Exam 4A
Chem 1121
Fall 2013

Name: KEY

SHORT RESPONSE. Show your work (where appropriate) to receive full credit. Use the conversion factor method for all conversion problems!

Q1. [15 pts.] Given the balanced chemical equation:

$$2C_2H_6(g) + 7O_2(g) \rightarrow 4CO_2(g) + 6H_2O(l)$$

a) How many **moles** of H_2O can be formed when 1.40 mol of O_2 reacts?

$$1.40\,\text{mol}\,O_2 \times \frac{6\,\text{mol}\,H_2O}{7\,\text{mol}\,O_2} = 1.20\,\text{mol}\,H_2O \quad (3\text{s.f.})$$

b) How many **grams** of H_2O can be formed when 2.19 mol of O_2 reacts?

H_2O

$2\times H = 2\times 1.008$

$1\times O = 1\times 16.00$

18.02

$$2.19\,\text{mol}\,O_2 \left| \frac{6\,\text{mol}\,H_2O}{7\,\text{mol}\,O_2} \right| \frac{18.02\,\text{g}\,H_2O}{1\,\text{mol}\,H_2O} = 33.8\,\text{g}\,H_2O \quad (3\text{s.f.})$$

c) How many **grams** of H_2O can be formed when 43.0 g of O_2 reacts?

O_2

$2\times O = 2\times 16.00$

32.00

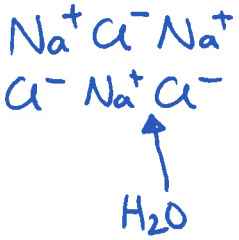
$$43.0\,\text{g}\,O_2 \left| \frac{1\,\text{mol}\,O_2}{32.00\,\text{g}\,O_2} \right| \frac{6\,\text{mol}\,H_2O}{7\,\text{mol}\,O_2} \left| \frac{18.02\,\text{g}\,H_2O}{1\,\text{mol}\,H_2O} \right| = 20.8\,\text{g}\,H_2O \quad (3\text{s.f.})$$

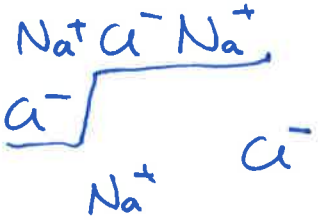
d) If 20.1 g of H_2O are actually formed in part c, what is the **percent yield** of this reaction?

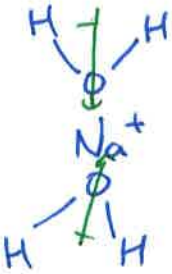
$$\%\,\text{yield} = \frac{\text{actual}}{\text{theoretical}} \times 100 = \frac{20.1\,\text{g}}{20.8\,\text{g}} \times 100 = 96.6\%$$

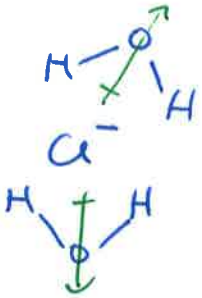
δ+ δ− → = dipole moment

Q2. [15 pts.] Explain the three steps that happen when an ionic compound such as NaCl dissolves in water. Draw a picture of the process as part of your answer.









Step 1.
Name: collision

Step 2.
Name: dissociation

Step 3.
Name: solvation

Q3. [10 pts.] Define the following solution terms:

a) solute smaller components in the solution

b) aqueous solvent is water

c) saturated max. amount of solute is dissolved for a given amount of solvent

d) concentrated high ratio of solute : solvent

e) unsaturated less solute dissolved than a saturated solution

Q4. [10 pts.] What's the molarity of a solution prepared by dissolving 12.4 g of NaF in water, until the total volume is 250. mL?

NaF
1×Na = 22.99
1×F = 19.00
41.99

$12.4\,g\,NaF \times \frac{1\,mol\,NaF}{41.99\,g\,NaF} = 0.295\,mol\,NaF$

$250.\,mL \times \frac{1\,L}{1000\,mL} = 0.250\,L$

$[NaF] = \frac{\#mol}{\#L} = \frac{0.295\,mol}{0.250\,L} = 1.18\,\frac{mol}{L}$ OR M.

Q5. [10 pts.] How many moles of HCl are in 25.0 mL of 12.0 M HCl(aq)?

$25.0\,mL \left| \frac{1\,L}{1000\,mL} \right| \frac{12.0\,mol\,HCl}{1\,L} = 0.300\,mol\,HCl$ (3 s.f.)

Q6. [7 pts.] What's the osmolarity of 1.5 M $Na_2SO_4(aq)$?

$Na_2SO_4(aq) \longrightarrow 2Na^+(aq) + SO_4^{2-}(aq)$

1.5 M → 2×1.5 M, 1×1.5 M

4.5 M

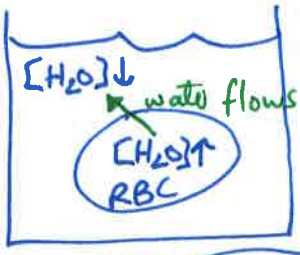
Q7. [8 pts.] What is meant by the term: "colligative property"? Give one example.

Colligative Properties are physical properties of solutions that are dependent upon total solute concentration, not solute identity!

ex: freezing-point depression

Q8. [10 pts.] What will happen if a red blood cell is placed in a hypertonic solution. Explain your answer.

Hypertonic = higher solute conc = lower H_2O conc!



Hypertonic soln has [solute]↑ ⇒ $[H_2O]$↓

⇒ water conc is greater in cell, than out.

⇒ water diffuses out of RBC

OSMOSIS (since RBC has semi-permeable membrane that prevents solute flow)

RBC will shrink in size (crenation)

Q9. [7 pts.] How many grams of solute are there in 140 mL of a 3.4 % (w/v) solution?

$$140\,mL \times \frac{3.4\,g\ solute}{100\,mL\ soln} = 4.8\,g\ solute\ (2\ s.f.)$$

Q10. [8 pts.] What are the four physical quantities that we typically measure when dealing with gases? What are their symbols?

i) pressure, whose symbol is P

ii) volume, whose symbol is V

iii) temperature, whose symbol is T

iv) #moles (chemical amount), whose symbol is n

BONUS: What is the relationship between mmHg and atm?

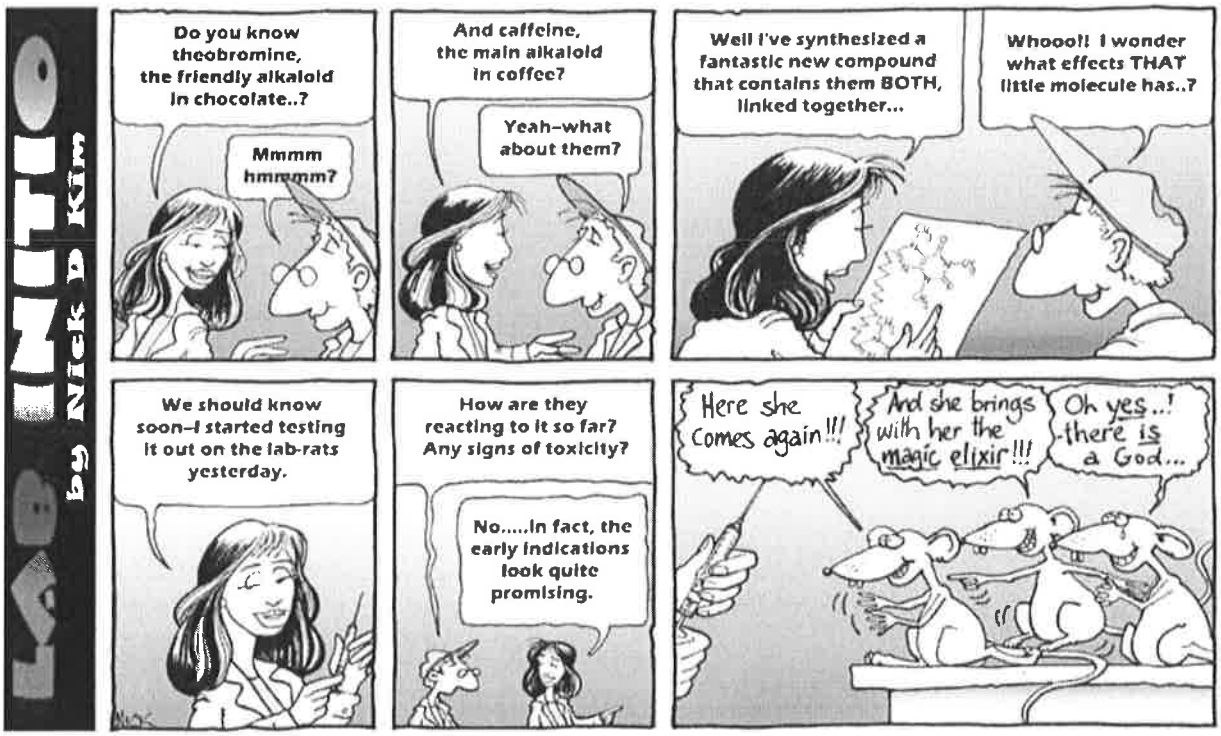
1 atm = 760 mmHg

Useful Information

Periodic Table of the Elements

IA	IIA											IIIA	IVA	VA	VIA	VIIA	VIIIA
1																	2
H																	He
1.01	2											13	14	15	16	17	4.00
3	4											5	6	7	8	9	10
Li	Be											B	C	N	O	F	Ne
6.94	9.01											10.81	12.01	14.01	16.00	19.00	20.18
11	12											13	14	15	16	17	18
Na	Mg											Al	Si	P	S	Cl	Ar
22.99	24.31	3	4	5	6	7	8	9	10	11	12	26.98	28.09	30.97	32.07	35.45	39.95
19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
39.10	40.08	44.96	47.87	50.94	52.00	54.94	55.85	58.93	58.69	63.55	65.39	69.72	72.61	74.92160	78.96	79.90	83.80
37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
85.47	87.62	88.91	91.22	92.91	95.94	[98]	101.07	102.91	106.42	107.87	112.41	114.82	118.71	121.76	127.60	126.90	131.29
55	56	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86
Cs	Ba*	Lu	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
132.91	137.33	174.97	178.49	180.95	183.84	186.21	190.23	192.22	195.08	196.97	200.59	204.38	207.20	208.98	[210]	[210]	[222]
87	88	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118
Fr	Ra**	Lr	Rf	Db	Sg	Bh	Hs	Mt									
[223]	[226]	[262]	[261]	[262]	[266]	[264]	[265]	[268]	[269]	[272]	[277]		[285]		[289]		[293]

*	57	58	59	60	61	62	63	64	65	66	67	68	69	70
	La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb
	138.91	140.12	140.91	144.24	[145]	150.36	151.96	157.25	158.93	162.50	164.93	167.26	168.93	173.04
**	89	90	91	92	93	94	95	96	97	98	99	100	101	102
	Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No
	[227]	232.04	231.04	238.03	[237]	[244]	[243]	[247]	[247]	[251]	[252]	[257]	[258]	[259]



Exam 4B
Chem 1121
Fall 2013

Name: KEY

SHORT RESPONSE. Show your work (where appropriate) to receive full credit. Use the conversion factor method for all conversion problems!

Q1. [10 pts.] Define the following solution terms:

a) solute _____

b) aqueous _____ 4A

c) saturated _____ Exam

d) concentrated _____ See

e) unsaturated _____

Q2. [8 pts.] What are the four physical quantities that we typically measure when dealing with gases? What are their symbols?

i) _____, whose symbol is _____

ii) _____, whose symbol is _____ 4A

iii) _____, whose symbol is _____ Exam

iv) _____, whose symbol is _____

See

Q3. [10 pts.] How many moles of HNO_3 are in 35.0 mL of 15.0 M HNO_3(aq)?

$$35.0\,mL \left| \frac{1\,L}{1000\,mL} \right| \frac{15.0\,mol\ HNO_3}{1\,L} = 0.525\,mol\ HNO_3 \quad (3\,s.f.)$$

Q4. [7 pts.] What's the osmolarity of 1.5 M K_2SO_4(aq)?

See Exam 4A

Q5. [8 pts.] What is meant by the term: "colligative property"? Give one example.

See exam 4A

Q6. [15 pts.] Explain the three steps that happen when an ionic compound such as NaCl dissolves in water. Draw a picture of the process as part of your answer.

See Exam 4A

Step 1.
Name:_____

Step 2.
Name:_____

Step 3.
Name:_____

Q7. [15 pts.] Given the balanced chemical equation:

$2C_2H_6(g) + 7O_2(g) \rightarrow 4CO_2(g) + 6H_2O(l)$

a) How many **moles** of CO_2 can be formed when 1.40 mol of O_2 reacts?

$$1.40\,mol\,O_2 \times \frac{4\,mol\,CO_2}{7\,mol\,O_2} = 0.800\,mol\,CO_2 \text{ (3 s.f.)}$$

b) How many **grams** of CO_2 can be formed when 2.19 mol of O_2 reacts?

CO_2

$1 \times C = 1 \times 12.01$

$2 \times O = 2 \times 16.00$

44.01

$$2.19\,mol\,O_2 \left| \frac{4\,mol\,CO_2}{7\,mol\,O_2} \right| \frac{44.01\,g\,CO_2}{1\,mol\,CO_2} = 55.1\,g\,CO_2 \text{ (3 s.f.)}$$

c) How many **grams** of CO_2 can be formed when 43.0 g of O_2 reacts?

O_2

$2 \times O = 2 \times 16.00$

32.00

$$43.0\,g\,O_2 \left| \frac{1\,mol\,O_2}{32.00\,g\,O_2} \right| \frac{4\,mol\,CO_2}{7\,mol\,O_2} \left| \frac{44.01\,g\,CO_2}{1\,mol\,CO_2} \right| = 33.8\,g\,CO_2 \text{ (3 s.f.)}$$

d) If 30.1 g of CO_2 are actually formed in part c, what is the **percent yield** of this reaction?

$$\%\,yield = \frac{actual}{theoretical} \times 100 = \frac{30.1\,g}{33.8\,g} \times 100 = 89.1\%$$

Q8. [10 pts.] What's the molarity of a solution prepared by dissolving 12.4 g of KF in water, until the total volume is 250. mL?

KF
1×K = 39.10
1×F = 19.00
58.10

$12.4\,g\,KF \times \frac{1\,mol\,KF}{58.10\,g\,KF} = 0.213\,mol\,KF$

$250.\,mL \times \frac{1\,L}{1000\,mL} = 0.250\,L$

$[KF] = \frac{\#\,mol}{\#\,L} = \frac{0.213\,mol}{0.250\,L} = 0.852\,\frac{mol}{L}$ OR M.

Q9. [10 pts.] What will happen if a red blood cell is placed in a hypotonic solution. Explain your answer. Hypotonic = Lower solute conc = Higher H_2O conc!

⇒ H_2O will diffuse into the RBC
But, since RBC has semi-permeable membrane, solute will not diffuse! (OSMOSIS). If H_2O enters RBC, RBC will expand + possibly burst (hemolysis).

Q10. [7 pts.] How many grams of solute are there in 140 mL of a 2.8 % (w/v) solution?

$140\,mL \times \frac{2.8\,g\,solute}{100\,mL\,solution} = 3.9\,g\,solute$ (2 s.f.)

BONUS: What is the relationship between mmHg and atm?

1 atm = 760 mmHg

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**	89	90	91	92	93	94	95	96	97	98	99	100	101	102
	Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No
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