DENSITY LAB PRACTICE TEST

Hello! Welcome to my Density Lab test. Hope it helps!

This section is the test packet which has the questions. The answer key is another PDF and there's an explanation sheet.

Instructions
There are two parts: written and hands-on, which was written to be virtual. Use SI units unless told otherwise and significant figures matter! Use 9.81 m/s for *g*.

If you have any questions or comments, need any clarifications or find any errors, you can either message me or fill out this form. There might be updates there too. Thanks!

WRITTEN PORTION (50 pts total)

MCQ (1 pt per problem, no penalties for wrong answers)

1. Which of the following molecules best follows the Kinetic Molecular Theory?
    a. CO_2
    b. NH_3
    c. H_2
    d. SO_2
    e. CCl_4

2. A student has *V* liters of an unknown gas. If its pressure is tripled and its temperature is halved, what would be the new volume?
    a. 3/2 *V*
    b. 2/3 *V*
    c. 6 *V*
    d. 1/6 *V*

3. A student is performing a lab in which he has to figure out the molar mass of diatomic oxygen experimentally. He has a 0.02500 g sample of diatomic oxygen in a 17.50 mL beaker and records the temperature of the room to be 27.0 degrees C and the pressure to be 1.000 atm. What molar mass of diatomic oxygen would be calculated using his measurements?
    a. 16.00 g/mol
    b. 32.00 g/mol
    c. 17.58 g/mol
    d. 35.17 g/mol

4. Another student is performing the same molar mass of diatomic oxygen lab. This student, however, is careless and misreads the thermometer. His measurement for temperature in C is two times that of the first student's. How much will their results differ?
    a. Student one's molar mass is exactly two times student two's
    b. Student two's molar mass is exactly two times student one's
    c. Their results will still be pretty similar and vary by less than two times
    d. Their results will vary by more than two times
    e. Not enough information to tell

5. A student is researching the populations of cities near her. She notes that Doune has 12,900 people, Camelot has 14,000 people and Anthrax has 11,300 people; Doune is two times bigger than Camelot and three times bigger than Anthrax. Rank the cities by increasing population density.
    a. Doune < Anthrax < Camelot
    b. Doune < Camelot < Anthrax
    c. Anthrax < Doune < Camelot
    d. Anthrax < Camelot < Doune

6. A student has a container with 5.00 M NaOH. He needs to get enough NaOH to react completely with his 15.00 mL of 3.00 M HCl, using the chemical equation below. At the very least, how much NaOH does he need?
   $NaOH + HCl \rightarrow H_2O + NaCl$
   a. 9.000 mL NaOH
   b. 25.00 mL NaOH
   c. 13.00 mL NaOH
   d. 17.00 mL NaOH

7. A student has a tank filled to the brim with water with a pressure meter halfway between the top and the bottom of the tank. If the diameter of the container were to be halved and the excess water taken away, how would the pressure measured by the pressure meter change? (to be more clear: diameter halved, pressure meter still halfway between top and bottom, tank still filled to the brim)
   a. The pressure is halved
   b. The pressure is doubled
   c. The pressure is quadrupled
   d. The pressure is quartered
   e. The pressure stays the same

8. A student needs a 2.50 M solution of KCl. He does this by diluting 15.0 mL of 4.00 M stock solution of KCl with more water. How much water does he need to add to end up with a 2.50 M solution of KCl?
   a. 24.0 mL
   b. 9.0 mL
   c. 39.0 mL
   d. 15.0 mL

9. A mountaineer is climbing K2. In order to be able to breathe at high altitudes, he brings with him pure O_2, which has a density of 1.43 g/L at STP. He climbs to Camp 2, where the temperature has become -10. degrees C and the pressure 0.750 atm. If the molar mass of the oxygen hasn't changed, what is its density at Camp 2?
   a. 1.11 g/L
   b. 29.2 g/L
   c. 0.556 g/L
   d. 0.899 g/L

10. A student is participating in a guess-the-number-of-items-in-a-jar contest. She thinks the height of the jar is 10 cm and the diameter is 5 cm. About how many 1 cubic centimeter beans can fit in the jar?
    a. About 150 beans
    b. About 180 beans
    c. About 210 beans
    d. About 240 beans

FRQ (pts specified next to questions)

1. Explain Boyle's Law. What does it state and why is this true? (3 pts)

2. Explain Gay-Lussac's Law. What does it state and why is this true? (3 pts)

3. Explain Charles' Law. What does it state and why is this true? (3 pts)

4. Explain the Ideal Gas Law. What are the five assumptions needed to be made in order to apply it? Under what conditions does it best apply? (7 pts)

5. A student is learning about concentration and needs to make a solution of NaCl. Her process:
   (1) She first measures out and weighs 10.0 g of NaCl using a balance.
   (2) She adds the 10.0 g to a volumetric flask.
   (3) She adds 100 mL of water and swirls the flask to dissolve the solute.
   (4) She adds water until the 500 mL mark on the flask is reached.
   Was there anything wrong with her process of making a solution? If so, name which step(s) are wrong and correct them. If not, calculate the concentration of the solution she makes. (3 pts)

6. Do gases with different densities mix? Why or why not? (3 pts)

7. A friend of yours accidentally drops his rubix cube into your 100% water pool and it sinks to a depth of 5.0 m. Considering the dimensions of a rubix cube is 4.0 cm x 4.0 cm x 4.0 cm, what is the magnitude of the buoyant force acting on it? (3 pts)

8. You drop (not throw) a toy into the bathtub filled with water. It travels 1.0 m before hitting the bottom. If the toy's volume is 40. cm^3, what is the buoyant force on the toy? (3 pts)

9. Using the same toy and bathtub from question 8, if it took 2.0 seconds for the toy to travel 1.0 m to the bottom, what is the density of the toy in g/cm^3? (The timer starts when the object is fully submerged.) (3 pts)

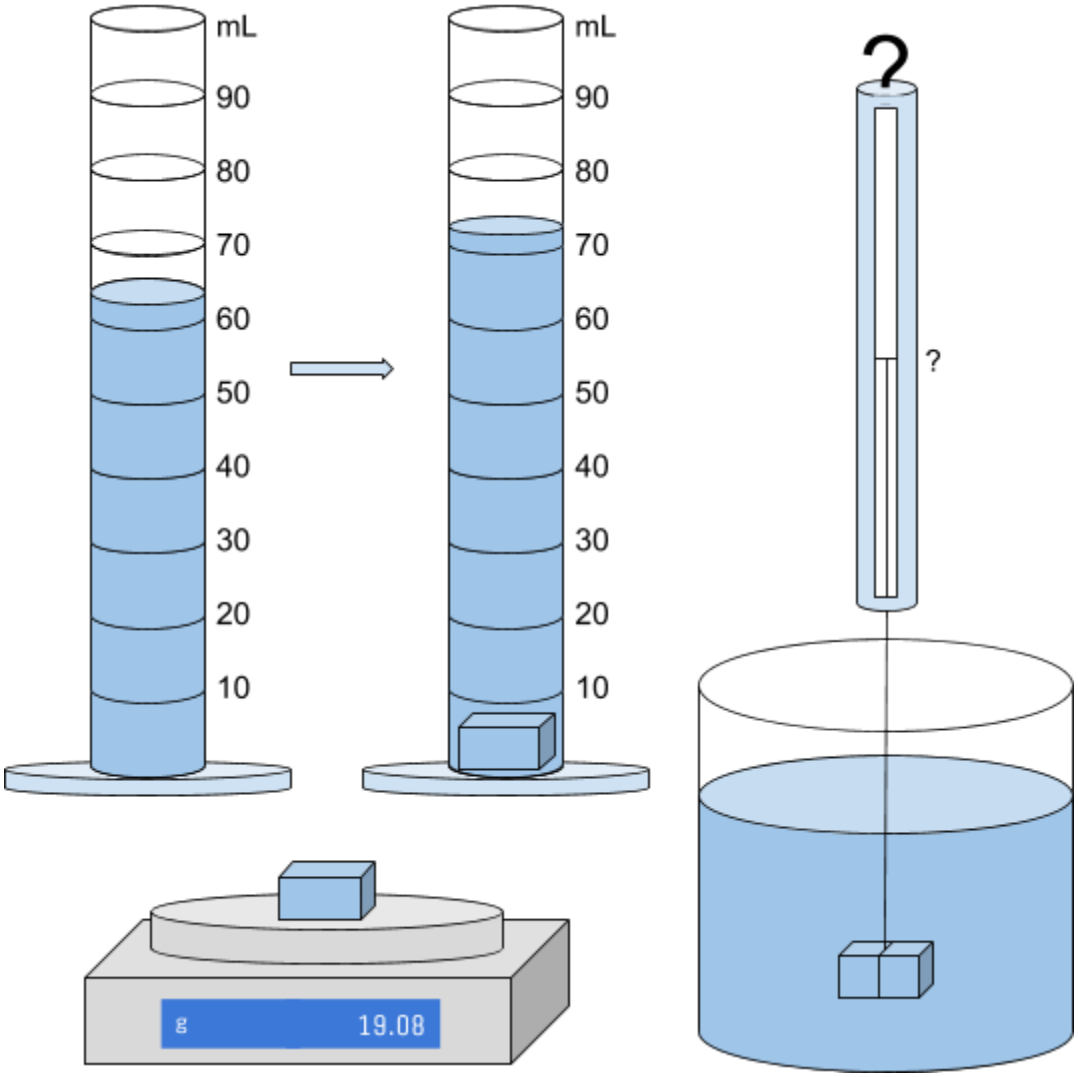
10. A student has 3.00 g of CCl_4. If the temperature of the room is 30. degrees C and the pressure is 740. torr, what is the volume of the CCl_4? (3 pts)

11. Gas 1 has a pressure of 2.0 atm and is in a 3.0 L container. Gas 2 has a pressure of 1.5 atm and is in a 2.0 L container. Gas 3 has a pressure of 4.0 atm and is in a 4.5 L container. If they are all combined and forced into an 8.0 L container, what is the resulting pressure? (3 pts)

12. A student needs to find the specific gravity of an object. He uses a balance to measure its mass to be 18.60 g. He uses a spring scale to measure its weight in water to be 0.15 N. What is its specific gravity? (3 pts)

(Kind Of) HANDS-ON PORTION

Station 1 (14 pts)
The measurements below are for Object A. The blue liquid is deionised water.



1. Calculate the density of Object A. (4 pts)

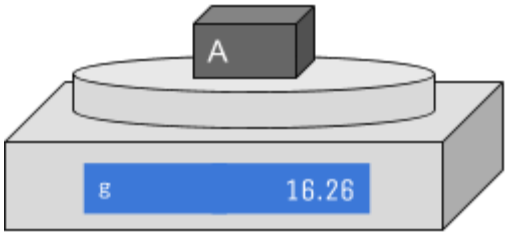
2. Calculate the specific gravity of Object A relative to water. (4 pts)

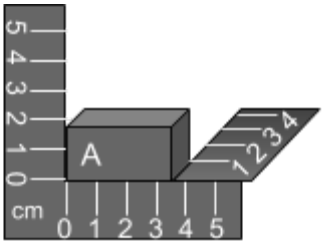
3. Calculate the weight of Object A in water, as depicted by the question mark next to the spring scale. (4 pts)

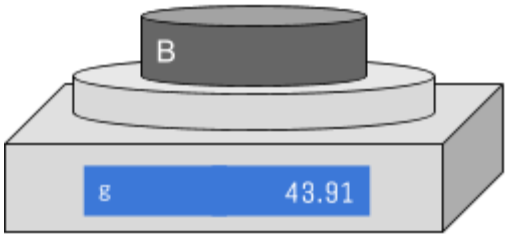
4. What is the name of the method used to find the volume of the object? (2 pt)

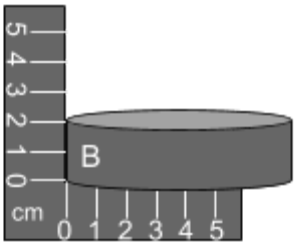
Station 2 (20 pts)

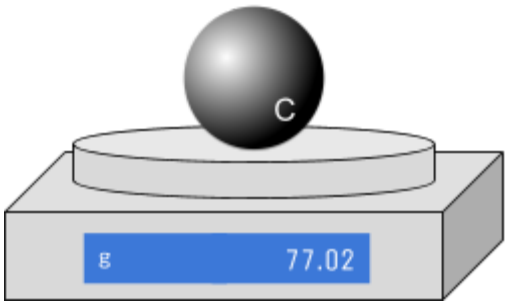
The measurements below are for Objects A, B and C as labelled.

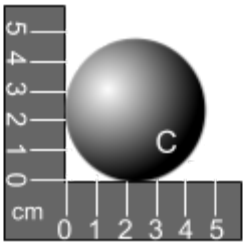






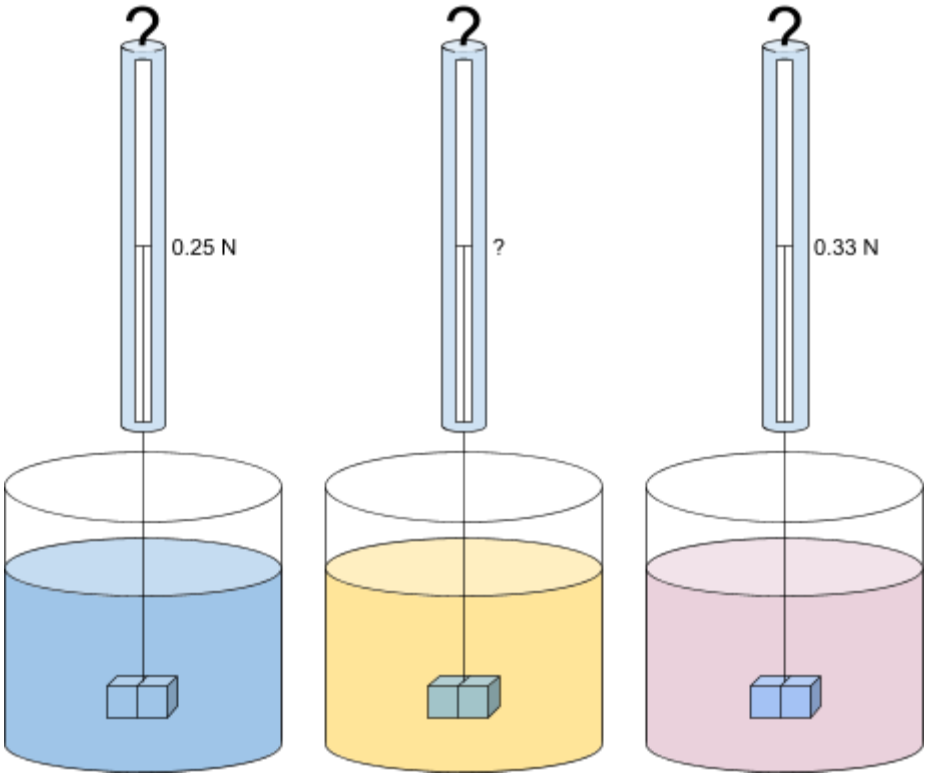






1. Find the density of Object A. (4 pts)
2. Find the density of Object B. (4 pts)
3. Find the density of Object C. (4 pts)
4. Which object(s) sink? Find the magnitude of the force of buoyancy for the object(s) that sink. (8 pts)

Station 3 (9 pts)
The measurements below are for Object A. The blue liquid is deionised water, the yellow liquid is vegetable oil (density of 0.93 g/mL) and the pink liquid is unknown.



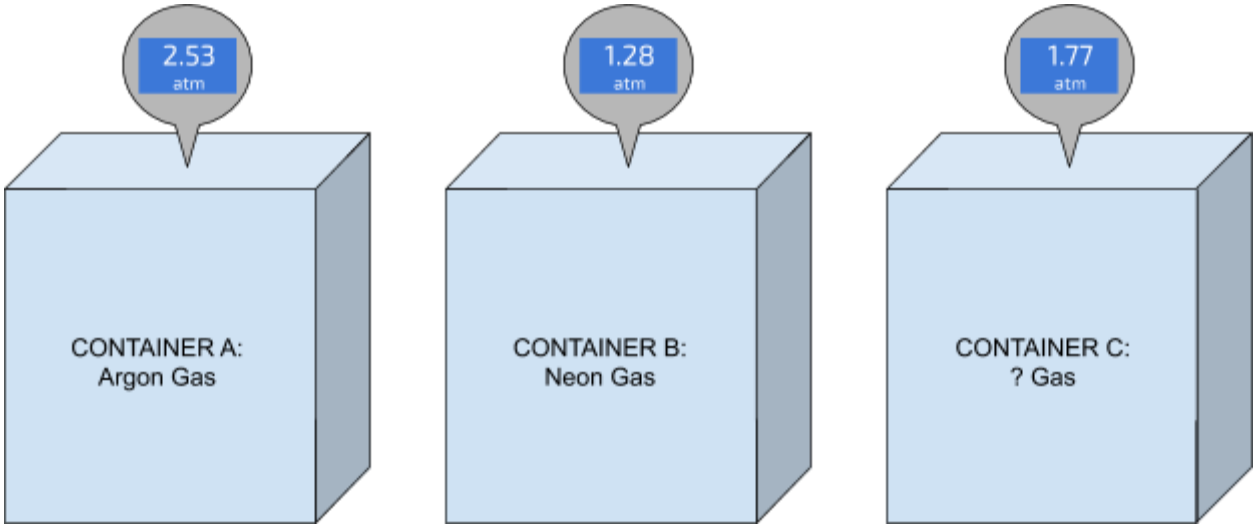
1. Calculate the weight of Object A in oil, as depicted by the question mark next to the spring scale. (4 pts)

2. Calculate the density of the unknown pink liquid. (4 pts)

3. Identify the unknown liquid based on the table below. (1 pt)

Liquid	Density (g/mL)
Honey	1.42
Pancake Syrup	1.37
Light Corn Syrup	1.33
Dish Soap	1.06
Milk	1.03
Baby Oil	0.83

Station 4 (7 pts)
The measurements below are for Argon, Neon and an unknown gas. All containers are the same size and at the same temperature.



1. What can the unknown gas be? Name one gas that has a molar mass similar to the one calculated from the information above. (3 pts)

2. If each container has equal grams of the corresponding gas, rank the containers in order of increasing number density (__<__<__) or state that they all have the same number densities. (2 pts)

3. If each container has equal moles of the corresponding gas, rank the containers in order of increasing number density (__<__<__) or state that they all have the same number densities. (2 pts)