

**OKLAHOMA SCHOOL of
SCIENCE and MATHEMATICS**

Chemistry - Summer Assignment

You will find very soon that chemistry is a fascinating language that is both verbal and pictorial. To learn a new language one must start with the alphabet to make words and sentences. Similarly, in chemistry one needs to begin to learn the symbols (alphabet) of the elements to make molecular formulae (words) and chemical equations (sentences). We have learned through the years that it is easier for the students to learn chemical concepts if they come to class with a background in chemical symbols, valence and nomenclature. You will be taking chemistry either in your first or second semester at OSSM. Plan on spending sometime this summer studying the following information before your arrival. This advance preparation will prove very beneficial to you.

- 1) Study the *Periodic Table of the Elements* (Handout #1). Learn and memorize the name and symbol of each element in groups 1 through 18.
 - Group 1 is called *alkali metals*: H (hydrogen), Li (Lithium), Na (Sodium), K (Potassium), Rb (Rubidium), Cs (Cesium), and Fr (Francium).
 - Group 2 is called *alkaline earth metals*: Be (Beryllium), Mg (Magnesium), Ca (Calcium), Sr (Strontium), Ba (Barium), and Ra (Radium).
 - Group 3–12 are called *transition metal elements* (these are optional for you to memorize). Skip elements with atomic numbers (57–71), Lanthanide series, and (89–103), Actinide series.
 - Group 13: B (Boron), Al (Aluminum), Ga (Gallium), In (Indium), Tl (Thallium)
 - Group 14: C (Carbon), Si (Silicon), Ge (Germanium), Sn (Tin), Pb (Lead)
 - Group 15: N (Nitrogen), P (Phosphorous), As (Arsenic), Sb (Antimony), Bi (Bismuth)
 - Group 16: O (Oxygen), S (Sulfur), Se (Selenium), Te (Tellurium), Po (Polonium)
 - Group 17: F (Fluorine), Cl (Chlorine), Br (Bromine), I (Iodine), At (Astatine)
 - Group 18: He (Helium), Ne (Neon), Ar (Argon), Kr (Krypton), Xe (Xenon), Rn (Radon)
- 2) Learn the list of symbols and charges for monatomic and polyatomic ions (Handout #2).
- 3) Learn the name and formula of 100 compounds (Handout #3 and #4 in Orientation booklet and also a loose-leaf copy). **The loose-leaf Handout #3 and #4 will be completed by you and returned to OSSM along with other required paperwork. The set that is included in this Orientation booklet is for you to record your answers since you will need these handouts throughout the course.**
- 4) Chemistry Summer Preparation Assignment – 1000 word essay, see handout #5
- 5) For web help and study please go to 1) <http://www.webelements.com/> or 2) <http://dbhs.wvusd.k12.ca.us/webdocs/Nomenclature/Acid-Nomenclature.html>
- 6) For additional questions or help, email Dr. Rahman (Fazlur.Rahman@ossm.edu), Dr. Ruibo Li (Ruibo.Li@ossm.edu), or Dr. Hossain (delwar.hossain@ossm.edu)

PERIODIC TABLE

Atomic Properties of the Elements

FREQUENTLY USED FUNDAMENTAL PHYSICAL CONSTANTS¹

¹ second = 9 192 631 770 periods of radiation corresponding to the transition between the two hyperfine levels of the ground state of ¹³³Cs

| | | |
|------------------|--|---------|
| c | 299 792 458 m s ⁻¹ | (exact) |
| h | 6.626 070 x 10 ⁻³⁴ J s | |
| e | 1.602 177 x 10 ⁻¹⁹ C | |
| electron mass | 9.109 384 x 10 ⁻³¹ kg | |
| m _p | 0.510 999 MeV | |
| m _n | 1.672 622 x 10 ⁻²⁷ kg | |
| α | 1/137.035 999 | |
| R _∞ | 10 973 731.569 m ⁻¹ | |
| R _{∞c} | 3.289 841 960 x 10 ¹⁵ Hz | |
| R _{∞hc} | 13 605 693 eV | |
| eV | 1.602 177 x 10 ⁻¹⁹ J | |
| k | 1.380 65 x 10 ⁻²³ J K ⁻¹ | |
| R | 8.314 5 J mol ⁻¹ K ⁻¹ | |

² For the most accurate values of these and other constants, visit physics.nist.gov/constants.

Solids
 Liquids
 Gases
 Artificially Prepared

NIST National Institute of Standards and Technology
 U.S. Department of Commerce

Physical Measurement Laboratory www.nist.gov/pml
 Standard Reference Data www.nist.gov/srd

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VIIA

| Group | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | | |
|-------|--|---|--|--|--|---|---|---|---|---|---|---|---|---|---|---|---|---|--|--|
| IA | IIB | IIIB | IVB | VB | VIB | VIB | VIIA | VIIIA | VIIIA | VIIIA | IB | IIIB | IIIA | IVA | VA | VIA | VIA | VIA | | |
| | 1 Li 3 6.94 1s ² s | 2 Be 4 9.0122 1s ² s ² | 3 B 5 10.81 1s ² s ² p | 4 C 6 12.011 1s ² s ² p ² | 5 N 7 14.007 1s ² s ² p ³ | 6 O 8 15.999 1s ² s ² p ⁴ | 7 F 9 18.998 1s ² s ² p ⁵ | 8 Ne 10 20.180 1s ² s ² p ⁶ | 9 Na 11 22.990 [Ne]3s | 10 Mg 12 24.305 [Ne]3s ² | 11 Al 13 26.982 [Ne]3s ² 3p | 12 Si 14 28.086 [Ne]3s ² 3p ² | 13 P 15 30.974 [Ne]3s ² 3p ³ | 14 S 16 32.06 [Ne]3s ² 3p ⁴ | 15 Cl 17 35.45 [Ne]3s ² 3p ⁵ | 16 Ar 18 39.95 [Ne]3s ² 3p ⁶ | | | | |
| | 19 K 19 39.098 [Ar]4s | 20 Ca 20 40.078 [Ar]4s | 21 Sc 21 44.956 [Ar]3d ¹ 4s ² | 22 Ti 22 47.867 [Ar]3d ² 4s ² | 23 V 23 50.942 [Ar]3d ³ 4s ² | 24 Cr 24 51.996 [Ar]3d ⁵ 4s | 25 Mn 25 54.938 [Ar]3d ⁵ 4s ² | 26 Fe 26 55.845 [Ar]3d ⁶ 4s ² | 27 Co 27 58.933 [Ar]3d ⁷ 4s ² | 28 Ni 28 58.693 [Ar]3d ⁸ 4s ² | 29 Cu 29 63.546 [Ar]3d ¹⁰ 4s | 30 Zn 30 65.38 [Ar]3d ¹⁰ 4s ² | 31 Ga 31 69.723 [Ar]3d ¹⁰ 4s ² 4p | 32 Ge 32 72.630 [Ar]3d ¹⁰ 4s ² 4p ² | 33 As 33 74.922 [Ar]3d ¹⁰ 4s ² 4p ³ | 34 Se 34 78.971 [Ar]3d ¹⁰ 4s ² 4p ⁴ | 35 Br 35 79.904 [Ar]3d ¹⁰ 4s ² 4p ⁵ | 36 Kr 36 83.80 [Ar]3d ¹⁰ 4s ² 4p ⁶ | | |
| | 37 Rb 37 85.468 [Kr]5s | 38 Sr 38 87.62 [Kr]5s | 39 Y 39 88.906 [Kr]4d ¹ 5s ² | 40 Zr 40 91.224 [Kr]4d ² 5s ² | 41 Nb 41 92.906 [Kr]4d ⁴ 5s | 42 Mo 42 95.96 [Kr]4d ⁵ 5s | 43 Tc 43 98.906 [Kr]4d ⁵ 5s | 44 Ru 44 101.07 [Kr]4d ⁷ 5s | 45 Rh 45 102.91 [Kr]4d ⁸ 5s | 46 Pd 46 106.42 [Kr]4d ¹⁰ | 47 Ag 47 107.87 [Kr]4d ¹⁰ 5s | 48 Cd 48 112.41 [Kr]4d ¹⁰ 5s ² | 49 In 49 114.82 [Kr]4d ¹⁰ 5s ² 5p | 50 Sn 50 118.71 [Kr]4d ¹⁰ 5s ² 5p ² | 51 Sb 51 121.76 [Kr]4d ¹⁰ 5s ² 5p ³ | 52 Te 52 127.60 [Kr]4d ¹⁰ 5s ² 5p ⁴ | 53 I 53 126.90 [Kr]4d ¹⁰ 5s ² 5p ⁵ | 54 Xe 54 131.29 [Kr]4d ¹⁰ 5s ² 5p ⁶ | | |
| | 55 Cs 55 132.91 [Xe]6s | 56 Ba 56 137.33 [Xe]6s | 57 La 57 138.91 [Xe]5d ¹ 6s ² | 58 Ce 58 140.12 [Xe]4f ¹ 5d ¹ 6s ² | 59 Pr 59 140.91 [Xe]4f ³ 6s ² | 60 Nd 60 144.24 [Xe]4f ⁴ 6s ² | 61 Pm 61 144.91 [Xe]4f ⁵ 6s ² | 62 Sm 62 150.36 [Xe]4f ⁶ 6s ² | 63 Eu 63 151.96 [Xe]4f ⁷ 6s ² | 64 Gd 64 157.25 [Xe]4f ⁷ 6s ² | 65 Tb 65 158.93 [Xe]4f ⁹ 6s ² | 66 Dy 66 162.50 [Xe]4f ¹⁰ 6s ² | 67 Ho 67 164.93 [Xe]4f ¹¹ 6s ² | 68 Er 68 167.26 [Xe]4f ¹² 6s ² | 69 Tm 69 168.93 [Xe]4f ¹³ 6s ² | 70 Yb 70 173.05 [Xe]4f ¹⁴ 6s ² | 71 Lu 71 174.97 [Xe]4f ¹⁴ 6s ² | | | |
| | 87 Fr 87 223 [Rn]7s | 88 Ra 88 226 [Rn]7s | 89 Ac 89 227 [Rn]6d ¹ 7s ² | 90 Th 90 232.04 [Rn]6d ² 7s ² | 91 Pa 91 231.04 [Rn]5f ² 6d ¹ 7s ² | 92 U 92 238.03 [Rn]5f ³ 6d ¹ 7s ² | 93 Np 93 237 [Rn]5f ⁶ 6d ¹ 7s ² | 94 Pu 94 239 [Rn]5f ⁷ 6d ¹ 7s ² | 95 Am 95 243 [Rn]5f ⁷ 6d ¹ 7s ² | 96 Cm 96 247 [Rn]5f ⁷ 6d ¹ 7s ² | 97 Bk 97 247 [Rn]5f ⁷ 6d ¹ 7s ² | 98 Cf 98 251 [Rn]5f ⁷ 6d ¹ 7s ² | 99 Es 99 252 [Rn]5f ⁷ 6d ¹ 7s ² | 100 Fm 100 253 [Rn]5f ⁷ 6d ¹ 7s ² | 101 Md 101 258 [Rn]5f ⁷ 6d ¹ 7s ² | 102 No 102 259 [Rn]5f ⁷ 6d ¹ 7s ² | 103 Lr 103 260 [Rn]5f ⁷ 6d ¹ 7s ² | | | |

¹Based upon c (1) indicates the mass number of the longest-lived isotope.
²For the most precise values and uncertainties, visit physics.nist.gov/constants and physics.nist.gov/units.

| Symbols and Charges for Monatomic Ions | | | | | | |
|--|---------------|--|------------------|--------------|------------------|--|
| Symbol | Name | | Symbol | Name | | |
| H ⁺ | hydrogen ion | | H ⁻ | hydride | | Note that the letters in an ion's name before the -ide ending is the stem. For example, the stem for bromide is brom-. |
| Li ⁺ | lithium ion | | F ⁻ | fluoride | | |
| Na ⁺ | sodium ion | | Cl ⁻ | chloride | | |
| K ⁺ | potassium ion | | Br ⁻ | bromide | | |
| Rb ⁺ | rubidium ion | | I ⁻ | iodide | | |
| Cs ⁺ | cesium ion | | O ²⁻ | oxide | | |
| Be ²⁺ | beryllium ion | | S ²⁻ | sulfide | | |
| Mg ²⁺ | magnesium ion | | Se ²⁻ | selenide | | |
| Ca ²⁺ | calcium ion | | Te ²⁻ | telluride | | |
| Sr ²⁺ | strontium ion | | | | | |
| Ba ²⁺ | barium ion | | Ag ⁺ | silver ion | N ³⁻ | nitride |
| Ra ²⁺ | radium ion | | Ni ²⁺ | nickel ion | P ³⁻ | phosphide |
| Zn ²⁺ | zinc ion | | Al ³⁺ | aluminum ion | As ³⁻ | arsenide |

| Symbol | Systematic name (Stock system) | Common name | Symbol | Systematic name (Stock system) | Common name |
|------------------|--------------------------------|-------------|-------------------------------|--------------------------------|-------------|
| Cu ⁺ | copper(I) | cuprous | Hg ₂ ²⁺ | mercury(I) | mercurous |
| Cu ²⁺ | copper(II) | cupric | Hg ²⁺ | mercury(II) | mercuric |
| Fe ²⁺ | iron(II) | ferrous | Pb ²⁺ | lead(II) | plumbous |
| Fe ³⁺ | iron(III) | ferric | Pb ⁴⁺ | lead(IV) | plumbic |
| Sn ²⁺ | tin(II) | stannous | Co ²⁺ | cobalt(II) | cobaltous |
| Sn ⁴⁺ | tin(IV) | stannic | Co ³⁺ | cobalt(III) | cobaltic |
| Cr ²⁺ | chromium(II) | chromous | Au ⁺ | gold(I) | aurous |
| Cr ³⁺ | chromium(III) | chromic | Au ³⁺ | gold(III) | auric |
| Mn ²⁺ | manganese(II) | manganous | | | |
| Mn ³⁺ | manganese(III) | manganic | | | |

| Symbols and Charges for Polyatomic Ions | | | |
|--|--------------|---|----------------------------------|
| Formula | Name | Formula | Name |
| NO ₃ ⁻ | nitrate | ClO ₄ ⁻ | perchlorate |
| NO ₂ ⁻ | nitrite | ClO ₃ ⁻ | chlorate |
| CrO ₄ ²⁻ | chromate | ClO ₂ ⁻ | chlorite |
| Cr ₂ O ₇ ²⁻ | dichromate | ClO ⁻ | hypochlorite |
| CN ⁻ | cyanide | IO ₄ ⁻ | periodate |
| MnO ₄ ⁻ | permanganate | IO ₃ ⁻ | iodate |
| OH ⁻ | hydroxide | IO ⁻ | hypoiodite |
| O ₂ ²⁻ | peroxide | BrO ₃ ⁻ | bromate |
| NH ₂ ⁻ | amide | BrO ⁻ | hypobromite |
| CO ₃ ²⁻ | carbonate | HCO ₃ ⁻ | hydrogen carbonate (bicarbonate) |
| SO ₄ ²⁻ | sulfate | HSO ₄ ⁻ | hydrogen sulfate (bisulfate) |
| SO ₃ ²⁻ | sulfite | HSO ₃ ⁻ | hydrogen sulfite (bisulfite) |
| C ₂ O ₄ ²⁻ | oxalate | HC ₂ O ₄ ⁻ | hydrogen oxalate (binoxalate) |
| PO ₄ ³⁻ | phosphate | HPO ₄ ²⁻ | hydrogen phosphate |
| PO ₃ ³⁻ | phosphite | H ₂ PO ₄ ⁻ | dihydrogen phosphate |

Student's Name (Please Print)

| Name | Formula | | Name | Formula |
|----------------------------|---------|--|-------------------------------|---------|
| 1. ammonium sulfide | | | 26. nickel(II) iodide | |
| 2. sodium nitrate | | | 27. mercurous oxide | |
| 3. cupric bromide | | | 28. lead(II) chlorite | |
| 4. aluminum sulfate | | | 29. stannic iodide | |
| 5. potassium nitrate | | | 30. iron(II) bisulfite | |
| 6. ferrous carbonate | | | 31. magnesium nitrate | |
| 7. lead(II) phosphate | | | 32. iron(III) chromate | |
| 8. sodium phosphide | | | 33. iron(II) chromate | |
| 9. cupric hydroxide | | | 34. copper(II) hydroxide | |
| 10. calcium fluoride | | | 35. cuprous carbonate | |
| 11. nickel(II) nitrate | | | 36. chromic acetate | |
| 12. silver cyanide | | | 37. calcium chlorate | |
| 13. ammonium sulfite | | | 38. cobaltous telluride | |
| 14. zinc sulfate | | | 39. mercurous perchlorate | |
| 15. tin(II) chloride | | | 40. zinc bicarbonate | |
| 16. antimony(III) chloride | | | 41. sodium phosphate | |
| 17. silver sulfide | | | 42. silver hypochlorite | |
| 18. magnesium hydroxide | | | 43. ammonium phosphate | |
| 19. ammonium carbonate | | | 44. ferrous chlorite | |
| 20. nickel(II) acetate | | | 45. potassium sulfide | |
| 21. sodium chromate | | | 46. tin(IV) bromide | |
| 22. chromic bisulfate | | | 47. lithium chromate | |
| 23. potassium permanganate | | | 48. magnesium bisulfate | |
| 24. silver perchlorate | | | 49. ferrous phosphate | |
| 25. potassium phosphate | | | 50. calcium sulfate dihydrate | |

Student's Name (Please Print)

| Formula | Name | Formula | Name |
|---|------|---|------|
| 51. FeCl ₃ | | 76. NH ₄ F | |
| 52. PbF ₂ | | 77. HgF ₂ | |
| 53. PbSO ₄ | | 78. K ₂ Cr ₂ O ₇ | |
| 54. KF | | 79. NH ₄ OH | |
| 55. NaCl | | 80. (NH ₄) ₂ SO ₄ | |
| 56. V ₂ O ₅ | | 81. Na ₂ O | |
| 57. AlBr ₃ | | 82. SnCrO ₄ | |
| 58. Ba(ClO ₄) ₂ | | 83. Al ₂ O ₃ | |
| 59. Ba ₃ (PO ₄) ₂ | | 84. CuCO ₃ | |
| 60. CdO | | 85. RbClO ₂ | |
| 61. FePO ₄ | | 86. CuS | |
| 62. Hg ₂ SO ₄ | | 87. MgI ₂ | |
| 63. KH | | 88. CoCl ₃ | |
| 64. Co ₂ (SO ₃) ₃ | | 89. NaCN | |
| 65. Al ₂ Se ₃ | | 90. Hg ₃ N ₂ | |
| 66. Ca ₃ P ₂ | | 91. NaBrO ₃ | |
| 67. Fe(NO ₂) ₃ | | 92. MnF ₄ | |
| 68. Sn ₃ (PO ₄) ₂ | | 93. Sb ₂ O ₅ | |
| 69. PbO ₂ | | 94. LiH | |
| 70. Be(OH) ₂ | | 95. VF ₅ | |
| 71. Sr(HCO ₃) ₂ | | 96. SnI ₄ | |
| 72. Sr(OH) ₂ | | 97. KOH | |
| 73. RaS | | 98. K ₂ O | |
| 74. Hg ₂ O ₂ | | 99. Rb ₂ SO ₄ | |
| 75. Hg ₂ (OH) ₂ | | 100. Li ₂ O | |

OKLAHOMA SCHOOL of SCIENCE and MATHEMATICS

Chemistry Summer Preparation Assignment

In addition to the Chemistry assignments the incoming students are asked to write a 500-1000 word essay (2-5 pages) on one of the following prompts.

- Greatest three Nobel Prizes in chemistry
- Best three elements in the periodic table
- Best three compounds that changed our lives for better
- Three elements that has detrimental effects on health
- Three molecules that are harmful to the environment
- Clean water and clean air and our citizens rights
- What are we made of? The story of amino acid, RNA and DNA molecules
- Carbohydrates: The food we eat
- Chemistry of cosmetics
- Chemistry of new materials

Your essay must include the following:

- A summary - An introduction (why it is important)
- What do we know?
- Statistical data, are there any applications?
- Benefit to society.
- A conclusion.

The essay must also have the following information:

- Title, author's name, date of submission
- Must include references and/or citations, (preferred MLA citations).
- The essay must be written in 12 font Times New Roman.
- The student may use any sources.