Density of Liquids Problems

Name_____

- *Always put a unit label on your answers.*
- *For some of these problems, you may need to refer to the **Density Reference sheet** – available in the reference section of the documents page.*

1. Why is density an intensive property?

2. Sally determined that 34.7 g of corn syrup had a volume of 23.8 ml. Determine the density of the corn syrup as measured by Emily?

3. Mac determined the mass of his graduated cylinder to be 33.5 g. When he put 18.7 ml of orange juice in the cylinder it had a mass of 57.1 g. He calculated the density of his orange juice to be 3.05 g/ml. Since he knew that the density of water was 1.0 g/ml, this value seemed much too high.
   a. Is his calculation incorrect?
   b. What should the density of the orange juice be?
   c. How might Mac have avoided his mistake?

4. The density of gasoline is 0.67 g/ml. Calculate the mass of 25.0 ml of gasoline.

5. The density of water is 1.0 g/ml. Calculate the mass of 38.8 ml of water.

6. Calculate the mass of 18.6 ml of methyl alcohol. (Remember that you can always look up the density of a known substance – that information is available under the reference section on the documents page.)

7. Calculate the volume of 34.7 g of glycerin.

8. Calculate the volume of 23 g of water.

9. Calculate the volume of 450 g of kerosene.

10. A container that holds 100.0 g of water when its full will hold only 78.2 g of nail polish remover (which is acetone) when its full. Determine the density of the nail polish remover.

Pay attention to your units. Note which cancel out, and which do not.

1. Density is an intensive property because whether you have a big beaker of water or a small beaker of water, the density will always be 1.0 g/ml. Two extensive properties combine to make an intensive property because they respond in ratio or proportionately to one another.

2. **1.46 g/ml** (round to 3sf) solve: $\frac{34.7g}{23.8ml} \times 38.8ml = 1.42857g/ml$

3. Bravo for Mac for making sure his answers make sense.
   a. His calculation is not correct.
   b. The orange juice should be **1.26 g/ml** (round to 3sf)
      - First he should subtract away the cylinder: 57.1 g – 33.5 g = 23.6 g Then solve: $\frac{23.6g}{18.7ml} = 1.262032g/ml$
   c. If Mac had remembered to use the tare button on the balance, he would only have recorded one mass measurement (of the orange juice itself) on his data table and avoided making this mistake.

4. **17 g** (2sf) Use your algebra skills to rewrite the density equation: m = D × V then solve: $\frac{0.67g}{1ml} \times 25.0ml = 16.75g$

5. **39 g** (round to 2sf) Again m = D × V then solve: $\frac{1.0g}{1ml} \times 38.8ml = 38.8g$

6. **15 g** (round to 2sf) Again m = D × V then solve: $\frac{0.81g}{1ml} \times 18.6ml = 15.066g$

7. **27.5 ml** (3sf) Use your algebra skills to rewrite the density equation, $V = \frac{m}{D}$ then solve: $34.7g \times \frac{1ml}{1.26g} = 27.53968ml$

   Notice that dividing by density is the same as multiplying by the inverse of the density, watch the units cancel.

8. **23 ml** (2sf) Use your algebra skills to rewrite the density equation: $V = \frac{m}{D}$ then solve: $23g \times \frac{1ml}{1g} = 23ml$

9. **549 ml** (2 sf) Use your algebra skills to rewrite the density equation: $V = \frac{m}{D}$ then solve: $450g \times \frac{1ml}{0.82g} = 548.78049ml$

10. **0.782 g/ml** (3sf) Since the container will hold 100 g of water and the density of water = 1.0 g/ml, we know that the cylinder will hold 100 ml of water. This means it will hold 100 ml of any liquid. Solve: $\frac{78.2g}{100ml} = 0.782g/ml$