

# ANSWER KEY

## GRAHAM'S LAW OF EFFUSION

Name \_\_\_\_\_

Graham's Law says that a gas will effuse at a rate that is inversely proportional to the square root of its molecular mass, MM. Expressed mathematically:

$$\frac{\text{rate}_1}{\text{rate}_2} = \sqrt{\frac{\text{MM}_2}{\text{MM}_1}}$$

Solve the following problems.

1. Under the same conditions of temperature and pressure, how many times faster will hydrogen effuse compared to carbon dioxide?

4.7

2. If the carbon dioxide in Problem 1 takes 32 sec to effuse, how long will the hydrogen take?

6.8 sec

3. What is the relative rate of diffusion of  $\text{NH}_3$  compared to He? Does  $\text{NH}_3$  effuse faster or slower than He?

0.49, slower

4. If the He in Problem 3 takes 20 sec to effuse, how long will  $\text{NH}_3$  take?

41 sec

5. An unknown gas diffuses 0.25 times as fast as He. What is the molecular mass of the unknown gas?

64 g/mole

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## ELEMENT SYMBOLS

Name \_\_\_\_\_

An element symbol can stand for one atom of the element or one mole of atoms of the element. (One mole =  $6.02 \times 10^{23}$  atoms of an element.)

Write the symbol for the following elements.

- |             |    |               |    |
|-------------|----|---------------|----|
| 1. oxygen   | O  | 11. plutonium | Pu |
| 2. hydrogen | H  | 12. americium | Am |
| 3. chlorine | Cl | 13. radium    | Ra |
| 4. mercury  | Hg | 14. germanium | Ge |
| 5. fluorine | F  | 15. zinc      | Zn |
| 6. barium   | Ba | 16. arsenic   | As |
| 7. helium   | He | 17. lead      | Pb |
| 8. uranium  | U  | 18. iron      | Fe |
| 9. radon    | Rn | 19. calcium   | Ca |
| 10. sulfur  | S  | 20. cobalt    | Co |

Write the name of the element that corresponds to each of the following symbols.

- |        |           |        |            |
|--------|-----------|--------|------------|
| 21. Kr | Krypton   | 31. Cu | Copper     |
| 22. K  | Potassium | 32. Ag | Silver     |
| 23. C  | Carbon    | 33. P  | Phosphorus |
| 24. Ne | Neon      | 34. Mn | Manganese  |
| 25. Si | Silicon   | 35. I  | Iodine     |
| 26. Zr | Zirconium | 36. Au | Gold       |
| 27. Sn | Tin       | 37. Mg | Magnesium  |
| 28. Pt | Platinum  | 38. Ni | Nickel     |
| 29. Na | Sodium    | 39. Br | Bromine    |
| 30. Al | Aluminum  | 40. Hg | Mercury    |

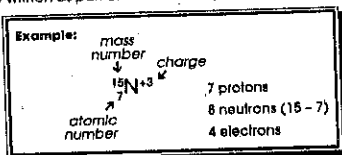
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## ATOMIC STRUCTURE

Name \_\_\_\_\_

An atom is made up of protons and neutrons (both found in the nucleus) and electrons (in the surrounding electron cloud). The atomic number is equal to the number of protons. The mass number is equal to the number of protons plus neutrons. In a neutral atom, the number of protons equals the number of electrons. The charge on an ion indicates an imbalance between protons and electrons. Too many electrons produces a negative charge, too few, a positive charge.

This structure can be written as part of a chemical symbol.



Complete the following chart.

Element/Ion	Atomic Number	Atomic Mass	Mass Number	Protons	Neutrons	Electrons
H	1	1.0079	1	1	0	1
H <sup>+</sup>	1	1.0079	1	1	0	0
<sup>12</sup> C	6	12.011	12	6	6	6
<sup>7</sup> Li <sup>+</sup>	3	6.941	7	3	4	2
<sup>35</sup> Cl	17	35.453	35	17	18	18
<sup>39</sup> K	19	39.0983	39	19	20	19
<sup>24</sup> Mg <sup>2+</sup>	12	24.305	24	12	12	10
As <sup>3-</sup>	33	74.9216	75	33	42	36
Ag	47	107.868	108	47	61	47
Ag <sup>+</sup>	47	107.868	108	47	61	46
S <sup>2-</sup>	16	32.06	32	16	16	18
U	92	238.029	238	92	146	92

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## ISOTOPES AND AVERAGE ATOMIC MASS

Name \_\_\_\_\_

Elements come in a variety of isotopes, meaning they are made up of atoms with the same atomic number but different atomic masses. These atoms differ in the number of neutrons.

The average atomic mass is the weighted average of all the isotopes of an element.

Example: A sample of cesium is 75% <sup>133</sup>Cs, 20% <sup>132</sup>Cs and 5% <sup>134</sup>Cs. What is its average atomic mass?

Answer:  $.75 \times 133 = 99.75$   
 $.20 \times 132 = 26.4$   
 $.05 \times 134 = 6.7$   
 Total = 132.85 amu = average atomic mass

Determine the average atomic mass of the following mixtures of isotopes.

1. 80% <sup>121</sup> I, 17% <sup>124</sup> I, 3% <sup>126</sup> I	126.86 amu
2. 50% <sup>197</sup> Au, 50% <sup>198</sup> Au	197.5 amu
3. 15% <sup>56</sup> Fe, 85% <sup>54</sup> Fe	55.85 amu
4. 99% <sup>1</sup> H, 0.8% <sup>2</sup> H, 0.2% <sup>3</sup> H	1.012 amu
5. 98% <sup>14</sup> N, 3% <sup>15</sup> N, 2% <sup>16</sup> N	14.07 amu
6. 98% <sup>12</sup> C, 2% <sup>13</sup> C	12.04 amu

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