Welcome to the UT Austin Chem Lab test! The test is subdivided into 5 problems in no particular order of difficulty, with 50 minutes to finish as usual. You can use a calculator, pen/pencil, blank scratch paper, and one page of notes per person. Ties will be broken using the following ordered list of questions: 53, 52, 51, 43, 30, 55, 57, 10, 31, 12, 54, 50, 48, 47, 44, 42, 41, 29, 27, 26, 25, 24, 23, 21, 17, 16, 3. Time won't be used as a tiebreaker, so please take as long as you need. In the unlikely event that there is still a tie, the remainder of questions back to front will be used as the tie-breaking order.

Question 1: The Chemistry of Coca-Cola

Like many soft drinks, Coca-Cola contains carbonated water, which is created by dissolving carbon dioxide gas in water. Dissolved carbon dioxide reacts to form carbonic acid via the following reaction:

CO_2 (aq) + H_2O (l) → H_2CO_3 (aq)   K = $1.7 * 10^{-3}$ at 298 K

1. (2.00 pts) Which of the following best describes the role of H_2O in the reaction above?

- A) Brønsted-Lowry acid
- B) Brønsted-Lowry base
- C) Lewis acid
- D) Lewis base

2. (3.00 pts)
The amount of carbon dioxide dissolved in carbonated water depends on its partial pressure above the liquid. If a sample of pure water is placed in a large container with a pressure of 3.0 atm which is 50.0% carbon dioxide by volume, what will be the concentration of carbon dioxide in the water at equilibrium? The K_h of carbon dioxide at this temperature is $3.34 * 10^{-2}$ mol/(L*atm).

- A) 0.10 M
- B) 0.050 M
- C) 0.017 M
- D) 0.033 M
- E) None of the above

3. (3.00 pts)
In most bottled soft drinks, the concentration of dissolved carbon dioxide at equilibrium is around 0.090 M. Based on this information and assuming the second deprotonation of carbonic acid is negligible, what is the pH of a drink like Coca-Cola? The $K_{a,1}$ of H_2CO_3 is $2.5 * 10^{-4}$.

- A) 1.92
- B) 2.32
- C) 3.71
- D) 8.82
- E) 4.65
- F) None of the above

When carbonated water is produced on an industrial scale, manufacturers try to maximize the amount of carbon dioxide that dissolves in the water. For each of the following changes to the scenario above, predict whether the change will cause the concentration of dissolved carbon dioxide to increase, decrease or stay the same:

4. (1.00 pts) Increasing the percentage of gaseous carbon dioxide in the container to 75.0% while keeping the pressure constant

- A) Increase
- B) Decrease
- C) No change

5. (1.00 pts) Opening the container to the atmosphere at Earth's surface, where the partial pressure of carbon dioxide is about 0.0042 atm

- A) Increase
- B) Decrease
- C) No change

6. (1.00 pts) Adding argon gas to the container while keeping the pressure constant (thereby increasing the volume)

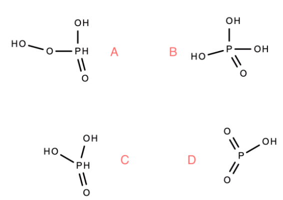
- A) Increase
- B) Decrease
- C) No change

7. (1.00 pts) Adding argon gas to the container while keeping the volume constant (thereby increasing the pressure)

- A) Increase
- B) Decrease
- C) No change

Of course, Coca-Cola would not be such a popular drink if its only ingredient were carbonated water! Eventually, the water is combined with a special (and very secret) syrup to create the finished product. While we don't know the exact formulation of the syrup, we do know that phosphoric acid is used to give the soda a tangy and sour taste.

8. (1.00 pts) Which of the following is the structure of phosphoric acid?



- A) A
- B) B
- C) C
- D) D

9. (2.00 pts)
The concentration of phosphoric acid in Coca-Cola can be determined by titration with NaOH. However, several modifications need to be made for the titration to work. For example, the sample of soda needs to be heated before titration. Why is this?

- A) To fully dissolve all of the phosphoric acid in the sample
- B) To convert all of the phosphoric acid to its fully protonated form
- C) To remove carbon dioxide which could interfere with the titration
- D) To make the reaction between phosphoric acid and NaOH faster and prevent overshooting the endpoint
- E) It tastes better warm
- F) None of the above

10. (2.00 pts)
Which of the following methods would be best to detect the second equivalence point of the titration, assuming we're titrating unaltered (besides the heating) Coca-Cola?

Data for phosphoric acid: $pK_{a,1} = 2.15$, $pK_{a,2} = 7.20$, $pK_{a,3} = 12.35$

- A) Using thymol blue as an indicator (pK = 1.7)
- B) Using bromocresol green as an indicator (pK = 4.7)
- C) Using bromothymol blue as an indicator (pK = 7.1)
- D) Using phenolphthalein as an indicator (pK = 9.4)
- E) None of these indicators would work well; another indicator should be used
- F) None of these indicators would work well; another method (e.g. pH electrode) should be used

11. (3.00 pts)
Let's say you want to carry out this titration; you fill a buret with 0.20 M NaOH and titrate a 150. mL sample of Coca-Cola to the second equivalence point. The initial reading on the buret is 21.70 mL and the final reading is 44.20 mL. What is the concentration of phosphoric acid in the sample?

- A) 0.012 M
- B) 0.015 M
- C) 0.029 M
- D) 0.030 M
- E) None of the above

During the titration, what would the pH of the solution be when the following volumes of NaOH are added to the original Coca-Cola sample?

12. (2.00 pts) 0 mL

- A) 1.86
- B) 1.99
- C) 2.13
- D) 2.44

13. (2.00 pts) 11.25 mL

- A) 2.2
- B) 3.6
- C) 4.7
- D) 7.2
- E) None of the above

14. (2.00 pts) 16.88 mL

- A) 4.7
- B) 7.2
- C) 9.8
- D) 12.4
- E) None of the above

15. (2.00 pts) 20.25 mL

- A) 7.2
- B) 7.8
- C) 9.8

D) 10.2

E) None of the above

16. (3.00 pts)
Lets say you want to repeat this titration with an identical sample. You re-fill the buret and begin the titration, but fall asleep with the stopcock slightly open. You later wate up and close the stopcock, but unfortunately it's too late as you've already overshot the second equivalence point. You measure the pH of the sample to be 11.40. By how much did you overshoot?

A) 0.6 mL

B) 1.1 mL

C) 1.7 mL

D) 2.2 mL

E) None of the above

17. (2.00 pts)
Another crucial ingredient in the syrup is sugar; most producers now use high-fructose corn syrup but a handful still use sucrose ($C_{12}H_{22}O_{11}$). According to one source, the drink contains about 11.0% sucrose by mass. What is the molar concentration of sucrose in Coca-Cola? Assume its density is 1.05 g/mL.

A) 0.294 M

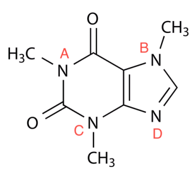
B) 0.321 M

C) 0.337 M

D) 0.382 M

E) None of the above

18. (2.00 pts) Caffeine, a weak base, is also an important part of the syrup. The structure of caffeine is shown below; which nitrogen is most basic?



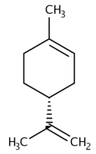
A) A

B) B

C) C

D) D

19. (2.00 pts)
The rest of the recipe is not well-known, but one suspected ingredient is orange oil, which consists primarily of D-limonene (structure shown below). Which of the following solvents would be the best choice to remove D-limonene from Coca-Cola using solvent extraction?



A) Benzene

B) Acetone

C) Dimethyl sulfoxide

D) Methanol

Question 2: Solubility and Water Softening

Water softening, which involves removing Ca^{2+} and Mg^{2+} from water, is part of the wastewater treatment process and is very important to prevent the buildup of precipitates in plumbing. One interesting method uses Na_2CO_3 to precipitate the two metals as their carbonates, which are both quite insoluble (K = 8.7 * 10^{-9} for $CaCO_3$ and 1.0 * 10^{-5} for $MgCO_3$ at 298 K).

20. (3.00 pts) Here's a warmup question: which of the following compounds are soluble (to >40 g/L) in water?

(Mark **ALL** correct answers)

- [ ] A) NH_4Cl
- [ ] B) $PbSO_4$
- [ ] C) $Ba(OH)_2$
- [ ] D) Hg_2Cl_2
- [ ] E) AgF
- [ ] F) LiOH

21. (3.00 pts) What's the solubility of $CaCO_3$ in a solution buffered to pH = 12? You can neglect the precipitation of compounds other than $CaCO_3$ (e.g. $Ca(OH)_2$).

- A) $9.3 * 10^{-5}$ g/L
- B) $9.3 * 10^{-3}$ g/L
- C) $4.2 * 10^{-3}$ g/L
- D) $5.1 * 10^{-4}$ g/L
- E) None of the above

22. (3.00 pts) In the previous example, which of the following would increase the solubility of $CaCO_3$ at equilibrium?

(Mark **ALL** correct answers)

- [ ] A) Increasing the pH of the solution
- [ ] B) Decreasing the pH of the solution
- [ ] C) Cooling the solution (ΔH_{sol} = -13.1 kJ/mol for $CaCO_3$)
- [ ] D) Stirring the solution

23. (3.00 pts)
On the other hand, we can also decrease the solubility of $CaCO_3$ if we have the right ions in the solution. What's the solubility of $CaCO_3$ in 0.5 M Na_2CO_3? You can neglect the precipitation of compounds other than $CaCO_3$ (e.g. $Ca(OH)_2$).

- A) $2.1 * 10^{-5}$ g/L
- B) $8.7 * 10^{-6}$ g/L
- C) $1.7 * 10^{-6}$ g/L
- D) $6.0 * 10^{-7}$ g/L
- E) None of the above

Let's say you want to "soften" a sample of water in the lab by adding solid Na_2CO_3. The original 100. mL sample contains 0.030 M Ca^{2+} and 0.010 M Mg^{2+}. You can assume that the volume of the sample doesn't change as the solid is added.

24. (2.00 pts) What is $[CO_3^{2-}]$ when calcium precipitation begins?

- A) $9.3 * 10^{-5}$ M
- B) $4.8 * 10^{-6}$ M
- C) $2.9 * 10^{-7}$ M
- D) $9.1 * 10^{-7}$ M
- E) None of the above

25. (2.00 pts) What is $[CO_3^{2-}]$ when magnesium precipitation begins?

- A) $3.2 * 10^{-3}$ M

B) $5.4 * 10^{-4}$ M

C) $1.0 * 10^{-3}$ M

D) $6.4 * 10^{-4}$ M

E) None of the above

26. (2.00 pts) What is $[Ca^{2+}]$ when magnesium precipitation begins?

A) $8.7 * 10^{-6}$ M

B) $3.0 * 10^{-2}$ M

C) $4.2 * 10^{-6}$ M

D) $3.3 * 10^{-5}$ M

E) None of the above

27. (2.00 pts)
If the original sample (without ever adding any Na_2CO_3) is combined with 250. mL of a solution of 0.040 M Ca^{2+} and 0.030 M Mg^{2+}, what will be the final concentrations of Ca^{2+} and Mg^{2+}, respectively?

A) 0.037 M and 0.019 M

B) 0.033 M and 0.019 M

C) 0.037 M and 0.024 M

D) 0.033 M and 0.024 M

E) None of the above

Some salts can be made more soluble in water using coordination complexes. For example, AgCl is usually highly insoluble in water ($K_{sp} = 1.6 * 10^{-10}$). However, it can be made more soluble by adding ammonia, which reacts with silver ions via the following reaction:

$Ag+ (aq) + 2NH_3 (aq) \rightarrow Ag(NH_3)_2^+ (aq)$ $K = 1.6 * 10^7$

28. (2.00 pts) Which terms best describe the role of the silver cation in the reaction above?

A) Electron acceptor; Lewis acid

B) Electron donor; Lewis acid

C) Electron acceptor; Lewis base

D) Electron donor; Lewis base

29. (2.00 pts) If $[Ag^+] = 1.5 * 10^{-7}$ M in a solution, what is the concentration of silver in parts-per notation?

A) 16 ppm

B) 23 ppm

C) 16 ppb

D) 23 ppb

E) None of the above

30. (2.00 pts) If 1 g of both AgCl and CuCl ($K_{sp} = 1.0 * 10^{-6}$) are added to 100. mL of water, what will $[Ag^+]$ and $[Cu^+]$ be at equilibrium, respectively?

A) $1.6 * 10^{-7}$ M and $1.0 * 10^{-3}$ M

B) $1.6 * 10^{-7}$ M and $8.2 * 10^{-4}$ M

C) $1.3 * 10^{-5}$ M and $1.0 * 10^{-3}$ M

D) $1.3 * 10^{-5}$ M and $8.2 * 10^{-4}$ M

E) None of the above

31. (2.00 pts) What is the solubility of AgCl in 0.020 M ammonia?

- A) $7.2 * 10^{-3}$ M
- B) $9.2 * 10^{-4}$ M
- C) $9.8 * 10^{-4}$ M
- D) $5.6 * 10^{-3}$ M
- E) None of the above

32. (1.00 pts) Will be value above increase, decrease or stay the same after a few drops of concentrated HCl are added to the solution?

- A) Increase
- B) Decrease
- C) Stay the same

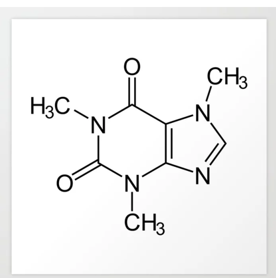
33. (1.00 pts) Ammonia has many uses besides making silver compounds more soluble in water. Which of the following are some examples?

(Mark **ALL** correct answers)

- A) As a precursor to phenol
- B) As a saponification reagent
- C) As an etchant in microfabrication
- D) As a fertilizer

Question 3: Decaffeination of Coffee

One of the major ingredients in coffee is caffeine and maybe the reason many of you drank coffee after staying up all night studying for this exam. Below is a caffeine molecule:



However, there are times when one does not want to drink coffee with caffeine. Therefore, there are many methods to decaffeinate coffee. This question will explore the topic of decaffeination of coffee.

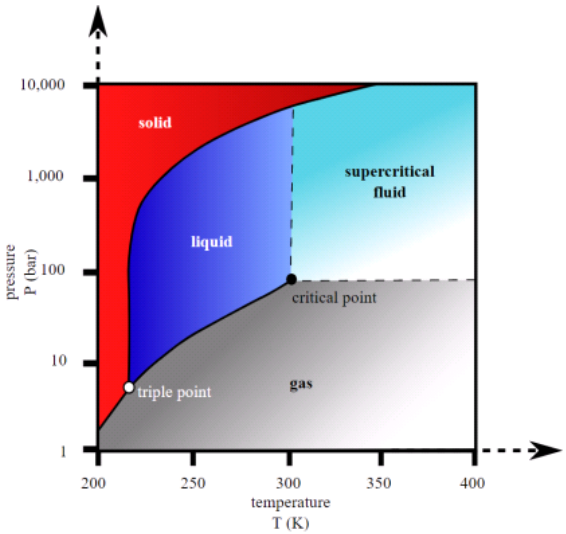
34. (2.00 pts)
One method of decaffeinating coffee is the Swiss Water Process. First, a fresh batch of coffee beans are soaked in very hot water to extract all the caffeine, oils, and flavorful molecules. The caffeine is then selectively removed from the hot water and the same hot water is used with a fresh batch of coffee beans. Which of the following reasons explain why new water is not used for subsequent batches?

- A)
Since we only care about extracting caffeine from the coffee beans, the process will work as long as there is no caffeine in the water/solution. Oils and other flavorful molecules will still be extracted the same even if we continue using the older solution.
- B)
Since the water already has all the caffeine, oils, and flavorful molecules, the solution is already saturated with respect to these molecules and there won't be a huge loss of oils/flavors in subsequent batches. However, caffeine will still be extacted and dissolve in the water.
- C) Caffeine will always transfer faster to the old water with oils and other favorful molecules as compared to new water.
- D)
The Swiss Water process should actually be using fresh water every time as caffeine won't be extracted from the beans if water with oils and other flavorful molecules is used.
- E) None of the above responses are correct

35. (1.00 pts) Which of the following molecules should be used to selectively remove the caffeine from the hot water and to form a distinct layer with water.

- A) Dichloromethane (CH2Cl2)
- B) Water (H2O)
- C) Ethanol (CH3CH2OH)

Another method of decaffeinating coffee includes using carbon dioxide at over 300 bar. Below is a phase diagram of carbon dioxide.



36. (2.00 pts) Which of the following is true about carbon dioxide at 300 bar and 100 degrees Celsius?

- A) It is only a solid.
- B) It is only a liquid
- C) It is only a gas
- D) Distinct liquid and gas phases do not exist
- E) None of the above are true

37. (1.00 pts) The point at which the density of liquid and the density of vapor are equal is referred to as what?

- A) Critical Point
- B) Isodensity Point
- C) Triple point
- D) Isobaric point
- E) Such a point can never exist
- F) None of the above

38. (1.00 pts) What is the point at which liquid, solid, and gas phases co-exist?

- A) Co-existance Point
- B) Critical Point
- C) Triple Point
- D) Such a point can never exist
- E) None of the above

39. (1.00 pts) It will be possible to extract 100% of the caffeine from the coffee beans if the correct method is used.

- True
- False

40. (1.00 pts) Instead of only using supercritical CO_2, a certain company uses ethanol as a co-solvent. Will this increase, decrease, or keep caffeine solubility the same?

- A) Increase
- B) Decrease
- C) Stay the same

If a solution is placed in a seperatory funnel and shaken with an immiscible solvent, the solute will partly dissolve in both layers. We can calculate an extraction coefficient K as the ratio of the concentration of the solute in each layer.

K = (molarity in other phase)/(molarity in aqueous phase) = (solubility in organic phase/ solubility in aqueous phase)

Solve the following problems given that at 25 degrees Celsius, 1 gram of caffeine dissolves in 45 mL of water, 530 mL of Diethyl Ether, 100 mL of Benzene, and 5.5 mL of chloroform.

41. (2.00 pts) What will the K - value be if water is dissolved in Diethyl Ether?

Give your answer to 3 decimal places in the following format:

X.XXX so if your answer is .5, it should be written as 0.500

Answers not in that format won't receive any credit.

42. (3.00 pts) If the extraction coefficient for another new substance is 6.0, how many grams of caffeine will dissolve in 100. mL of this substance?

Give your answer in grams to 2 decimal places in the following format:

XX.XX, so if your answer is 2g, the answer would be 02.00

43. (4.00 pts)
In order to solve this problem, think of K as a solubility constant. If 1 gram of caffeine in 100 mL of water is to be extracted into 150 mL of chloroform, how many grams of caffeine would remain in the water?

- A) 0.926 grams
- B) 0.073 grams
- C) 0.893 grams
- D) 0.107 grams
- E) 0.400 grams
- F) None of the above are correct

44. (2.00 pts) How many grams of caffeine will dissolve in 100 mL of water.

Give your answer in grams to 2 decimal places in the following format:

XX.XX, so if your answer is 2g, the answer would be 02.00

Question 4: Mystery Powder Dry Lab

The chemist John Teller is trying to determine the composition of a mystery powder that he found. Based on previous tests, he knows that the only three components are NaCl, $NaHCO_3$ and Na_2CO_3. Being a highly intelligent chemist, John knows that he can use just a single titration to figure out the exact composition of the powder.

45. (1.00 pts) John previously ran a flame test to confirm the presence of sodium in the sample. Which color did he see?

- A) Yellow
- B) Red
- C) Purple
- D) Green
- E) Light blue

46. (2.00 pts) John wants to use HCl as a titrant and needs to use a strong acid. In addition to HCl, which of the following acids could he use?

(Mark **ALL** correct answers)

- A) HF
- B) HBr
- C) HI
- D) HNO_3
- E) $HClO_2$
- F) $HClO_4$

47. (2.00 pts)
Before using our HCl, John needs to standardize it using a primary standard. If it takes 40.44 mL of HCl solution to fully neutralize 0.30 g of pure Na_2CO_3, what is the concentration of the HCl titrant?

- A) 0.07 M
- B) 0.14 M
- C) 0.28 M
- D) 0.56 M
- E) None of the above

48. (2.00 pts)
John now adds 1.00 g of the mixture to 50 mL of water in an Erlenmeyer flask and plans to titrate with the now-standardized HCl. During the titration there will be two equivalence points. Given that for HCO_3^-, pK_a = 10.3 and pK_b = 7.7, which two indicators should be used?

(Mark **ALL** correct answers)

- A) Alizarin (pH range of color change: 11.0 - 12.4)
- B) Phenolphthalein (pH range of color change: 8.2 - 10.0)
- C) Bromothymol blue (pH range of color change: 6.0 - 7.6)
- D) Bromocresol green (pH range of color change: 3.8 - 5.4)

John proceeds with the titration using the correct indicators from the previous question. He needs 10.06 mL titrant to reach the first equivalence point, and an **additional** 18.40 mL titrant to reach the second equivalence point. Since the autograded questions don't allow error carried forward, please **use 0.30 M as the HCl concentration in the following questions regardless of what you got for the standardization question.**

49. (1.00 pts) At the first equivalence point, which of the following ions has the highest concentration in the solution?

- A) H_3O^+
- B) OH^-
- C) HCO_3^-
- D) CO_3^{2-}

50. (2.00 pts) What is the percentage by mass of Na_2CO_3 in John Teller's mystery powder? Remember that the powder contains only NaCl, $NaHCO_3$ and Na_2CO_3.

- A) 8%
- B) 16%

C) 32%

D) 64%

E) None of the above

51. (2.00 pts) What is the percentage by mass of $NaHCO_3$ in John Teller's mystery powder?

A) 10%

B) 21%

C) 42%

D) 84%

52. (3.00 pts)
Unfortunately John is not as clever as he thought, and made a mistake during his titration. When reading the initial (before the titration) volume on the buret, he had his eyes well above the level of the meniscus and read it at an angle. Is your answer to the previous question (assuming it was correct) an overestimate or underestimate of the true mass percentage of $NaHCO_3$ in the powder?

A) Overestimate

B) Underestimate

C) Neither

If the mixture contained only $NaHCO_3$ and Na_2CO_3, John wouldn't need to do a titration at all! Consider a 1.00 g sample of a mixture containing only $NaHCO_3$ and Na_2CO_3. The mixture is heated from room temperature to 400 K, cooled back to room temperature and re-weighed giving a mass of 0.75 g.

53. (1.00 pts) In the example above, which gases are released in significant quantities from the mixture?

(Mark **ALL** correct answers)

A) H_2

B) CO

C) CO_2

D) H_2O

E) O_2

54. (2.00 pts) If the 0.75 g sample is heated again, this time to 1300 K, and cooled back to room temperature, what would its new mass be?

A) 0.22 g

B) 0.31 g

C) 0.44 g

D) 0.51 g

E) None of the above

55. (2.00 pts) What is the mass percentage of $NaHCO_3$ in the original mixture?

A) 17%

B) 42%

C) 34%

D) 68%

56. (2.00 pts)
Let's say we made a mistake when we measured out the original 1.00 g sample of the mixture; we accidentally spilled some extra mixture from our spatula onto the balance which was included in the 1.00 g measurement, but never actually heated and reweighed. In this case, was the answer you gave to the last question (assuming you were right) an overestimate or underestimate of the true mass percentage of $NaHCO_3$ in the mixture?

- A) Overestimate
- B) Underestimate
- C) Neither

Question 5: Distillation of Water and Ethanol

As the long range price of oil and energy continue to increase, ethyl alcohol as a liquid fuel will be a viable alternative fuel source (especially for internal combustion spark ignition engines). However, when making ethyl alcohol, after the fermentation process, only a small percentage of alcohol will remain in the water mixture. Distillation is usually used to seperate the alcohol and water to obtain alcohol in a pure enough form to be used for fuel.

57. (1.00 pts) What is the main concept used behind distillation? Pick the concept that is most directly related to distillation, not a concept that is related to it.

- A) Melting Point
- B) Boiling Point
- C) Pressure
- D) Solubility
- E) None of the Above

58. (1.00 pts) When using the most traditional method to distill water and ethanol,

- A) Water will be seperated from the ethanol first leaving the ethanol behind
- B) Ethanol will be seperated from the water first leaving water behind
- C) Both water and ethanol will be seperated at the same time and will collect in two different containers
- D) None of the above

59. (2.00 pts) Which of the following statements are true assuming you start with a mixture of 10% ethanol by mass and used fractional distillation?

- A) Water and Ethanol will form an azeotrope at around 96% ethanol so fractional distillation can't be used to obtain a solution with more than 96% ethanol.
- B) Fractional distillation can be used to produce a solution that is very close (>99%) to pure ethanol
- C) It is impossible using any technique to produce ethanol at concentrations higher than 96%
- D) Both A and C
- E) Statements A, B, and C are false

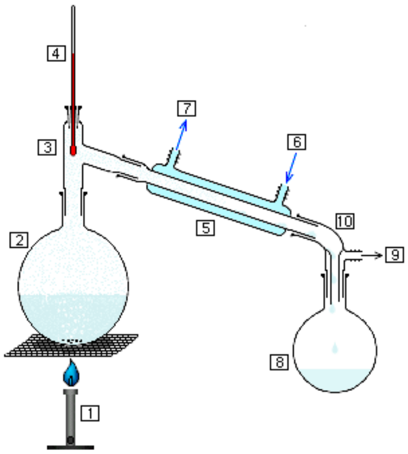
60. (2.00 pts)
The density of pure water at 25 degrees Celsius is .99704 g/mL while the density of pure ethanol at 25 degrees Celsius is .78522 g/mL. A 50/50 mixture of both of these has a density

- A) Below .78522 g/mL
- B) Above .99704 g/mL
- C) Between .78522 g/mL and .99704 g/mL
- D) None of the above

61. (1.00 pts) Does water or ethanol have a higher vapor pressure?

- A) Water
- B) Ethanol
- C) They both have the same vapor pressure

Based on what you know about distillation identify the following components on a distillation diagram. You should be able to answer the following questions with a basic understanding of distillation even if you have never seen a diagram or distillation take place in practice.



62. (1.00 pts) What is Label 1 on the diagram?

- A) Condenser
- B) Thermometer
- C) Heat Source
- D) None of the above

63. (1.00 pts) What is label 5 on the diagram?

- A) Heat source
- B) Thermometer
- C) Condenser
- D) None of the above

64. (1.00 pts) Where will the mixture of water and ethanol be located?

- A) In flask 2
- B) In flask 8
- C) None of the above

65. (2.00 pts) Which of the following can use distillation?

- A) Creation of distilled water
- B) Desalination of water
- C) Production of alcoholic drinks
- D) Purification of crude oil
- E) All of the above
- F) None of the above

We hope you enjoyed taking our test!

-Satvik and Yannik

Please fill out this survey so we can improve future tests (Open the link in a new tab and fill it out after time is complete):

https://forms.gle/xMHfECaLbKiLhEQT6 (https://forms.gle/xMHfECaLbKiLhEQT6)

Thanks!