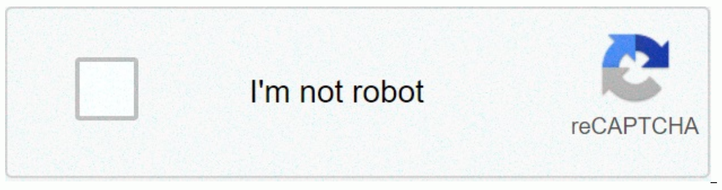

Continue

What is isoelectronic with ar

The Isoelectronic Series An Isoelectronic Series is a group of atoms/ions that have the same number of electrons. ExamplesN3-, O2-, F-, Ne, Na+, Mg2+, Al3+This series has every 10 electrons. P3-, S2-, Cl-, Ar, K+, Ca2+, Sc3+This series each has 18 electrons. A typical question of isoelectronic series usually involves size comparisons. Since the number of electrons is the same, the size is determined by the number of protons. Al has 13 protons, therefore the nuclear charge is greatest and pulls the electrons closer, thus the smallest. N3- has 7 protons and nuclear charge it the smallest of series. Thus it has the smallest handle on the electrons, and this species is the largest. Chemical Demonstration Videos The questions posted on the site are user generated only, Doubtnut has no ownership or control over the nature and content of these issues. Doubtnut is not responsible for any discrepancies in the duplicity of content on these matters. In order to continue enjoying our site, we ask that you confirm your identity as a human being. Thank you very much for your cooperation. Species with the same electronic configuration are said to be isoelectronic.1. Name Symbol Electronic configuration shells undershellHelium He 2 1s2 Hydride ion H- 2 1s2 Lithium ion Li + 2 1s2 Han, H- and Li + are all isoelectronic species because they have the same electronic configuration. Isoelectronic species must have the same number of electrons in total. Name Symbol Electronic configuration Total Number of Electrons shell Helium atom He 2 1s2 2 Hydride ion H- 2 1s2 2 Lithium ion Li + 2 1s2 2 He, H- and Li + are all isoelectronic species and have the same total number of electrons. To determine whether two or more species are isoelectronic: (a) Write the electronic configuration for electrically neutral2 atoms of the elements. (b) Write the electronic configuration of any ions: ⚛ For positively charged ions (cations) remove electrons from the highest energy level of the atom ⚛ For negatively charged ions (anions) add electrons to the atom's highest occupied energy level (c) If two or more species have the same electronic configuration they are said to be isoelectronic. Note that isoelectronic species tend to have very similar chemical properties. Helium atom, hydride ion and lithium ion are all isoelectronic species: They all have the same ground state electronic configuration as Noble Gas helium: 1s2 Just like helium, hydridions and lithium ions are considered non-active. Please do not block ads on this site. No ads = no money for us = no free stuff for you! Isoelectronic Configurations of atoms and ions Consider an atom of Nobel Gas (Group 18 elements) argon, Ar. Argon has atomic number of 18 (Z = 18). An atom of argon has 18 positively charged protons in its core and 18 negatively charged electrons orbiting 3 cores of the various levels: First energy level: 2 electrons in s subshell Second energy level: 2 electrons in s subshell and 6 electrons in the p-subshell Third energy level: 2 electrons in s subshell and 6 electrons in the undershell in its simplest form, we could write the electronic configuration of an atom of argon in terms of shell (energy levels) as 2,8,8 In terms of subshells , the electronic configuration would be represented as 1s22s222p63s23p6 Argon is the ONLY element whose atoms have ground state electronic configuration of 1s222p63s23p6 But there are ions of other elements that may have ground-state electronic configuration 1s22s2p63s23p6 Consider an atom of chlorine, Cl. Chlorine has an atomic number of 17 (Z = 17). One atom of chlorine has 17 positively charged protons in its core and 17 negatively charged electrons orbitthe core of different energy levels: First energy level: 2 electrons in s subshell Second energy level: 2 electrons in s subshell and 6 electrons in the p-subshell Third energy level: 2 electrons in s subshell and 5 electrons in the p-subshell In its simplest form , we were able to write the electronic configuration of chlorine as 2.8.7 in case of the shell , the electronic configuration would be represented as 1s22s22p63s23p5 Like all group 17 (halogen) elements, atoms of chlorine can obtain an electron to form an anion (negatively charged ion) with a charge of 1-. Now, let's consider what happens if this chloratom gets an electron to form the chloride ion. chloratoma + electron → chloride ion Cl+ e-→ Cl- Where will this extra electron go? It will enter into the undershell 3p to complete this subshell (and also complete this energy level). chloratom + electron → chloride ion Cl + e-→ Cl- electronicconfiguration 1s22s22p63s23p5 + e-→ 1s22s22p63s23p6 The electronic configuration of chloride ion, Cl-, is 1s2222p63s23p6. The electronic configuration of an argonatom in the land state is also 1s22s22p63s23p6. Let's say the chloride ion is isoelectronic with the argon atom. It is also possible for cations, positively charged ions, to be isoelectronic with the argonatom in their soil state. Think of an atom of potassium, K, in its soil state. Potassium has an atomic number of 19 (Z = 19). There are 19 positively charged protons in the nucleus of an atom of potassium. There are 19 negatively charged electrons orbiting the nucleus of a potassium atom in the ground state. First energy level: 2 electrons in s subshell Second energy level: 2 electrons in the undershell and 6 electrons in the p-undershell Third energy level: 2 electrons in s undershell and 6 electrons in p undershell Fourth energy level: 1 electron in s undershell In its simplest form, we were able to write the electronic configuration of potassium as 2,8,8,1 In the case of subshell , the electronic would be represented as 1s22s22p63s23p64s1 Like all group 1 (alkali metal) elements, potassium will easily lose an electron to form a cation with a charge of +1. potassium atom → potassium ion + electron K → K+ + e- The electron that is lost will come from the highest energy level, the fourth energy level: potassium atom → potassium ion + electron K → K+ + e- electron configuration 1s222p63s23p64s1 → 1s22s22p63s23p6 + e- And we can see that the potassium ion, K+, has the same electronic configuration as chloride ion, Cl-, and the same electronic configuration as an atom of argon Ar. Therefore, Ar, Cl-, and K+ are said to be isoelectronic species. Similarly, we can see that an atom of calcium, Ca, (atomic number = 20) has an electronic configuration of 1s22s22p63s23p64s2 Like all group 2 (alkali-earth) metals, calcium will lose 2 electrons from its highest energy level to form a cation with a charge of 2 +. The calcium ion, Ca2+, will have the electronic configuration 1s22s22p63s23p6 Ca2+ said to be isoelectronic with Ar, Cl and K+ Do you know this? Join AUS-e-TUTE! Play the game now! If we consider the possible ions of the first 20 elements of the Periodic Table, we can draw up a table that summarizes which of the species are isoelectronic with atoms of a group 18 element (Noble Gas): Isoelectronic with He: 1s2 Isoelectronic with Ne: 1s22s22p6 Isoelectronic with 1Ar: 1s22s22p63s23p6 Cations Anions Cations Anions Cations Anions Li+Be2+B3+C4+ H- Na+Mg2+Al3+Si4+ N3-O2-F- K+Ca2+ P3-S2-Cl- Do you understand this? Join AUS-e-TUTE! Take the test now! Question : Which of the species below is NOT isoelectronic with Al3+ ? ⚛ Na+ ⚛ O2 ⚛ B3+ Please justify your answer. Solution: (Based on the StoPGoPS method in problem solving.) What is the question that asks you to do? (i) determine which species is not isoelectronic with the others; (ii) Justify your response. What information (information) have you received in this matter? Extract data from the query: Formula of the species: Al3 + (reference) ⚛ Na + ⚛ O2- ⚛ B3 + What is the relationship between what you know and what you need to find out? Definition: isoelectronic species have the same electronic configuration. Write the electronic configuration of each species: Al3+ (reference) Al, Z = 13, ground-state electronic configuration 1s22s22s22p63s23p1 Atom of Al loses 3 electrons from the highest energy level (third energy level) to form Al3+: Al3+ ground-state electronic configuration: 1s22s22p6 Na+ Na, Z = 11, ground-state electronic configuration 1s22s22p63s1 Atom of Na loses 1 electron from highest energy level (third energy level) to form Na+ : Na+ ground-state electronic configuration : 1s22s22p6 O2-O, Z = 8, ground-state electronic configuration 1s22s22p4 Atom of O gains 2 electrons to form O2-: O2- mark-state electronic configuration: 1s22s22p6 B3 + B, Z = 5, mark-state electronic configuration 1s22s22p1 Atom of B loses 3 electrons from other energy level to form B3 +: B3 + ground-state electronic configuration: 1s2 Decide which species is NOT isoelectronic with Al3 + All species (Al3+, Na+ and O2-) have the same electronic configuration (1s22s22p6) BESIDES B3+ which has the electronic conformation 1s2. B3+ is therefore NOT isoelectronic with Al3+ Is your answer reasonable? Make sure that Al3+, Na+ and O2 all have the same total number of electrons and that B3+ has a different number of electrons. No. electrons(Al3+) = Z(Al) -3 = 13 - 3 = 10 no. electrons(Na+) = Z(Na) -1 = 11 - 1 = 10 no. electrons(O2-) = Z(O) +2 = 8 + 2 = 10 no. electrons(B3+) = Z(B) -3 = 5 = 3 = 2 All species have 10 electrons in total EXCEPT B3+, so B3+ cannot be isoelectronics with the other species. State your solution to the problem species that are not isoelectronic and justify answers: (i) B3+ is not isoelectronic with Al3+ (ii) because the electronic configuration of B3+ (1s2) is NOT the same as the electronic configuration of Al3+ (1s22s22p6). Can you apply this? Join AUS-e-TUTE! Take the exam now! Nwo!