[TP] Which contains the most molecules?

4% 1. 1 g of H_2
30% 2. 45 g of Cl_2
21% 3. 28 g of N_2
45% 4. 24 g of CH_4

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Lecture 3 CH131 Fall 2020

Thursday, September 10, 2020

- Compete: Atomic weight
- Chemist's dozen: The mole
- Example problems: Chemical formulas, equations, and reaction yields

Next: Complete example problems; Limiting reagent recipe; Begin ch3: Chemical bonding: The classical description

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[TP] The molar mass of Cl is 35.453 g. ^{37}Cl has a natural abundance of 24.24%. Which of the following statements is true?

1% 1. The mass of one atom of naturally occurring Cl is 35.453 g divided by Avogadro's number
69% 2. The mass of one atom of naturally occurring Cl cannot be 35.453 g divided by Avogadro's number.
30% 3. Neither of the statements is true.

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Terms to distinguish

Relative atomic mass, A_r: ratio of mass of an isotope relative to mass of 1/12 of one ^{12}C atom

A_r of ^{13}C is 13.00335 (unitless)

Atomic mass unit, u: 1/12 mass of one ^{12}C atom

$1\ u = (1/12) \times (12\ g) / N_A = g / N_A = 1.66054 \times 10^{-24}\ g$

Atomic weight: average of relative atomic masses of an element

Atomic weight of C is 12.01 (unitless)

Molar mass, M: Mass in grams numerically equal to atomic weight; that is, the mass in grams of N_A "average atoms" of an element

Molar mass of C is 12.01 g

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Chemist's dozen: mole → counting by weighing

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Mole: Count by weighing

The mass in g of 1 mol of any element is called its molar mass

Number of particles in 1 mol is $N_A = 6.02214076 \times 10^{23}$

Each of these amounts contains the same number of atoms

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[TP] Which contains the most molecules?

0%	1.	1 g of H_2
6%	2.	45 g of Cl_2
10%	3.	28 g of N_2
84%	4.	24 g of CH_4

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Mass to molecules

Which contains the most molecules?

1 g of H_2: $1\text{ g} \times \frac{\text{mol}}{2\text{ g}} = 0.5\text{ mol}$

45 g of Cl_2: $45\text{ g} \times \frac{\text{mol}}{(2\times35)\text{ g}} = 0.64\text{ mol}$

28 g of N_2: $28\text{ g} \times \frac{\text{mol}}{(2\times14)\text{ g}} = 1.0\text{ mol}$

24 g of CH_4: $24\text{ g} \times \frac{\text{mol}}{(12+4\times1)\text{ g}} = 1.5\text{ mol}$

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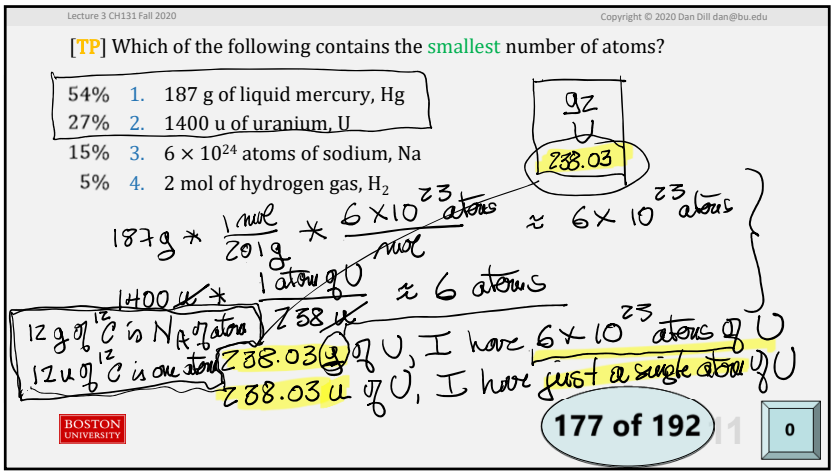
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[TP] Which of the following contains the smallest number of atoms?
54% 1. 187 g of liquid mercury, Hg
27% 2. 1400 u of uranium, U
15% 3. 6 × 10^24 atoms of sodium, Na
5% 4. 2 mol of hydrogen gas, H2
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0

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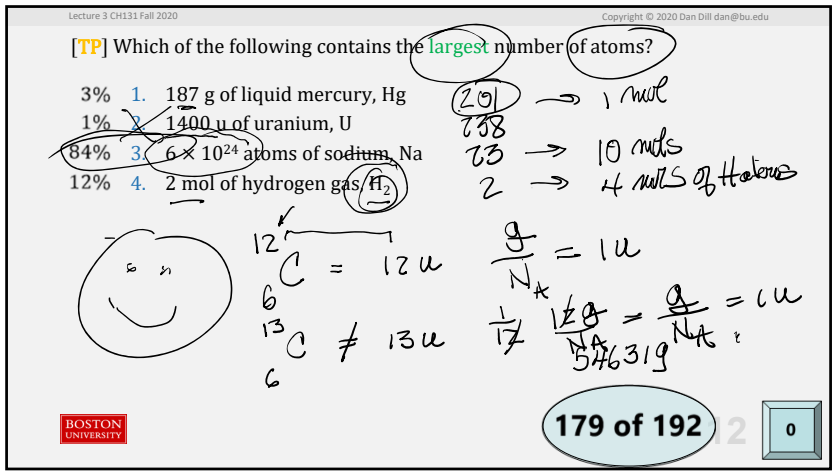
Lecture 3 CH131 Fall 2020
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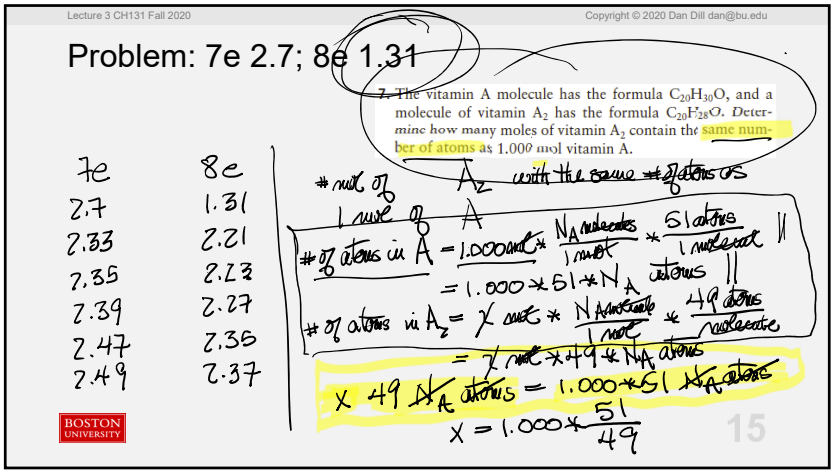
[TP] Which of the following contains the largest number of atoms?
3% 1. 187 g of liquid mercury, Hg
1% 2. 1400 u of uranium, U
84% 3. 6 × 10^24 atoms of sodium, Na
12% 4. 2 mol of hydrogen gas, H2
179 of 192
0

12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Problem: 7e 2.7; 8e 1.31
7e 2.7 2.33 2.35 2.39 2.47 2.49
8e 1.31 2.21 2.23 2.27 2.35 2.37

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