



## Introduction to Nuclear Chemistry: Isotopes

### QOD:

1. How is nuclear chemistry different from “regular chemistry”?
2. If the atomic mass is the sum of the number of protons and neutrons, why is it not a whole number?
3. What is an isotope of an element? How is its mass determined?
4. Write Uranium-235 in isotope notation.

# Radioactive Isotopes

**Isotope** - atoms of an element with different number of neutrons.

## **Stability of Isotopes:**

1. Isotopes with atomic number >83 are unstable
2. Isotope with an atomic mass differing significantly from the mass on the periodic table are usually unstable.

1

H

Hydrogen

2

He

Helium

3

Li

Lithium

4

Be

Beryllium

5

B

Boron

6

C

Carbon

7

N

Nitrogen

8

O

Oxygen

9

F

Fluorine

10

Ne

Neon

11

Na

Sodium

12

Mg

Magnesium

13

Al

Aluminum

14

Si

Silicon

15

P

Phosphorus

16

S

Sulfur

17

Cl

Chlorine

18

Ar

Argon

19

K

Potassium

20

Ca

Calcium

21

Sc

Scandium

22

Ti

Titanium

23

V

Vanadium

24

Cr

Chromium

25

Mn

Manganese

26

Fe

Iron

27

Co

Cobalt

28

Ni

Nickel

29

Cu

Copper

30

Zn

Zinc

31

Ga

Gallium

32

Ge

Germanium

33

As

Arsenic

34

Se

Selenium

35

Br

Bromine

36

Kr

Krypton

37

Rb

Rubidium

38

Sr

Strontium

39

Y

Yttrium

40

Zr

Zirconium

41

Nb

Niobium

42

Mo

Molybdenum

43

Tc

Technetium

44

Ru

Ruthenium

45

Rh

Rhodium

46

Pd

Palladium

47

Ag

Silver

48

Cd

Cadmium

49

In

Indium

50

Sn

Tin

51

Sb

Antimony

52

Te

Tellurium

53

I

Iodine

54

Xe

Xenon

55

Cs

Cesium

56

Ba

Barium

57

La

Lanthanum

72

Hf

Hafnium

73

Ta

Tantalum

74

W

Tungsten

75

Re

Rhenium

76

Os

Osmium

77

Ir

Iridium

78

Pt

Platinum

79

Au

Gold

80

Hg

Mercury

81

Tl

Thallium

82

Pb

Lead

83

Bi

Bismuth

84

Po

Polonium

85

At

Astatine

86

Rn

Radon

87

Fr

Francium

88

Ra

Radium

89

Ac

Actinium

104

Rf

Rutherfordium

105

Db

Dubnium

106

Sg

Seaborgium

107

Bh

Bohrium

108

Hs

Hassium

109

Mt

Meitnerium

110

Ds

Darmstadtium

111

Rg

Roentgenium

112

Cn

Copernicium

113

Nh

Nihonium

114

Fl

Flerovium

115

Mc

Moscovium

116

Lv

Livermorium

117

Ts

Tennessine

118

Og

Oganesson

58

Ce

Cerium

59

Pr

Praseodymium

60

Nd

Neodymium

61

Pm

Promethium

62

Sm

Samarium

63

Eu

Europium

64

Gd

Gadolinium

65

Tb

Terbium

66

Dy

Dysprosium

67

Ho

Holmium

68

Er

Erbium

69

Tm

Thulium

70

Yb

Ytterbium

71

Lu

Lutetium

90

Th

Thorium

91

Pa

Protactinium

92

U

Uranium

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Neptunium

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Plutonium

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Americium

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Cm

Curium

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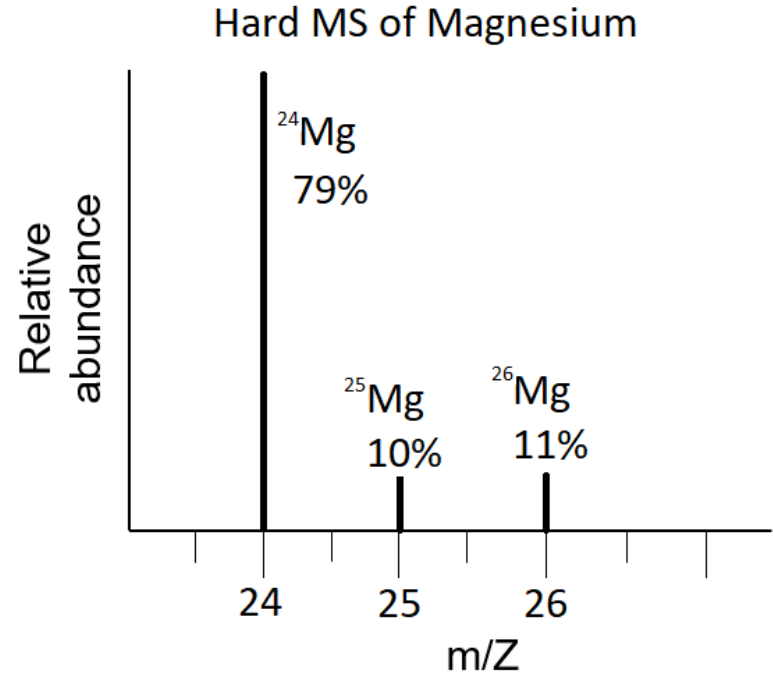
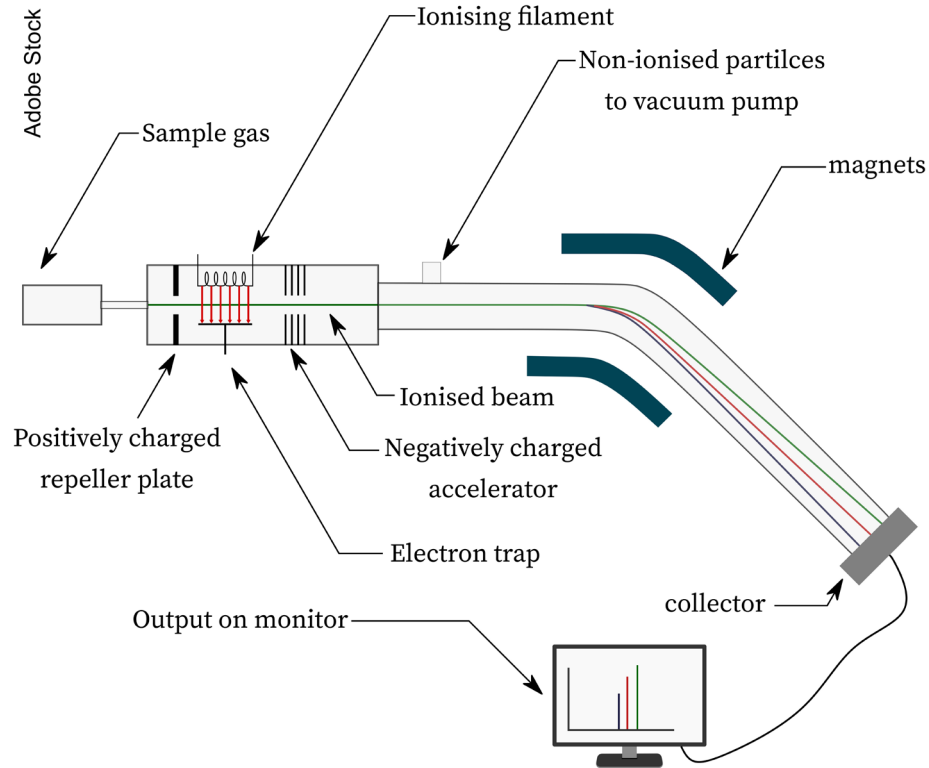
# Review of the Nucleus

Element	# Protons	# Neutrons	Atomic mass of the isotope	Isotope Notation	Stability
Curium-247	_____	_____	_____	_____	_____
Tin - _____	_____	67	_____	_____	_____
_____	_____	8	16	_____	_____
_____	_____	_____	_____	$^{84}_{36}\text{Kr}$	_____
_____	81	127	_____	_____	_____

# Calculating Average Atomic Mass

1. Calculate the average atomic mass of copper if  $^{63}\text{Cu}$  has an abundance of 69.17% and  $^{65}\text{Cu}$  has an abundance of 30.83%.
2. Strontium consists of 4 isotopes with masses of 84 (abundance 0.5%), 86 (abundance 9.9%), 87 (abundance 7.0%), and 88 (abundance 82.6%). Calculate the average atomic mass.
3. Calculate the average atomic mass of iodine if out of 100 atoms, 80 have a mass of 127 amu, 17 have a mass of 126 amu, and 3 have a mass of 128 amu.

# Mass Spectroscopy of Isotopes



Calculate the average atomic mass of magnesium, given the information above.