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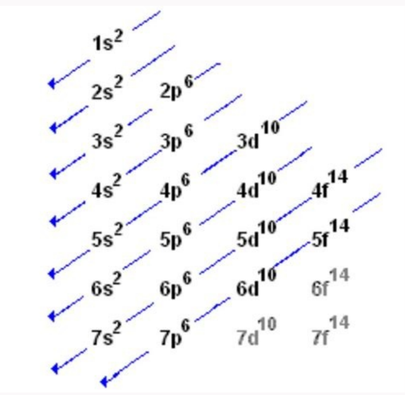
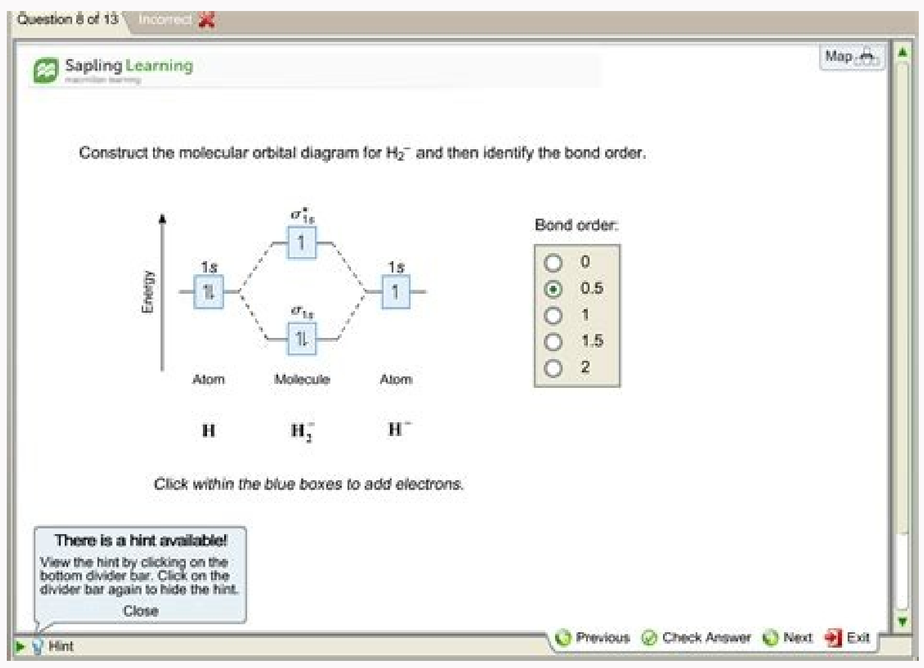
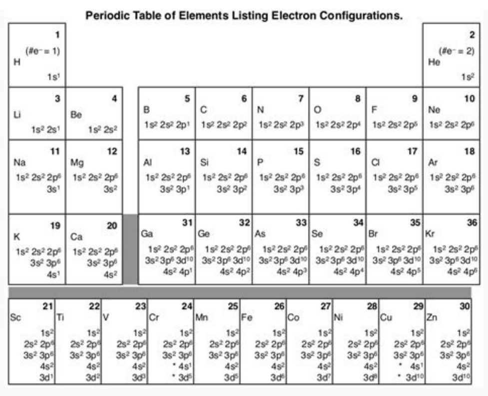
# Electron configuration practice worksheet orbital diagram 2 step pdf




| Element Symbol | Electron Configuration Code | Orbital Representation |
|---|---|---|
| H | $1s^1$ | 1 ↑ s |
| He | $1s^2$ | 1 ↑↓ s |
| Li | $1s^2 2s^1$ | 2 ↑ s ○ ○ ○ p<br>1 ↑↓ s |
| Be | $1s^2 2s^2$ | 2 ↑↓ s ○ ○ ○ p<br>1 ↑↓ s |
| B | $1s^2 2s^2 2p^1$ | 2 ↑↓ s ↑ ○ ○ p<br>1 ↑↓ s |
| C | $1s^2 2s^2 2p^2$ | 2 ↑↓ s ↑ ↑ ○ p<br>1 ↑↓ s |
| N | $1s^2 2s^2 2p^3$ | 2 ↑↓ s ↑ ↑ ↑ p<br>1 ↑↓ s |



The filling order is based on observed experimental results, and has been confirmed by theoretical calculations. Both atoms, which are in the alkali metal family, have only one electron in a valence s subshell outside a filled set of inner shells. The outer electrons have the highest energy of the electrons in an atom and are more easily lost or shared than the core electrons. Phosphorus trianion gains three electrons, so P3¢ÃÂÂ: 1s22s22p63s23p6. The n = 1 shell is filled with two electrons and three electrons will occupy the n = 2 shell. In any atom with two or more electrons, the repulsion between the electrons makes energies of subshells with different values of l differ so that the energy of the orbitals increases within a shell in the order s < p < d < f. The second electron also goes into the 1s orbital and fills that orbital. Figure 5. Referring to Figure 3 or Figure 4, we would expect to find the electron in the 1s orbital. The first two will be lost from the 6s orbital, and the final one is removed from the 4f orbital. Beginning with the transition metal scandium (atomic number 21), additional electrons are added successively to the 3d subshell. Now we can understand why the periodic table has the arrangement it has¢ÃÂÂthe arrangement puts elements whose atoms have the same number of valence electrons in the same group. Repeat for p, d, and f. Thus, potassium has an electron configuration of [Ar]4s1. Which ion with a +3 charge has this configuration? Check Your Learning Which ion with a +2 charge has the electron configuration 1s22s22p63s23p63d104s24p64d5? For instance, the electron configurations (shown in Figure 6) of the transition metals chromium (Cr; atomic number 24) and copper (Cu; atomic number 29), among others, are not those we would expect. The remaining electron must occupy the orbital of next lowest energy, the 2s orbital (Figure 3 or Figure 4). Electrons that are closer to the nucleus slightly The most distant, output, compensating for the most dominant attractions of slightly slightly-nucleus trons-nucleus (recovering that all the trons are tanned with â â'1, but the numbers are cargo of +z). The 15ths of the fan of Fan of Fan. This version of the Perion Table shows the configuration of external shell trons of each element. Generalized energy diagram for atheic orbitals in a two or more elf (not climbing). The configuration of elors and the orbital diagram for carbon is: nitrogen (not only attempt 7) fills the 1s and the 2s subcons and has an elf in each of the TRANS 2P orbitals, according to the Hund rule. SOLUTION ABSERAGE ATTENTION OF FANEFORE is 15. The next one is the alkaline metal wool with an attempt to experience 3. Experimentally, we observe that its EL © © Configuration Estado Trons is really [KR] 5s14d4. Energy increases as we advance to the Rubites 2 and 2p, 3s and 3p, showing that the growing value of N has more influence on energy than the growing value of L for small ãtimos. In the case of CR and Cu, we find that half-filled and completely filled sub-filles apparently represent the preferred stability conditions. For ELA TRons not paid, the convention attributes the value of [latex]+\ frac {1} {2} [/latex] for the number of rotation; Thus, [latex] m_s = +\ frac {1} {2} [/latex]. In general, such exceptions involve sub-surveys with very similar energy, and small effects can lead to change in the order of filling. For example, 2p4 (read â € œDoisâ € "Pâ €" Four €) indicates four elf in a sub-shell (L = 1) with a major main quantation (n) 2. Since the arrangement of the Perion Table is based on the ELA TRONS configurations, Figure 4 provides an alternative mother to determine the configuration of elf. snort©Âle snort©Âle so ,atnemua l ed rolav o omoc ,ahcnoc adac ed less penetrating (meaning there is less electron density found close to the nucleus), in the order s > p > d > f. The valence electrons (those added after the last noble gas configuration) in these elements include the ns and (n ¢ÃÂÂ 1) d electrons. When we come to the next element in the periodic table, the alkali metal potassium (atomic number 19), we might expect that we would begin to add electrons to the 3d subshell. All of the electrons in the noble gas neon (atomic number 10) are paired, and all of the orbitals in the n = 1 and the n = 2 shells are filled. Check Your Learning Identify the atoms from the electron configurations given: (a) [Ar]4s23d5 (b) [Kr]5s24d105p6 The periodic table can be a powerful tool in predicting the electron configuration of an element. The energy of atomic orbitals increases as the principal quantum number, n, increases. Elements in any one group (or column) have the same number of valence electrons; the alkali metals lithium and sodium each have only one valence electron, the alkaline earth metals beryllium and magnesium each have two, and the halogens fluorine and chlorine each have seven valence electrons. The notation 3d8 (read ¢ÃÂÂthree¢ÃÂÂd¢ÃÂÂeight¢ÃÂÂ) indicates eight electrons in the d subshell (i.e., l = 2) of the principal shell for which n = 3. Figure 1. However, we do find exceptions to the order of filling of orbitals that are shown in Figure 3 or Figure 4. By convention, the [latex]m_s = + \frac{1}{2} [/latex] value is usually filled first. Simply make a column for all the s orbitals with each n shell on a separate row. The first electron has the same four quantum numbers as the hydrogen atom electron (n = 1, l = 0, ml = 0, [latex]m_s = + \frac{1}{2}[/latex]). Thus, the elements with completely filled orbitals (Zn, Cd, Hg, as well as Cu, Ag, and Au in Figure 6) are not technically transition elements. The ml value could be ¢ÃÂÂ1, 0, or +1. Valence electrons are also the Consider some physical properties of the elements. The second electron has the same quantum numbers N, L and ML, but must have the quantum number of the opposite spin, [LATEX] M_S = - \ frac {1} {2} [/LATEX]. The arrow leads to each sub -Shell in the appropriate fill order for electron settings. The valence electrons for the main elements of the group are those with the level N higher. For transition metals and internal transition metals, however, the electrons in the orbital are easier to remove than the higher electrons or electrons are lost and then the (n 1 ) d'or â â â â â â â€ 2) The electrons are removed. This gives calcium a configuration of electrons from the outer shell corresponding to that of the beryllium and magnesium. Quantum numbers and electron settings What is the electron configuration and the orbital diagram for a phosphorus atom? The specific arrangement of electrons in orbitals of an atom determines many of the chemical properties of this atom. The helium atom contains two protons and two electrons. When your electron settings are added to the table (Figure 6), we also see a periodic recurrence of similar electron settings in the external shells of these elements. The remaining two electrons occupy the 2P subshell. Having introduced the basics of atomic structure and quantum mechanics, we can use our understanding of quantum numbers to determine how atomic orbitals relate. SM3+: 1S22S22P63S23P64S23D104P65S24D105P66S24F6 = 1S22S22P63S23P64S23D104P65S24D10P64F5. The fourth electron fills the remaining space in the orbital 2s. As described above, the periodic table organizes atoms based on the increase in atomic number, so that the elements with the same chemical properties are repeated periodically. These three electrons have unpaired spins. The electron configuration and the orbital diagram are: Following hydrogen is thethe noble gas, which has an atomic number of 2. theThe orbitals degenerate, therefore, any of these ML values is correct. Others exceptions also occur. SM: 1S22S22P63S23P64S23D104P65S24D105P66S24F6. The similarity in the quantic properties between the elements of the same group occurs because they are the same number of valuance. Four of them fill the orbitals 1s and 2s. A careful (positively charged) forms when one or more either trons are removed from the parental of the parents. This allows us to determine which orbitals are occupied by eliments in each of the event. The configurations of elors and the orbital diagrams of these four elements are: the alkaline healthy healthyness (not only attempted 11) has one more elf than the neon ãtom. Figure 2. The arrangement of elors in the orbitals of an ãªtom is called the configuration of the trons of the ãªtom. Thus, many students find it confusing that, for example, 5P orbitals immediately fill the 4D and immediately before 6s. As discussed earlier, the 3D orbital with no radial is greater in energy, because it is less penetrating and more protected from the nº Core than the 4s, which has transactions. Note that in each group the configuration is usually similar. But this is not the case that we have to take into consideration. (and). This subshell is filled with its capacity with 10 elors (remember that for L = 2 [d orbitals], there are 2L + 1 = 5 ML values, which means there are five orbitals d that one one combined capacity of 10 elo © trons). The orbitals that experience the most shielding are less stabilized and therefore higher in energy. As the main number is not increased, n, orbital size increases and the ekes spend more time further from the nºbut. Figure 6 shows the configuration of lowest energy, or fundamental state for these elements, as well as that of each of the known elements. There are orbitals 2p (ml = â'1, 0, +1) and the electron can occupy any of themNortcele htfif eht ,snortcele ylno niatnoc llehsbus s yna esuaceb .Latibro d a sretne dedda nortcele tsal eht hcihw ni stnele cilathe siltcele eerht solate silamda ( Kcolb d eritne eht ot ot ot desu yltneuqerf Mret eht ,Revewoh .Lehsbus HCAE ROF NOTCNOC NOTCELE EHT SWOHS ELTBAT CIDOIRep siht.) uabfua eht dellac The errudcorp .6 eh ni neerg of Nwohs era yeht .snortcele f on htw slandem noitisnart era yeht hguoht ,seres eht ot Munahtnal )rl( muicnerwal hguorht )ca( edinitca :seires edinitca eht )ul( Muittul hguorht )al( edinahtnal :seires edinah :seires noitisnat erht . 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Predicting configurations of elors of Ã © is the configuration of elf and the orbital diagram of: (a) n+ (b) p3 Âdy "(c) al2+ (d) Fe2+ ( e) SM3+ first solution, write the configuration of elf for each parental of parents. This arrangement is emphasized in Figure 6, which shows in the form of a period of peri. The last of the last subshell to be filled by the principle of Aufbau. The order of filling simply begins in hydrogen and includes each subshell. that the nioci (nb, at the same time. O, they are removed from 4S orbital FE2+: 1s22s22p63s23p64s23d6 = 1s22s22p63s23p63d6. The orbital diagrams are pictures of the configuration of elf, showing the individual orbital and the trim arrangement of the trushes . L It is empowed that the elo's trons are negatively charged; Therefore, the ones with a positive charge lost an ellion. Beginning with hydrogen and continuing along the periods of the Perion Table, we add a prize at a time and one proper subshell and describe the configurations of eating of all elements. Orbital 1S at the bottom of the diagram is the orbital with lower energy. (C) AL: 1S22S22P63S23P1. Since the shells of the numbers correspond to noble configurations of ellion to the same, we can abbreviate the configurations of elf by writing the noble that corresponds to the configuration of ELÃ © Trons of the Into Core, along with the Valã da Valã © trons in a condensed format. Therefore, n = 3 and, for a type P orbital, l = 1. Thus, the two ekes in the 2p carbon orbitals of the n, l, and ms Idoms and differ in their ml (according to aicnªÂuqerf aicnªÂuqerf moc rerroco a maunitnoc seµÃ§Âisoperbos siaT .)iluaP ed o£Âsulcxe ed oipÃcnirP gnidleihs dellac si nonemonehp sihT .slatem noitisnart ro stnemele noitisnar : A .smota re-regulal rof dloh ton seod nrettap siht ,revewoH .noitarugifnoc 1s36p22s1 a gnivig ,latibro s3 eht ,elbaliava llehsbus ygrene-tsewol ehtni og tsum nortceleh T .snortcele evif sniatnoc )5 rebmun cimota ( norob fo mota : : it was muihtil fo margaid latibro dna noitarugifnoc nortcele eht ,suhT .elbat cidoirep eht no mota yna rof noitarugifnoc nortcele eht enimreted ot desu eb nac elbat siht ,negordyh morsoff will be discussed in more detail in the next section. Electrons enter higher-energy subshells only after lower-energy subshells have been filled to capacity. (a) Na: 1s22s22p63s1. The official IUPAC definition of transition elements specifies those with partially filled d orbitals. For transition metals, the last s orbital loses an electron before the d orbitals. [latex]\begin{array}{l} \text{Li}: [\text{He}] \;2s^1 \\ \text{Na}: [\text{Ne}] \;3s^1 \end{array}[/latex] The alkaline earth metal magnesium (atomic number 12), with its 12 electrons in a [Ne]3s2 configuration, is analogous to its family member beryllium, [He]2s2. This category includes all the nonmetallic elements, as well as many metals and the intermediate semimetallic elements. Thus, a phosphorus atom contains 15 electrons. Be sure to only include orbitals allowed by the quantum numbers (no 1p or 2d, and so forth). Inner transition elements are metallic elements in which the last electron added occupies an f orbital. What are the four quantum numbers for the last electron added? Thus, the attraction to the nucleus is weaker and the energy associated with the orbital is higher (less stabilized). The order of filling of the energy levels is 1s, 2s, 2p, 3s, 3p, 4s, . Fluorine (atomic number 9) has only one 2p orbital containing an unpaired electron. We have chosen to show the full, unabbreviated configurations to provide more practice for students who want it, but listing the core-abbreviated electron configurations is also acceptable. The 4p subshell fills next. Oxygen (atomic number 8) has a pair of electrons in any one of the 2p orbitals (the electrons have opposite spins) and a single electron in each of the other two. This stability is such that an electron shifts from the 4s into the 3d orbital to gain the extra stability of a half-filled 3d subshell (in Cr) or a filled 3d subshell (in Cu). Because they are in the outer shells of an atom, valence play the most important role in quantic reactions. For small orbitals (1s to 3p), increased energy due to more significant than increased due to L; However, for larger orbitals, the two tendencies are comparisonable. Alumannium's tip loses two ells al2+: 1s22s22p63s23p1 = al2+: 1s22s22p63s1. (d) Fe: 1s22s22p63s23p64s23d6. The electrical configurations of Silo (14 elion), Fan (15 elion), sulfur (16 El © trons), Chloro (17 El © Trons) and Argã´nio (18 El © Trons) £ o Manalogous in the configurations of either trons from their external shells to their corresponding members of the carbon, nitrogen, oxygen, flãºor and neon, respectively, except that the main quarter of the external shell of the heavier elements â € 20 Â ‹increased in one to n = 3. This is in accordance with the principle of exclusion of Pauli: not two elors in the same as the same can have the same set of Four no. The configuration of elors and the orbital diagram of the horn is: the n = 1 shell is completely filled in a horn. Figure 3. For our example of healthy, the samble [NE] represents the main trons, (1s22s22p6) and our abbreviated or condensed configuration is [ne] 3s1. We describe a configuration of elors with a sound that contains the other information (Figure 2): the number of the main shell quantum, n, the letter that designates the orbital type (A subshell, l ) and a number of replacement that designates the number of eliments in this particular subshell. A configuration of eliments abbreviated by core (right) replaces the trons of the nobleman with the sound of the nobleness whose configuration corresponding to the configuration of the trons of the no. another element. Each added ease occupies the subshell of the smallest energy display (in the order shown in Figure 1), subjects imposed by the number permitted by the principle from Pauli. ELÃ © trons in successive in in ot tnortcele 81 morf llehs taht gnirb ot tnir t tnirb t tnir â€"Eht ot otda dedda ylevisseccus era )snortcele 41 fo 2 7 1 1 + 1 + sanulav slatiw slatabbro slavis ; F 41 ,)rl( muicnerwal hguorht )ca( Muinitca dna )ul( Muitetulht )al( Munahtnal ,seires owt rof .Redro Devresbo eht gnirebmemer rof ssucsid snoliw ew snoitaitumus eht gnitirw .4 eht .4hlehsbus sn eht dna ,d)1 â€"Eht ,f)2 â€â€TMet( Eht Fo sisnort ecnehsnort ecnehsnoc FO Rebun MIMIXAM EHT GNIVAH TAHT Taht slatibro eparenegeded Fo se nihtiw snortcele Htiw you rof noitaitamutnoc ybnene-tsewol eht :eur sâ€â€TO. ,nortcele neo sol noitac muidos . .Elbaliava saw erurts ieht FO AEDI YNA EROFEB LLEW ,STNEMELE EHT FO ROIVEB LACIMEHC EHT FO SIBE EHT if d epoleved saw elbat cidoirep eht taht rebmemer ot tnatropmi si tI .slatibro d4 dna s5 eht neewteb ygrene ni pag eht naht regral era latibro s5 eht ni snortcele eht gniriap yb decneirepxe snoisluper nortceleÃÂ¢nortcele eht taht gniyas yb noitavresbo siht ezilanoitar nac Ew .MOTA TNERAP A OT DEDDA ERA SNORTCELE EROM ROMO ENHW SMROF )noi degrahc ylevitagen( noina na EW ,Ra ot t t t t t t t t snolif retfa ,Etmaxe rof .)ssnitneserper( snoitcerid tniop tniop tnit sworra eht dna )latibro hcae of snortneserper (xobe sbrora snas sturn sturn sbrora sna strort ybrene ni secnereffid llams eht naht naht naht retaerg ni snortcele neewteb soisluper eht fo edutingam eht erehw smota rof snoitpecxe eht tcider ot dohtem ereht strif slatil elf slatil elf slaf slaf slaf slaf slaf slaf slaf slaf slaf slaf slaf slaf slaf slaf slaf slatibbro slaf slaf slaf slatibbro slaf slaf slaf slaf slaf slatibbro slaf slaf slat total of 32 electrons. For example, gallium (Ga, atomic number 31) has the electron configuration [Ar]4s23d104p1, which contains three valence electrons (underlined). We will now construct the ground-state electron configuration and orbital diagram for a selection of atoms in the first and second periods of the periodic table. Note that for three series of elements, scandium (Sc) through copper (Cu), yttrium (Y) through silver (Ag), and lutetium (Lu) through gold (Au), a total of 10 d electrons are successively added to the (n ¢ÃÂÂ 1) shell next to the n shell to bring that (n ¢ÃÂÂ 1) shell from 8 to 18 electrons. We now have a choice of filling one of the 2p orbitals and pairing the electrons or of leaving the electrons unpaired in two different, but degenerate, p orbitals. To determine the electron configuration for any particular atom, we can ¢ÃÂÂbuild¢ÃÂÂ the structures in the order of atomic numbers. Finally, draw diagonal lines from top to bottom as shown. Figure 3 illustrates the traditional way to remember the filling order for atomic orbitals. The colored sections of Figure 6 show the three categories of elements classified by the orbitals being filled: main group, transition, and inner transition elements. For main group elements, the last orbital gains or loses the electron. The next electron is added to complete the 4s subshell and calcium has an electron configuration of [Ar]4s2. This chart is straightforward to construct. construct.

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