Science-1A Lecture: Week-15, Monday, November 15, 2021

Preparation for Quiz 7 which will be passed out next week.

I had numbering errors for the questions in Quiz 7 which I have now fixed on the web site but are incorrect on pages 171-174 of the Physics Handouts. The questions are the same, just the question numering is in error. In the following, I use the corrected numbering.

The questions and solutions for the practice questions of Quiz-7 are at
https://yosemitefoothills.com/Science-1A/QuizAndTestPractice/SampleQuestions-Quiz-7.pdf
and
https://yosemitefoothills.com/Science-1A/QuizAndTestPractice/SampleQuestions-Quiz-7-Solutions.pdf

You will need to use your Periodic Table of Elements at
https://yosemitefoothills.com/Science-1A/Handouts/Week-09/PeriodicTableOfElements.jpg
for the remainder of the course. Know how to find stuff on it and in the Equation Sheet on pages 122-127 of the Physics Handouts and also at
https://yosemitefoothills.com/Science-1A/EquationAndSymbolNotes.pdf .

Below are specific references to the various sample questions for Quiz 7.

For **question 1**, recall that a **dipole moment** is formed when a molecule has one side that is positive and the opposite side negative. Water does this far more than most molecules because the oxygen grabs electrons so tightly from the hydrogen atoms. The large dipole moment of water driven by thermal agitation acts like a wrench which can pull atoms off of salt crystals and pull the charged end of soap molecules to remove grime.

For **question 2**, remember how lead is at the center of the Flint, Michigan, disaster referenced at the end of the note at
https://yosemitefoothills.com/Science-1A/OnlineLectureAndLabNotes/Week-12-Lecture-Friday-October-29-2021.pdf .
I expect that you have watched the videos linked to there.

For **question 3**, see page 3 of the Lecture notes at
https://yosemitefoothills.com/Science-1A/OnlineLectureAndLabNotes/Week-09-Lab-Wednesday-October-6-2021.pdf
for a discussion of hydrogen bonding.

For **question 4**, soap is discussed at the end of the Week 11 Lab Notes. See page 2 of
https://yosemitefoothills.com/Science-1A/OnlineLectureAndLabNotes/Week-11-Lab-Wednesday-October-20-2021.pdf
which links to
https://yosemitefoothills.com/Science-1A/Handouts/Week-10/Soap.pdf .

For **questions 5-9** which are about the definitions of dissolve, saturated solution, salinity, solubility, molarity, and electrolyte. The questions give the definitions and you must remember which words to insert. The following might help:

A small amount of salt added to water will **dissolve**, increasing the **salinity** of the solution. But as more salt is added, a limit (the **solubility** of the salt) is reached beyond which no more salt is dissolved. The solution is then a **saturated** solution.

The **molarity** of a substance added to water is the number of moles added per liter of water, mol/L.

For more, see
https://yosemitefoothills.com/Science-1A/OnlineLectureAndLabNotes/Week-14-Lab-Wednesday-November-10-2021.pdf

The discussion about electrolytes relating to **questions 10 and 11** is at
https://yosemitefoothills.com/Science-1A/OnlineLectureAndLabNotes/Week-14-Lecture-Friday-November-12-2021.pdf

Question 12 has to do with what happens to the freezing point of water when something like salt is added. Salt or other impurities added to ice tend to force the water molecules in the ice to be farther apart and therefore less able to lock together. This causes the ice to melt and absorb heat cooling the salted ice/water mix to as low as 7 ^{o}C below freezing.

Before freezer technology was available, ice cream was made by adding salt to ice which made it get colder as the salt dissolved into the ice. In freezing weather, especially in the mountains or in the Midwest or New England states, trucks spread salt on the roads to lower the freezing point of the ice. This, by the way, also causes cars to rust more quickly.

Question 13 is about adding sugar to water which raises its boiling point. The animation about evaporation at *https://yosemitefoothills.com/Science-1A/Handouts/Week-04/EvaporationIntoVacuum-40K.gif* shows that vapor pressure is determined by a balance between the number of atoms or molecules kicked out of the liquid by thermal agitation and the number returning. The added heavy sugar molecules move more slowly in the heated water and obstruct the ejection of water molecules into the vapor. As a result, a higher temperature will be necessary to get a matching number kicked into the vapor. Boiling happens when the vapor pressure matches the atmospheric pressure, so the boiling must then happen at a higher temperature. In short, the boiling point will be raised by adding sugar.

For **questions 14-15 and 20-25**, see the notes about acids, bases, and pH at *https://yosemitefoothills.com/Science-1A/OnlineLectureAndLabNotes/Week-14-Lab-Wednesday-November-10-2021.pdf* . That note gives you a link to a more detailed explanation at *https://yosemitefoothills.com/Science-1A/Handouts/Week-12/WaterAndSolutions.pdf* Consider $[H_3O^+]$ the same as $[H^+]$ since within about 10^{-12} s or so after an $[H^+]$ is formed, it bumps into a water molecule and the reaction $H^+(aq) + H_2O(l) \Rightarrow H_3O^+(aq)$ happens.

Question 16 is a statement of the general definition of a salt. Just remember it.

Questions 17-19 are really quite easy. They are acid-base reactions where the hydrogen ions move from one negative ion to another. It is musical chairs for parts of molecules. The first one is really simple – the hydrogen of HCl changes places with the Na of NaOH so that the result is NaCl and HOH (the same as H_2O).

The next two require identifying the negative polyatomic ions, but the hint tells you what they are. Still, you must make sure that the charges match. SO_4^{--} has a charge of -2, so it requires 2 H^+ ions or 2 Na^+ ions. That is why it was necessary to write 2NaOH and to show that $2H_2O$ are produced.

Acetic acid CH_3COOH has its CH_3COO^- polyatomic ion acting as a unit. It is swapped with the OH^- in NaOH to produce sodium acetate CH_3COONa and H_2O.

Questions 20-25 were covered higher in this page, particularly at the link *https://yosemitefoothills.com/Science-1A/Handouts/Week-12/WaterAndSolutions.pdf* .