



SELF-ASSESSMENT READINESS CHECK FOR THE CHEMISTRY PLACEMENT EXAM

Version 1.3

Directions: The placement exam you will eventually be given is multiple choice, closed notes. You may use a calculator on this self-assessment. On the actual CHEM105 placement exam, you will NOT be permitted to use a calculator (problems will be designed so you can solve them without a calculator). On the CHEM120 placement exam, you WILL be permitted to use a non-graphing calculator. Just as with this practice exam, needed conversion factors, and a periodic table will be provided.

- ***A PERIODIC TABLE IS PROVIDED AT THE END OF THIS EXAM BOOK FOR YOUR REFERENCE. You may also need some of the following commonly used constants and formulae:***

$$PV = nRT$$

$$R \text{ (the gas constant)} = 0.0821 \text{ L atm mole}^{-1} \text{ K}^{-1} = 62.3 \text{ L-mm Hg mole}^{-1} \text{ K}^{-1}$$

$$1 \text{ mole of a gas} = 22.4 \text{ L at S.T.P.}$$

$$1 \text{ mL} = 1 \text{ cm}^3$$

$$\text{Avogadro's Number} = 6.02 \times 10^{23} \text{ objects per mole}$$

$$1 \text{ atmosphere} = 760 \text{ mm Hg} = 760 \text{ torr (exactly)}$$

$$1 \text{ calorie} = 4.184 \text{ joules} = 0.001 \text{ Calorie}$$

$$M_1V_1 = M_2V_2 \text{ (dilution)}$$

$$^{\circ}\text{F} = (9/5)^{\circ}\text{C} + 32 \quad ^{\circ}\text{C} = (5/9)^{\circ}\text{F} - 32 \quad T (^{\circ}\text{C}) + 273.15 = \text{Kelvins (K)}$$

$$\text{pH} = -\log [\text{H}^+] \quad \text{and} \quad [\text{H}^+] = 10^{-\text{pH}} K_w = 1.00 \times 10^{-14} = [\text{H}^+][\text{OH}^{1-}]$$

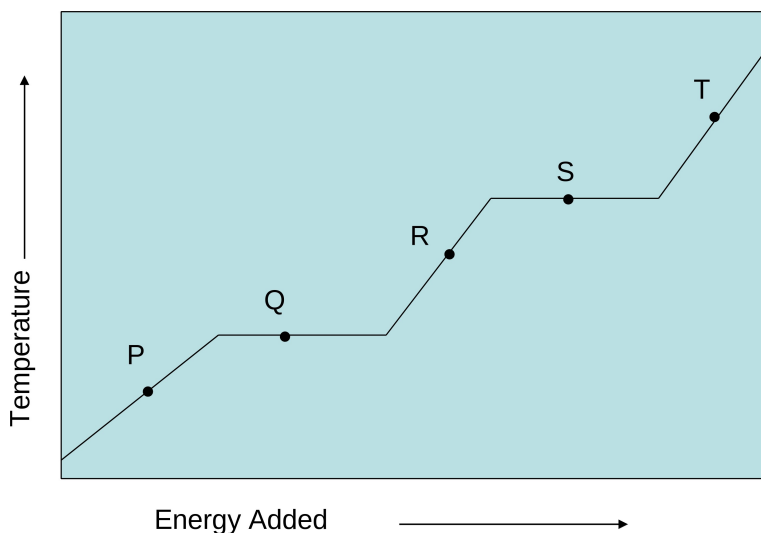
$$1 \text{ pound (lb)} = 0.454 \text{ kg} \quad 1 \text{ kg} = 2.20 \text{ lb} \quad 1 \text{ inch} = 2.54 \text{ cm (exactly)}$$

$$1 \text{ qt} = 946 \text{ mL}$$

- The mass of an object is
 - the force between the object and the earth
 - a measure of the amount of matter contained by the object
 - the amount of space the object occupies
 - The same as the object's weight
- Which of the following is an example of a *chemical change*?
 - Snow melts on a warm spring day.
 - A pencil is sharpened.
 - Gas bubbles appear in a just-opened bottle of soda.
 - A log burns in the fireplace.
- Magnesium Chloride (MgCl_2) is best classified as a
 - a compound
 - an element
 - homogeneous mixture
 - heterogeneous mixture
- Which of the following is the best example of a homogeneous mixture?
 - Air
 - A cheeseburger
 - Vinegar and oil salad dressing
 - Milk
- The metric prefix "nano" denotes what fraction of a basic unit?
 - 10^{-3}
 - 10^{-6}
 - 10^{-9}
 - 10^{-12}
- The number 0.00026 expressed correctly using scientific notation is
 - 2.6×10^{-3}
 - 2.6×10^3
 - 2.6×10^{-4}
 - 2.6×10^4
- Which number has the greatest number of significant digits?
 - 4.0015
 - 17.5000
 - 0.0000625
 - 6.022×10^{23}
- A temperature of 105°C is equivalent to what Kelvin temperature?
 - 168 K
 - 168 K
 - 378 K
 - 2.8×10^4 K
- Which of the following processes would be said to be endoergic (endothermic)?
 - water freezes
 - steam condenses to liquid
 - water evaporates
 - more than one response is correct

10. The direct change from the solid state to the vapor state is called
 a. evaporation b. sublimation c. boiling d. fusion
11. A solution is made by combining 4.00 g of sugar and 100 mL of water (density = 1.00 g/mL). What is the concentration in % w/w?
 a. 26.0 b. 4.00 c. 0.0400 d. 3.85
12. A nugget of gold with a mass of 521 g is added to 50.0 mL of water. The water level rises to a volume of 77.0 mL. What is the density of the gold?
 a. 19.3 g/mL b. 10.4 g/mL c. 6.77 g/mL d. 0.0518 g/mL
13. If the heat of fusion for water is 80. cal/g, how many calories are needed to melt 45.0 g of ice at 0°C?
 a. 3.6 cal b. 3.6×10^3 cal c. 1.8 cal d. 80. cal
14. Which of the following particles has no electric charge?
 a. an electron b. a proton c. a neutron d. a positron
15. What is the nuclear composition of $^{125}_{53}\text{I}$?
 a. 53 neutrons and 125 protons c. 53 protons and 125 neutrons
 b. 53 neutrons and 72 protons d. 53 protons and 72 neutrons
16. There is an element in the periodic table that has 34 protons and 46 neutrons. Referring to the periodic table provided, what is this element's symbol?
 a. Se b. Pd c. Hg d. C
17. You have a 16.0 gram sample of a radioactive isotope having a half-life of 1.25 years. How many grams of this isotope will remain in the sample after 5 years?
 a. 8.00 g b. 4.00 g c. 2.00 g d. 1.00 g
18. Which of the following is used to generate electricity at nuclear power plants?
 a. nuclear fusion c. cyclotron bombardment
 b. nuclear fission d. radioactive decay
19. The symbol of the element in period 2, group 13 is
 a. Mg b. Be c. Al d. B
20. Which of the following electron sublevels has the highest energy?
 a. 4d b. 4f c. 4p d. 4s
21. Which of the following elements is classified as a transition element? (The numbers given are atomic numbers.)
 a. element 37 b. element 41 c. element 82 d. element 54

22. The total number of p orbitals in a p sublevel is
 a. 2 b. 3 c. 6 d. 10
23. Which of the following is a noble gas?
 a. oxygen b. hydrogen c. neon d. chlorine
24. The maximum number of electrons that can occupy the $3p$ sublevel is
 a. 2 b. 4 c. 6 d. 10
25. Which of the following elements has an electronic configuration of $1s^2 2s^2 2p^6 3s^2 3p^1$ in its neutral state?
 a. F b. Al c. Mg d. Ga
26. Based on the concept of periodicity, which of the following elements should have chemical properties somewhat similar to those of oxygen (element 8)?
 a. N b. S c. F d. More than one is correct
27. Which of the following elements would you expect to have the HIGHEST first ionization energy?
 a. Lithium b. Fluorine c. Beryllium d. Neon



For the next two problems, refer to the State Diagram above. The amount of energy added is shown along the horizontal axis, and the temperature is shown on the vertical axis, with *temperature increasing in the direction shown by the arrow*.

28. Judging by the diagram, at point P the sample was most likely a
 a. solid b. liquid c. gas d. element

29. The sample was at its boiling temperature at what labeled point on the state diagram?
 a. P b. Q c. R d. S
30. Which of the following elements has 6 valence electrons?
 a. C b. Cs c. N d. O
31. Which of the following compounds would require a Roman numeral if its name were written out?
 a. CaSO_4
 b. $\text{Mg}_3(\text{PO}_4)_2$
 c. H_2O_2
 d. FeCl_3
32. When Beryllium forms an ion, it would be represented as:
 a. Be^- b. Be^{2-} c. Be^+ d. Be^{2+}
33. A covalent bond results when
 a. one atom gives up an electron to another atom
 b. one atom gives up two electrons to another atom
 c. two atoms share a pair of electrons
 d. two atoms share a single electron
34. Which of the following has the highest electronegativity?
 a. Cl b. N c. O d. F
35. Which of the following covalent molecules would be *polar*?
 a. $\text{O}\equiv\text{C}$ c. $\text{Cl}-\text{Cl}$
 b. $\text{H}-\text{H}$ d. CH_4
36. The correct name for K_2SO_4 is
 a. potassium sulfate c. potassium sulfite
 b. potassium sulfide d. potassium tetrasulfoxxygen
37. A polar molecule must have
 a. polar bonds c. neither a) nor b)
 b. an unsymmetric arrangement d. both a) and b)
38. When the equation below is properly balanced, what coefficient is in front of KCl?

$$\text{KClO}_3 \rightarrow \text{KCl} + \text{O}_2$$
 a. 1 b. 2 c. 3 d. 4

39. When chemists say that a substance is *oxidized* in a chemical process, they mean that the substance:
 a. loses electrons b. gains electrons c. loses protons d. gains neutrons
40. What is the correct name for the compound $\text{Fe}_3(\text{PO}_4)_2$
 a. Fermium Phosphoxide
 b. Iron (III) Phosphide
 c. Iron (III) Phosphate
 d. Iron (II) Phosphate
41. Consider the reaction: $\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3$. When the equation is correctly interpreted in terms of moles, how many moles of H_2 will react with one mole of N_2 ?
 a. 1 b. 2 c. 3 d. 6
42. In the reaction $2\text{H}_2\text{O} \rightarrow 2\text{H}_2 + \text{O}_2$, 2.0 moles of water will produce how many grams of O_2 ?
 a. 16 b. 32 c. 36 d. 64
43. If 5 grams of CO and 5 grams of O_2 are combined according to the reaction $2\text{CO} + \text{O}_2 \rightarrow 2\text{CO}_2$, which is the limiting reagent?
 a. CO_2 b. O_2 c. CO d. CO and O_2
44. What are the coefficients needed to correctly balance the following reaction:
 $\underline{\hspace{1cm}} \text{CH}_4 + \underline{\hspace{1cm}} \text{O}_2 \rightarrow \underline{\hspace{1cm}} \text{CO}_2 + \underline{\hspace{1cm}} \text{H}_2\text{O}$
 a. 2,8,2,4 b. 2,4,2,4 c. 1,2,1,2 d. none of these
45. Which of the following chemical compounds would be expected to have hydrogen bonding?
 a. CH_4 c. CH_3OH
 b. $\text{H}_3\text{C}-\text{CH}_3$ d. H_2SO_4
46. Sodium Sulfate has the formula
 a. NaSO_3 c. Na_2S
 b. Na_2SO_4 d. $\text{Na}(\text{SO}_4)_2$
47. Increasing the temperature of a gas at constant volume does what to the pressure of the gas?
 a. increases b. decreases c. has no effect d. first increases, then decreases

48. 2500 liters of oxygen gas is produced at 1.00 atm of pressure. It is to be compressed and stored in a 20.0 liter cylinder. If temperature is constant, calculate the pressure of the oxygen in the cylinder.
- a. 125 atm b. 4.0 atm c. 80.0 atm d. 8.00 atm
49. What pressure will 3.20 mol of N_2 gas exert if confined in a 15.0 L container at 100 °C?
- a. 1.75 atm b. 6.53 atm c. 3.27 atm d. 13.0 atm
50. What is the total pressure of a gaseous mixture that contains three gases with partial pressures of 0.845 atm, 120 torr and 210 mm Hg?
- a. 1175 torr b. 972 torr c. 0.411 atm d. 331 torr
51. A solution is made by dissolving a small amount of salt in a beaker of water. The water is referred to as the
- a. precipitate b. filtrate c. solvent d. solute
52. When solid NaOH is dissolved in water, the solution becomes hot. The solution process is
- a. exothermic c. neither exothermic nor endothermic
b. endothermic d. can't be classified
53. A solution is made by dissolving 5.84 grams of NaCl in enough distilled water to give a final volume of 1.00 L. What is the molarity of the solution?
- a. 0.100 b. 1.00 c. 0.0250 d. 0.400
54. How many moles of Na_2CO_3 would be needed to react with 750 mL of 0.250 M H_2SO_4 solution by the reaction: $Na_2CO_3 + H_2SO_4 \rightarrow Na_2SO_4 + CO_2 + H_2O$
- a. 3.00×10^3 b. 0.333 c. 1.33 d. 0.188
55. Calculate the number of moles of ZnCl₂ in 100 mL of 0.300 M solution.
- a. 3.00×10^{-2} b. 0.300 c. 30.0 d. 3.00
56. A solution of sugar water has solid sugar crystals on the bottom that won't dissolve despite stirring for an hour. This is probably happening because
- a. Sugar is nonpolar and won't dissolve in water.
b. The partial pressure of the sugar is too high.
c. The solution is saturated.
d. Osmosis is occurring.

	IA	IIA	IIIB	IVB	VB	VIB	VII B	VIII B	IB	IIB	IIIA	IVA	VA	VIA	VIIA	VIIIA		
1	1 H 1.0	THE PERIODIC TABLE OF THE ELEMENTS														2 He 4.0		
2	3 Li 6.9	4 Be 9.0										5 B 10.8	6 C 12.0	7 N 14.0	8 O 16.0	9 F 19.0	10 Ne 20.2	
3	11 Na 23.0	12 Mg 24.3										13 Al 27.0	14 Si 28.1	15 P 31.0	16 S 32.1	17 Cl 35.5	18 Ar 39.9	
4	19 K 39.1	20 Ca 40.1	21 Sc 45.1	22 Ti 47.9	23 V 50.9	24 Cr 52.0	25 Mn 54.9	26 Fe 55.9	27 Co 58.9	28 Ni 58.7	29 Cu 63.5	30 Zn 65.4	31 Ga 69.7	32 Ge 72.6	33 As 74.9	34 Se 79.0	35 Br 79.9	36 Kr 83.8
5	37 Rb 85.5	38 Sr 87.6	39 Y 88.9	40 Zr 91.2	41 Nb 92.9	42 Mo 95.9	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
6	55 Cs 132.9	56 Ba 137.3	57 La* 138.9	72 Hf 178.5	73 Ta 180.9	74 W 183.9	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)
7	87 Fr (223)	88 Ra (226)	89 Ac** (227)	104 Rf (261)	105 Db (262)	106 Sg (266)	107 Bh (262)	108 Hs (265)	109 Mt (266)	110 Ds (271)	111 Rg (272)							

The *Lanthanide and **Actinide Series:

6	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
7	90 Th 232.0	91 Pa (231)	92 U 238.0	93 Np (244)	94 Pu (242)	95 Am (247)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (257)	102 No (259)	103 Lr (260)