Exercise 3.3b(H)
Mole Conversions

Name: ______________________

Date:_________________ Per:________

The ***mole*** is a unit of amount used in chemistry to group fundamental particles (atoms, ions, molecules, formula units) into packages large enough to be used in the laboratory. It provides a bridge between the number of particles in a sample and a measurable mass in grams. A mole of a substance is defined as *the mass of substance containing the same number of fundamental units as there are atoms in exactly 12.000 g of ^{12}C.* Since all atomic masses are expressed relative to ^{12}C, the atomic mass listed on the period table represents the mass of 1 mole of that element in grams.

One Step: Mole → Mass Conversions

$$\textbf{mol X} \times \frac{\textbf{molar mass X}}{\textbf{1 mol X}} = \textbf{g X}$$

One Step: Mass → Mole Conversions

$$\textbf{g X} \times \frac{\textbf{1 mol X}}{\textbf{molar mass X}} = \textbf{mol X}$$

DIRECTIONS: Calculate the mass of:

1. 1.00 mol cobalt atoms
2. 0.638 mol arsenic atoms
3. 0.0100 mol sodium atoms
4. 7.18×10^{-4} mol argon atoms

DIRECTIONS: Calculate the number of moles in:

5. 87.4 g calcium
6. 12.5 g copper
7. 1.25 kg silicon
8. 146 g helium

In this class the number of particles present in exactly 12.000 g of ^{12}C will be estimated as 6.022×10^{23}. This amount is referred to as Avogadro's number (N_A). This is the number of particles present in 1 mole of a substance.

One Step: Mole → Particle Conversions

$$\textbf{mol X} \times \frac{\textbf{6.022 x 10}^{23}\textbf{ p. X}}{\textbf{1 mol X}} = \textbf{p. X}$$

One Step: Particle → Mole Conversions

$$\textbf{p. X} \times \frac{\textbf{1 mol X}}{\textbf{6.022 x 10}^{23}\textbf{ p. X}} = \textbf{mol X}$$

DIRECTIONS: Calculate the number of atoms in:

9. 1.26 mol potassium
10. 0.249 mol lithium
11. 2.00 mol sulfur
12. 0.0250 mol manganese

DIRECTIONS: Calculate the number of moles in:

13. 4.58×10^{24} atoms chromium
14. 2.10×10^{25} atoms titanium
15. 8.54×10^{23} atoms mercury
16. 1.35×10^{24} atoms lead

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Answers: 1) 58.9 g 2) 47.8 g 3) 0.230 g 4) 0.0287 g 5) 2.18 mol 6) 0.197 mol 7) 44.5 mol 8) 36.5 mol 9) 7.59×10^{23} p. 10) 1.50×10^{23} p. 11) 1.20×10^{24} p. 12) 1.51×10^{22} p. 13) 7.61 mol 14) 34.9 mol 15) 1.42 mol 16) 2.24 mol 17) 68.8 g 18) 89.4 g 19) 2.60 g 20) 5.44×10^{23} p. 21) 2.43×10^{24} p. 22) 4.82×10^{23} p.

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Because *1 mole = 6.022 x* 10^{23} and *1 mole = the atomic mass of an element in grams*, the mole may be used to convert between the number of atoms in a sample and its mass.

<u>Two Step: Particle → Mass Conversions</u>

_ p. X	***1 mol X***	***molar mass X***	
	6.022 x 10^{23} ***p. X***	***1 mol X***	= _____ ***g X***

DIRECTIONS: Calculate the mass of:

17. 3.45 x 10^{24} atoms carbon

18. 9.17 x 10^{23} atoms nickel

19. 1.45 x 10^{22} atoms silver

Because *1 mole = the atomic mass of an element in grams and, 1 mole = 6.022 x* 10^{23} the mole may be used to convert between mass and the number of atoms in a sample.

<u>Two Step: Mass → Particle Conversions</u>

_ g X	***1 mol X***	***6.022 x*** 10^{23} ***p. X***	
	molar mass X	***1 mol X***	= _____ ***p. X***

DIRECTIONS: Calculate the number of atoms in:

20. 178 g gold

21. 125 g phosphorus

22. 15.2 g fluorine

Answers: 1) 58.9 g 2) 47.8 g 3) 0.230 g 4) 0.0287 g 5) 2.18 mol 6) 0.197 mol 7) 44.5 mol 8) 36.5 mol 9) 7.59 x10^{23} p. 10) 1.50 x10^{23} p. 11) 1.20 x10^{24} p. 12) 1.51 x10^{22} p. 13) 7.61 mol 14) 34.9 mol 15) 1.42 mol 16) 2.24 mol 17) 68.8 g 18) 89.4 g 19) 2.60 g 20) 5.44 x10^{23} p. 21) 2.43 x10^{24} p. 22) 4.82 x10^{23} p.