

Atoms are neutral because they contain the same number of positive protons as negative electrons. For example, the atom  ${}_{11}^{23}\text{Na}$  is neutral because it contains 11 protons (11+ charges) and 11 electrons (11- charges).

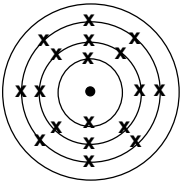
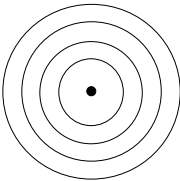
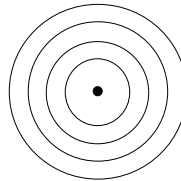
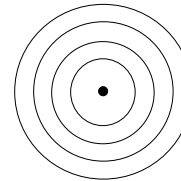
Ions are particles that contain a different number of protons and electrons. For example, an ion with 11 protons (11+ charges) and 10 electrons (10- charges) has an overall charge of 1+.

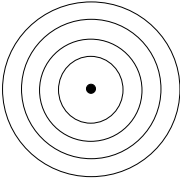
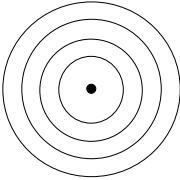
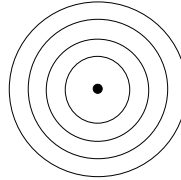
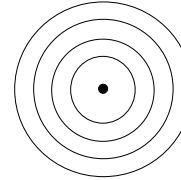
The noble gas elements (Group 0 elements) have very stable electron arrangements. Ions also have the electron structure of the noble gases (group 0 elements), except  $\text{H}^+$  which has no electrons at all.

- 1) Complete the table below to show whether particles are atoms or ions, and for ions their charge.

Number and overall charge of protons	11+	11+	16+	4+	13+	18+	17+	15+	21+	1+	32+	35+
Number and overall charge of electrons	11-	10-	18-	2-	10-	18-	18-	18-	18-	0-	32-	36-
Atom or ion?	atom	ion	ion									
Overall charge		1+	2-									

- 2) Complete the table below to show the electronic structure of some common ions. The first one has been done for you. You will need to use the Periodic Table to help.

Ion	$\text{Cl}^-$	$\text{Li}^+$	$\text{F}^-$	$\text{Mg}^{2+}$
Protons	17			
Electrons	18			
Electron structure				
Electron structure	2,8,8			

Ion	$\text{K}^+$	$\text{S}^{2-}$	$\text{H}^+$	$\text{P}^{3-}$
Protons				
Electrons				
Electron structure				
Electron structure				

- 3) Complete the table to show the number of electrons and electron structure of the following ions and the noble gas atoms. **All the ions are from question 2.**

Ion or noble gas atom	He	Ne	Ar	Cl <sup>-</sup>	Li <sup>+</sup>	F <sup>-</sup>	Mg <sup>2+</sup>	K <sup>+</sup>	S <sup>2-</sup>	P <sup>3-</sup>
Number of electrons										
Electron structure										

- 4) What is the link between the electron structure of ions and noble gas atoms?

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- 5) Complete the following table about some atoms and ions. The first row has been done for you.

Particle	Atom or ion	Atomic number	Mass number	Number of protons	Number of neutrons	Number of electrons	Electron structure
$^{23}_{11}\text{Na}^+$	ion	11	23	11	12	10	2,8
$^{23}_{11}\text{Na}$							
$^{40}_{20}\text{Ca}^{2+}$							
	atom	9	19				
				17	20	18	
				17	18	18	
		19	39			18	
				18	22	18	
		1	1			0	
		4			5		2

Area	Strength	To develop	Area	Strength	To develop
Done with care and thoroughness			Can deduce electron structure of ions		
Good SPG			Can deduce electron structure of atoms		
Can deduce charge from P+E numbers			Knows link between ion and Group 0 electron structures		
Can work out number of P+E in ions			Can work with PNE / atomic / mass numbers in atoms & ions		