Moles, Moles, and More Moles! (Mole Packet) Name: KEY

Show all work using dimensional analysis, with units at every step. Draw a box around your final answer.

Section A: Convert to <u>moles</u>.

1. 6.02 x 10^{23} molecules CO_2 $\frac{6.02\times10^{23}\ \text{molecules}\ CO_2}{1}\times\frac{1\ \text{mol}\ CO_2}{6.02\times10^{23}\ \text{molec.}\ CO_2}=1.00\ \text{mol}\ CO_2$
2. 1.806 x 10^{23} molecules Cl_2 $\frac{1.806\times10^{23}\ \text{molec.}\ Cl_2}{1}\times\frac{1\ \text{mol}\ Cl_2}{6.02\times10^{23}\ \text{molec.}\ Cl_2}=0.300\ \text{mol}\ Cl_2$
3. 1.51 x 10^{23} molecules H_2O $\frac{1.51\times10^{23}\ \text{molec.}\ H_2O}{1}\times\frac{1\ \text{mol}\ H_2O}{6.02\times10^{23}\ \text{molec.}\ H_2O}=0.251\ \text{mol}\ H_2O$
4. 1000 molecules P_4O_{10} $\frac{1000\ \text{molecules}\ P_4O_{10}}{1}\times\frac{1\ \text{mol}\ P_4O_{10}}{6.02\times10^{23}\ \text{molec.}\ P_4O_{10}}=2\times10^{-21}\ \text{mol}\ P_4O_{10}$
5. 1 molecule NH_3 $\frac{1\ \text{molec.}\ NH_3}{1}\times\frac{1\ \text{mol}\ NH_3}{6.02\times10^{23}\ \text{molec.}\ NH_3}=2\times10^{-24}\ \text{mol}\ NH_3$
6. 34 grams NH_3 $\frac{34\ g\ NH_3}{1}\times\frac{1\ \text{mol}\ NH_3}{17.04\ g\ NH_3}=2.0\ \text{mol}\ NH_3$
7. 50.0 grams $CaCO_3$ $\frac{50.0\ g\ CaCO_3}{1}\times\frac{1\ \text{mol}\ CaCO_3}{100.09\ g\ CaCO_3}=0.500\ \text{mol}\ CaCO_3$
8. 360 grams H_2O $\frac{360\ g\ H_2O}{1}\times\frac{1\ \text{mol}\ H_2O}{18.02\ g\ H_2O}=20.\ \text{mol}\ H_2O$
9. 9.00 grams H_2SO_4 $\frac{9.00\ g\ H_2SO_4}{1}\times\frac{1\ \text{mol}\ H_2SO_4}{98.09\ g\ H_2SO_4}=0.0918\ \text{mol}\ H_2SO_4$
10. 1.00 gram NaCl $\frac{1.00\ g\ NaCl}{1}\times\frac{1\ \text{mol}\ NaCl}{58.44\ g\ NaCl}=0.0171\ \text{mol}\ NaCl$

Section B: Convert to <u>mass (in grams)</u>.

11. 5.0 moles NH_3 $\frac{5.0\ \text{mol}\ NH_3}{1}\times\frac{17.04\ g\ NH_3}{1\ \text{mol}\ NH_3}=85\ g\ NH_3$
12. 4.50 moles NaCl $\frac{4.50\ \text{mol}\ NaCl}{1}\times\frac{58.44\ g\ NaCl}{1\ \text{mol}\ NaCl}=263\ g\ NaCl$
13. 0.30 mole HCl $\frac{0.30\ \text{mol}\ HCl}{1}\times\frac{36.46\ g\ HCl}{1\ \text{mol}\ HCl}=11\ g\ HCl$
14. 0.00200 mole Na_2SO_4 $\frac{0.00200\ \text{mol}\ Na_2SO_4}{1}\times\frac{142.05\ g\ Na_2SO_4}{1\ \text{mol}\ Na_2SO_4}=0.284\ g\ Na_2SO_4$
15. 1.50 x 10^{-4} mole AgCl $\frac{1.50\times10^{-4}\ \text{mol}\ AgCl}{1}\times\frac{143.32\ g\ AgCl}{1\ \text{mol}\ AgCl}=0.0215\ g\ AgCl$
16. 2.0 moles CO_2 $\frac{2.0\ \text{mol}\ CO_2}{1}\times\frac{44.01\ g\ CO_2}{1\ \text{mol}\ CO_2}=88.02\ g\ CO_2$
17. 1.8 moles PCl_3 $\frac{1.8\ \text{mol}\ PCl_3}{1}\times\frac{137.32\ g\ PCl_3}{1\ \text{mol}\ PCl_3}=250\ g\ PCl_3$
18. 35.0 moles NH_3 $\frac{35.0\ \text{mol}\ NH_3}{1}\times\frac{17.04\ g\ NH_3}{1\ \text{mol}\ NH_3}=596\ g\ NH_3$
19. 0.0500 mole SO_2 $\frac{0.0500\ \text{mol}\ SO_2}{1}\times\frac{64.07\ g\ SO_2}{1\ \text{mol}\ SO_2}=3.20\ g\ SO_2$
20. 1.00 x 10^{-3} mole CO $\frac{1.00\times10^{-3}\ \text{mol}\ CO}{1}\times\frac{28.01\ g\ CO}{1\ \text{mol}\ CO}=0.0280\ g\ CO$

Section C: Convert to <u>moles</u>.

21. 12.04 x 10^{23} atoms He $\frac{12.04\times10^{23}\text{ atoms He}}{1}\times\frac{1\text{ mol He}}{6.02\times10^{23}\text{ atoms He}} = 2.00\text{ mol He}$

22. 3.01 x 10^{23} atoms Cu $\frac{3.01\times10^{23}\text{ atoms Cu}}{1}\times\frac{1\text{ mol Cu}}{6.02\times10^{23}\text{ atoms Cu}} = 0.500\text{ mol Cu}$

23. 3.612 x 10^{23} atoms Fe $\frac{3.612\times10^{23}\text{ atoms Fe}}{1}\times\frac{1\text{ mol Fe}}{6.02\times10^{23}\text{ atoms Fe}} = 0.600\text{ mol Fe}$

24. 100 atoms Ar $\frac{100\text{ atoms Ar}}{1}\times\frac{1\text{ mol Ar}}{6.02\times10^{23}\text{ atoms Ar}} = \times10^{-22}\text{ mol Ar}$

25. 1 atom S $\frac{1\text{ atom S}}{1}\times\frac{1\text{ mol S}}{6.02\times10^{23}\text{ atoms S}} = 2\times10^{-24}\text{ mol S}$

26. 24 grams C $\frac{24\text{ g C}}{1}\times\frac{1\text{ mol C}}{12.01\text{ g C}} = 2.0\text{ mol C}$

27. 59.3 grams Sn $\frac{59.3\text{ g Sn}}{1}\times\frac{1\text{ mol Sn}}{118.71\text{ g Sn}} = 0.500\text{ mol Sn}$

28. 98.9 grams Na $\frac{98.9\text{ g Na}}{1}\times\frac{1\text{ mol Na}}{22.99\text{ g Na}} = 4.30\text{ mol Na}$

29. 5000 grams K $\frac{5000\text{ g K}}{1}\times\frac{1\text{ mol K}}{39.10\text{ g K}} = 100\text{ mol K}$

30. 0.00500 gram Ne $\frac{0.00500\text{ g Ne}}{1}\times\frac{1\text{ mol Ne}}{20.18\text{ g Ne}} = 2.48\times10^{-4}\text{ mol Ne}$

Section D: Convert to <u>mass (in grams)</u>.

31. 10.0 moles Na $\frac{10.0\text{ mol Na}}{1}\times\frac{22.99\text{ g Na}}{1\text{ mol Na}} = 230.\text{ g Na}$

32. 2.20 moles Sn $\frac{2.20\text{ mol Sn}}{1}\times\frac{118.71\text{ g Sn}}{1\text{ mol Sn}} = 261\text{ g Sn}$

33. 5.00 moles Ag $\frac{5.00\text{ mol Ag}}{1}\times\frac{107.87\text{ g Ag}}{1\text{ mol Ag}} = 539\text{ g Ag}$

34. 0.000300 mole Au $\frac{0.000300\text{ mol Au}}{1}\times\frac{196.97\text{ g Au}}{1\text{ mol Au}} = 0.0591\text{ g Au}$

35. 1.00 x 10^{7} moles B $\frac{1.00\times10^{7}\text{ mol B}}{1}\times\frac{10.81\text{ g B}}{1\text{ mol B}} = 1.08\times10^{8}\text{ g B}$

Section E: Convert to <u>number of atoms</u>.

36. 3.00 moles Ar $\frac{3.00\text{ mol Ar}}{1}\times\frac{6.02\times10^{23}\text{ atoms Ar}}{1\text{ mol Ar}} = 1.81\times10^{24}\text{ atoms Ar}$

37. 8.50 moles Fe $\frac{8.50\text{ mol Fe}}{1}\times\frac{6.02\times10^{23}\text{ atoms Fe}}{1\text{ mol Fe}} = 5.12\times10^{24}\text{ atoms Fe}$

38. 25.0 moles Ar $\frac{25.0\text{ mol Ar}}{1}\times\frac{6.02\times10^{23}\text{ atoms Ar}}{1\text{ mol Ar}} = 1.57\times10^{25}\text{ atoms Ar}$

39. 0.00100 mole Na $\frac{0.00100\text{ mol Na}}{1}\times\frac{6.02\times10^{23}\text{ atoms Na}}{1\text{ mol Na}} = 6.02\times10^{20}\text{ atoms Na}$

40. 1.0 x 10^{-5} mole Al $\frac{1.0\times10^{-5}\text{ mol Al}}{1}\times\frac{6.02\times10^{23}\text{ atoms Al}}{1\text{ mol Al}} = 6.02\times10^{18}\text{ atoms Al}$

Section F: Convert to <u>mass (in grams)</u>.

41. 6.02×10^{23} atoms Ca $\frac{6.02\times10^{23}\text{ atoms Ca}}{1} \times \frac{1\text{ mol Ca}}{6.02\times10^{23}\text{ atoms Ca}} \times \frac{40.08\text{ g Ca}}{1\text{ mol Ca}} = 40.08\text{ g Ca}$

42. 1.204×10^{23} atoms Bi $\frac{1.204\times10^{23}\text{ atoms Bi}}{1} \times \frac{1\text{ mol Bi}}{6.02\times10^{23}\text{ atoms Bi}} \times \frac{208.98\text{ g Bi}}{1\text{ mol Bi}} = 41.80\text{ g Bi}$

43. 3.01×10^{23} atoms Ni $\frac{3.01\times10^{23}\text{ atoms Ni}}{1} \times \frac{1\text{ mol Ni}}{6.02\times10^{23}\text{ atoms Ni}} \times \frac{58.69\text{ g Ni}}{1\text{ mol Ni}} = 29.3\text{ g Ni}$

44. 1000 atoms Al $\frac{1000\text{ atoms Al}}{1} \times \frac{1\text{ mol Al}}{6.02\times10^{23}\text{ atoms Al}} \times \frac{26.98\text{ g Al}}{1\text{ mol Al}} = 4.\times10^{-20}\text{ g Al}$

45. 1 atom Na $\frac{1\text{ atom Na}}{1} \times \frac{1\text{ mol Na}}{6.02\times10^{23}\text{ atoms Na}} \times \frac{22.99\text{ g Na}}{1\text{ mol Na}} = 4\times10^{-23}\text{ g Na}$

Section G: Convert to <u>number of atoms</u>.

46. 540 grams Al $\frac{540\text{ g Al}}{1} \times \frac{1\text{ mol Al}}{26.98\text{ g Al}} \times \frac{6.02\times10^{23}\text{ atoms Al}}{1\text{ mol Al}} = 1.2\times10^{25}\text{ atoms Al}$

47. 294 grams Au $\frac{294\text{ g Au}}{1} \times \frac{1\text{ mol Au}}{196.97\text{ g Au}} \times \frac{6.02\times10^{23}\text{ atoms Au}}{1\text{ mol Au}} = 8.99\times10^{23}\text{ atoms Au}$

48. 6.35 grams Cu $\frac{6.35\text{ g Cu}}{1} \times \frac{1\text{ mol Cu}}{63.55\text{ g Cu}} \times \frac{6.02\times10^{23}\text{ atoms Cu}}{1\text{ mol Cu}} = 6.02\times10^{22}\text{ atoms Cu}$

49. 2000 grams Mg $\frac{2000\text{ g Mg}}{1} \times \frac{1\text{ mol Mg}}{24.31\text{ g Mg}} \times \frac{6.02\times10^{23}\text{ atoms Mg}}{1\text{ mol Mg}} = 5\times10^{25}\text{ atoms Mg}$

50. 1.00 gram Li $\frac{1.00\text{ g Li}}{1} \times \frac{1\text{ mol Li}}{6.94\text{ g Li}} \times \frac{6.02\times10^{23}\text{ atoms Li}}{1\text{ mol Li}} = 8.67\times10^{22}\text{ atoms Li}$

Section H: Convert to <u>number of molecules</u>.

51. 72 grams HCl $\frac{72\text{ g HCl}}{1} \times \frac{1\text{ mol HCl}}{36.46\text{ g HCl}} \times \frac{6.02\times10^{23}\text{ molecules HCl}}{1\text{ mol HCl}} = 1.2\times10^{24}\text{ molecules HCl}$

52. 9.0 grams H_2O $\frac{9.0\text{ g H}_2\text{O}}{1} \times \frac{1\text{ mol H}_2\text{O}}{18.02\text{ g H}_2\text{O}} \times \frac{6.02\times10^{23}\text{ molecules H}_2\text{O}}{1\text{ mol H}_2\text{O}} = 3.0\times10^{23}\text{ molecules H}_2\text{O}$

53. 22 grams CO_2 $\frac{22\text{ g CO}_2}{1} \times \frac{1\text{ mol CO}_2}{44.01\text{ g CO}_2} \times \frac{6.02\times10^{23}\text{ molecules CO}_2}{1\text{ mol CO}_2} = 3.0\times10^{23}\text{ molecules CO}_2$

54. 500 grams NO $\frac{500\text{ g NO}}{1} \times \frac{1\text{ mol NO}}{30.01\text{ g NO}} \times \frac{6.02\times10^{23}\text{ molecules NO}}{1\text{ mol NO}} = 1.\times10^{25}\text{ molecules NO}$

55. 1.00 gram CCl_4 $\frac{1.00\text{ g CCl}_4}{1} \times \frac{1\text{ mol CCl}_4}{153.81\text{ g CCl}_4} \times \frac{6.02\times10^{23}\text{ molecules CCl}_4}{1\text{ mol CCl}_4} = 3.91\times10^{23}\text{ molecules CCl}_4$

Section I: Convert to <u>mass (in grams)</u>.

56. 6.02×10^{23} molecules Cl_2 $\frac{6.02\times10^{23}\text{ molecules Cl}_2}{1} \times \frac{1\text{ mol Cl}_2}{6.02\times10^{23}\text{ molecules Cl}_2} \times \frac{70.90\text{ g Cl}_2}{1\text{ mol Cl}_2} = 70.90\text{ g Cl}_2$

57. 3.01×10^{23} molecules SO_2 $\frac{3.01\times10^{23}\text{ molecules SO}_2}{1} \times \frac{1\text{ mol SO}_2}{6.02\times10^{23}\text{ molecules SO}_2} \times \frac{64.07\text{ g SO}_2}{1\text{ mol SO}_2} = 32.04\text{ g SO}_2$

58. 1.81 x 10^{24} molecules CO_2 $\frac{1.81\times10^{24}\ \text{molec. } CO_2}{1} \times \frac{1\ \text{mol } CO_2}{6.02\times10^{23}\ \text{molec.}} \times \frac{44.01\ \text{g } CO_2}{1\ \text{mol } CO_2} = 132\ \text{g } CO_2$

59. 1000 molecules H_2S $\frac{1000\ \text{molec. } H_2S}{1} \times \frac{1\ \text{mol } H_2S}{6.02\times10^{23}\ \text{molec. } H_2S} \times \frac{34.09\ \text{g } H_2S}{1\ \text{mol } H_2S} = 6\times10^{-20}\ \text{g } H_2S$

60. 1 molecule H_2O $\frac{1\ \text{molec. } H_2O}{1} \times \frac{1\ \text{mol } H_2O}{6.02\times10^{23}\ \text{molec. } H_2O} \times \frac{18.02\ \text{g } H_2O}{1\ \text{mol } H_2O} = 3\times10^{-23}\ \text{g } H_2O$

Section J: Convert from _____ to _____...

61. 5,432 molecules of O_2 to moles of O_2 $\frac{5432\ \text{molec. } O_2}{1} \times \frac{1\ \text{mol } O_2}{6.02\times10^{23}\ \text{molec. } O_2} = 9.02\times10^{-21}\ \text{mol } O_2$

62. 685 grams of SO_2 to moles of SO_2 $\frac{685\ \text{g } SO_2}{1} \times \frac{1\ \text{mol } SO_2}{64.07\ \text{g } SO_2} = 10.7\ \text{mol } SO_2$

63. 5.1 x 10^{30} moles of Na to atoms of Na $\frac{5.1\times10^{30}\ \text{mol Na}}{1} \times \frac{6.02\times10^{23}\ \text{atoms Na}}{1\ \text{mol Na}} = 3.1\times10^{54}\ \text{atoms Na}$

64. 5.00 mol of SF_6 to grams of SF_6 $\frac{5.00\ \text{mol } SF_6}{1} \times \frac{146.07\ \text{g } SF_6}{1\ \text{mol } SF_6} = 730.\ \text{g } SF_6$

65. 201.7 grams of H_2 to moles of H_2 $\frac{201.7\ \text{g } H_2}{1} \times \frac{1\ \text{mol } H_2}{2.02\ \text{g } H_2} = 99.9\ \text{mol } H_2$

66. 15.00 grams of C to atoms of C $\frac{15.00\ \text{g C}}{1} \times \frac{1\ \text{mol C}}{12.01\ \text{g C}} \times \frac{6.02\times10^{23}\ \text{atoms C}}{1\ \text{mol C}} = 7.52\times10^{23}\ \text{atoms C}$

67. 6.02 x 10^{23} molecules of H_2O to grams of H_2O
$\frac{6.02\times10^{23}\ \text{molec. } H_2O}{1} \times \frac{1\ \text{mol } H_2O}{6.02\times10^{23}\ \text{molec. } H_2O} \times \frac{18.02\ \text{g } H_2O}{1\ \text{mol } H_2O} = 18.0\ \text{g } H_2O$

68. 4.56 mol of Fe to atoms of Fe $\frac{4.56\ \text{mol Fe}}{1} \times \frac{6.02\times10^{23}\ \text{atoms Fe}}{1\ \text{mol Fe}} = 2.75\times10^{24}\ \text{atoms Fe}$

69. 0.0182 g of NaCl to moles of NaCl $\frac{0.0182\ \text{g NaCl}}{1} \times \frac{1\ \text{mol NaCl}}{58.44\ \text{g NaCl}} = 3.11\times10^{-4}\ \text{mol NaCl}$

70. 5.88 x 10^{18} atoms of He to moles of He $\frac{5.88\times10^{18}\ \text{atoms He}}{1} \times \frac{1\ \text{mol He}}{6.02\times10^{23}\ \text{atoms He}} = 9.77\times10^{-6}\ \text{mol He}$

71. 3.00 x 10^{41} atoms of Cu to grams of Cu $\frac{3.00\times10^{41}\ \text{atoms Cu}}{1} \times \frac{1\ \text{mol Cu}}{6.02\times10^{23}\ \text{atoms Cu}} \times \frac{63.55\ \text{g Cu}}{1\ \text{mol Cu}} = 3.17\times10^{19}\ \text{g Cu}$

72. 0.867 moles of CO to grams of CO $\frac{0.867\ \text{mol CO}}{1} \times \frac{28.01\ \text{g CO}}{1\ \text{mol CO}} = 24.3\ \text{g CO}$

73. 2.34 grams of N_2O to molecules of N_2O $\frac{2.34\ \text{g } N_2O}{1} \times \frac{1\ \text{mol } N_2O}{44.02\ \text{g } N_2O} \times \frac{6.02\times10^{23}\ \text{molec } N_2O}{1\ \text{mol } N_2O} = 3.20\times10^{22}\ \text{molecules } N_2O$

74. 0.0054 moles of Hg to grams of Hg $\frac{0.0054\ \text{mol Hg}}{1} \times \frac{200.59\ \text{g Hg}}{1\ \text{mol Hg}} = 1.1\ \text{g Hg}$

75. 10.04 grams of Cl_2 to molecules of Cl_2 $\frac{10.04\ \text{g } Cl_2}{1} \times \frac{1\ \text{mol } Cl_2}{70.90\ \text{g } Cl_2} \times \frac{6.02\times10^{23}\ \text{molec. } Cl_2}{1\ \text{mol } Cl_2} = 8.52\times10^{22}\ \text{molecules } Cl_2$