

CHEM 106

The Periodic Table and Atoms / Ions



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CHEMISTRY of Atoms / Ions

- Atomic Number = 12 (atom's identity)
- Atomic Mass = 24
- 12 protons; # neutrons = 24 - 12
- neutral atom has 12 electrons
- Ion contains 10 electrons: symbol?



- $12 p^+ + 10 e^- = +2$



CHEMISTRY of Atoms / Ions

- Atomic Number = 17 (atom's identity)
- Atomic Mass = ?
- # protons = ? ; # neutrons = ?
- neutral atom has ? electrons
- Ion contains 18 electrons: symbol?



- $17 p^+ + 18 e^- = -1$



Ions

δ Cation: A positive ion



δ Anion: A negative ion



δ Ionic Bonding: Force of attraction
between oppositely charged ions.

QUESTION

Calcium plays several critical roles in the functioning of human cells. However, this form of calcium is the ion made with 20 protons and 18 electrons. Therefore the ion would be...

- A. positive and called an anion.
- B. positive and called a cation.
- C. negative and called an anion.
- D. negative and called a cation.

Answer

Calcium plays several critical roles in the functioning of human cells. However, this form of calcium is the ion made with 20 protons and 18 electrons. Therefore the ion would be...

- A. positive and called an anion.
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- C. negative and called an anion.
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An atom of calcium (20 protons = 20+) which has lost two electrons (now with 18-). The ion would have a +2 charge. Positive ions are called cations.

QUESTION

Of the following, which would NOT qualify as an isotope of ^{35}Cl ?

- A. ^{36}Cl
- B. $^{35}\text{Cl}^-$
- C. $^{37}\text{Cl}^-$
- D. ^{37}Cl

Answer

Of the following, which would NOT qualify as an isotope of ^{35}Cl ?

- A. ^{36}Cl
- B. $^{35}\text{Cl}^-$
- C. $^{37}\text{Cl}^-$
- D. ^{37}Cl

B. has the same number of neutrons as the atom in the question, therefore it does not fit the criteria for isotopes (i.e. different number of neutrons with the same proton number). Isotopes can be ions as well as neutral atoms. $^{37}\text{Cl}^-$ and ^{37}Cl are also not a pair of isotopes.

Worksheet: Atoms/Ions

Nuclear Symbol	Number of Protons	Number of Neutrons	Number of Electrons	Atomic Number (Z)	Mass Number (A)
$^{12}_6\text{C}$	6	6	6	6	12
$^{14}_7\text{N}$			7		
	7	8	7		
			18	20	40
$^{17}\text{O}^{2-}$				8	
^{56}Fe			26		
$^{19}\text{F}^-$				9	

Circle isotopes of each other and link them with a double headed arrow.

QUESTION

Which of these species has the highest number of electrons?

- A) $^{20}_{20}\text{Ca}$ B) $^{19}_{19}\text{K}^+$ C) $^{16}_{16}\text{S}^{2-}$ D) $^{15}_{15}\text{P}^{3-}$

Answer

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- A) $^{20}_{20}\text{Ca}$ B) $^{19}_{19}\text{K}^+$ C) $^{16}_{16}\text{S}^{2-}$ D) $^{15}_{15}\text{P}^{3-}$

QUESTION

The ion $^{45}\text{Sc}^{3+}$ has

- A) 24 electrons, 21 protons and 24 neutrons
 B) 18 electrons, 21 protons and 24 neutrons
 C) 24 electrons, 24 protons and 21 neutrons
 D) 18 electrons, 24 protons and 21 neutrons

Answer

The ion $^{45}\text{Sc}^{3+}$ has

- A) 24 electrons, 21 protons and 24 neutrons
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Some Common Monatomic Ions of the Elements

Trends of the Elements

	1A (1)																	7A (17)	8A (18)
1	H ⁺																		
2	Li ⁺																		
3	Na ⁺	Mg ²⁺											Al ³⁺					S ²⁻	Cl ⁻
			3B (3)	4B (4)	5B (5)	6B (6)	7B (7)	8B (8) (9) (10)				1B (11)	2B (12)						
4	K ⁺	Ca ²⁺					Cr ³⁺	Mn ²⁺	Fe ³⁺	Co ²⁺		Cu ⁺ Cu ²⁺	Zn ²⁺					Br ⁻	
5	Rb ⁺	Sr ²⁺										Ag ⁺	Cd ²⁺	Sn ²⁺ Sn ⁴⁺				I ⁻	
6	Cs ⁺	Ba ²⁺										Hg ₂ ²⁺ Hg ²⁺	Pb ²⁺ Pb ⁴⁺						
7																			