

Holiday Mole Exchange Mole Conversions Worksheet #3

Towards the end of each year the chemistry teachers at CV and their families get together for a white mole gift exchange party (the rest of the world sometimes has “white elephant” gift exchanges but, as you know now, moles are way cooler than elephants). Wishing you, our favorite students, further holiday converting fun, we have prepared this little experience for you. Consider it our gift to you for the holidays

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1. Mr. Kanter knows how much Mr. Beran loves wind surfing. To jet-assist Mr. Beran on those less-than-windy days, one of Mr. Kanter's gifts to Mr. Beran is a bottle of compressed chlorine gas. If there are 29.3 kg of gas in the bottle before it is used, what volume will the chlorine gas plume be over the Columbia River after Mr. Beran empties the bottle completely? (Hint: how is chlorine found in nature as a gas? When discharged, the gas will be at STP). [9260 L of Cl_2]
2. Mr. Beran knows how much Mr. Kirsch loves rocks. One of his gifts to Mr. Kirsch is a 245-gram piece of pyrite (a.k.a “fools gold” or, perhaps more importantly to you, FeS_2).
 - a) How many moles of pyrite does Mr. Kirsch now have? [2.04 moles FeS_2]
 - b) If Mr. Kirsch gets so excited that he drools all over his new piece of pyrite (assume he drools only water), until he has drooled four times as many water molecules as formula units of pyrite, what mass of water has Mr. Kirsch drooled? [147 grams H_2O]
3. Mr. Kirsch knows that Mr. Kanter has recently purchased a new house. It is an older house and needs to be freshened up a bit. Being the tight-wad that he is, Mr. Kirsch gets a discounted can of air freshener scented with dihydrogen sulfide. The can of air freshener contains 2.95 moles of dihydrogen sulfide.
 - a) How many grams of dihydrogen sulfide are in the can? [101 grams H_2S]
 - b) What volume would this gas have at STP? [66.1 L H_2S]
4. Mr. Kanter is somewhat down-in-the-dumps. He just recently realized that at Halloween he used the last of his calcium carbide (CaC_2 ; the super-secret ingredient for the exploding, self-carving pumpkins!).
 - a) Mr. Beran has purchased 20.3 grams of calcium carbide for Mr. Kanter. How many moles is this? [.317 moles CaC_2]
 - b) If Mr. Kirsch steals 7.51 grams before Mr. Beran gives Kanter his gift, how many carbon atoms does Mr. Kirsch now have? [1.41×10^{23} C atoms]
5. At some point in the party, Mr. Beran, for lack of anything better to do, decides to carry out a little experiment with the salt on the dinner table (which happens, he notices, to be cobalt (II) chloride – a notorious hydrate). He is troubled however for he can't remember how many water molecules are associated with each formula unit of cobalt (II) chloride. Therefore, using the Kanters' fine china and their gas stove top, Mr. Beran heats the salt in order to drive off the associated water.
 - a) If the remaining mass after heating is 6.93 grams, how many moles of cobalt (II) chloride were originally present? [.053 moles CoCl_2]
 - b) If cobalt (II) chloride is a hexahydrate (with six water molecules for every formula unit of cobalt (II) chloride), what was the original mass of the salt that was heated? [12.7 grams $\text{CoCl}_2 \cdot 6\text{H}_2\text{O}$]
 - c) How many chlorine atoms were in the original amount of salt that was heated? [6.43×10^{22} Cl atoms]
 - d) If all this chlorine were vaporized and formed a gas of diatomic gas molecules, what volume would the chlorine gas have at STP? [1.20 L Cl_2]