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W. Bailey

KEY

CHMG-141 GENERAL & ANALYTICAL CHEMISTRY I
With Dr. Bailey

Group members: _____

Recitation

Week 2

(Ch. 1)

Key Skills:

- Working with atomic numbers, mass numbers, and Isotope symbols
- Calculating atomic weight
- Converting between Moles and numbers of atoms
- Converting between mass and amount (in Moles)
- Nuclear reactions

1). Working with the Periodic table:

a) Name the third-period noble gas

Argon (Ar)

b) Name the 5-th period alkaline earth metal

Strontium (Sr)

c) Name the ~~second~~ ^{third}-period halogen

Chlorine (Cl)

~~second period~~
^{second period}
halogen

Fluorine (F)

2). Which of the following pairs of elements do you expect to be most similar? Why?

- a) N and Ni
- b) Mo and Sn
- c) Na and Mg
- d) Cl and F
- e) Si and P

← Cl and F are halogens, group 7A; they have the same number (7) of valence electrons.

3). What element is defined by the following information?

a) $p^+ = 50$, $n^0 = 20$, $e^- = 50$

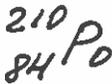
a) Tin (Sn), $Z = 50$

b) $p^+ = 13$, $n^0 = 14$, $e^- = 10$

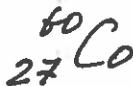
b) Aluminum Al (Al^{+3} ion)
 $Z = 13$

4). Write symbols for the following isotopes:

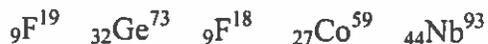
a) Polonium-210



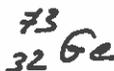
b) Z = 27 and A = 60



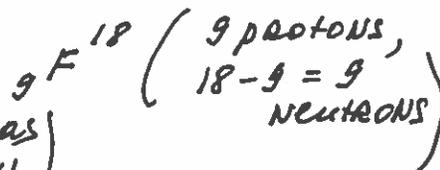
5) Given the following nuclear notations:



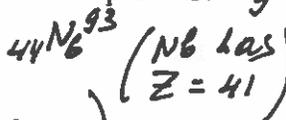
a) Which one has 32 protons?



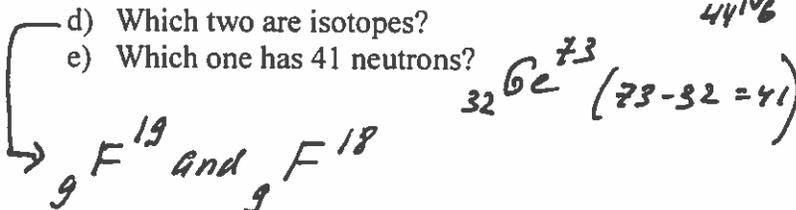
b) Which one has the same number of neutrons as it has protons?



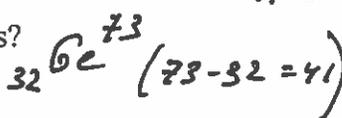
c) Which one has an incorrect atomic number?



d) Which two are isotopes?



e) Which one has 41 neutrons?



6). Rubidium has two naturally occurring isotopes with the following masses and natural abundance:

Isotope	Mass (amu)	Abundance	Contribution
Rb-85	84.9118	72.15	$0.7215 \times 84.9118 = 61.26 \text{ amu}$
Rb-87	86.9092	27.85	$0.2785 \times 86.9092 = 24.20 \text{ amu}$

Calculate the atomic weight of rubidium

$$\text{Total} = 85.46 \text{ amu}$$

7). Calculate:

a) How many moles of nickel are in 44.03 grams?

$$44.03 \text{ g Ni} \times \frac{1 \text{ mol Ni}}{58.69 \text{ g Ni}}$$

$$= \boxed{0.7502 \text{ mol Ni}}$$

b) What is the mass of 9.041×10^{24} lithium atoms?

$$9.041 \times 10^{24} \text{ at. Li} \times \frac{1 \text{ mol Li}}{6.022 \times 10^{23} \text{ at. Li}} \times \frac{6.94 \text{ g Li}}{1 \text{ mol Li}} =$$

$$= \boxed{104.2 \text{ g Li}}$$

c) How many grams of Ca are in 4.55 moles?

$$4.55 \text{ mole}_{\text{Ca}} \times \frac{40.08 \text{ g Ca}}{1 \text{ mole Ca}} = \boxed{182 \text{ g Ca}}$$

d) 27.92 grams of iron are how many atoms of iron?

$$27.92 \text{ g Fe} \times \frac{1 \text{ mole}}{55.85 \text{ g Fe}} \times \frac{6.022 \times 10^{23} \text{ atoms}}{1 \text{ mole}} =$$

$$18.0 \times 10^{21} \text{ at. Pt} \times \frac{1 \text{ mole}}{6.022 \times 10^{23} \text{ at. Pt}} = \boxed{3.010 \times 10^{-2} \text{ atoms Fe}}$$

Problem 8: You have a piece of copper that is 9.36 cm long, 7.23 cm wide and 0.95 mm thick. Density of copper is 9.00 g/cm³

How many atoms of copper are in this piece of copper?

The strategy:

1. Find mass of the piece of copper (dimentions → volume → mass)
2. Find how many moles of copper are in this sample
3. Find how many atoms of copper are in this sample

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$$\boxed{3.00 \times 10^{-2} \text{ mole Pt}}$$

Problem 9: Recently, there has been concern about pollution in the home from radon, a radioactive gas whose elemental molar mass is 222 g/mol. The Environmental Protection Agency believes that a level of radon of 3.6 × 10⁻¹⁷ g/L of air is unhealthy. At this level,

1. How many moles of radon would there be in a living room whose volume is 2455 L?
2. How many atoms is this?

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Problem 10:

- (a) $^{126}_{50}\text{Sn} \rightarrow \text{?} + \text{?}$
- (b) $^{210}_{88}\text{Ra} \rightarrow \text{?} + \text{?}$
- (c) $^{77}_{37}\text{Rb} \rightarrow \text{?} + \text{?}$
- (d) $^{76}_{36}\text{Kr} + \text{?} \rightarrow \text{?}$

Handwritten notes and solutions for Problem 10:

a) $^{126}_{50}\text{Sn} \rightarrow \text{?} + \text{?}$ (Radium → Tin)
 $^{126}_{50}\text{Sn} \rightarrow \text{?} + \text{?}$ (β-Radiation electron)
 $^{126}_{50}\text{Sn} \rightarrow \text{?} + \text{?}$ (Antimony)

b) $^{210}_{88}\text{Ra} \rightarrow \text{?} + \text{?}$ (α-Radiation)
 $^{210}_{88}\text{Ra} \rightarrow \text{?} + \text{?}$ (Radon)

c) $^{77}_{37}\text{Rb} \rightarrow \text{?} + \text{?}$ (positron Emission)

d) $^{76}_{36}\text{Kr} + \text{?} \rightarrow \text{?}$ (Electron capture)

Problem 8: You have a piece of copper that is 9.36 cm long, 7.23 cm wide and 0.95 mm thick. Density of copper is 9.00 g/cm^3
How many atoms of copper are in this piece of copper?

The strategy:

1. Find mass of the piece of copper (dimensions \rightarrow volume \rightarrow mass)
2. Find how many moles of copper are in this sample
3. Find how many atoms of copper are in this sample

$$\textcircled{1} \quad V = 9.36 \text{ cm} \times 7.23 \text{ cm} \times \left(0.95 \text{ mm} \times \frac{10^{-1} \text{ cm}}{1 \text{ mm}}\right) = 6.43 \text{ cm}^3$$

$$\text{mass} = 6.43 \text{ cm}^3 \times 9.00 \frac{\text{g}}{\text{cm}^3} = 57.9 \text{ g}$$

$$\textcircled{2} \quad \# \text{ moles} = 57.9 \text{ g} \times \frac{1 \text{ mole Cu}}{63.55 \text{ g}} = 0.910 \text{ mole}$$

$$\textcircled{3} \quad \# \text{ atoms} = 0.910 \text{ mole} \times \frac{6.022 \times 10^{23} \text{ atoms}}{1 \text{ mole}} = 5.5 \times 10^{23} \text{ atoms}$$

Problem 9: Recently, there has been concern about pollution in the home from radon, a radioactive gas whose elemental molar mass is 222 g/mol. The Environmental Protection Agency believes that a level of radon of $3.6 \times 10^{-17} \text{ g/L}$ of air is unhealthy. At this level,

1. How many moles of radon would there be in a living room whose volume is 2455 L?
2. How many atoms is this?

$$\# \text{ moles} = \left(3.6 \times 10^{-17} \frac{\text{g}}{\text{L}} \times 2455 \text{ L}\right) \times \frac{1 \text{ mole}}{222 \text{ g}} =$$

$$= 3.98 \times 10^{-16} \text{ mole}$$

$$\# \text{ atoms} = 3.98 \times 10^{-16} \text{ mole} \times \frac{6.022 \times 10^{23} \text{ atoms}}{1 \text{ mole}}$$

$$= \boxed{2.4 \times 10^8 \text{ atoms}}$$