New Jersey Science League – Chemistry I Exam
January 2017 PINK TEST Corrections #19

Choose the answer that best completes the statement or questions below and fill in the appropriate response on the form. If you change an answer, be sure to completely erase your first choice. You may use the given periodic table and formula sheet as well as a calculator. On the formula sheets is a table of the activity series of the elements. Please PRINT your name, school, area and which test you are taking on to the scan-tron.

1. A titration was performed to find the concentration (molarity) of barium hydroxide with the following results:

Trial	Molarity
1	1.32 +/- 0.01
2	1.33 +/- 0.01
3	1.31 +/- 0.01

The actual concentration of barium hydroxide was determined to be 1.000 Molar; the results of the titration are:
   A. both accurate and precise
   B. accurate but imprecise
   C. precise but inaccurate
   D. both inaccurate and imprecise
   E. accuracy and precision are impossible to determine with the available information

2. A piece of metal with a mass of 16.6 g is submerged in 46.3 ml of water in a graduated cylinder. The water level increases to 48.6 ml. The **correct** value for the density of the metal from this data is:
   A. 7.217 g/ml
   B. 7.2 g/ml
   C. 0.14 g/ml
   D. 0.138 g/ml
   E. more than 0.1 g/ml away from any of these values

3. Manganese makes up 1.3 x 10^{-4}percent by mass in a healthy body. How many grams of manganese would be found in the body of a person weighing 183 pounds? (2.2 lbs = 1.0 kg)
   A. 110 g
   B. 0.11 g
   C. 11 g
   D. 0.24 g
   E. none of these

4. The density of a liquid is determined by massing 10, 20, 30, 40 and 50 ml of the liquid in a 250 ml beaker. If a graph of total mass of the beaker plus the liquid versus volume is plotted, which statement would be true?
   A. the slope of the line is independent of the identity of the liquid
   B. the line will pass through the origin
   C. the slope of the line will be 1.0
   D. The y intercept is the mass of the empty beaker
   E. The x intercept is the negative value of the mass of the beaker

5. Which of the following experiments listed below did **not** give the results described?
   A. The electric discharge tube proved that electrons have a negative charge
   B. Millikan's oil drop experiment showed that the charge on any particle was a simple multiple of the charge on the electron
   C. The Rutherford gold foil experiment was useful in determining the nuclear charge on the atom
   D. The Rutherford experiment proved the Thomson "plum Pudding" model of the atom to be essentially correct

6. All of the following are extensive properties **<u>except</u>**:
   A. mass
   B. weight
   C. volume
   D. density

7. Which of the following statements is (are) **<u>true</u>**?
   A. ^{18}O and ^{19}F have the same number of neutrons
   B. ^{14}C and ^{14}N are isotopes of each other because they have the same mass number
   C. $^{18}O^{2-}$ has the same number of electrons as ^{20}Ne
   D. a and b
   E. a and c

8. Consider the **unbalanced** equation for the combustion of methane:
   $CH_{4(g)} + O_{2(g)} \rightarrow CO_{2(g)} + H_2O_{(g)}$ What is the number of moles of carbon dioxide formed when 4 moles of CH_4 is burned?
   A. 1 B. 2 C. 3 D. 4 E. none of these

9. When a piece of aluminum foil is added to a solution of copper (II) chloride, a mixture of aluminum chloride(aq) and copper metal are formed. Write and balanced the equation for this reaction, with coefficients in their lowest ratio. What is the coefficient of the <u>copper</u> metal?
   A. 1 B. 2 C. 3 D. 4 E. 6

10. If barium thiocyanate is $Ba(SCN)_2$, what is the subscript for sodium in the formula for sodium thiocyanate?
    A. 1 B. 2 C. 3 D. 4 E. none of these

11. The reaction: $KI_{(aq)} + Br_{2(l)} \rightarrow KBr_{(aq)} + I_{(s)}$ can be classified as a(n)
    A. synthesis reaction
    B. single replacement reaction
    C. double displacement reaction
    D. oxidation-reduction reaction
    E. two of these

12. Once the charge of the electron was determined what other scientist's experimental results were needed to determine the mass of the electron?
    A. Rutherford
    B. Dalton
    C. Darwin
    D. Thomson
    E. Both Rutherford and Thomson

13. Which is a **chemical** process?
    A. Filtration
    B. Distillation
    C. Electrolysis
    D. Chromatography
    E. Sublimation

14. Aluminum readily reacts with copper II sulfate solution in a single replacement reaction. What is <u>the sum of the coefficients of the products</u> in the completed balanced equation, when all coefficients are reduced to their simplest whole number?
    A. 4 B. 5 C. 7 D. 9 E. 12

15. 125.0 g of ethylene (C_2H_4) burns in oxygen to produce carbon dioxide and water. How many grams of CO_2 are formed?
A. 57.50 g
B. 250.0 g
C. 327.0 g
D. 392.2 g
E. 425.6 g

16. Adipic acid contains 49.32 % carbon, 43.84 % oxygen and 6.85 % hydrogen by mass. What is the empirical formula for adipic acid?
A. C_3HO_3
B. $C_2H_5O_4$
C. C_2HO_3
D. $C_3H_3O_4$
E. $C_3H_5O_2$

17. Given the following statements about chemical reactions:
I. Mass is conserved II. Atoms are conserved III. Moles are conserved
IV. Volume is conserved V. Molecules are conserved
Which is (are) always true for chemical reaction?
A. All are true
B. Only numeral I is true
C. Numerals I and II are true
D. Numerals I, II, and III are true.
E. Only I, III, and V are true.

18. When 2.40 mg sample of a certain compound containing only C atoms and H atoms is burned in an atmosphere of oxygen, 6.00 mg of carbon dioxide is produced. Which expression represents the mg of hydrogen in the sample?
A. 3.00 mg
B. $\frac{6.00 \times 12.0}{44.0}$
C. $(6.00 \times \frac{44.0}{12.0}) - 2.40$
D. $2.40 - (6.00 \times \frac{12.0}{44.0})$
E. $2.40 \times \frac{12}{44}$

19. How many **oxygen ions** are in one unit of calcium hydroxide?
A. 1 B. 2 C. 3 D. 4 E. none of these

20. Consider the **unbalanced** equation for the combustion of methane:
$$C_3H_{8(g)} + O_{2(g)} \rightarrow CO_{2(g)} + H_2O_{(g)}.$$
How many **moles of which** **reactant remains** after the reaction of a mixture containing1.0 mole of each reactant goes to completion?
A. 0.2 moles of C_3H_8 remains
B. 0.8 moles of C_3H_8 remains
C. 1.0 moles of C_3H_8 remains
D. 1.0 moles of O_2 remains
E. 5.0 moles of O_2 remains

21. Using the table below determine which terms on the left correctly match the terms of the right.

M - Pure substance	P – Sodium chloride
N- Solution	Q – Oil and vinegar
O – Heterogeneous mixture	R – sugar in water

A. MP, NQ, OR
B. MR, NQ, OP
C. MQ, NP, OR
D. MQ, NR, OP
E. MP, NR, OQ

22. Consider the reaction $2Mg_{(s)} + O_{2(g)} \rightarrow 2MgO_{(g)}$. In an experiment, 0.15 moles of magnesium react with excess oxygen to produce 5.6 g of magnesium oxide. What is the percent yield for this reaction?

A. 7%
B. 93%
C. 2.5%
D. 5.6%
E. none of these

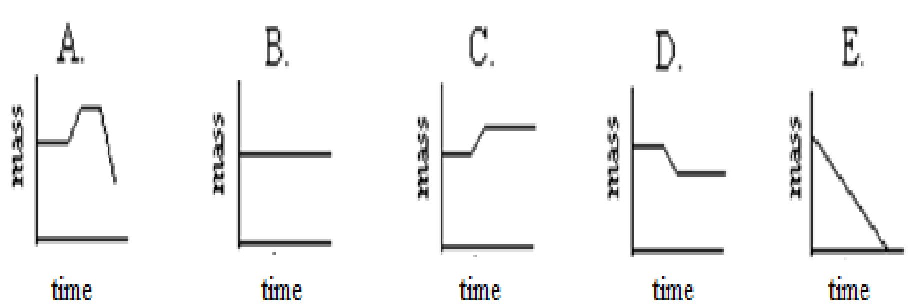
23. What is the mass in grams of 1 atom of aluminum?

A. 26.98 g
B. 6.02×10^{23} g
C. 4.5×10^{-23} g
D. 1.66×10^{-24}g
E. cannot be determined from the information given

24. Which is **<u>always true</u>** for a negatively charged ion?

A. Number protons = number neutrons
B. Number protons = number electrons
C. Number protons > number electrons
D. Number electrons = number neutrons
E. Number of electrons > number of protons

25. A sample of blue copper (II) sulfate pentahydrate ($CuSO_4 \bullet 5H_2O$) is heated in a crucible until it turns to a white solid. Which graph <u>most nearly represents</u> the change in mass of the crucible and its contents?



Periodic Table and Chemistry Formulae Final copy 1-20-2017

Periodic Table of the Elements
amu to 4 significant figures

1 1A	2 2A	3 3B	4 4B	5 5B	6 6B	7 7B	8 8B	9 8B	10 8B	11 1B	12 2B	13 3A	14 4A	15 5A	16 6A	17 7A	18 8A
1 **H** 1.008																	2 **He** 4.003
3 **Li** 6.941	4 **Be** 9.012											5 **B** 10.81	6 **C** 12.01	7 **N** 14.01	8 **O** 16.00	9 **F** 19.00	10 **Ne** 20.18
11 **Na** 22.99	12 **Mg** 24.31											13 **Al** 26.98	14 **Si** 28.09	15 **P** 30.97	16 **S** 32.07	17 **Cl** 35.45	18 **Ar** 39.95
19 **K** 39.10	20 **Ca** 40.08	21 **Sc** 44.96	22 **Ti** 47.88	23 **V** 50.94	24 **Cr** 52.00	25 **Mn** 54.94	26 **Fe** 55.85	27 **Co** 58.93	28 **Ni** 58.69	29 **Cu** 63.55	30 **Zn** 65.39	31 **Ga** 69.72	32 **Ge** 72.61	33 **As** 74.92	34 **Se** 78.96	35 **Br** 79.90	36 **Kr** 83.80
37 **Rb** 85.47	38 **Sr** 87.62	39 **Y** 88.91	40 **Zr** 91.22	41 **Nb** 92.91	42 **Mo** 95.94	43 **Tc** (98)	44 **Ru** 101.1	45 **Rh** 102.9	46 **Pd** 106.4	47 **Ag** 107.9	48 **Cd** 112.4	49 **In** 114.8	50 **Sn** 118.7	51 **Sb** 121.8	52 **Te** 127.6	53 **I** 126.9	54 **Xe** 131.3
55 **Cs** 132.9	56 **Ba** 137.3	57 **La** 138.9	72 **Hf** 178.5	73 **Ta** 180.9	74 **W** 183.8	75 **Re** 186.2	76 **Os** 190.2	77 **Ir** 192.2	78 **Pt** 195.1	79 **Au** 197.0	80 **Hg** 200.6	81 **Tl** 204.4	82 **Pb** 207.2	83 **Bi** 209.0	84 **Po** (209)	85 **At** (210)	86 **Rn** (222)
87 **Fr** (223)	88 **Ra** (226)	89 **Ac** (227)	104 **Rf** (261)	105 **Db** (262)	106 **Sg** (263)	107 **Bh** (262)	108 **Hs** (265)	109 **Mt** (266)	110 **Ds** (281)	111 **Rg** (272)	112 **Cn** (285)	113 (Uut) (284)	114 **Fl** (289)	115 (Uup) (288)	116 **Lv** (293)	117 (Uus) (294)	118 (Uuo) (294)

58 **Ce** 140.1	59 **Pr** 140.9	60 **Nd** 144.2	61 **Pm** (145)	62 **Sm** 150.4	63 **Eu** 152.0	64 **Gd** 157.3	65 **Tb** 158.9	66 **Dy** 162.5	67 **Ho** 164.9	68 **Er** 167.3	69 **Tm** 168.9	70 **Yb** 173.0	71 **Lu** 175.0	**Lanthanide Series**
90 **Th** 232.0	91 **Pa** 231.0	92 **U** 238.0	93 **Np** (237)	94 **Pu** (244)	95 **Am** (243)	96 **Cm** (247)	97 **Bk** (247)	98 **Cf** (251)	99 **Es** (252)	100 **Fm** (257)	101 **Md** (258)	102 **No** (259)	103 **Lr** (262)	**Actinide Series**

CHEMISTRY FORMULAS

GASES, LIQUIDS, SOLUTIONS

$PV = nRT$

$\frac{(P + n^2a)(V - nb)}{V^2} = nRT$

$P_A = P_{total} \bullet X_A$

$P_{total} = P_A + P_B + P_C +$

$n = \frac{m}{M}$

Kelvin = °C + 273

$P_1V_1 = P_2V_2$

$\frac{V_1}{T_1} = \frac{V_2}{T_2}$

$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

$d = \frac{m}{V}$

$u_{rms} = \sqrt{\frac{3kt}{m}} = \sqrt{\frac{3RT}{M}}$

$KE_{per\ molecule} = \frac{mv^2}{2}$

$KE_{per\ mole} = \frac{3RT}{2}$

$\frac{r_1}{r_2} = \sqrt{\frac{M_2}{M_1}}$

M, molarity = $\frac{\text{moles solute}}{\text{liter of solution}}$

P = pressure
V = volume
T = Temperature
n = number of moles
d = density
m = mass
v = velocity
where $X_A = \frac{\text{moles A}}{\text{total moles}}$
u_{rms} = root-mean-square-root
KE = Kinetic energy
r = rate of effusion
M = Molar mass
π = osmotic pressure
i = van't Hoff factor
K_f = molal freezing point constant
K_b = molal boiling point constant
Q = reaction quotient
I =current in amperes
q = charge in coulombs
t = time
E^o = standard reduction potential
Keq = equilibrium constant

R, Gas constant = $\frac{8.31\ \text{Joules}}{\text{Mole Kelvin}}$

$= 0.0821\ \frac{\text{liter atm}}{\text{mole Kelvin}}$

$= 8.31\ \frac{\text{volts coulombs}}{\text{mole Kelvin}}$

Boltzmann's constant,
$k = 1.38 \times 10^{-23}\ \frac{\text{Joule}}{\text{K}}$

$K_{f\ water}$ = 1.86 Kelvin /molal
$K_{b\ water}$ = 0.512 Kelvin /molal

STP = 0.00 °C, 1.00 atm (101.3 kPa)
= 14.7 psi

1 faraday ℑ = 96,500 coulombs/ mole of electrons

°C x 9/5 + 32 = °F
(°F - 32) x 5/9 = °C

ATOMIC STRUCTURE

$\Delta E = h\nu$

$c = \nu\lambda$

$\lambda = \frac{h}{mv}$

$p = mv$

$E_n = \frac{-2.178 \times 10^{-18}}{n^2}$ joule

E = energy
ν = frequency
λ = wavelength
p = momentum
v = velocity
n = principal quantum number
c = speed of light 3.00×10^{8} m/s
h = Planck's constant = 6.63×10^{-34} Joule s
k = Boltzmann constant = 1.38×10^{-23} joule/K
Avogadro's number = 6.02×10^{23} molecules/mole
e = electron charge = -1.602×10^{-19} coulomb
1 electron volt/atom = 96.5×10^{23} kj/mole

OXIDATION-REDUCTION ELECTROCHEMISTRY

$Q = \frac{[C]^c[D]^d}{[A]^a[B]^b}$

where a B + b B ↔ c C + d D

$I = q/t$ I = amperes, q = charge in coulombs, t = time in seconds.

$E_{cell} = E^o_{cell} - \frac{RT}{n\Im}\ln Q = E^o_{cell} - \frac{0.0592}{n}\log Q$ @ 25°C

$\log K = \frac{nE^o}{0.0592}$

1 Faraday $\Im$ = 96,500 coulombs/mole

EQUILIBRIUM

$K_w = 1 \times 10^{-14}$ at 25°C

$pH = -\log[H^+]$; $pOH = -\log[OH^-]$

$pH + pOH = 14$

$pH = pK_a + \log\frac{[A^{-1}]}{[HA]}$

$pOH = pK_b + \log\frac{[HB^+]}{[B]}$

$pK_a = -\log K_a$, $pK_b = -\log K_b$

$K_p = K_c(RT)^{\Delta n}$

Δn = moles product gas – moles reactant gas

EQUILIBIRUM TERMS

K_a = weak acid
K_b = weak base
K_w = water
K_p = gas pressure
K_c = molar concentration

KINETICS EQUATIONS

$A_o - A = kt$ A_0 is initial concentration, amount.

$$\ln\frac{A_o}{A} = kt$$

$$\frac{1}{A} - \frac{1}{A_o} = kt$$

$$\ln\left(\frac{k_2}{k_1}\right) = \frac{E_a}{R}\left(\frac{1}{T_1} - \frac{1}{T_2}\right)$$

THERMOCHEMISTRY

$\Delta S^o = \sum\Delta S^o$ products $- \sum\Delta S^o$ reactants

$\Delta H^o = \sum\Delta H^o$ products $- \sum\Delta H^o$ reactants

$\Delta G^o = \sum\Delta G^o$ products $- \sum\Delta G^o$ reactants

$\Delta G^o = \Delta H^o - T\Delta S^o$

$\Delta G^o = -RT\ln K = -2.303\,RT\log K$

$\Delta G^o = -n\Im E^o$

$\Delta G = \Delta G^o + RT\ln Q = \Delta G^o + 2.303\,RT\log Q$

$q = mC\Delta T$

$C_p = \frac{\Delta H}{\Delta T}$

$q = mH_f$

$q = mH_v$.

$\Delta U = \Delta H - P\Delta V$

S^o = standard entropy
H^o = standard enthalpy
G^o = standard free energy
E^o = standard reduction potential
T = temperature
q = heat
c = specific heat capacity

C_p = molar heat capacity at constant pressure
1 faraday $\Im$ = 96,500 coulombs/mole

$C_{water} = \frac{4.18 \text{ joule}}{\text{g K}}$

Water $H_f = \frac{330 \text{ joules}}{\text{gram}}$

Water $H_v = \frac{2260 \text{ joules}}{\text{gram}}$

ΔU = change internal energy of a system
ΔH= change in energy of a system
-PΔV = work of gases
1liter-atm = 101.325 J

Metal Activity Series	
Metal	**Metal Ion**
Li	Li^{+1}
K	K^{+1}
Ba	Ba^{+2}
Ca	Ca^{+2}
Na	Na^{+1}
Mg	Mg^{+2}
Al	Al^{+3}
Mn	Mn^{+2}
Zn	Zn^{+2}
Cr	Cr^{+3}
Fe	Fe^{+2}
Co	Co^{+2}
Ni	Ni^{+2}
Sn	Sn^{+2}
Pb	Pb^{+2}
H_2	$2\ H^{+1}$
Cu	Cu^{+2}
Ag	Ag^{+1}
Hg	Hg^{+2}
Pt	Pt^{+2}
Au	Au^{+3}

Chemistry I Answer Key <u>PINK TEST</u>
Date: January 12, 2017 Corrections #19

1.	**C**	**6.**	**D**	**11.**	**E**	**16.**	**E**	**21.**	**E**
2.	**B**	**7.**	**E**	**12.**	**D**	**17.**	**C**	**22.**	**B**
3.	**B**	**8.**	**D**	**13.**	**C**	**18.**	**D**	**23.**	**C**
4.	**D**	**9.**	**C**	**14.**	**A**	**19.**	**B &(E)**	**24.**	**E**
5.	**D**	**10.**	**A**	**15.**	**D**	**20.**	**B**	**25.**	**D**

<u>CHEMISTRY I (No AP or second year students in this category.)</u>
Chemistry I Topics of Study 2016-2017 Season Pink Exam **<u>CHEMISTRY 1</u>** <u>For Honor's, Enriched or College Prep. Not for AP or Second year students.</u> 25 multiple choice questions per exam.
<u>All questions deal with the applications of chemical concepts not just memorization of ideas or steps</u>.
<u>January Test</u>: scientific method, measurement, factor label conversions, properties, density, graphing, mixtures, compounds, formulas, mole, weight percent, chemical reactions, using the metal and non-metal activity series for writing chemical reactions, types of reactions, stoichiometry, atomic structure and history which includes alpha, beta, gamma radiation, but not electronic configuration.

<u>February Test</u>: Quantum Theory, Electronic structure, orbital notation, dot notation, periodic behavior, specific heat, heat of phase changes, molar heat of fusion, molar heat of vaporization, graphs of phase changes, plus January topics.

<u>March Test</u>: Chemical bonding, molecular structure, simple isomers, intermolecular attractions, redox but not balancing redox equations, kinetic theory, solids, liquids, gases, gas laws, gas Stoichiometry, mole fraction as applied to gases, plus January and February topics.

<u>April Test</u>: solutions, use of solubility rules, reaction rates, chemical equilibrium, entropy, reaction spontaneity, Keq, acids, bases, salts, net ionic equations, thermo chemistry, ΔH, Hess's law, radioactive decay reactions, plus January, February, and March topics.

Dates for 2017 Season

Thursday January 12, 2017 Thursday February 9, 2017

Thursday March 9, 2017 Thursday April 13, 2017

All areas and schools must complete the April exam and mail in the results by April 28th, 2017

New Jersey Science League
PO Box 65 Stewartsville, NJ 08886-0065
phone # 908-213-8923 fax # 908-213-9391 email: **newjsl@ptd.net**
Web address: **http://entnet.com/~personal/njscil/html/**

What is to be mailed back to our office?

PLEASE RETURN THE AREA RECORD AND ALL TEAM MEMBER SCANTRONS (ALL STUDENTS PLACING 1ST, 2ND, 3RD, AND 4TH).

If you return scantrons of alternates, then label them as ALTERNATES.

Dates 2018 Season

Thursday January 11, 2018 Thursday February 8, 2018

Thursday March 8, 2018 Thursday April 12, 2018

New Jersey Science League – Chemistry I Exam

February 9, 2017 PINK TEST Corrections:

Choose the answer that best completes the statement or questions below and fill in the appropriate response on the form. If you change an answer, be sure to completely erase your first choice. You may use the given periodic table and formula sheet as well as a calculator. On the formula sheets is a table of the activity series of the elements. Please PRINT your name, school, area and which test you are taking on to the scan-tron.

1. This word is used to describe substances uniform in composition; components are distributed evenly throughout the mixture (e.g. sugar water, salt water)

A. Solvent
B. Homogeneous
C. Heterogeneous
D. Suspensions

2. A typical class ring will contain 5.5g of gold (1 ring=5.5g). There are 1.6 grams of gold for every ton of gold ore mined. How many tons of gold ore are need to make the typical class ring?

A. 3.4 tons
B. 4.6 tons
C. 6.4 tons
D. 5.5 tons

3. The reaction: $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ can be classified as a(n)

A. single replacement reaction
B. combustion
C. oxidation-reduction reaction
D. two of these

4. A metal, **M**, forms an oxide of formula M_2O_3. The ground state valence shell electron configuration of the M atom is

A. ns^2np^1
B. np^6
C. $4s^13d^{10}$
D. $4f^7$

5. All of the following are characteristic of metals except:

A. ductile
B. malleable
C. good conductors of heat
D. tend to gain electrons in chemical reactions

6. Naturally occurring copper exists as two isotopes, Cu-63 and Cu-65. The atomic mass of copper is 63.55 amu. What is the approximate percent abundance of Cu-63? C is Correct not A.

A. 30%
B. 50%
C. 70%
D. 90%

7. For which of the following transitions does the light emitted have the longest wavelength?

A. n = 4 to n = 3
B. n = 4 to n = 2
C. n = 4 to n = 1
D. all of these transitions would emit light at the same wavelength

8. Which of the following statements about quantum theory is **incorrect**?

A. No two electrons can have the same set of four quantum numbers
B. The energy and position of an electron cannot be determined simultaneously
C. Lower energy orbitals are filled with electrons before higher energy orbitals
D. When filling orbitals of equal energy, two electrons will occupy the same orbital before filling a new orbital

9. How many d orbitals have a value of n = 2

A. 0
B. 3
C. 5
D. 7

10. Which of the following atoms or ions has 3 unpaired electrons?

A. Al
B. N
C. O
D. S^{2-}

11. What is the molar mass of fluorapatite, $Ca_5(PO_4)_3F$?

A. 286.1
B. 430.2
C. 398.6
D. 504.3

12. The empirical formula for lindane is CHCl. If the molar mass for lindane is 290.8 g/mole, how many carbon atoms does a molecule of lindane contain?

A. 2
B. 4
C. 6
D. 8

13. In the Claus reaction series shown below, sulfur is generated from hydrogen sulfide.

$$2H_2S + 3O_2 \rightarrow 2SO_2 + 2H_2O$$
$$SO_2 + 2H_2S \rightarrow 3S + 2H_2O$$

How many grams of sulfur are produced from 48.0 grams of oxygen?

A. 16.0
B. 32.1
C. 48.1
D. 96.2

14. How many single electrons does the ion Fe^{3+} have? (Single or unpaired)

A. 1
B. 2
C. 3
D. 4
E. 5

15. An element has the electron configuration $[Kr]4d^{10}5s^{2}5p^{2}$. The element is a(n)

A. Nonmetal
B. Metal
C. Transition element
D. Lanthanide

16. All halogens have the following number of valence electrons

A. 1
B. 3
C. 5
D. 7

17. The first ionization energy for calcium is 590 kJ/mole. The second ionization energy is

A. 590 kJ/mole
B. Less than 590 kJ/mole
C. Greater than 590 kJ/mole
D. More information is needed to answer the question

18. Which of the following exhibits the correct orders for increasing both atomic radius and ionization energy, respectively?

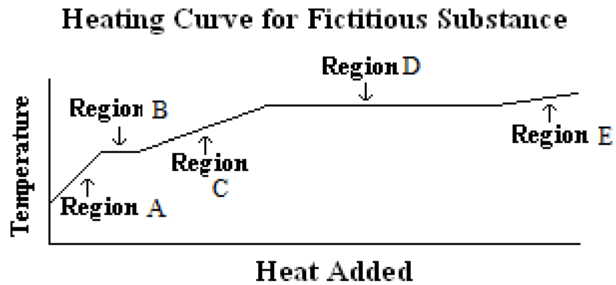
A. S, O, F and F, O, S
B. F, S, O and O, S, F
C. S, F, O and S, F O
D. F, O, S and S, O, F

19. Which of the following statements is true?

A. The atomic radius of Li is larger than that of Cs
B. The ionization energy of S^{2-} is greater than that of Cl^{-}
C. The ionic radius of Fe^{+} is larger than that of Fe^{3+}
D. The first ionization energy for H is greater than that of He

20. The heating curve for a fictitious substance is pictured below. The substance is initially in the solid state. In what region is the substance **boiling**?

A. Region A
B. Region B
C. Region C
D. Region D
E. Region E



21. When 30.0 mL of pure water at 280. K is mixed with 50.0 mL of pure water at 330. K, what is the final temperature of the mixture?

A. 290. K
B. 311 K
C. 320 K
D. 405 K

22. A wet shirt is put on a clothesline to dry on a sunny day. The shirt dries because water molecules

A. gain heat energy and condense
B. gain heat energy and evaporate
C. lose heat energy and condense
D. lose heat energy and evaporate

23. 49.5 g of H_2O is being boiled at its boiling point of 100 °C. How many kJ of energy is required to boil the entire sample of water? The molar heat of vaporization for water is 40.7 kJ/mol

A. 112.kJ
B. 2000 kJ
C. 20.1 kJ|
D. 120. kJ

24. A 100.0 g piece of metal at 100°C is added to 140.0 g of water at 25.0°C. After thermal equilibrium is established, the final temperature of the mixture is 29.6°C. Calculate the heat capacity of the metal. (specific heat of water is 4.184 J/g °C)

A. 0.38 J/g °C
B. 0.76 J/g °C
C. 0.96 J/g °C
D. 0.031 J/g °C

25. How many joules of energy are needed to completely melt 25 g of ice at 0°C if the enthalpy of fusion for ice is 6.02 kJ/mole?

A. 3.87 kJ
B. 4.15 kJ
C. 8.37 kJ
D. 150.5 kJ

Periodic Table and Chemistry Formulae Final copy 2-17-2017

1 1A																	18 8A
1 **H** 1.008	2 2A	Periodic Table of the Elements amu to 4 significant figures										13 3A	14 4A	15 5A	16 6A	17 7A	2 **He** 4.003
3 **Li** 6.941	4 **Be** 9.012											5 **B** 10.81	6 **C** 12.01	7 **N** 14.01	8 **O** 16.00	9 **F** 19.00	10 **Ne** 20.18
11 **Na** 22.99	12 **Mg** 24.31	3 3B	4 4B	5 5B	6 6B	7 7B	8 8B	9 8B	10 8B	11 1B	12 2B	13 **Al** 26.98	14 **Si** 28.09	15 **P** 30.97	16 **S** 32.07	17 **Cl** 35.45	18 **Ar** 39.95
19 **K** 39.10	20 **Ca** 40.08	21 **Sc** 44.96	22 **Ti** 47.88	23 **V** 50.94	24 **Cr** 52.00	25 **Mn** 54.94	26 **Fe** 55.85	27 **Co** 58.93	28 **Ni** 58.69	29 **Cu** 63.55	30 **Zn** 65.39	31 **Ga** 69.72	32 **Ge** 72.61	33 **As** 74.92	34 **Se** 78.96	35 **Br** 79.90	36 **Kr** 83.80
37 **Rb** 85.47	38 **Sr** 87.62	39 **Y** 88.91	40 **Zr** 91.22	41 **Nb** 92.91	42 **Mo** 95.94	43 **Tc** (98)	44 **Ru** 101.1	45 **Rh** 102.9	46 **Pd** 106.4	47 **Ag** 107.9	48 **Cd** 112.4	49 **In** 114.8	50 **Sn** 118.7	51 **Sb** 121.8	52 **Te** 127.6	53 **I** 126.9	54 **Xe** 131.3
55 **Cs** 132.9	56 **Ba** 137.3	57 **La** 138.9	72 **Hf** 178.5	73 **Ta** 180.9	74 **W** 183.8	75 **Re** 186.2	76 **Os** 190.2	77 **Ir** 192.2	78 **Pt** 195.1	79 **Au** 197.0	80 **Hg** 200.6	81 **Tl** 204.4	82 **Pb** 207.2	83 **Bi** 209.0	84 **Po** (209)	85 **At** (210)	86 **Rn** (222)
87 **Fr** (223)	88 **Ra** (226)	89 **Ac** (227)	104 **Rf** (261)	105 **Db** (262)	106 **Sg** (263)	107 **Bh** (262)	108 **Hs** (265)	109 **Mt** (266)	110 **Ds** (281)	111 **Rg** (272)	112 **Cn** (285)	113 (Uut) (284)	114 **Fl** (289)	115 (Uup) (288)	116 **Lv** (293)	117 (Uus) (294)	118 (Uuo) (294)

58 **Ce** 140.1	59 **Pr** 140.9	60 **Nd** 144.2	61 **Pm** (145)	62 **Sm** 150.4	63 **Eu** 152.0	64 **Gd** 157.3	65 **Tb** 158.9	66 **Dy** 162.5	67 **Ho** 164.9	68 **Er** 167.3	69 **Tm** 168.9	70 **Yb** 173.0	71 **Lu** 175.0	**Lanthanide Series**
90 **Th** 232.0	91 **Pa** 231.0	92 **U** 238.0	93 **Np** (237)	94 **Pu** (244)	95 **Am** (243)	96 **Cm** (247)	97 **Bk** (247)	98 **Cf** (251)	99 **Es** (252)	100 **Fm** (257)	101 **Md** (258)	102 **No** (259)	103 **Lr** (262)	**Actinide Series**

CHEMISTRY FORMULAS

GASES, LIQUIDS, SOLUTIONS

$PV = nRT$

$\frac{(P + n^2a)(V - nb)}{V^2} = nRT$

$P_A = P_{total} \bullet X_A$

$P_{total} = P_A + P_B + P_C +$

$n = \frac{m}{M}$

Kelvin = °C + 273

$P_1V_1 = P_2V_2$

$\frac{V_1}{T_1} = \frac{V_2}{T_2}$

$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

$d = \frac{m}{V}$

$u_{rms} = \sqrt{\frac{3kt}{m}} = \sqrt{\frac{3RT}{M}}$

$KE_{per\ molecule} = \frac{mv^2}{2}$

$KE_{per\ mole} = \frac{3RT}{2}$

$\frac{r_1}{r_2} = \sqrt{\frac{M_2}{M_1}}$

M, molarity = $\frac{\text{moles solute}}{\text{liter of solution}}$

P = pressure
V = volume
T = Temperature
n = number of moles
d = density
m = mass
v = velocity
where $X_A = \frac{\text{moles A}}{\text{total moles}}$
u_{rms} = root-mean-square-root
KE = Kinetic energy
r = rate of effusion
M = Molar mass
π = osmotic pressure
i = van't Hoff factor
K_f = molal freezing point constant
K_b = molal boiling point constant
Q = reaction quotient
I =current in amperes
q = charge in coulombs
t = time
E^o = standard reduction potential
Keq = equilibrium constant

R, Gas constant = $8.31 \frac{\text{Joules}}{\text{Mole Kelvin}}$
$= 0.0821 \frac{\text{liter atm}}{\text{mole Kelvin}}$
$= 8.31 \frac{\text{volts coulombs}}{\text{mole Kelvin}}$

Boltzmann's constant,
$k = 1.38 \times 10^{-23} \frac{\text{Joule}}{\text{K}}$

$K_{f\ water}$ = 1.86 Kelvin /molal
$K_{b\ water}$ = 0.512 Kelvin /molal

STP = 0.00 °C, 1.00 atm (101.3 kPa = 760 mm of Hg = 760 Torr) = 14.7 psi

1 faraday ℑ = 96,500 coulombs/ mole of electrons

°C x 9/5 + 32 = °F
(°F - 32) x 5/9 = °C

ATOMIC STRUCTURE

$\Delta E = h\nu$

$c = \nu\lambda$

$\lambda = \dfrac{h}{mv}$

$p = mv$

$E_n = \dfrac{-2.178 \times 10^{-18}}{n^2}$ joule

E = energy

ν = frequency

λ = wavelength

p = momentum

v = velocity

n = principal quantum number

c = speed of light 3.00×10^8 m/s

h = Planck's constant = 6.63×10^{-34} Joule s

k = Boltzmann constant = 1.38×10^{-23} joule/K

Avogadro's number = 6.02×10^{23} molecules/mole

e = electron charge = -1.602×10^{-19} coulomb

1 electron volt/atom = 96.5×10^{23} kj/mole

OXIDATION-REDUCTION ELECTROCHEMISTRY

$Q = \dfrac{[C]^c[D]^d}{[A]^a[B]^b}$

where a B + b B $\leftrightarrow$ c C + d D

I = q/t   I = amperes, q = charge in coulombs, t = time in seconds.

$E_{cell} = E^o_{cell} - \dfrac{RT}{n\Im}\ln Q = E^o_{cell} - \dfrac{0.0592}{n}\log Q$ @ 25°C

$\log K = \dfrac{nE^o}{0.0592}$

1 Faraday $\Im$ = 96,500 coulombs/mole

EQUILIBRIUM

$K_w = 1 \times 10^{-14}$ at 25°C

$pH = -\log[H^+]$; $pOH = -\log[OH^-]$

pH + pOH = 14

$pH = pK_a + \log\dfrac{[A^{-1}]}{[HA]}$

$pOH = pK_b + \log\dfrac{[HB^+]}{[B]}$

$pK_a = -\log K_a$, $pK_b = -\log K_b$

$K_p = K_c(RT)^{\Delta n}$

Δn = moles product gas – moles reactant gas

EQUILIBIRUM TERMS

K_a = weak acid

K_b = weak base

K_w = water

K_p = gas pressure

K_c = molar concentration

KINETICS EQUATIONS

$A_o - A = kt$ A_0 is initial concentration, amount.

$$\ln\frac{A_o}{A} = kt$$

$$\frac{1}{A} - \frac{1}{A_o} = kt$$

$$\ln\left(\frac{k_2}{k_1}\right) = \frac{E_a}{R}\left(\frac{1}{T_1} - \frac{1}{T_2}\right)$$

THERMOCHEMISTRY

$\Delta S^o = \sum\Delta S^o$ products $- \sum\Delta S^o$ reactants

$\Delta H^o = \sum\Delta H^o$ products $- \sum\Delta H^o$ reactants

$\Delta G^o = \sum\Delta G^o$ products $- \sum\Delta G^o$ reactants

$\Delta G^o = \Delta H^o - T\Delta S^o$

$\Delta G^o = -RT\ln K = -2.303\,RT\log K$

$\Delta G^o = -n\Im E^o$

$\Delta G = \Delta G^o + RT\ln Q = \Delta G^o + 2.303\,RT\log Q$

$q = mC\Delta T$

$C_p = \dfrac{\Delta H}{\Delta T}$

$q = mH_f$

$q = mH_v$.

$\Delta U = \Delta H - P\Delta V$

S^o = standard entropy

H^o = standard enthalpy

G^o = standard free energy

E^o = standard reduction potential

T = temperature

q = heat

c = specific heat capacity

C_p = molar heat capacity at constant pressure

1 faraday $\Im$ = 96,500 coulombs/mole

$C_{water} = \dfrac{4.18 \text{ joule}}{\text{g K}}$

Water $H_f = \dfrac{330 \text{ joules}}{\text{gram}}$

Water $H_v = \dfrac{2260 \text{ joules}}{\text{gram}}$

ΔU = change internal energy of a system

ΔH= change in energy of a system

$-P\Delta V$ = work of gases

1liter-atm = 101.325 J

Metal Activity Series

Metal	Metal Ion
Li	Li^{+1}
K	K^{+1}
Ba	Ba^{+2}
Ca	Ca^{+2}
Na	Na^{+1}
Mg	Mg^{+2}
Al	Al^{+3}
Mn	Mn^{+2}
Zn	Zn^{+2}
Cr	Cr^{+3}
Fe	Fe^{+2}
Co	Co^{+2}
Ni	Ni^{+2}
Sn	Sn^{+2}
Pb	Pb^{+2}
H_2	$2\ H^{+1}$
Cu	Cu^{+2}
Ag	Ag^{+1}
Hg	Hg^{+2}
Pt	Pt^{+2}
Au	Au^{+3}

Chemistry I Answer Key PINK TEST

Date: February 9, 2017 Corrections:

1.	B	6.	~~A~~ (C)	11.	D	16.	D	21.	B
2.	A	7.	A	12.	C	17.	C	22.	B
3.	D	8.	D	13.	D	18.	D	23.	A
4.	A	9.	A	14.	E	19.	C	24.	A
5.	D	10.	B	15.	B	20.	D	25.	C

CHEMISTRY I (No AP or second year students in this category.)

Chemistry I Topics of Study 2016-2017 Season Pink Exam **CHEMISTRY 1** For Honor's, Enriched or College Prep. Not for AP or Second year students. 25 multiple choice questions per exam.

All questions deal with the applications of chemical concepts not just memorization of ideas or steps.

January Test: scientific method, measurement, factor label conversions, properties, density, graphing, mixtures, compounds, formulas, mole, weight percent, chemical reactions, using the metal and non-metal activity series for writing chemical reactions, types of reactions, stoichiometry, atomic structure and history which includes alpha, beta, gamma radiation, but not electronic configuration.

February Test: Quantum Theory, Electronic structure, orbital notation, dot notation, periodic behavior, specific heat, heat of phase changes, molar heat of fusion, molar heat of vaporization, graphs of phase changes, plus January topics.

March Test: Chemical bonding, molecular structure, simple isomers, intermolecular attractions, redox but not balancing redox equations, kinetic theory, solids, liquids, gases, gas laws, gas Stoichiometry, mole fraction as applied to gases, plus January and February topics.

April Test: solutions, use of solubility rules, reaction rates, chemical equilibrium, entropy, reaction spontaneity, Keq, acids, bases, salts, net ionic equations, thermo chemistry, ΔH, Hess's law, radioactive decay reactions, plus January, February, and March topics.

Dates for 2017 Season

Thursday January 12, 2017 Thursday February 9, 2017

Thursday March 9, 2017 Thursday April 13, 2017

All areas and schools must complete the April exam and mail in the results by April 28th, 2017

New Jersey Science League

PO Box 65 Stewartsville, NJ 08886-0065

phone # 908-213-8923 fax # 908-213-9391 email: **newjsl@ptd.net**

Web address: **http://entnet.com/~personal/njscil/html/**

What is to be mailed back to our office?

PLEASE RETURN THE AREA RECORD AND ALL TEAM MEMBER SCANTRONS (ALL STUDENTS PLACING 1ST, 2ND, 3RD, AND 4TH).

If you return scantrons of alternates, then label them as ALTERNATES.

Dates 2018 Season

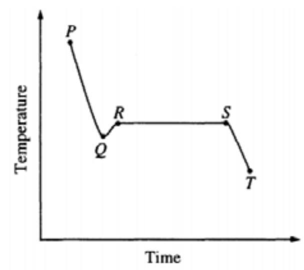
Thursday January 11, 2018 Thursday February 8, 2018

Thursday March 8, 2018 Thursday April 12, 2018

New Jersey Science League – Chemistry I Exam Corrections
March 9, 2017 PINK TEST

Choose the answer that best completes the statement or questions below and fill in the appropriate response on the form. If you change an answer, be sure to completely erase your first choice. You may use the given periodic table and formula sheet as well as a calculator. On the formula sheets is a table of the activity series of the elements. Please PRINT your name, school, area and which test you are taking on to the scan-tron.

1. The cooling curve for a pure substance as it changes from a liquid to a solid is down below. The solid and the liquid coexist at
   A. Point Q only
   B. Point R only
   C. All points on the curve between Q and S
   D. All points on the curve between R and T



2. Atoms of ^{16}O, ^{17}O, and ^{18}O have the same number of
   A. protons, but a different number of electrons
   B. protons, but a different number of neutrons
   C. electrons, but a different number of protons
   D. neutrons, but a different number of protons

3. What are the coefficients that will balance the skeleton equation below? Each choice has the coefficients in the order of the substances in the chemical reaction when balanced.

   ____$AlCl_3$ + _____NaOH → ____$Al(OH)_3$ + ____NaCl

   A. 1, 3, 1, 3 C. 1, 1, 1, 3
   B. 3, 1, 3, 1 D. 1, 3, 3, 1

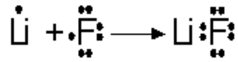
4. 871 ml of gas were **collected over water** at 12.0°C and 84.1 kPa. The water vapor pressure at 12.0 °C is 1.4 kPa. What would be the volume of dry gas at standard pressure if the temperature remained constant?
   A. 735 ml C. 711 ml
   B. 101.3 ml D. 723 ml

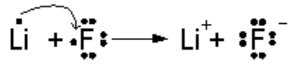
5. What is conserved in the reaction shown below? For this reaction is a problem.

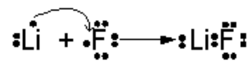
   $H_2(g) + Cl_2(g) \rightarrow 2HCl(g)$

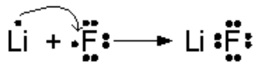
   A. mass only C. mass, moles and molecules only
   B. mass and moles only D. mass, moles, molecules and volume

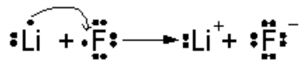
6. Which one of the following equations represents the reaction between lithium and fluorine?

A. 

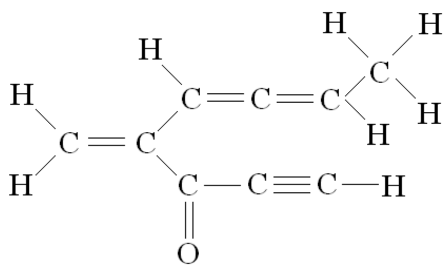
C. 

E. 

B. 

D. 

7. In the structural formula below, how many sigma and pi bonds are present?



A. 17 sigma bond and 0 pi bond
C. 11 sigma bond and 6 pi bond
B. 17 sigma bond and 5 pi bond
D. 17 sigma bonds and 6 pi bonds

8. Avogadro's number of representative particles is equal to one ____.
A. kilogram
C. kelvin
B. gram
D. mole

9. For which of the following conversions does the value of the conversion factor depend upon the formula of the substance?
A. volume of gas (STP) to moles
B. density of gas (STP) to molar mass
C. mass of any substance to moles
D. moles of any substance to number of particles

10. The atomic radius of main-group elements generally increases down a group because ________.
A. effective nuclear charge increases down a group
B. effective nuclear charge decreases down a group
C. the principal quantum number of the valence orbitals increases
D. both effective nuclear charge increases down a group and the principal quantum number of the valence orbitals increases

11. Which of the following has the **smallest** radius?

A. Cl^-
C. S^{2-}
B. K^+
D. Ca^{2+}

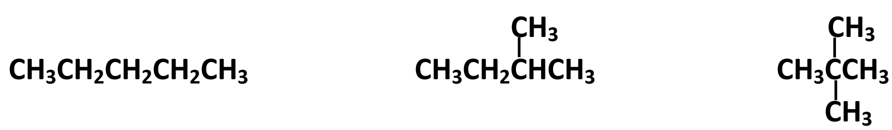
12. As the number of bonds between two carbon atoms <u>increases</u>, which one of the following <u>decreases</u>?

    A. number of electrons between the carbon atoms
    B. bond energy
    C. bond length
    D. all of these

13. When a water molecule forms a hydrogen bond with another water molecule, which atoms are involved in the interaction?
    A. A hydrogen from one molecule and a hydrogen from the other molecule.
    B. A hydrogen from one molecule and an oxygen from the other molecule.
    C. An oxygen from one molecule and an oxygen from the other molecule.
    D. Two hydrogens from one molecule and one hydrogen from the other molecule.

14. Which of the species below would you expect to show <u>no hydrogen bonding</u>?
    A. NH_3
    B. H_2O
    C. HF
    D. CH_4

15. The b.p. of the following compounds is expected to decrease in this order (highest b.p. first):



I II III

A. I > II > III B. III > I > II C. III > II > I D. II > III > I

16. Which one of the following substances has the greatest difference in electronegativity?
    A. CsF C. NaCl
    B. CsCl D. NaF

17. Which of the following would be <u>most soluble</u> in water?
    A. CH_3-O-CH_3 C. CH_3Cl
    B. CH_3OH D. CH_4

18. Consider the following neutral atoms in their ground state electron structure: Ca, Cl, C, and P. Arrange these atoms from the least number of single electrons (unpaired) to the most number of single electrons. A substance with no single electrons will count as 0. Use an = for those that have the same number of single (unpaired) electrons.
    A. Cl < Ca = C < P C. P < C < Cl < Ca
    B. Ca < Cl < C < P D. Ca = C = Cl < P

19. The difference between a molecular formula and a structural formula is that:

A. Molecular formulas give you the ratios of the elements in a compound, while structural formulas tell you how many atoms of each element are present.
B. Molecular formulas tell you where the atoms in a compound are, while structural formulas do not.
C. Molecular formulas do not tell you where the atoms in a compound are located, while structural formulas do.
D. Molecular and structural formulae give the same information

20. A 4.37 g sample of a certain diatomic gas occupies a volume of 3.00 L at 1.00 atm and a temperature of 45^oC. Identify the gas.

A. F_2
B. N_2
C. H_2
D. O_2

21. A mixture of gases at STP contains 0.100 moles nitrogen, 0.200 moles oxygen, and 0.200 moles carbon dioxide. What is the partial pressure of nitrogen gas in the mixture?

A. 608 torr
B. 152 torr
C. 760 torr
D. 304 torr

22. Gaseous C_2H_4 reacts with O_2 according to the following unbalanced equation: (yes balance it first)

$$\mathbf{C_2H_{4(g)} + O_{2(g)} \rightarrow CO_{2(g)} + H_2O_{(g)}}$$

What volume of oxygen at STP is needed to react with 1.50 mol of C_2H_4?

A. 4.50 L
B. 33.6 L
C. 101 L
D. 202 L

23. Use the kinetic molecular theory of gases to predict what would happen to a closed sample of a gas whose temperature increased while its volume decreased.

A. Its pressure would decrease
B. Its pressure would increase
C. Its pressure would hold constant
D. The number of moles of the gas would decrease

24. The proper assignment of oxidation numbers to the elements in the polyatomic ion CO_3^{2-} would be

A. +6 for C and –6 for O.
B. +6 for C and –2 for O.
C. +4 for C and –6 for O.
D. +4 for C and –2 for O.

25. Which element is <u>oxidized</u> in the following redox reaction?

$$\mathbf{2\ H_2S + O_2 \rightarrow 2\ H_2O + 2\ S}$$

A. sulfur in H_2S
B. hydrogen in H_2S
C. oxygen in O_2
D. oxygen in H_2O

Periodic Table and Chemistry Formulae Final copy 2-17-2017

Periodic Table of the Elements
amu to 4 significant figures

1 1A	2 2A	3 3B	4 4B	5 5B	6 6B	7 7B	8 8B	9 8B	10 8B	11 1B	12 2B	13 3A	14 4A	15 5A	16 6A	17 7A	18 8A
1 **H** 1.008																	2 **He** 4.003
3 **Li** 6.941	4 **Be** 9.012											5 **B** 10.81	6 **C** 12.01	7 **N** 14.01	8 **O** 16.00	9 **F** 19.00	10 **Ne** 20.18
11 **Na** 22.99	12 **Mg** 24.31											13 **Al** 26.98	14 **Si** 28.09	15 **P** 30.97	16 **S** 32.07	17 **Cl** 35.45	18 **Ar** 39.95
19 **K** 39.10	20 **Ca** 40.08	21 **Sc** 44.96	22 **Ti** 47.88	23 **V** 50.94	24 **Cr** 52.00	25 **Mn** 54.94	26 **Fe** 55.85	27 **Co** 58.93	28 **Ni** 58.69	29 **Cu** 63.55	30 **Zn** 65.39	31 **Ga** 69.72	32 **Ge** 72.61	33 **As** 74.92	34 **Se** 78.96	35 **Br** 79.90	36 **Kr** 83.80
37 **Rb** 85.47	38 **Sr** 87.62	39 **Y** 88.91	40 **Zr** 91.22	41 **Nb** 92.91	42 **Mo** 95.94	43 **Tc** (98)	44 **Ru** 101.1	45 **Rh** 102.9	46 **Pd** 106.4	47 **Ag** 107.9	48 **Cd** 112.4	49 **In** 114.8	50 **Sn** 118.7	51 **Sb** 121.8	52 **Te** 127.6	53 **I** 126.9	54 **Xe** 131.3
55 **Cs** 132.9	56 **Ba** 137.3	57 **La** 138.9	72 **Hf** 178.5	73 **Ta** 180.9	74 **W** 183.8	75 **Re** 186.2	76 **Os** 190.2	77 **Ir** 192.2	78 **Pt** 195.1	79 **Au** 197.0	80 **Hg** 200.6	81 **Tl** 204.4	82 **Pb** 207.2	83 **Bi** 209.0	84 **Po** (209)	85 **At** (210)	86 **Rn** (222)
87 **Fr** (223)	88 **Ra** (226)	89 **Ac** (227)	104 **Rf** (261)	105 **Db** (262)	106 **Sg** (263)	107 **Bh** (262)	108 **Hs** (265)	109 **Mt** (266)	110 **Ds** (281)	111 **Rg** (272)	112 **Cn** (285)	113 (Uut) (284)	114 **Fl** (289)	115 (Uup) (288)	116 **Lv** (293)	117 (Uus) (294)	118 (Uuo) (294)

58 **Ce** 140.1	59 **Pr** 140.9	60 **Nd** 144.2	61 **Pm** (145)	62 **Sm** 150.4	63 **Eu** 152.0	64 **Gd** 157.3	65 **Tb** 158.9	66 **Dy** 162.5	67 **Ho** 164.9	68 **Er** 167.3	69 **Tm** 168.9	70 **Yb** 173.0	71 **Lu** 175.0	**Lanthanide Series**
90 **Th** 232.0	91 **Pa** 231.0	92 **U** 238.0	93 **Np** (237)	94 **Pu** (244)	95 **Am** (243)	96 **Cm** (247)	97 **Bk** (247)	98 **Cf** (251)	99 **Es** (252)	100 **Fm** (257)	101 **Md** (258)	102 **No** (259)	103 **Lr** (262)	**Actinide Series**

CHEMISTRY FORMULAS

GASES, LIQUIDS, SOLUTIONS

$PV = nRT$

$\frac{(P + n^2a)(V-nb)}{V^2} = nRT$

$P_A = P_{total} \bullet X_A$

$P_{total} = P_A + P_B + P_C +$

$n = \frac{m}{M}$

Kelvin = °C + 273

$P_1V_1 = P_2V_2$

$\frac{V_1}{T_1} = \frac{V_2}{T_2}$

$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

$d = \frac{m}{V}$

$u_{rms} = \sqrt{\frac{3kt}{m}} = \sqrt{\frac{3RT}{M}}$

$KE_{per\ molecule} = \frac{mv^2}{2}$

$KE_{per\ mole} = \frac{3RT}{2}$

$\frac{r_1}{r_2} = \sqrt{\frac{M_2}{M_1}}$

M, molarity = $\frac{\text{moles solute}}{\text{liter of solution}}$

P = pressure
V = volume
T = Temperature
n = number of moles
d = density
m = mass
v = velocity
where $X_A = \frac{\text{moles A}}{\text{total moles}}$
u_{rms} = root-mean-square-root
KE = Kinetic energy
r = rate of effusion
M = Molar mass
π = osmotic pressure
i = van't Hoff factor
K_f = molal freezing point constant
K_b = molal boiling point constant
Q = reaction quotient
I =current in amperes
q = charge in coulombs
t = time
E^o = standard reduction potential
Keq = equilibrium constant

R, Gas constant = $\frac{8.31\ \text{Joules}}{\text{Mole Kelvin}}$
$= \frac{0.0821\ \text{liter atm}}{\text{mole Kelvin}}$
$= \frac{8.31\ \text{volts coulombs}}{\text{mole Kelvin}}$

Boltzmann's constant,
$k = 1.38 \times 10^{-23}\ \frac{\text{Joule}}{\text{K}}$

$K_{f\ water}$ = 1.86 Kelvin /molal
$K_{b\ water}$ = 0.512 Kelvin /molal

STP = 0.00 °C, 1.00 atm (101.3 kPa = 760 mm of Hg = 760 Torr) = 14.7 psi

1 faraday ℑ = 96,500 coulombs/ mole of electrons

°C x 9/5 + 32 = °F
(°F - 32) x 5/9 = °C

ATOMIC STRUCTURE

$\Delta E = h\nu$

$c = \nu\lambda$

$\lambda = \dfrac{h}{m v}$

$p = m v$

$E_n = \dfrac{-2.178 \times 10^{-18}}{n^2}$ joule

E = energy
ν = frequency
λ = wavelength
p = momentum
v = velocity
n = principal quantum number
c = speed of light 3.00×10^{8} m/s
h = Planck's constant = 6.63×10^{-34} Joule s
k = Boltzmann constant = 1.38×10^{-23} joule/K
Avogadro's number = 6.02×10^{23} molecules/mole
e = electron charge = -1.602×10^{-19} coulomb
1 electron volt/atom = 96.5×10^{23} kj/mole

OXIDATION-REDUCTION ELECTROCHEMISTRY

$Q = \dfrac{[C]^c[D]^d}{[A]^a[B]^b}$

where a B + b B $\leftrightarrow$ c C + d D

I = q/t I = amperes, q = charge in coulombs, t = time in seconds.

$E_{cell} = E^o_{cell} - \dfrac{RT}{n\Im}\ln Q = E^o_{cell} - \dfrac{0.0592}{n}\log Q$ @ 25^oC

$\log K = \dfrac{nE^o}{0.0592}$

1 Faraday $\Im$ = 96,500 coulombs/mole

EQUILIBRIUM

$K_w = 1 \times 10^{-14}$ at 25^oC

$pH = -\log[H^+]$; $pOH = -\log[OH^-]$

pH + pOH = 14

$pH = pK_a + \log\dfrac{[A^{-1}]}{[HA]}$

$pOH = pK_b + \log\dfrac{[HB^+]}{[B]}$

$pK_a = -\log K_a$, $pK_b = -\log K_b$

$K_p = K_c(RT)^{\Delta n}$

Δn = moles product gas – moles reactant gas

EQUILIBIRUM TERMS

K_a = weak acid
K_b = weak base
K_w = water
K_p = gas pressure
K_c = molar concentration

KINETICS EQUATIONS

$A_o - A = kt$ A_0 is initial concentration, amount.

$$\ln\frac{A_o}{A} = kt$$

$$\frac{1}{A} - \frac{1}{A_o} = kt$$

$$\ln\left(\frac{k_2}{k_1}\right) = \frac{E_a}{R}\left(\frac{1}{T_1} - \frac{1}{T_2}\right)$$

THERMOCHEMISTRY

$\Delta S^o = \sum\Delta S^o$ products – $\sum\Delta S^o$ reactants

$\Delta H^o = \sum\Delta H^o$ products – $\sum\Delta H^o$ reactants

$\Delta G^o = \sum\Delta G^o$ products – $\sum\Delta G^o$ reactants

$\Delta G^o = \Delta H^o - T\Delta S^o$

$\Delta G^o = -RT\ln K = -2.303\,RT\log K$

$\Delta G^o = -n\Im E^o$

$\Delta G = \Delta G^o + RT\ln Q = \Delta G^o + 2.303\,RT\log Q$

$q = mC\Delta T$

$C_p = \dfrac{\Delta H}{\Delta T}$

$q = mH_f$

$q = mH_v$.

$\Delta U = \Delta H - P\Delta V$

S^o = standard entropy
H^o = standard enthalpy
G^o = standard free energy
E^o = standard reduction potential
T = temperature
q = heat
c = specific heat capacity

C_p = molar heat capacity at constant pressure
1 faraday $\Im$ = 96,500 coulombs/mole

$C_{water} = \dfrac{4.18 \text{ joule}}{g\,K}$

Water $H_f = \dfrac{330 \text{ joules}}{\text{gram}}$

Water $H_v = \dfrac{2260 \text{ joules}}{\text{gram}}$

ΔU = change internal energy of a system
ΔH= change in energy of a system
$-P\Delta V$ = work of gases
1liter-atm = 101.325 J

Metal Activity Series

Metal	Metal Ion
Li	Li^{+1}
K	K^{+1}
Ba	Ba^{+2}
Ca	Ca^{+2}
Na	Na^{+1}
Mg	Mg^{+2}
Al	Al^{+3}
Mn	Mn^{+2}
Zn	Zn^{+2}
Cr	Cr^{+3}
Fe	Fe^{+2}
Co	Co^{+2}
Ni	Ni^{+2}
Sn	Sn^{+2}
Pb	Pb^{+2}
H_2	2 H^{+1}
Cu	Cu^{+2}
Ag	Ag^{+1}
Hg	Hg^{+2}
Pt	Pt^{+2}
Au	Au^{+3}

Chemistry I Answer Key PINK TEST **Corrections:**
Date: March 9, 2017

1.	C	6.	C	11.	D	16.	A	21.	B
2.	B	7.	D	12.	C	17.	B	22.	C
3.	A	8.	D	13.	B	18.	B	23.	B
4.	C	9.	C	14.	D	19.	C	24.	D
5.	~~A~~ (D)	10.	C	15.	A	20.	A	25.	A

CHEMISTRY I (No AP or second year students in this category.)
Chemistry I Topics of Study 2016-2017 Season Pink Exam **CHEMISTRY 1** For Honor's, Enriched or College Prep. Not for AP or Second year students. 25 multiple choice questions per exam.
All questions deal with the applications of chemical concepts not just memorization of ideas or steps.
January Test: scientific method, measurement, factor label conversions, properties, density, graphing, mixtures, compounds, formulas, mole, weight percent, chemical reactions, using the metal and non-metal activity series for writing chemical reactions, types of reactions, stoichiometry, atomic structure and history which includes alpha, beta, gamma radiation, but not electronic configuration.
February Test: Quantum Theory, Electronic structure, orbital notation, dot notation, periodic behavior, specific heat, heat of phase changes, molar heat of fusion, molar heat of vaporization, graphs of phase changes, plus January topics.
March Test: Chemical bonding, molecular structure, simple isomers, intermolecular attractions, redox but not balancing redox equations, kinetic theory, solids, liquids, gases, gas laws, gas Stoichiometry, mole fraction as applied to gases, plus January and February topics.
April Test: solutions, use of solubility rules, reaction rates, chemical equilibrium, entropy, reaction spontaneity, Keq, acids, bases, salts, net ionic equations, thermo chemistry, ΔH, Hess's law, radioactive decay reactions, plus January, February, and March topics.

Dates for 2017 Season

Thursday March 9, 2017 Thursday April 13, 2017

All areas and schools must complete the April exam and mail in the results by April 28th, 2017

New Jersey Science League

PO Box 65 Stewartsville, NJ 08886-0065

phone # 908-213-8923 fax # 908-213-9391 email: **newjsl@ptd.net**

Web address: **http://entnet.com/~personal/njscil/html/**

What is to be mailed back to our office?

PLEASE RETURN THE AREA RECORD AND ALL TEAM MEMBER SCANTRONS (ALL STUDENTS PLACING 1ST, 2ND, 3RD, AND 4TH).

If you return scantrons of alternates, then label them as ALTERNATES.

Dates 2018 Season

Thursday January 11, 2018 Thursday February 8, 2018

Thursday March 8, 2018 Thursday April 12, 2018

New Jersey Science League – Chemistry I Exam No Corrections
April 2017 PINK TEST

Choose the answer that best completes the statement or questions below and fill in the appropriate response on the form. If you change an answer, be sure to completely erase your first choice. You may use the given periodic table and formula sheet as well as a calculator. On the formula sheets is a table of the activity series of the elements. Please PRINT your name, school, area and which test you are taking on to the scan-tron.

1. Vitamin E ,a fat soluble substance, is hydrophobic. It is stored in the body. Vitamin E is:

A. polar
B. nonpolar
C. an electrolyte
D. able to dissolve in water

2. A solution is made by dissolving some salt in a beaker of water. The salt is referred to as the
A. solute B. filtrate C. solution D. solvent

3. Which statement regarding water is **true**?

A. Energy must be given off in order to break down the crystal lattice of ice to a liquid
B. Water's hydrogen bonds are weaker than covalent bonds
C. Liquid water is less dense than solid water
D. Only covalent bonds are broken when ice melts

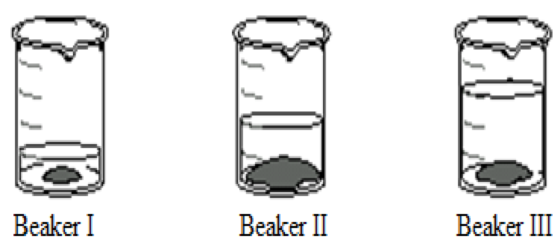
4. In which of the following processes will energy be evolved as heat?

A. Sublimation
B. Crystallization
C. Vaporization
D. Melting

5. A 10.0 g sample of HF is dissolved in 300 mL of solution. The concentration of the solution is:

A. 1.7 M
B. 3.0 M
C. 0.10 M
D. 5.0 M

6. The following three beakers each had different amounts of PbI_2(solid) added. Then different amounts of water were added to each as indicated by the drawings. The aqueous solutions became saturated with PbI_2. The three beakers each contain different volumes of a saturated solution of PbI_2 and different masses of solid PbI_2 :



What is the relationship for the $[Pb^{2+}]$ in the solutions in the three beakers?

A. I = II = III
B. I > II > III
C. II > III > I
D. III > II > I

7. Which of the following aqueous solutions contains the greatest number of ions?

A. 400.0 mL of 0.10 M NaCl
B. 300.0 mL of 0.10 M $CaCl_2$
C. 200.0 mL of 0.10 M $FeCl_3$
D. 800.0 mL of 0.10 M sugar ($C_{12}H_{22}O_{11}$)

8. The balanced net ionic equation for precipitation of $CaCO_3$ when aqueous solutions of Na_2CO_3 and $CaCl_2$ are mixed is __________.

A. $2\ Na^{+}_{(aq)} + CO_3^{2-}{}_{(aq)} \rightarrow Na_2CO_{3(aq)}$
B. $2\ Na^{+}_{(aq)} + Cl^{-}_{(aq)} \rightarrow 2NaCl_{(aq)}$
C. $Ca^{2+}_{(aq)} + CO_3^{2-}{}_{(aq)} \rightarrow CaCO_{3(aq)}$
D. $Ca^{2+}_{(aq)} + CO_3^{2-}{}_{(aq)} \rightarrow CaCO_{3(s)}$

9. The rate of a reaction depends upon:

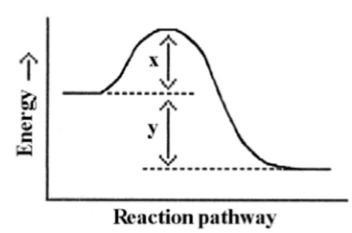
A. the concentration of the reactants.
B. the temperature of the reaction.
C. whether or not a catalyst is used.
D. the nature of the reactants.
E. All of the above are correct.

10. The rate law for a reaction is **rate = k[A][B]^2** Which of the following statements is/are **true**?

I. If [B] is doubled, the reaction rate will increase by a factor of 4.
II. The reaction is first order in A.
III. k is the reaction rate constant
IV. The reaction is second order overall

A. Only I and II are true
B. I, II, and IV are true
C. I, II, and III are true
D. Only IV is true

11. Which energy difference in the energy profile below corresponds to the activation energy for the forward reaction?



A. x
B. y
C. x + y
D. y - x

12. What is true of any reversible reaction that has reached equilibrium?

A. More products will be produced if the reaction is cooled
B. All products and reactants will have the same concentrations
C. There is a specific ratio of products to reactants at a specific temperature
D. The forward and backward reactions are occurring at different speeds

13. Which of the following is true for a system whose equilibrium constant is relatively small?

A. It will take a short time to reach equilibrium.
B. It will take a long time to reach equilibrium.
C. The equilibrium lies to the left.
D. The equilibrium lies to the right.
E. Two of these.

14. The value of ΔH for the reaction below is -72 kJ. How many kJ of heat are released when 1.0 mol of HBr is formed in this reaction?

$$\mathbf{H_{2\,(g)} + Br_{2\,(g)} \rightarrow 2HBr_{(g)}}$$

A. -36 B. -72 C. 36 D. 72

15. What is ΔH for the following reaction ? $\mathbf{IF_{5\,(g)} \rightarrow IF_{3\,(g)} + F_{2\,(g)}}$

$\mathbf{IF_{(g)} + F_{2\,(g)} \rightarrow IF_{3\,(g)}}$ $\Delta H = \mathbf{-390\ kJ}$

$\mathbf{IF_{(g)} + 2\,F_{2\,(g)} \rightarrow IF_{5\,(g)}}$ $\Delta H = \mathbf{-745\ kJ}$

A. -1135 B. +35 C. -355 D. +355

16. The pH of a 0.0001 M KOH solution is:

A. 10
B. 2
C. 4
D. 7

17. According to the Bronstead-Lowry theory of acids and bases, which substances are bases in the following reaction? $HA + H_2O \leftrightarrow H_3O^+ + A^-$

A. HA and H_2O
B. H_2O and H_3O^+
C. HA and A^-
D. H_2O and A^-

18. Which of the following is a salt of the conjugate base of $HC_2H_3O_2$?

A. $C_2H_3O_2^-$
B. $NaC_2H_3O_2$
C. H_2O
D. OH^-

19. If the pOH of solution A is 2.5 and the pOH of B is 10.1, then which of the following is true?

A. Solution A has a higher concentration of hydronium ions than B.
B. Solution B has a higher concentration of hydroxide ions than A.
C. Solution A is more basic than solution B.
D. Solution A is more acidic than solution B.

20. Which one of the following reactions is (are) spontaneous at all temperatures?

A. $CO_{2(s)} \rightarrow CO_{2(g)}$ $\Delta H = +25.1$ kJ
B. $2\ NCl_{3(g)} \rightarrow 3\ Cl_{2(g)} + N_{2(g)}$ $\Delta H = -460$ kJ
C. Both are spontaneous at all temperatures
D. Both are non-spontaneous at all temperatures

21. Which of the following shows a decrease in entropy?

A. Melting ice
B. Precipitation
C. Liquid reactants forming a gas
D. A burning piece of wood

22. Uranium-238 emits an alpha particle($^{4}He_{2}^{2+}$) What does it transmutate into?
A. Th-234
B. Th-242
C. U-234
D. Pu-242

23. Isotopes of an element have nuclei with

A. the same number of protons, but different numbers of neutrons.
B. the same number of protons, and the same number of neutrons
C. different number of protons, and a different number of neutrons.
D. a different number of protons, and the same number of neutrons.

24. If 4.0×10^{18} atoms decay with a half-life of 2.3 years, how many atoms remain after 6.9 years?

A. 5.0×10^{17}
B. 1.7×10^{18}
C. 1.3×10^{17}
D. 1.1×10^{18}

25. Which one of the following is a strong electrolyte?

A. water, H_2O
B. potassium fluoride, KF
C. glucose, $C_6H_{12}O_6$
D. methanol, CH_3OH

Periodic Table and Chemistry Formulae Final copy 2-17-2017

Periodic Table of the Elements
amu to 4 significant figures

1 1A	2 2A	3 3B	4 4B	5 5B	6 6B	7 7B	8 8B	9 8B	10 8B	11 1B	12 2B	13 3A	14 4A	15 5A	16 6A	17 7A	18 8A
1 **H** 1.008																	2 **He** 4.003
3 **Li** 6.941	4 **Be** 9.012											5 **B** 10.81	6 **C** 12.01	7 **N** 14.01	8 **O** 16.00	9 **F** 19.00	10 **Ne** 20.18
11 **Na** 22.99	12 **Mg** 24.31											13 **Al** 26.98	14 **Si** 28.09	15 **P** 30.97	16 **S** 32.07	17 **Cl** 35.45	18 **Ar** 39.95
19 **K** 39.10	20 **Ca** 40.08	21 **Sc** 44.96	22 **Ti** 47.88	23 **V** 50.94	24 **Cr** 52.00	25 **Mn** 54.94	26 **Fe** 55.85	27 **Co** 58.93	28 **Ni** 58.69	29 **Cu** 63.55	30 **Zn** 65.39	31 **Ga** 69.72	32 **Ge** 72.61	33 **As** 74.92	34 **Se** 78.96	35 **Br** 79.90	36 **Kr** 83.80
37 **Rb** 85.47	38 **Sr** 87.62	39 **Y** 88.91	40 **Zr** 91.22	41 **Nb** 92.91	42 **Mo** 95.94	43 **Tc** (98)	44 **Ru** 101.1	45 **Rh** 102.9	46 **Pd** 106.4	47 **Ag** 107.9	48 **Cd** 112.4	49 **In** 114.8	50 **Sn** 118.7	51 **Sb** 121.8	52 **Te** 127.6	53 **I** 126.9	54 **Xe** 131.3
55 **Cs** 132.9	56 **Ba** 137.3	57 **La** 138.9	72 **Hf** 178.5	73 **Ta** 180.9	74 **W** 183.8	75 **Re** 186.2	76 **Os** 190.2	77 **Ir** 192.2	78 **Pt** 195.1	79 **Au** 197.0	80 **Hg** 200.6	81 **Tl** 204.4	82 **Pb** 207.2	83 **Bi** 209.0	84 **Po** (209)	85 **At** (210)	86 **Rn** (222)
87 **Fr** (223)	88 **Ra** (226)	89 **Ac** (227)	104 **Rf** (261)	105 **Db** (262)	106 **Sg** (263)	107 **Bh** (262)	108 **Hs** (265)	109 **Mt** (266)	110 **Ds** (281)	111 **Rg** (272)	112 **Cn** (285)	113 (Uut) (284)	114 **Fl** (289)	115 (Uup) (288)	116 **Lv** (293)	117 (Uus) (294)	118 (Uuo) (294)

58 **Ce** 140.1	59 **Pr** 140.9	60 **Nd** 144.2	61 **Pm** (145)	62 **Sm** 150.4	63 **Eu** 152.0	64 **Gd** 157.3	65 **Tb** 158.9	66 **Dy** 162.5	67 **Ho** 164.9	68 **Er** 167.3	69 **Tm** 168.9	70 **Yb** 173.0	71 **Lu** 175.0	**Lanthanide Series**
90 **Th** 232.0	91 **Pa** 231.0	92 **U** 238.0	93 **Np** (237)	94 **Pu** (244)	95 **Am** (243)	96 **Cm** (247)	97 **Bk** (247)	98 **Cf** (251)	99 **Es** (252)	100 **Fm** (257)	101 **Md** (258)	102 **No** (259)	103 **Lr** (262)	**Actinide Series**

CHEMISTRY FORMULAS

GASES, LIQUIDS, SOLUTIONS

$PV = nRT$

$\frac{(P + n^2a)\ (V-nb)}{V^2} = nRT$

$P_A = P_{total} \bullet X_A$

$P_{total} = P_A + P_B + P_C +$

$n = \frac{m}{M}$

Kelvin = °C + 273

$P_1V_1 = P_2V_2$

$\frac{V_1}{T_1} = \frac{V_2}{T_2}$

$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

$d = \frac{m}{V}$

$u_{rms} = \sqrt{\frac{3kt}{m}} = \sqrt{\frac{3RT}{M}}$

$KE_{per\ molecule} = \frac{mv^2}{2}$

$KE_{per\ mole} = \frac{3RT}{2}$

$\frac{r_1}{r_2} = \sqrt{\frac{M_2}{M_1}}$

M, molarity = $\frac{\text{moles solute}}{\text{liter of solution}}$

P = pressure
V = volume
T = Temperature
n = number of moles
d = density
m = mass
v = velocity
where $X_A = \frac{\text{moles A}}{\text{total moles}}$
u_{rms} = root-mean-square-root
KE = Kinetic energy
r = rate of effusion
M = Molar mass
π = osmotic pressure
i = van't Hoff factor
K_f = molal freezing point constant
K_b = molal boiling point constant
Q = reaction quotient
I =current in amperes
q = charge in coulombs
t = time
E^o = standard reduction potential
Keq = equilibrium constant

R, Gas constant = $\frac{8.31\ \text{Joules}}{\text{Mole Kelvin}}$
$= \frac{0.0821\ \text{liter atm}}{\text{mole Kelvin}}$
$= \frac{8.31\ \text{volts coulombs}}{\text{mole Kelvin}}$

Boltzmann's constant,
$k = 1.38 \times 10^{-23}\ \frac{\text{Joule}}{\text{K}}$

$K_{f\ water}$ = 1.86 Kelvin /molal
$K_{b\ water}$ = 0.512 Kelvin /molal

STP = 0.00 °C, 1.00 atm (101.3 kPa = 760 mm of Hg = 760 Torr) = 14.7 psi

1 faraday ℑ = 96,500 coulombs/ mole of electrons

°C x 9/5 + 32 = °F
(°F - 32) x 5/9 = °C

ATOMIC STRUCTURE

$\Delta E = h\nu$

$c = \nu\lambda$

$\lambda = \frac{h}{mv}$

$p = mv$

$E_n = \frac{-2.178 \times 10^{-18}}{n^2}$ joule

E = energy

ν = frequency

λ = wavelength

p = momentum

v = velocity

n = principal quantum number

c = speed of light 3.00×10^8 m/s

h = Planck's constant = 6.63×10^{-34} Joule s

k = Boltzmann constant = 1.38×10^{-23} joule/K

Avogadro's number = 6.02×10^{23} molecules/mole

e = electron charge = -1.602×10^{-19} coulomb

1 electron volt/atom = 96.5×10^{23} kj/mole

OXIDATION-REDUCTION ELECTROCHEMISTRY

$Q = \frac{[C]^c[D]^d}{[A]^a[B]^b}$

where a B + b B $\leftrightarrow$ c C + d D

I = q/t I = amperes, q = charge in coulombs, t = time in seconds.

$E_{cell} = E^o_{cell} - \frac{RT}{n\Im}\ln Q = E^o_{cell} - \frac{0.0592}{n}\log Q$ @ 25°C

$\log K = \frac{nE^o}{0.0592}$

1 Faraday $\Im$ = 96,500 coulombs/mole

EQUILIBRIUM

$K_w = 1 \times 10^{-14}$ at 25°C

$pH = -\log[H^+]$; $pOH = -\log[OH^-]$

pH + pOH = 14

$pH = pK_a + \log\frac{[A^{-1}]}{[HA]}$

$pOH = pK_b + \log\frac{[HB^+]}{[B]}$

$pK_a = -\log K_a$, $pK_b = -\log K_b$

$K_p = K_c(RT)^{\Delta n}$

Δn = moles product gas – moles reactant gas

EQUILIBIRUM TERMS

K_a = weak acid

K_b = weak base

K_w = water

K_p = gas pressure

K_c = molar concentration

KINETICS EQUATIONS

$A_o - A = kt$ A_0 is initial concentration, amount.

$$\ln\frac{A_o}{A} = kt$$

$$\frac{1}{A} - \frac{1}{A_o} = kt$$

$$\ln\left(\frac{k_2}{k_1}\right) = \frac{E_a}{R}\left(\frac{1}{T_1} - \frac{1}{T_2}\right)$$

THERMOCHEMISTRY

$\Delta S^o = \sum\Delta S^o$ products – $\sum\Delta S^o$ reactants

$\Delta H^o = \sum\Delta H^o$ products – $\sum\Delta H^o$ reactants

$\Delta G^o = \sum\Delta G^o$ products – $\sum\Delta G^o$ reactants

$\Delta G^o = \Delta H^o - T\Delta S^o$

$\Delta G^o = -RT\ln K = -2.303\,RT\log K$

$\Delta G^o = -n\Im E^o$

$\Delta G = \Delta G^o + RT\ln Q = \Delta G^o + 2.303\,RT\log Q$

$q = mC\Delta T$

$C_p = \frac{\Delta H}{\Delta T}$

$q = mH_f$

$q = mH_v$.

$\Delta U = \Delta H - P\Delta V$

S^o = standard entropy

H^o = standard enthalpy

G^o = standard free energy

E^o = standard reduction potential

T = temperature

q = heat

c = specific heat capacity

C_p = molar heat capacity at constant pressure

1 faraday $\Im$ = 96,500 coulombs/mole

$C_{water} = \frac{4.18 \text{ joule}}{\text{g K}}$

Water $H_f = \frac{330 \text{ joules}}{\text{gram}}$

Water $H_v = \frac{2260 \text{ joules}}{\text{gram}}$

ΔU = change internal energy of a system

ΔH= change in energy of a system

$-P\Delta V$ = work of gases

1liter-atm = 101.325 J

Metal Activity Series

Metal	Metal Ion
Li	Li^{+1}
K	K^{+1}
Ba	Ba^{+2}
Ca	Ca^{+2}
Na	Na^{+1}
Mg	Mg^{+2}
Al	Al^{+3}
Mn	Mn^{+2}
Zn	Zn^{+2}
Cr	Cr^{+3}
Fe	Fe^{+2}
Co	Co^{+2}
Ni	Ni^{+2}
Sn	Sn^{+2}
Pb	Pb^{+2}
H_2	$2\ H^{+1}$
Cu	Cu^{+2}
Ag	Ag^{+1}
Hg	Hg^{+2}
Pt	Pt^{+2}
Au	Au^{+3}

Chemistry I Answer Key PINK TEST No Corrections
Date: April 2017

1.	B	6.	A	11.	A	16.	A	21.	B
2.	A	7.	B	12.	C	17.	D	22.	A
3.	B	8.	D	13.	C	18.	B	23.	A
4.	B	9.	E	14.	C	19.	C	24.	A
5.	A	10.	C	15.	D	20.	B	25.	B

Chemistry I Topics of Study 2016-2017 Season Pink Exam **CHEMISTRY 1** For Honor's, Enriched or College Prep. Not for AP or Second year students. 25 multiple choice questions per exam.

All questions deal with the applications of chemical concepts not just memorization of ideas or steps.

January Test: scientific method, measurement, factor label conversions, properties, density, graphing, mixtures, compounds, formulas, mole, weight percent, chemical reactions, using the metal and non-metal activity series for writing chemical reactions, types of reactions, stoichiometry, atomic structure and history which includes alpha, beta, gamma radiation, but not electronic configuration.

February Test: Quantum Theory, Electronic structure, orbital notation, dot notation, periodic behavior, specific heat, heat of phase changes, molar heat of fusion, molar heat of vaporization, graphs of phase changes, plus January topics.

March Test: Chemical bonding, molecular structure, simple isomers, intermolecular attractions, redox but not balancing redox equations, kinetic theory, solids, liquids, gases, gas laws, gas Stoichiometry, mole fraction as applied to gases, plus January and February topics.

April Test: solutions, use of solubility rules, reaction rates, chemical equilibrium, entropy, reaction spontaneity, Keq, acids, bases, salts, net ionic equations, thermo chemistry, ΔH, Hess's law, radioactive decay reactions, plus January, February, and March topics.

Dates for 2017 Season
Thursday April 13, 2017
All areas and schools must complete the April exam and mail in the results by April 28th, 2017

New Jersey Science League
PO Box 65 Stewartsville, NJ 08886-0065
phone # 908-213-8923 fax # 908-213-9391 email: **newjsl@ptd.net**
Web address: **http://entnet.com/~personal/njscil/html/**

What is to be mailed back to our office?

PLEASE RETURN THE AREA RECORD AND ALL TEAM MEMBER SCANTRONS (ALL STUDENTS PLACING 1ST, 2ND, 3RD, AND 4TH).

If you return scantrons of alternates, then label them as ALTERNATES.

Dates 2018 Season
Thursday January 11, 2018 Thursday February 8, 2018
Thursday March 8, 2018 Thursday April 12, 2018