

These problems are intended to *supplement* the problems in the textbook, not *replace* them.

**Questions**

**Note: Assume that liquid volumes are additive.**

1. What is the molarity of the solution which contains 0.00234 moles of solute in 175 mL of solution?
2. How many moles of solute are there in 692.10 mL of a 4.2513 M solution?
3. What is the molarity of chromic acid in the solution which contains 3.77 grams of  $\text{H}_2\text{CrO}_4$  in 675 mL of solution?
4. What volume of 9.26 M NaOH solution is needed to give 0.5166 moles of sodium hydroxide?
5. What volume of 6.00 M  $\text{HBrO}_4$  solution is needed to give 11.4 grams of perbromic acid?
6. What is the molarity of a  $\text{K}_2\text{CO}_3$  solution if 3.50 L contains 28 grams of potassium carbonate?
7. How many grams of acetic acid are there in 1.000 quart of vinegar if the vinegar is 0.8331 M in acetic acid?
8. How many gallons of a 4.00 M  $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$  solution are needed to give 13.0 pounds of ammonium dichromate?
9. How many moles of hydroxide ions are there in 82.35 mL of a 2.164 M  $\text{Sr}(\text{OH})_2$  solution?
10. How many quarts of water are needed to give 1.00 gram of oxygen gas if the  $\text{O}_2$  concentration is 0.0020 M?
11. What is the molarity of chloride ions in a solution prepared by dissolving 168.5 mg of  $\text{CaCl}_2$  in 975.0 mL of water? (Assume no volume change upon addition of the solid.)
12. What is the total molarity of nitrate ions in 3.500 L of a solution which is 0.7500 M in aluminum nitrate and 0.1250 M in sodium nitrate?
13. You must prepare a 0.540 M solution of potassium permanganate. You have 27.5 grams of solid  $\text{KMnO}_4$ . What is the maximum volume of solution that you can prepare?
14. What is the molarity of all ions that are present in a solution prepared by dissolving 20.00 grams of chromium(III) sulfate in enough water to make 8.75 liters total?
15. How many tons (not metric tons) of calcium iodide are there in  $1.9 \times 10^8$  kL of 2.75 M  $\text{CaI}_2$  solution?
16. A solution is 0.04623 M in  $\text{K}_3\text{PO}_4$ . If 30.00 mL of this solution is added to enough water to make 125.00 mL total, then what is the concentration of this new diluted solution?
17. If enough water is added to 28.43 mL of a 12.63 M  $\text{Ca}(\text{NO}_3)_2$  solution to make 150.0 mL of solution, then what is the final concentration of calcium nitrate?
18. What molarity of potassium permanganate solution is needed if 10.0 L of it mixed with 7.5 L of water gives a 4.50 M  $\text{KMnO}_4$  solution?

19. What is the final volume if 43.52 mL of 0.234 M sulfuric acid is mixed with enough water to make a 0.0345 M solution?
20. What volume of 15.00 M  $\text{CaCl}_2$  solution is needed to make 3.000 gallons of 5.500 M solution?
21. What is the final concentration of hydrogen ions if 4.526 L of 0.3521 M hydrobromic acid is mixed with 5.275 L of 1.563 M nitric acid?
22. What is the final concentration of chloride ions if 1.560 L of 5.00 M hydrochloric acid is mixed with 565 mL of 2.95 M calcium chloride?

**You prepare 175.0 mL of solution by mixing 50.0 mL of liquid toluene,  $\text{C}_6\text{H}_5\text{CH}_3$  (density = 0.867 g/mL) with 125.0 mL of liquid benzene,  $\text{C}_6\text{H}_6$  (density = 0.874 g/mL).**

23. What is the molarity of toluene in this solution?
24. What is the molarity of benzene in this solution?

### Answers

If you cannot figure out how to get the correct answer, go to your instructor, Science Tutoring Center, SI, etc.

NOTE: molar mass values were taken from the CHE 111 Lab Manual and used without rounding

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|--|---------------------------------------|--|
| 1. 0.0134 M                                  | 9. 0.3564 mol $\text{OH}^{1-}$        | 17. 2.394 M $\text{Ca}(\text{NO}_3)_2$ |
| 2. 2.9423 mol                                | 10. 17 quarts                         | 18. 7.88 M $\text{KMnO}_4$             |
| 3. 0.0473 M $\text{H}_2\text{CrO}_4$         | 11. 0.003114 M $\text{Cl}^{1-}$       | 19. 295 mL                             |
| 4. 0.0558 L or 55.8 mL                       | 12. 2.375 M $\text{NO}_3^{1-}$        | 20. 1.100 gal. or 4.163 L              |
| 5. 0.0131 L or 13.1 mL                       | 13. 0.322 L or 322 mL                 | 21. 1.004 M $\text{H}^{1+}$            |
| 6. 0.058 M $\text{K}_2\text{CO}_3$           | 14. 0.0291 M ions                     | 22. 5.238 M $\text{Cl}^{1-}$           |
| 7. 47.33 g $\text{HC}_2\text{H}_3\text{O}_2$ | 15. $1.7 \times 10^8$ tons            | 23. 2.69 M toluene                     |
| 8. 1.55 gallons                              | 16. 0.01110 M $\text{K}_3\text{PO}_4$ | 24. 7.99 M benzene                     |