**09 Intermolecular Forces Lab (2994004)**

Question | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |

**Description**
Question # 1 is due by the start of class.

**Instructions**
Objective: To observe the rate of temperature changes due to evaporation of six different liquids and then use intermolecular forces to explain the differences in evaporation rates.

Materials: Computer or iPad, Logger-Lite Software or Vernier Graphical Analysis app, 2 four port USB hubs, 6 temperature probes, paper towel, rubber bands, 6 tiny test tubes (10 ml), test tube rack, 1-propanol, cyclohexane, propanone (acetone), glycerol (glycerin), methanol, water.

Procedure 1(computer):

1. Examine the models of 1-propanol, cyclohexane, acetone, methanol, water, and glycerin. Predict the order of evaporation.

2. Cut a paper towel into a piece about 2 cm by 6 cm, wrap each temperature probe, and secure with a small rubber band. Turn on the computer and plug in the USB hubs. Open the program: Logger Lite. Now plug in the temperature probes in the following order (IMPORTANT): red first, blue second, green third, gold fourth, purple fifth, and brown sixth. Set these aside for a moment.

3. Add about 3 ml of 1-propanol to a tiny test tube and set it in the test tube rack near the red star. Add about 3 ml of glycerin to a tiny test tube and set it in the test tube rack near the blue star. Add about 3 ml of cyclohexane to a tiny test tube and set it in the test tube rack near the green star. Add about 3 ml of propanone to a tiny test tube and set it in the test tube rack near the gold star. Add about 3 ml of methanol to a tiny test tube and set it in the test tube rack near the purple star. Add about 3 ml of water to a tiny test tube and set it in the test tube rack near the brown star.

4. Insert the red temperature probe into the test tube containing 1-propanol, the blue temperature probe into the test tube containing glycerin, the green temperature probe into the tube containing the cyclohexane, the gold temperature probe into the test tube containing the acetone, the purple temperature probe into the test tube containing the methanol, the brown temperature probe into the test tube containing the water.

5. Click the “Collect” button. Simultaneously remove all six temperature probes, invert them and hold them so that they do not touch each other or the table (or anything else). Observe the graph displayed on the computer. Allow the data to collect for about 150 seconds, then click the “Stop” button.

6. Dispose of the 1-propanol, acetone, methanol, water, and glycerin into the sink and rinse with tap water. The cyclohexane should be place in a waste container (not in the sink).

7. List the intermolecular forces present in each substance. Count the number of electrons in each substance. Sketch the graph displayed on the computer and explain the results.

Procedure 2(iPad):

1. Examine the models of 1-propanol, cyclohexane, acetone, methanol, water, and glycerin. Predict the order of evaporation.

2. Cut a paper towel into a piece about 2 cm by 6 cm, wrap each temperature probe, and secure with a small rubber band. Open the app: Vernier Graphical Analysis. Connect the wireless temperature probes in numerical order. Set these aside for a moment.

3. Label 6 small test tubes with numbers 1-6. Add about 3 ml of 1-propanol to test tube 1 set it in the test tube rack.. Add about 3 ml of glycerin to test tube 2 and set it in the test tube rack. Add about 3 ml of cyclohexane to test tube 3 and set it in the test tube rack. Add about 3 ml of propanone (acetone) to test tube 4 and set it in the test tube. Add about 3 ml of methanol to test tube 5 and set it in the test tube rack. Add about 3 ml of water to test tube 6 and set it in the test tube rack.

4. Insert the temperature probe 1 into test tube 1. Insert the other temperature probes into the test tubes corresponding to their numbers

5. Click the “Collect” button. Simultaneously remove all six temperature probes, invert them and hold them so that they do not touch each other or the table (or anything else). Observe the graph displayed on the computer. Allow the data to collect for about 150 seconds, then click the “Stop” button.

6. Dispose of the 1-propanol, acetone, methanol, water, and glycerin into the sink and rinse with tap water. The cyclohexane should be place in a waste container (not in the sink). Remove the rubber band and paper towel from the temperature probes and dispose of them.

7. List the intermolecular forces present in each substance. Count the number of electrons in each substance. Sketch the graph displayed on the computer and explain the results.

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**1.** Question Details Objective and procedure summary [3413760]

Restate the objective in your own words using complete sentences. Summarize the steps in your procedure. (Be sure and include any safety concerns).

**2.** Question Details Intermolecular Forces rank prediction [4035728]

Using the models, predict the rank the of the following liquids in order of decreasing intermolecular forces.

*most* -

-

-

-

-

*least* -

**3.** Question Details Upload Lab Photo [3413757]

Upload a photo of the lab apparatus with your face in the photo as you perform some part of the lab. Title the image with a unique file name before you upload it.(Maybe use your initials and part of the lab title) Choose File no file selected It must be less than 5 MB in size.

**4.** Question Details Intermolecular Forces rank [2352516]

Based on the data from the lab, rank the following liquids in order of decreasing intermolecular forces.

*most* -

-

-

-

-

*least* -

**5.** Question Details Number of electrons (intermolecular forces lab) [2352518]

How many electrons are in the electron cloud for each liquid:

a. acetone

b. cyclohexane

c. glycerin

d. methanol

e. 1-propanol

f. water

**6.** Question Details Upload Lewis Structures [3740660]

Upload a photo of your notes with a drawing of the Lewis structures of each of the 6 molecules. Label each molecule. Use dashes instead of dots. Choose File no file selected It must be less than 5 MB in size.

**7.** Question Details Intermolecular forces type [2352519]

Which intermolecular forces are present in acetone:
☐ London dispersion forces ☐dipole-dipole interactions ☐hydrogen bonds

Which intermolecular forces are present in cyclohexane:
☐ London dispersion forces ☐dipole-dipole interactions ☐hydrogen bonds

Which intermolecular forces are present in glycerin:
☐ London dispersion forces ☐dipole-dipole interactions ☐hydrogen bonds

Which intermolecular forces are present in methanol:
☐ London dispersion forces ☐dipole-dipole interactions ☐hydrogen bonds

Which intermolecular forces are present in 1-propanol:
☐ London dispersion forces ☐dipole-dipole interactions ☐hydrogen bonds

Which intermolecular forces are present in water:
☐ London dispersion forces ☐dipole-dipole interactions ☐hydrogen bonds

**8.** Question Details Upload Lab Graph [3414163]

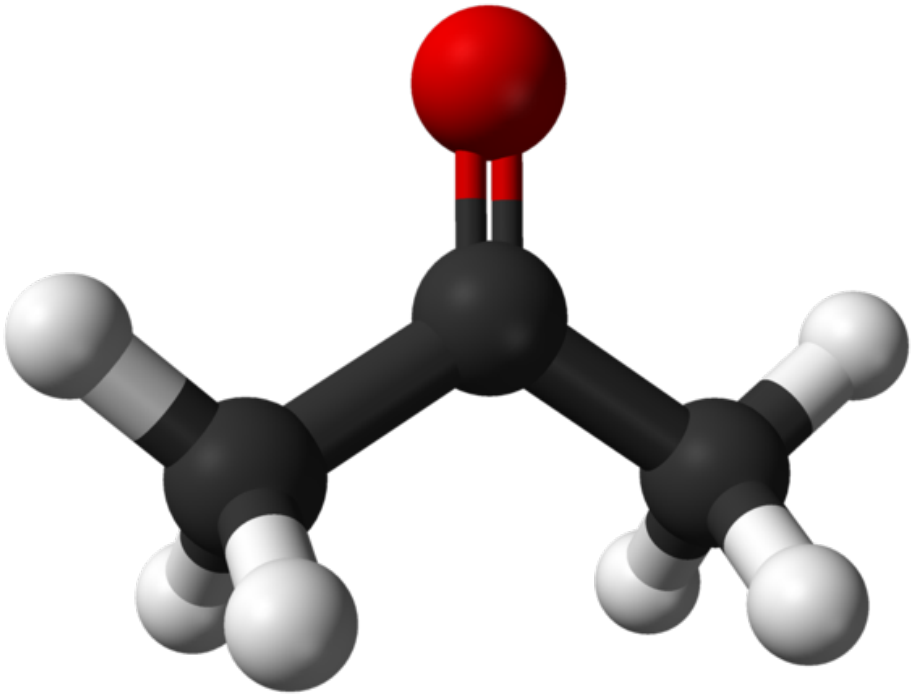
Upload a photo of the graph you created in Data Analysis or Logger Lite. Choose File no file selected It must be less than 5MB in size.

**9.** Question Details Intermolecular forces graph essay [2352570]

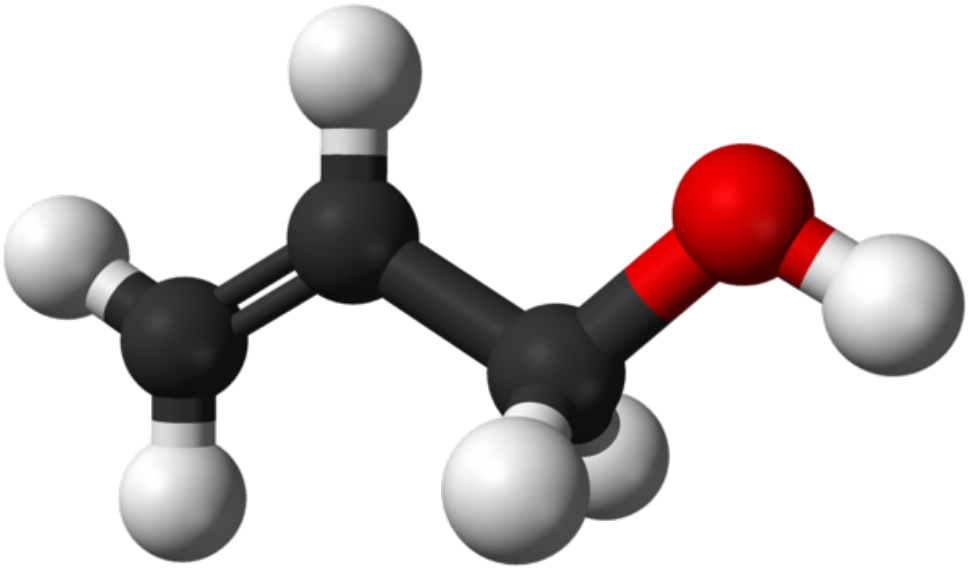
Describe the graph and explain the results.

**10.** Question Details Intermolecular Forces Lab 05 [3190301]

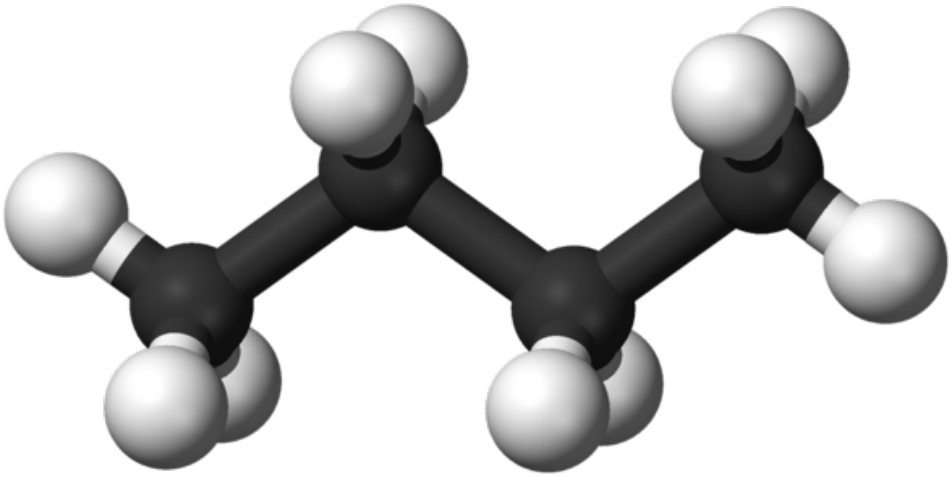
Acetone, $C_3H_6O$



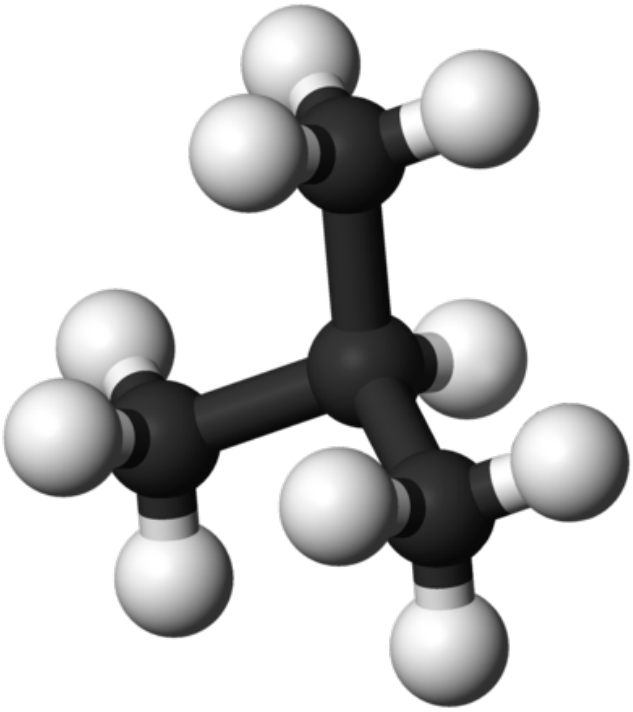
Allyl Alcohol, $C_3H_6O$



Butane, $C_4H_{10}$



Isobutane, $C_4H_{10}$



Each of the four molecules shown above has a very similar sized electron cloud (32,32,34,34 electrons).
Rank the four molecules from lowest to highest boiling points.

*lowest* -

-

-

*highest* -

Explain why each molecule's boiling point is higher or lower than the other molecules pictured. Include the intermolecular

forces at work in each molecule.

**11.** Question Details Observations, Skills utilized and learning [3413764]

What observations did you make during the lab? What chemistry concepts, laws, and/or skills were necessary to complete this lab? What did you learn or re-learn? Use complete sentences.

Assignment Details

Name (AID): **09 Intermolecular Forces Lab (2994004)**
Submissions Allowed: **5**
Category: **Homework**
Code:
Locked: **Yes**
Author: **Ryan, Matt (** mryan@allsaintsschool.org **)**
Last Saved: **Dec 2, 2017 07:02 PM CST**
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