

CHM130 CHAPTER 9 HOMEWORK KEY

1. Check all of the following that are equal to 1 mole:

The following are all **equal to 1 mole**: 28.02 g N₂, 153.81 g CCl₄, 6.02x10²³ CH₄ molecules, 22.4 L HCl (g), and 119.00 g KBr.

One mole of SO₂ has a mass of 64.07 g, NOT 60.09 g; one mole of NO₂ has a mass of 46.01 g, NOT 30.01 g; and one mole of I₂ has a mass of 253.80 g, NOT 126.90 g. Also, only 1 mole of any **gas** occupies a volume of 22.4 L at STP, and 6.02x10²³ of anything is equal to 1 mole.

2. The molar mass (MM) of CBr₄ is _____ g/mol.

$$\text{MM of C} + 4(\text{MM of Br}) = 12.01 + 4(79.90) = \mathbf{331.61 \text{ g/mol}}$$

3. The molar mass (MM) of the CuCr₂O₇ is _____ g/mol.

$$\text{MM of Cu} + 2(\text{MM of Cr}) + 7(\text{MM of O}) = 63.55 + 2(52.00) + 7(16.00) = \mathbf{279.55 \text{ g/mol}}$$

4. The molar mass (MM) of the (NH₄)₂SO₄ is _____ g/mol.

$$2(\text{MM of N}) + 8(\text{MM of H}) + \text{MM of S} + 4(\text{MM of O}) = 2(14.01) + 8(1.01) + 32.07 + 4(16.00) = \mathbf{132.17 \text{ g/mol}}$$

5. The molar mass (MM) of Fe(C₂H₃O₂)₃ is _____ g/mol.

$$\text{MM of Fe} + 6(\text{MM of C}) + 9(\text{MM of H}) + 6(\text{MM of O}) = 55.85 + 6(12.01) + 9(1.01) + 6(16.00) = \mathbf{233.00 \text{ g/mol}}$$

6. What mass of NO₂ is present in 3.00 moles of NO₂?

$$3.00 \text{ moles NO}_2 \times \frac{46.01 \text{ g NO}_2}{\text{mol NO}_2} = \mathbf{138 \text{ g NO}_2}$$

7. How many moles of CO are present in 175 g of CO?

$$175 \text{ g CO} \times \frac{\text{mol CO}}{28.01 \text{ g CO}} = \mathbf{6.25 \text{ moles CO}}$$

8. How many moles of HCl are present in 50.0 g of HCl?

$$50.0 \text{ g HCl} \times \frac{\text{mol HCl}}{36.46 \text{ g HCl}} = \mathbf{1.37 \text{ moles HCl}}$$

9. How many moles of NO(g) are present in 50.0 L of NO(g) at STP?

$$50.0 \text{ L NO} \times \frac{\text{mol NO}}{22.4 \text{ L NO}} = \mathbf{2.23 \text{ moles NO}}$$

10. How many moles of argon gas are present in 75.0 L of argon at STP?

$$75.0 \text{ L Ar} \times \frac{\text{mol Ar}}{22.4 \text{ L Ar}} = \mathbf{3.35 \text{ moles Ar}}$$

11. How many neon atoms are present in 25.0 g of neon?

$$25.0 \text{ g Ne} \times \frac{\text{mol Ne}}{20.18 \text{ g Ne}} \times \frac{6.02 \times 10^{23} \text{ Ne atoms}}{\text{mol Ne}} = \mathbf{7.46 \times 10^{23} \text{ Ne atoms}}$$

12. How many NH₃ molecules are present in 65.0 g of NH₃?

$$65.0 \text{ g NH}_3 \times \frac{\text{mol NH}_3}{17.04 \text{ g NH}_3} \times \frac{6.02 \times 10^{23} \text{ NH}_3 \text{ molecules}}{\text{mol NH}_3} = \mathbf{2.30 \times 10^{24} \text{ NH}_3 \text{ molecules}}$$

13. What mass of HF(g) is present in 60.0L of HF(g)?

$$60.0 \text{ L HF} \times \frac{\text{mol HF}}{22.4 \text{ L HF}} \times \frac{20.01 \text{ g HF}}{\text{mol HF}} = \mathbf{53.6 \text{ g HF}}$$

14. What mass of He(g) is present in 25.0L of He(g)?

$$25.0 \text{ L He} \times \frac{\text{mol He}}{22.4 \text{ L He}} \times \frac{4.00 \text{ g He}}{\text{mol He}} = \mathbf{4.46 \text{ g He}}$$

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15. What mass of NO(g) is present in 55.0L of NO(g)?

$$55.0 \text{ L NO} \times \frac{\text{mol NO}}{22.4 \text{ L NO}} \times \frac{30.01 \text{ g NO}}{\text{mol NO}} = \mathbf{73.7 \text{ g NO}}$$

16. What volume (in L) of argon gas is present in 50.0 g of argon?

$$50.0 \text{ g Ar} \times \frac{\text{mol Ar}}{39.95 \text{ g Ar}} \times \frac{22.4 \text{ L Ar}}{\text{mol Ar}} = \mathbf{28.0 \text{ L Ar}}$$

17. What volume (in L) of CO gas is present in 105 g of CO(g)?

$$105 \text{ g CO} \times \frac{\text{mol CO}}{28.01 \text{ g CO}} \times \frac{22.4 \text{ L CO}}{\text{mol CO}} = \mathbf{84.0 \text{ L CO}}$$

18. Calculate the mass percentage of each element in CO₂.

One mole of CO₂ (MM=44.01 g/mol) contains 12.01 g of carbon and 32.00 g of oxygen.

$$\text{C: } \frac{1(12.01 \text{ g C})}{44.01 \text{ g CO}_2} \times 100\% = \mathbf{27.29\% \text{ C}}$$

$$\text{O: } \frac{2(16.00 \text{ g O})}{44.01 \text{ g CO}_2} \times 100\% = \mathbf{72.71\% \text{ O}}$$

19. Calculate the mass percentage of each element in Na₃P.

One mole of Na₃P (MM=99.94 g/mol) contains 68.97 g of sodium and 30.97 g of phosphorus.

$$\text{Na: } \frac{3(22.99 \text{ g Na})}{99.94 \text{ g Na}_3\text{P}} \times 100\% = \mathbf{69.01\% \text{ Na}}$$

$$\text{P: } \frac{1(30.97 \text{ g P})}{99.94 \text{ g Na}_3\text{P}} \times 100\% = \mathbf{30.99\% \text{ P}}$$

20. Calculate the mass percentage of each element in CaCrO₄.

One mole of CaCrO₄ (MM=156.08 g/mol) contains 40.08 g of calcium, 52.00 g of chromium, and 64.00 g of oxygen.

$$\text{Ca: } \frac{1(40.08 \text{ g Ca})}{156.08 \text{ g CaCrO}_4} \times 100\% = \mathbf{25.68\% \text{ Ca}}$$

$$\text{Cr: } \frac{1(52.00 \text{ g Cr})}{156.08 \text{ g CaCrO}_4} \times 100\% = \mathbf{33.32\% \text{ Cr}}$$

$$\text{O: } \frac{4(16.00 \text{ g O})}{156.08 \text{ g CaCrO}_4} \times 100\% = \mathbf{41.00\% \text{ O}}$$