

NYA AP Chemistry Summer Assignment 2023

AP Chemistry is the equivalent of a two-semester general chemistry college course. Due to the significant amount of material covered and the fact that this is the first exposure to chemistry for most of you, it is necessary for you to have a grasp of the basics before we meet together in the fall. Please do not wait until the very end of the summer to complete this assignment—chemistry is highly cumulative, so don't cram. Learn the material well.

The summer assignment will be graded for completion only. It is important that you complete the assignment on your own and do not just look up or copy the answers. Doing so will not improve your grade and you will miss out on wrestling with the content which is important when mastering concepts in chemistry.

NB: The review and lab book that are listed on the NYA virtual bookstore are not needed for the summer assignment, but should be brought with you on the first day of school.

Assignment:

1. Email me when you are ready to begin the summer assignment and I will email you a copy of the reading. A periodic table and a list of common ions are located at the end of this file. You will be able to use both of these (minus the polyatomic ions you have to memorize) on the Unit 0 Test. Keep them handy when you complete the problems.
2. Read and take notes on Unit 0.
3. Answer the questions to all 'Tasks' interspersed throughout the reading on a separate piece of paper. *These will be graded for completion only.*
4. Email me your answers to all tasks by September 4th. I will send you the answer key when I receive your answers. Correct your answers in a different color pen and bring them with you to the first class in September for full credit.
5. Study for the Unit 0 Quiz on the material listed on the second page of this sheet. You will only be asked for recall of the information. This will be given on the first day of class.
6. Study for the Unit 0 Test that will be given during the first week of classes in September (exact date TBD). There is a study guide on Page 3 of this assignment that includes everything you have to have memorized and be able to do on the test. Come to class having studied with questions ready!

First day of class: I will collect your corrected task and worksheet answers and you will take the Unit 0 Quiz on the material from page 2 of this assignment. I will also answer questions over the summer assignment.

First week of class: You will be given the Unit 0 Test covering the material on page 3 of this assignment (exact date TBD).

If you have any questions, feel free to email me (lsmith@nya.org).

See you in the fall!
Mrs. Smith

To memorize for Unit 0 Quiz on the first day of class:

1. The following polyatomic ions:

NH ₄ ⁺	Ammonium
CN ⁻	Cyanide
CH ₃ CO ₂ ⁻	Acetate
NO ₃ ⁻	Nitrate
CO ₃ ²⁻	Carbonate
SO ₄ ²⁻	Sulfate
SO ₃ ²⁻	Sulfite
MnO ₄ ⁻	Permanganate
PO ₄ ³⁻	Phosphate
ClO ₃ ⁻	Chlorate
ClO ₄ ⁻	Perchlorate
OH ⁻	Hydroxide

2. The following metric prefixes:

kilo (k)	10 ³
milli (m)	10 ⁻³
micro (μ)	10 ⁻⁶
nano (n)	10 ⁻⁹

3. The locations of the following on the periodic table:

Nonmetals
Metals
Metalloids

4. The following definitions:

Atomic number = number of protons

Mass number = neutrons + protons

Molecular compound = compound that contains all nonmetals

Ionic compound = compound that contains metals and nonmetals or a metal with a polyatomic ion or ammonium and a nonmetal.

5. The following prefixes:

1	2	3	4	5	6	7	8	9	10
mono-	di-	tri-	tetra-	penta-	hexa-	hepta-	octa-	nona-	deca-

6. Temperature conversion formula

$$T_k = T_{°C} + 273$$

7. Density formula

$$\text{density} = \text{mass/volume or } d = m/V$$

Unit 0 Test Study Guide

To Memorize:

1. Properties of solids, liquids, and gases (Page 3 of text)
2. Names of the different changes of states (Page 4 of text)
3. Rules for moving decimal places and the effect on the exponent in scientific notation (Page 6 of text)
4. SI units (Page 7 of text)
5. Metric prefixes (only those on Page 2 of this assignment)
6. Temperature formula (Page 9 of text)
7. Density formula (Page 10 of text)
8. Rules for determining the number of significant figures present in a number (Page 11 of text)
9. Rules for determining the correct number of significant figures to be shown as a result of a calculation (Page 11 of text)
10. Definitions of accuracy and precision (Page 13 of text)
11. Formula for percentage error (Page 13 of text)
12. Location of metals, nonmetals, and metalloids on the periodic table (Page 16 of text)
13. Properties of subatomic particles (Table on page 15 of text)
14. Definitions of atomic number and mass number (Page 15 of text)
15. Polyatomic ions (only those on Page 2 of this assignment)
16. Rules for naming binary ionic compounds, binary acids, oxoacids, ionic compounds with polyatomic ions, and binary molecular compounds (Pages 17-23 of text)

To Master:

1. Distinguish between the 3 states of matter based on descriptions of substances and/or particulate drawings.
2. Identify and distinguish between the 6 changes of states.
3. Distinguish between a physical and a chemical change.
4. Convert numbers from standard to scientific notation and vice versa.
5. Identify the type (mass, length, etc.) of measurement for a given number.
6. Translate between the names and abbreviations for the SI units.
7. Convert from one unit to another (metric, temperature, or using any other conversion factor I provide). You only need to memorize the metric prefixes referenced on page 2 of this assignment and the Kelvin-Celsius formula. You do not have to use dimensional analysis for this (even though I strongly recommend it) but you must show your work for ANY credit.
8. Calculate the density of a substance or use density to calculate the mass or volume of a substance.
9. Determine the number of significant figures in a given number.
10. Adjust calculated answers to give the correct number of significant figures.
11. Distinguish between accuracy and precision.
12. Calculate percentage error.
13. Identify substances as metals, nonmetals or metalloids based on their location on the periodic table.
14. Determine the number of protons, electrons, and neutrons in a given atomic symbol.
15. Write atomic symbols when given the number of protons, electrons, and neutrons.
16. Identify compounds as ionic, molecular, or acids.
17. Name and/or write formulas for binary ionic compounds (use common ions charts given in this assignment)
18. Name and/or write formulas for binary acids.
19. Name and/or write formulas for oxoacids and ionic compounds containing polyatomic ions.
20. Name and/or write formulas for binary molecular compounds.

1	1A											18	8A					
1	1 H Hydrogen 1.01											2 He Helium 4.00						
2	3 Li Lithium 6.94	4 Be Beryllium 9.01											5 B Boron 10.81	6 C Carbon 12.01	7 N Nitrogen 14.01	8 O Oxygen 16.00	9 F Fluorine 19.00	10 Ne Neon 20.18
3	11 Na Sodium 22.99	12 Mg Magnesium 24.31	3 3B	4 4B	5 5B	6 6B	7 7B	8 8B	9	10	11 1B	12 2B	13 Al Aluminum 26.98	14 Si Silicon 28.09	15 P Phosphorus 30.97	16 S Sulfur 32.07	17 Cl Chlorine 35.45	18 Ar Argon 39.95
4	19 K Potassium 39.10	20 Ca Calcium 40.08	21 Sc Scandium 44.96	22 Ti Titanium 47.87	23 V Vanadium 50.94	24 Cr Chromium 52.00	25 Mn Manganese 54.94	26 Fe Iron 55.85	27 Co Cobalt 58.93	28 Ni Nickel 58.69	29 Cu Copper 63.55	30 Zn Zinc 65.39	31 Ga Gallium 69.72	32 Ge Germanium 72.61	33 As Arsenic 74.92	34 Se Selenium 78.96	35 Br Bromine 79.90	36 Kr Krypton 83.80
5	37 Rb Rubidium 85.47	38 Sr Strontium 87.62	39 Y Yttrium 88.91	40 Zr Zirconium 91.22	41 Nb Niobium 92.91	42 Mo Molybdenum 95.94	43 Tc Technetium (98)	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.91	46 Pd Palladium 106.42	47 Ag Silver 107.87	48 Cd Cadmium 112.41	49 In Indium 114.82	50 Sn Tin 118.71	51 Sb Antimony 121.76	52 Te Tellurium 127.60	53 I Iodine 126.90	54 Xe Xenon 131.29
6	55 Cs Cesium 132.91	56 Ba Barium 137.33	57 La Lanthanum 138.91	72 Hf Hafnium 178.49	73 Ta Tantalum 180.95	74 W Tungsten 183.84	75 Re Rhenium 186.21	76 Os Osmium 190.23	77 Ir Iridium 192.22	78 Pt Platinum 195.08	79 Au Gold 196.97	80 Hg Mercury 200.59	81 Tl Thallium 204.38	82 Pb Lead 207.2	83 Bi Bismuth 208.98	84 Po Polonium (209)	85 At Astatine (210)	86 Rn Radon (222)
7	87 Fr Francium (223)	88 Ra Radium (226)	89 Ac Actinium (227)	104 Rf Rutherfordium (261)	105 Db Dubnium (262)	106 Sg Seaborgium (266)	107 Bh Bohrium (264)	108 Hs Hassium (269)	109 Mt Meitnerium (268)									
			58 Ce Cerium 140.12	59 Pr Praseodymium 140.91	60 Nd Neodymium 144.24	61 Pm Promethium (145)	62 Sm Samarium 150.36	63 Eu Europium 151.96	64 Gd Gadolinium 157.25	65 Tb Terbium 158.93	66 Dy Dysprosium 162.50	67 Ho Holmium 164.93	68 Er Erbium 167.26	69 Tm Thulium 168.93	70 Yb Ytterbium 173.04	71 Lu Lutetium 174.97		
			90 Th Thorium 232.04	91 Pa Protactinium 231.04	92 U Uranium 238.03	93 Np Neptunium (237)	94 Pu Plutonium (244)	95 Am Americium (243)	96 Cm Curium (247)	97 Bk Berkelium (247)	98 Cf Californium (251)	99 Es Einsteinium (252)	100 Fm Fermium (257)	101 Md Mendelevium (258)	102 No Nobelium (259)	103 Lr Lawrencium (262)		

Key

11	—	Atomic number
Na	—	Element symbol
Sodium	—	Element name
22.99	—	Average atomic mass*

* If this number is in parentheses, then it refers to the atomic mass of the most stable isotope.

AP Common Ions

CATIONS (+ve)			ANIONS (-ve)		
Name	Symbol/ Formula	Alternative*	Name	Symbol/ Formula	Alternative*
Aluminum	Al ³⁺		Bromide	Br ⁻	
Ammonium	NH ₄ ⁺		Bromate (I)	BrO ⁻	(<u>Hypobromite</u>)
Arsenic (III)	As ³⁺		Bromate (III)	BrO ₂ ⁻	(<u>Bromite</u>)
Arsenic (V)	As ⁵⁺		Bromate (V)	BrO ₃ ⁻	(<u>Bromate</u>)
Barium	Ba ²⁺		Bromate (VII)	BrO ₄ ⁻	(<u>Perbromate</u>)
Bismuth (III)	Bi ³⁺		Carbonate	CO ₃ ²⁻	
Bismuth (V)	Bi ⁵⁺		Chlorate (I)	ClO ⁻	(<u>Hypochlorite</u>)
Cadmium	Cd ²⁺		Chlorate (III)	ClO ₂ ⁻	(<u>Chlorite</u>)
Calcium	Ca ²⁺		Chlorate (V)	ClO ₃ ⁻	(<u>Chlorate</u>)
Chromium (II)	Cr ²⁺		Chlorate (VII)	ClO ₄ ⁻	(<u>Perchlorate</u>)
Chromium (III)	Cr ³⁺		Chloride	Cl ⁻	
Cobalt (II)	Co ²⁺		Chromate	CrO ₄ ²⁻	
Cobalt (III)	Co ³⁺		Cyanide	CN ⁻	
<u>Copper (I)</u>	Cu ⁺	(Cuprous)	Dichromate	Cr ₂ O ₇ ²⁻	
<u>Copper (II)</u>	Cu ²⁺	(Cupric)	Dihydrogen Phosphate	H ₂ PO ₄ ⁻	
Hydrogen	H ⁺		Ethanoate	C ₂ H ₃ O ₂ ⁻	(<u>Acetate</u>)
Hydronium	H ₃ O ⁺		Fluoride	F ⁻	
<u>Iron (II)</u>	Fe ²⁺	(Ferrous)	Hydride	H ⁻	
<u>Iron (III)</u>	Fe ³⁺	(Ferric)	<u>Hydrogen Carbonate</u>	HCO ₃ ⁻	(Bicarbonate)
<u>Lead (II)</u>	Pb ²⁺	(Plumbous)	<u>Hydrogen Oxalate</u>	HC ₂ O ₄ ⁻	(Binoxalate)
<u>Lead (IV)</u>	Pb ⁴⁺	(Plumbic)	Hydrogen Phosphate	HPO ₄ ²⁻	
Lithium	Li ⁺		<u>Hydrogen Sulfate</u>	HSO ₄ ⁻	(Bisulfate)
Magnesium	Mg ²⁺		<u>Hydrogen Sulfide</u>	HS ⁻	(Bisulfide)
Manganese (II)	Mn ²⁺		<u>Hydrogen Sulfite</u>	HSO ₃ ⁻	(Bisulfite)
Manganese (IV)	Mn ⁴⁺		Hydroxide	OH ⁻	
<u>Mercury (I)</u>	Hg ₂ ²⁺	(Mercurous)	Iodate (I)	IO ⁻	(<u>Hypoiodite</u>)
<u>Mercury (II)</u>	Hg ²⁺	(Mercuric)	Iodate (III)	IO ₂ ⁻	(<u>Iodite</u>)
Nickel (II)	Ni ²⁺		Iodate (V)	IO ₃ ⁻	(<u>Iodate</u>)
Potassium	K ⁺		Iodate (VII)	IO ₄ ⁻	(<u>Periodate</u>)
Silver	Ag ⁺		Iodide	I ⁻	
Sodium	Na ⁺		Manganate (VII)	MnO ₄ ⁻	(<u>Permanganate</u>)
Strontium	Sr ²⁺		Nitrate	NO ₃ ⁻	
<u>Tin (II)</u>	Sn ²⁺	(Stannous)	Nitride	N ³⁻	
<u>Tin (IV)</u>	Sn ⁴⁺	(Stannic)	Nitrite	NO ₂ ⁻	
Zinc	Zn ²⁺		<u>Oxalate</u>	C ₂ O ₄ ²⁻	(Ethandioate)
			Oxide	O ²⁻	
			Peroxide	O ₂ ²⁻	
			Phosphate	PO ₄ ³⁻	
			Phosphide	P ³⁻	
			Phosphite	PO ₃ ³⁻	
			Sulfate	SO ₄ ²⁻	
			Sulfide	S ²⁻	
			Sulfite	SO ₃ ²⁻	
			Thiosulfate	S ₂ O ₃ ²⁻	
			Thiocyanate	SCN ⁻	

* In the case of the cations, the alternative names are generally redundant in modern chemistry, but the anions *sometimes* use the alternate names. E.g. the oxyhalogen ions (bromate, chlorate, iodate etc.) are usually referred to by the alternate names, but HSO₃⁻ is more commonly called Hydrogen Sulfite. In each case where two names are given, the more common one used in the United States is underlined.

POLYATOMIC IONS				
+2	+1	-1	-2	-3
Hg ₂ ²⁺	NH ₄ ⁺	BrO ⁻	CO ₃ ²⁻	PO ₃ ³⁻
		BrO ₂ ⁻	C ₂ O ₄ ²⁻	PO ₄ ³⁻
		BrO ₃ ⁻	CrO ₄ ²⁻	
		BrO ₄ ⁻	Cr ₂ O ₇ ²⁻	
		C ₂ H ₃ O ₂ ⁻	HPO ₄ ²⁻	
		ClO ⁻	SO ₃ ²⁻	
		ClO ₂ ⁻	SO ₄ ²⁻	
		ClO ₃ ⁻	S ₂ O ₃ ²⁻	
		ClO ₄ ⁻		
		CN ⁻		
		HCO ₃ ⁻		
		HC ₂ O ₄ ⁻		
		H ₂ PO ₄ ⁻		
		HS ⁻		
		HSO ₃ ⁻		
		HSO ₄ ⁻		
		IO ⁻		
		IO ₂ ⁻		
		IO ₃ ⁻		
		IO ₄ ⁻		
		MnO ₄ ⁻		
		NO ₂ ⁻		
		NO ₃ ⁻		
		OH ⁻		
		SCN ⁻		



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