Review for the General Chemistry Final Exam. A periodic table and tables of abbreviations and constants will be provided, similar to the tables below.

PERIODIC TABLE OF THE ELEMENTS

1A												3A	4A	5A	6A	7A	8A
1 H 1.008	2A																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	3B	4B	5B	6B	7B		8B		1B	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 181.0	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 226.0	89 Ac 227.0	104 Unq (261)	105 Unp (262)	106 Unh (263)	107 Uns (262)	108 Uno (265)	109 Une (266)									

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
90 Th 232.0	91 Pa 231.0	92 U 238.0	93 Np 237.0	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 (260)

ABBREVIATIONS AND SYMBOLS

amount in moles	n	free energy	G	molar mass	M
ampere	A	frequency	ν	mole	mol
atmosphere	atm	gas constant	R	mole fraction	χ
atomic mass unit	u	gram	g	Planck's constant	h
Avogadro constant	N_A	hour	h	pressure	P
Celsius temperature	°C	joule	J	rate constant	k
coulomb	C	kelvin	K	reaction quotient	Q
electromotive force	E	kilopascal	kPa	second	s
energy of activation	E_a	liter	L	speed of light	c
enthalpy	H	pressure	mmHg	temperature, K	T
entropy	S	minute	min	time	t
equilibrium constant	K	molal	m	volt	V
Faraday constant	F	molar	M	volume	V

CONSTANTS

$R = 8.314\ \text{J·mol}^{-1}\text{·K}^{-1}$

$R = 0.0821\ \text{L·atm·mol}^{-1}\text{·K}^{-1}$

$1\ F = 96{,}500\ \text{C}$

$1\ F = 96{,}500\ \text{J·V}^{-1}$

$N_A = 6.022 \times 10^{23}\ \text{mol}^{-1}$

$h = 6.626 \times 10^{-34}\ \text{J·s}$

$c = 2.998 \times 10^{8}\ \text{m·s}^{-1}$

$1\ \text{atm} = 760\ \text{mmHg} = 101.3\ \text{kPa}$

$V\ (\text{ideal})\ \text{at STP} = 22.4\ \text{L·mol}^{-1}$

Review for the General Chemistry Final Exam
First Semester Part 1 of 3

Part 1. Introductory Concepts

1. What is the formula of ammonium dichromate?

(A) $(NH_4)_2Cr_2O_7$ (B) $NH_4Cr_2O_7$
(C) $(NH_4)_2CrO_4$ (D) $NH_3Cr_2O_7$

2. What is the name of K_2SO_3?

(A) potassium sulfate (B) kallium sulfide
(C) potassium sulfite (D) dipotassium sulfide

3. What is the formula of chromium(III) carbonate?

(A) $Cr_2(CO_3)_3$ (B) $Cr(CO_3)_3$
(C) Cr_3CO_3 (D) $Cr_3(CO_3)_2$

4. What is the name of P_4S_6?

(A) triphosphorus sulfite
(B) phosphorus hexasulfate
(C) phosphorus sulfide
(D) tetraphosphorus hexasulfide

5. What is the name of $V_3(PO_4)_2$?

(A) vanadium diphosphate
(B) vanadium(III) diphosphate
(C) vanadium(II) phosphate
(D) vanadium(III) phosphate

6. Suppose four students determined the molar mass of an unknown solid in lab. It was later revealed to be lithium chloride monohydrate. There results were (all in g mol^{-1}): 58.39, 58.37, 58.33 and 58.34. These results are:

(A) both accurate and precise
(B) not accurate but precise
(C) accurate but not precise
(D) neither accurate nor precise

7. Sodium chloride has a solubility or 35.9 g/100 mL water. What is its molar solubility in mol/L?
(Given: MM(NaCl) = 58.4 g mol^{-1})

(A) 0.163 mol/L (B) 0.477 mol/L
(C) 6.15 mol/L (D) 20.97 mol/L

8. The density of carbon tetrachloride is 1.60 g mL^{-1}. How many moles are there in a liter of the pure CCl_4?
(Given: MM(CCl_4) = 154 g mol^{-1})

(A) 10.4 mol (C) 23.7 mol
(B) 11.3 mol (D) 33.7 mol

9. If 1.0 g samples of each compound were dehydrated, which sample would lose the greatest mass of water?

	Molar Masses:
(A) $LiCl \cdot H_2O$	60. g mol^{-1}
(B) $MgSO_4 \cdot H_2O$	138. g mol^{-1}
(C) $FeSO_4 \cdot H_2O$	170. g mol^{-1}
(D) $SrC_2O_4 \cdot H_2O$	194. g mol^{-1}

10. Which produces the greatest number of ions when one mole dissolves in water?

(A) NaCl (B) NH_4Cl
(C) NH_4NO_3 (D) Na_2SO_4

11. What is the molar mass (in g mol^{-1}) of anhydrous iron(III) sulfate, to the nearest whole number?
(Given: atomic masses:
Fe: 55.8 g mol^{-1}, O: 16.0 g mol^{-1}, S 32.1 g mol^{-1})

(A) 104 (B) 152 (C) 248
(D) 336 (E) 400

12. Most nonmetals

(A) are relatively good reducing agents.
(B) form hydroxides that are basic or amphoteric.
(C) form anions more readily than cations.
(D) are lustrous and highly conductive.
(E) have only 1, 2, or 3 electrons in the outermost shell.

13. Which is most likely to be characteristic of an atom showing metallic properties?

(A) a low atomic number
(B) a high ratio of protons to neutrons
(C) more than five valence electrons
(D) fewer than three valence electrons

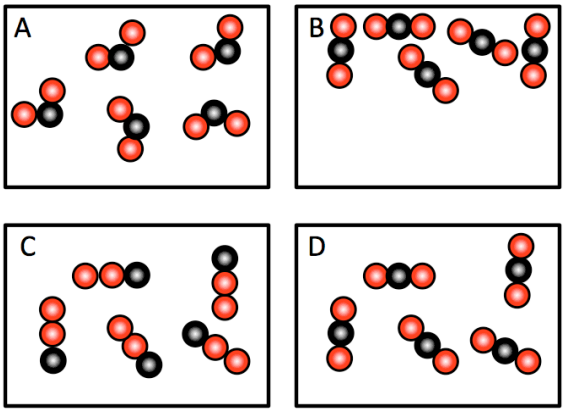
14. The mass of a metal cylinder was determined on an analytical balance and found to be 50.208 g. The volume of the metal cylinder was measured and determined to be 5.6 mL. The density of the metal cylinder, expressed to the proper number of significant digits, is

(A) 8.966 g mL^{-1} (C) 9 g mL^{-1}
(B) 8.97 g mL^{-1} (D) 9.0 g mL^{-1}

15. What mass of oxygen is present in 150 g $Fe_2(SO_4)_3$?
(Given: Atomic mass of O: 16 g mol^{-1}, molar mass of $Fe_2(SO_4)_3$: 399.7 g mol^{-1})

(A) 6.00 g (C) 72.1 g
(B) 24.0 g (D) 83.2 g

16. Which picture best represents $CO_2(g)$?



(A) Figure A
(B) Figure B
(C) Figure C
(D) Figure D

17. Balance the equation with the smallest whole number coefficients. What is the sum of the coefficients (a + b + c + d)?

_a_ $NO_2(g)$ + _b_ $NH_3(g)$ → _c_ $N_2(g)$ + _d_ $H_2O(g)$

(A) 13 (C) 17
(B) 16 (D) 33

18. Which pair of 1 M solutions would form a precipitate when mixed?

(A) NaCl(aq) + $AgNO_3(aq)$
(B) $NaNO_3(aq)$ + $NH_4Cl(aq)$
(C) $CuCl_2(aq)$ + $K_2SO_4(aq)$
(D) $KC_2H_3O_2(aq)$ + LiBr(aq)

19. Which pair substances is listed with the least soluble one first?

(A) KCl, $BaSO_4$
(B) $(NH_4)_2SO_4$, $CuSO_4$
(C) FeS, $Ca(NO_3)_2$
(D) $NaC_2H_3O_2$, $CaCO_3$

20. What is the net ionic reaction for the reaction between hydrochloric acid solution and sodium hydroxide solution?

(A) HCl(aq) + NaOH(aq) → NaCl(aq) + $H_2O(l)$
(B) $H_3O^+(aq)$ + $OH^-(aq)$ → 2 $H_2O(l)$
(C) $H^+(aq) + Cl^-(aq) + Na^+(aq) + OH^-(aq)$ → $Na^+ + Cl^-(aq)$ + 2 $H_2O(l)$
(D) $H_3O^+(aq) + OH^-(aq)$ → 4 $H_4O_2(l)$

21. All of the following substances are soluble in water. Identify the one that would not conduct electricity as a 0.10 M solution.

(A) $HNO_3(aq)$ (C) $KC_2H_3O_2(aq)$
(B) $C_6H_{12}O_6(aq)$ (D) NaOH(aq)

22. Which of the following solutions is weakly conducting?

(A) $HC_2H_3O_2(aq)$ (C) $H_2SO_4(aq)$
(B) $NH_4ClO_2(aq)$ (D) $CuSO_4(aq)$

23. Which substance is an example of vanadium in the +4 oxidation state?

(A) $V(NO_3)_3$ (C) V_2O_5
(B) $V_2(CrO_4)_3$ (D) $VOCl_2$

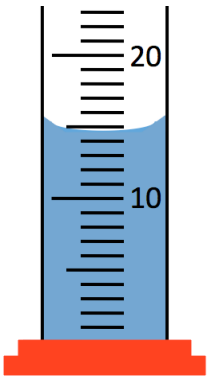
24. Identify (a) the oxidizing agent and (b) the reducing agent in the following unbalanced reaction.

$KMnO_4(aq) + Na_2SO_3(aq) \rightarrow MnO_2(s) + Na_2SO_4(aq)$

(A) (a) $KMnO_4(aq)$ and (b) $Na_2SO_3(aq)$
(B) (a) $Na_2SO_3(aq)$ and (b) $KMnO_4(aq)$
(C) (a) $MnO_2(s)$ and (b) $Na_2SO_4(aq)$
(D) (a) $Na_2SO_4(aq)$ and (b) $MnO_2(s)$

25. What is the proper volume in the graduated cylinder?

(A) 14.7 mL
(B) 15 mL
(D) 15.50 mL
(C) 25.2 mL



Part 2. Stoichiometry

26. How many moles of nitrate ion are present in 250 mL of 0.100 M $Zn(NO_3)_2$?

(A) 0.0125 (C) 0.0250
(B) 0.0500 (D) 25.0

27. What volume of s 0.125 M sucrose solution is needed to produce 250.0 mL of 0.0100 M sucrose?

(A) 0.0320 mL (C) 31.3 mL
(B) 20.0 mL (D) 50.0 mL

28. How many moles of Fe are needed to produce 10.0 mol of H_2?

$4\ H_2O(g) + 3\ Fe(s) \rightarrow Fe_3O_4(s) + 4\ H_2(g)$

(A) 7.50 mol (C) 15.0 mol
(B) 13.3 mol (D) 30.0 mol

29. How many grams of aluminum chloride can one obtain from 6.00 mol of barium chloride?
(Atomic masses: Al: 27.0 g mol^{-1}, Cl: 35.5 g mol^{-1})

$$Al_2(SO_4)_3 + 3\ BaCl_2 \rightarrow 3\ BaSO_4 + 2\ AlCl_3$$

(A) 1250 g (B) 801 g
(C) 534 g (D) 134 g

30. If 0.50 mol of Na_3PO_4 is mixed with 0.30 mol of $BaCl_2$, the maximum number of moles of barium phosphate which can be formed is

(A) 0.10 (B) 0.15
(C) 0.30 (D) 0.50

31. What is the empirical formula for the substance known to contain Na, B, and O and found to be 54.0 % Na and 8.50 % B? (Given atomic masses: B: 10.8 g mol^{-1}, Na: 23.0 g mol^{-1}, O: 16.0 g mol^{-1})

(A) Na_4BO_4 (C) $Na_2B_2O_3$
(B) Na_3BO_3 (D) NaB_2O_2

32. A hydrocarbon undergoes complete combustion to give 0.44 g of CO_2 and 0.27 g of H_2O. What is the *simplest* (empirical) formula of the hydrocarbon?
(Given: Molar masses:
CO_2: 44.0 g mol^{-1}, H_2O: 18.0 g mol^{-1})

(A) $C_{44}H_{27}$ (B) CH_4
(C) C_2H_3 (D) CH_3

33. When $Pb(NO_3)_2$ is heated in air, it decomposes to a lead oxide. If 2.00 g $Pb(NO_3)_2$ produce 1.35 g of the oxide, what is the formula of the oxide? (Given atomic masses: N: 14.0 g mol^{-1}, O: 16.0 g mol^{-1}, Pb: 207.2 g mol^{-1})

(A) Pb_2O_3 (B) PbO_2
(C) PbO (D) Pb_3O_4

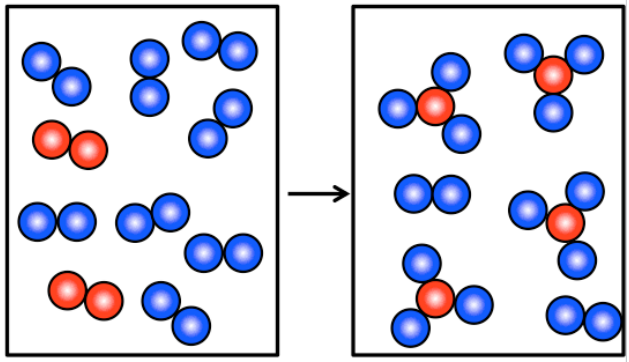
34. A 6.80 g coin was dissolved in nitric acid and 6.21 g of AgCl was precipitated by the addition of excess sodium chloride:

$$Ag^+(aq) + Cl^-(aq) \rightarrow AgCl(s)$$

Calculate the percentage silver in the coin. (Given atomic masses: Ag: 107.9 g mol^{-1}, Cl: 35.5 g mol^{-1})

(A) 24.7% (B) 68.7%
(C) 75.3% (D) 91.3%

Use this diagram to answer the next two questions. The red atoms are A and the blue atoms are B.



35. What is the limiting reagent?

(A) A (B) B
(C) A_2 (D) B_2

36. What is the balance equation?

(A) $A_2 + 3\ B_2 \rightarrow 6\ AB_3$
(B) $A + 3\ B \rightarrow AB_3$
(C) $2\ A_2 + 8\ B_2 \rightarrow 4\ AB_3 + 2\ B_2$
(D) $A_2 + 3\ B_2 \rightarrow 2\ AB_3$

37. Suppose 1.250 mol $NiCl_2(s)$ and 102 g $(NH_4)_2S(s)$ are dissolved separately in water and then mixed together with stirring. What is the theoretical yield of NiS(s)?
(Given: molar masses: $NiCl_2$: 129.6 g mol^{-1}, $(NH_4)_2S$: 68.0 g mol^{-1}, (NiS: 90.7 g mol^{-1})

(A) 0.875 g (B) 1.25 g
(C) 113 g (D) 136 g

38. Suppose the theoretical yield of lead(II) iodide was expected to be 0.100 mol. In an experiment, the actual yield was 39.2 g. What is the percent yield?
(Given: molar masses: PbI_2: 461 g mol^{-1})

(A) 1.80 % (B) 88.6 %
(C) 18 % (D) 85 %

Answers

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

6. B
7. C
8. A
9. A
10. D

11. E
12. C
13. D
14. D
15. C

16. D
17. D
18. A
19. C
20. B

21. B
22. A
23. D
24. A
25. A

26. B

27. B
28. A
29. C
30. A
31. B

32. D
33. C
34. B
35. C

36. D
37. C
38. D

Please notify Dr Mattson (brucemattson@creighton.edu) of any mistakes or problems with this review.