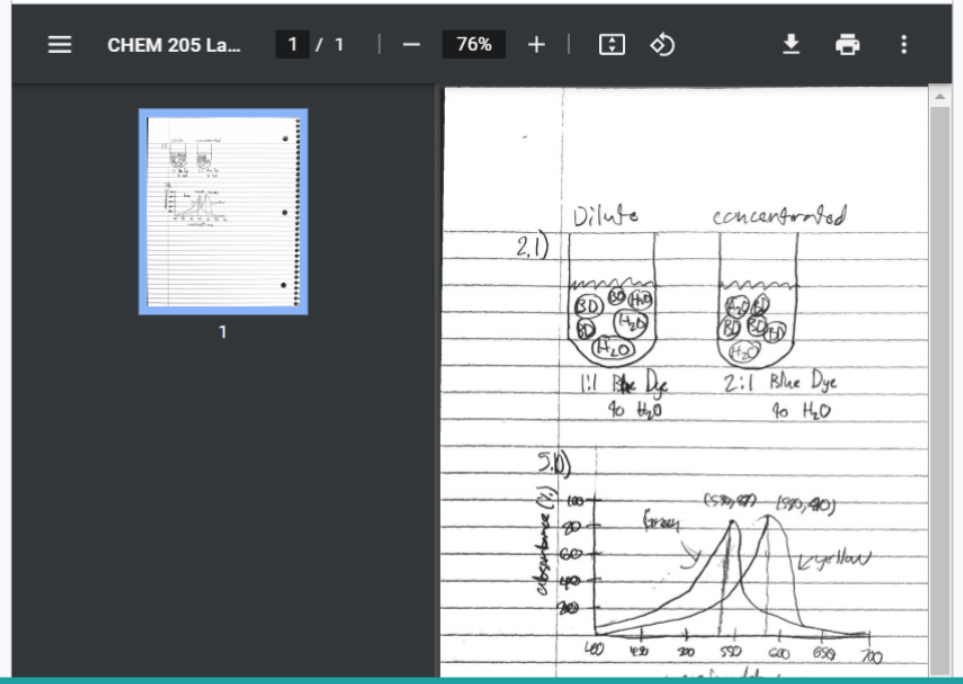
Q2.1 Molecular-Level Picture
0.5 Points

Sketch **molecular-level** pictures (pictures that imagine "zooming in" to see what is present at the scale of molecules and atoms) of two of the solutions you'll look at today – a dilute solution of blue food dye in water, and a concentrated solution of blue food dye in water.

You should sketch molecular-level illustrations of both dilute and concentrated solutions on paper (or another means, if you choose) and then upload a photo of them here.

[If you're having trouble thinking about how to begin, think about using one symbol to represent water molecules and a different symbol to represent dye molecules.]

CHEM 205 Lab 1.pdf Download



2.1: Molecular-Level Picture

61 OF 61 GRADED

TOTAL POINTS
0.5 / 0.5 pts

Rubric Settings Pop Out
Collapse View

1 -0.0
Reasonable drawings showing dye molecules and a contrast between dilute and concentrated

2 -0.25
Doesn't clearly represent both dilute and concentrated solution

3 -0.5
Answer missing/blank

+ Add Rubric Item | Create Group | Import...

SUBMISSION SPECIFIC ADJUSTMENTS
Point Adjustment 0

Provide comments specific to this submission

APPLY PREVIOUSLY USED COMMENTS

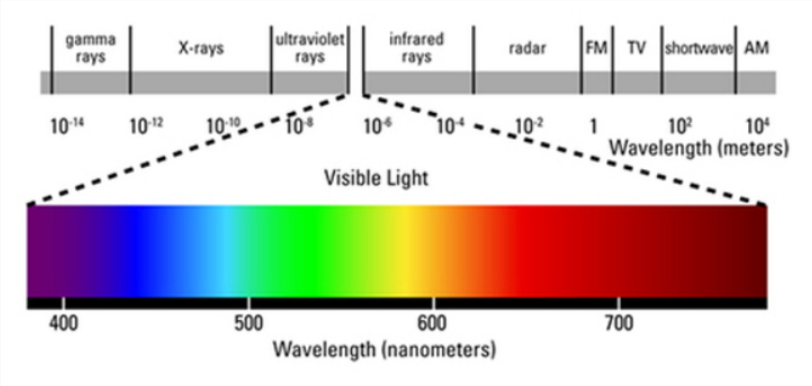
Submission: 4 of 61

Previous Ungraded | Previous | Next | Next Ungraded

Remote Labs

Q4.4
0.2 Points

In cells D3 through D31 in your spreadsheet, enter the approximate color of light for each wavelegnth, based on the diagram below. (If we were in the lab, we could stick a slip of paper into the spectrophotometer and see a dot of colored light on it.)



(Image source: https://electromagneticspectrumscience.weebly.com/visible-light.html)

What is the wavelength of maximum absorbance for each solution? (you may have more than one)

λ_{max} for concentrated blue solution (nm) =
λ_{max} for dilute blue solution (nm) =

concentrated= 630 nm
dilute= 630nm

4.4

61 OF 61 GRADED

TOTAL POINTS
0.2 / 0.2 pts

Rubric Settings | Pop Out | Collapse View

1 -0.0
Lambda-max reported for both solutions, around 630 nm

2 -0.05
Reports incorrect lambda-max (for blue solutions, this should be around 630 nm)

3 -0.2
Answer missing/blank

+ Add Rubric Item | Create Group | Import...

SUBMISSION SPECIFIC ADJUSTMENTS
Point Adjustment 0

Provide comments specific to this submission

APPLY PREVIOUSLY USED COMMENTS

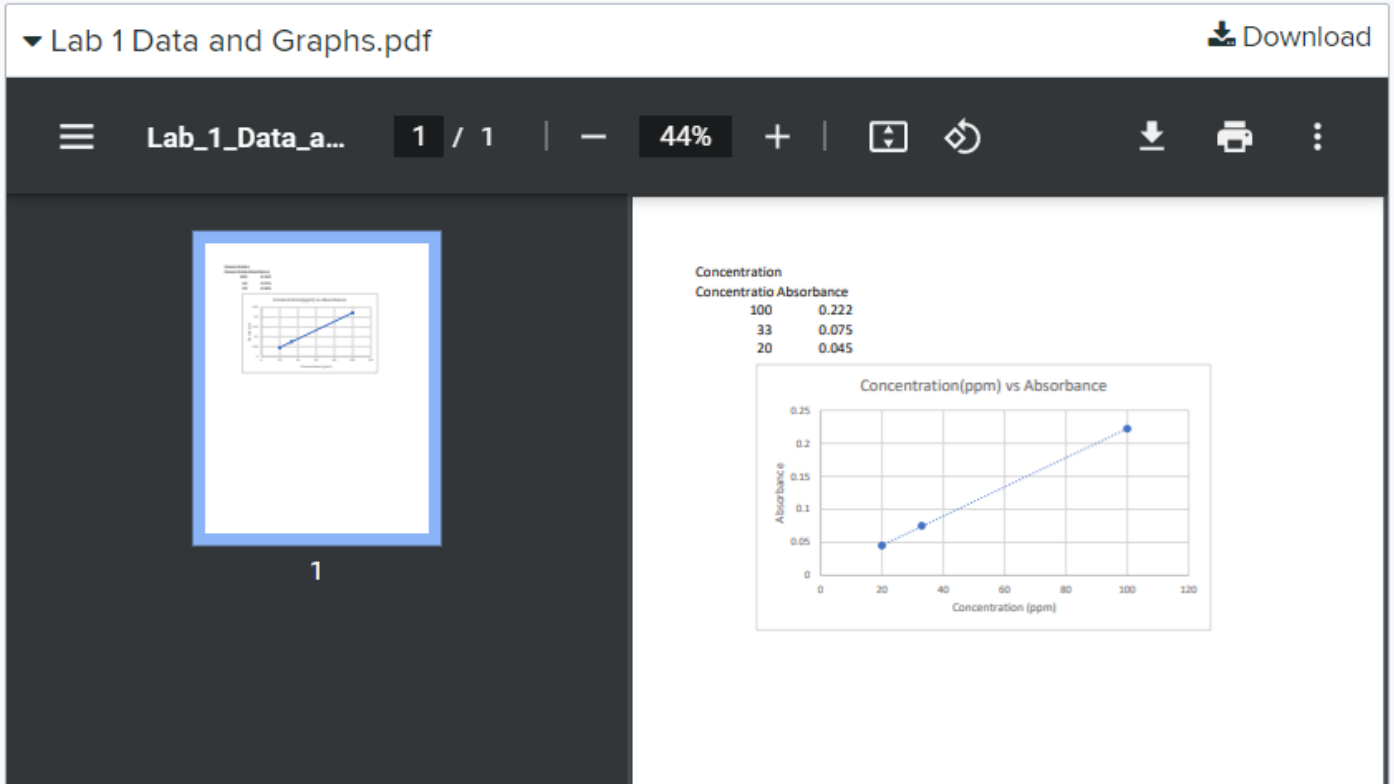
Remote Labs

Q6.5

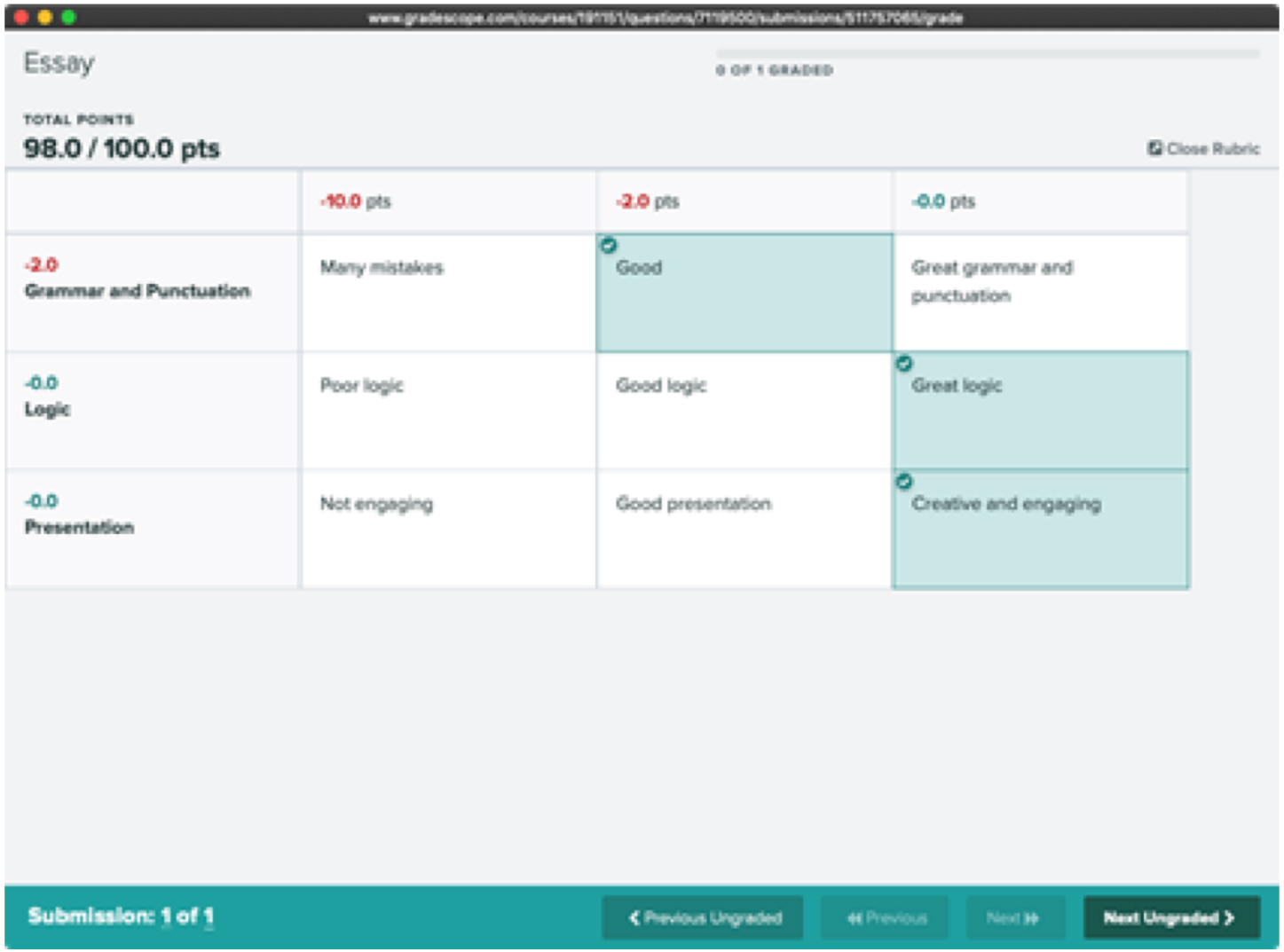
0.5 Points

Attach a copy of your graph (You can export from Excel as a PDF, see https://www.investintech.com/resources/blog/archives/8125-how-to-excel-chart-to-pdf.html , or take a clear screenshot or picture and upload that).

Be sure your graph is properly labelled and titled.



Next term: Matrix-style rubrics for formal lab writeups. (currently in beta)



Thanks:

Oregon Tech Winter 2021 CHE202 students (work shared with permission)

Oregon Tech Chemistry Colleagues:
Addie Clark, Travis Lund, Christy VanRooyen (+ we're hiring!)

Questions:

Email: Seth.Anthony@oit.edu

(I am happy to share resources!)

Join me in the Extended Q&A room to continue our conversation!