

This quiz is take-home and open book, and it is intended that all members of the group contribute to completing it. It is a violation of the Academic Honor Code to sign a quiz that you did not work on. **The quiz is due at the end of class on Tuesday, November 21.**

List names in alphabetical order, and print them clearly!
Put names on all pages, and staple pages together

Points

1. You add 19.2 g of NaCl to a 500.0 mL volumetric flask and add water to the mark on the flask so that the total solution volume is 500.0 mL.

- (2) (a) What is the **molarity** of the solution?

$$19.2 \text{ g NaCl} \frac{1 \text{ mol NaCl}}{(23.0 + 35.5) \text{ g}} = 0.328 \text{ moles NaCl}$$

$$\frac{0.328 \text{ moles NaCl}}{500.0 \text{ mL} \times \frac{1 \text{ L}}{1000 \text{ mL}}} = 0.656 \text{ M (or } 0.656 \frac{\text{mol}}{\text{L}})$$

(-0.1 pt if sig. fig. in answer is wrong. 1 pt for FW, 1 pt for M)

- (1) (b) If you wanted to measure out an amount of solution that contained 0.100 moles of NaCl, what volume of solution would you measure?

$$0.100 \text{ moles} \times \frac{1 \text{ L}}{0.656 \text{ moles}} = 0.152 \text{ L (or 152 mL)}$$

(-0.1 pt if sig fig is wrong. If (a) is wrong, but answer used correctly here, don't double penalize)

- (3) 2. You want to prepare 250.0 mL of a 0.150 M solution of glucose ($\text{C}_6\text{H}_{12}\text{O}_6$) using a 250.0 mL volumetric flask. How many grams of glucose must you add to the volumetric flask?

$$\text{MW}_{\text{glucose}} = (6 \times 12.0 + 12 \times 1.0 + 6 \times 16.0) = 180.0 \frac{\text{g}}{\text{mol}}$$

$$V \times M = \text{moles, so } 0.250 \text{ L} \times 0.150 \frac{\text{mol}}{\text{L}} = 0.0375 \text{ mol glucose}$$

$$0.0375 \text{ mol} \times \frac{180.0 \text{ g}}{1 \text{ mol}} = 6.75 \text{ g glucose}$$

(1 pt MW glucose, 1 pt moles of glucose, 1 pt g of glucose, 0.1pt sig fig; accept 6.75 without units)

List names in alphabetical order. Be sure to staple pages together!

3. You have a concentrated solution of hydrochloric acid (HCl) that the label says is 6.0 M. You want to prepare one liter of a diluted solution that is 0.20 M in HCl by adding the appropriate amount of concentrated HCl solution to a 1.000 L volumetric flask and filling the flask with water.

- (2) (a) How many moles of HCl would you need for this dilute solution?

$$0.20 \frac{\text{mol}}{\text{L}} \times 1.000 \text{ L} = 0.20 \text{ mol}$$

(0.1 sig fig; accept 12 without units)

- (2) (b) How many mL of the 6.0 M solution must you add to the volumetric flask?

$$0.20 \text{ mol} \times \frac{1 \text{ L}}{6.0 \text{ M}} = 0.033 \text{ L} \times \frac{10^3 \text{ mL}}{1 \text{ L}} = 33. \text{ mL}$$

(0.1 sig fig; accept 20 without units)

- (1) (c) Approximately how many mL of water will be required to then fill the volumetric flask to the 1.000 L mark, assuming the volumes are additive on mixing (not necessarily always a valid assumption)?

$$1.000 \text{ L} - 0.033 \text{ L} = 0.967 \text{ L} \times 10^3 \text{ mL/L} = 967 \text{ mL}$$

(accept 980 without units. never mind sig fig)

- (2) 4. You want to winterize your car by mixing ethylene glycol with water in your cooling system. You drain your cooling system and find it holds 6.5 L. You want to add back 6.5 L of a 20% by volume ethylene glycol solution. Assuming volumes are additive, how many L of ethylene glycol and how many L of water do you add?

$$20\% \text{ of } 6.5 \text{ L is } 0.20 \times 6.5 = 1.3 \text{ L of ethylene glycol}$$

$$\text{Add to } 6.5 - 1.3 = 5.2 \text{ L water}$$

- (2) 5. To make a 10% by mass solution of NaHCO_3 in water, how many grams of NaHCO_3 must be added to 50.0 mL of water?

$$50.0 \text{ mL of water} \times \frac{1.00 \text{ g}}{\text{mL}} = 50.0 \text{ g water; let } x = \text{g NaHCO}_3$$

$$\text{For } 10\% \text{ solution, } \frac{x}{x + 50.0 \text{ g water}} = 0.10$$

$$x = 0.10 x + 5.00$$

$$0.90 x = 5.00$$

$$x = \frac{5.00}{0.90} = 5.6 \text{ g NaHCO}_3$$

(neglect sig. fig. since 10% is ambiguous)