

CHEM*1040, General Chemistry I

Mock Midterm Examination, Fall 2012

Instructions: This mock midterm is formatted similar to the actual midterm. There are 25 multiple-choice questions and 5 short answer questions. To obtain the optimal benefits from this mock midterm, attempt to complete it in midterm settings (quiet, no notes, no textbook) prior to attending an SLG session. The mock midterm will be taken up the week before the midterm at the following SLG session. Good Luck!!!

<u>Leader</u>	<u>Room</u>	<u>Day & Time</u>
Molei	Lib 384	Thursday Oct. 11 th 5:30-8:30pm

Tips for actual midterm: Bring a pencil to fill in the bubble sheet for the multiple-choice section. Bring pens for the short answer section – only answers done in ink will be considered for remarking if there is a problem. Also, bring your student ID card with you, do not wear a peaked hat, and go to the bathroom ahead of time.

Stress Reduction Kit



Directions:

1. Place kit on FIRM surface.
2. Follow directions in circle of kit.
3. Repeat step 2 as necessary, or until unconscious.
4. If unconscious, cease stress reduction activity.

Disclaimer: Please note that this 'mock midterm' was prepared by students. This resource is not designed to be used independently of the SLG Sessions listed above. Please use this resource for referral only – it is supplemental review and is not meant to be a substitute for lecture or textbook material, or individual studying. This document may contain errors, which may not be apparent unless, or even if, you attend the session for which it is intended. This document has not been approved nor endorsed by, nor is it affiliated with, the Department of Chemistry.

Part A: Multiple Choice

For each question, circle the letter of the one correct answer. There is no penalty for incorrect answers.

- In a reaction, a 1.00g sample of an acid, HX, requires 36.0 mL of 0.300 M NaOH_(aq) for complete reaction. What is the molar mass of the acid?
 - 0.0926 g/mol
 - 82.1 g/mol
 - 92.6 g/mol
 - 41.1 g/mol
 - 0.0248 g/mol

- For a solution labelled "0.40 M barium hydroxide," which of the following is correct?
 - $[\text{OH}^-] = 0.80 \text{ M}$, $[\text{Ba}^{2+}] = 0.40 \text{ M}$
 - $[\text{OH}^-] = 0.20 \text{ M}$, $[\text{Ba}^{2+}] = 0.40 \text{ M}$
 - $[\text{OH}^-] = 0.80 \text{ M}$, $[\text{Ba}^{2+}] = 0.80 \text{ M}$
 - $[\text{OH}^-] = 0.40 \text{ M}$, $[\text{Ba}^{2+}] = 0.80 \text{ M}$
 - $[\text{OH}^-] = 0.40 \text{ M}$, $[\text{Ba}^{2+}] = 0.40 \text{ M}$

- Combustion analysis of a 12.0 mg sample of ibuprofen produced 9.50 mg of water. What is the percent hydrogen in ibuprofen?
 - 8.88%
 - 17.6%
 - 35.2%
 - 4.40%
 - 39.6%

- How many oxygen atoms are present in 2.00 millimoles of SO₃?
 - 3.61×10^{21}
 - 1.20×10^{24}
 - 6.02×10^{23}
 - 3.61×10^{24}
 - 1.20×10^{21}

5. Which of the following sets of quantum numbers WOULD BE permissible for an electron, according to the rules for quantum numbers:

- a) $n=1, l=0, m_l=0, m_s=+1$
- b) $n=1, l=3, m_l=+3, m_s=+\frac{1}{2}$
- c) $n=3, l=2, m_l=+3, m_s=-\frac{1}{2}$
- d) $n=0, l=1, m_l=0, m_s=+\frac{1}{2}$
- e) $n=2, l=1, m_l=-1, m_s=+\frac{1}{2}$**

6. How many resonance structures does an ozone molecule have?

- a) 1
- b) 2**
- c) 3
- d) None
- e) 2.5

7. Which has the higher ionization energy?

- a) Cs is higher than Rb
- b) Mg is higher than Be
- c) Si is higher than C
- d) Ca is higher than K**
- e) a) and c)

8. What volume of 0.150 M $\text{HCl}_{(\text{aq})}$ should be diluted to 250 mL with water to give a concentration of 0.00500 M $\text{HCl}_{(\text{aq})}$?

- a) 7.50 mL
- b) 6.90 mL
- c) 1.25 mL
- d) 8.33 mL**
- e) 17.0 mL

9. A triple bond consists of

- a) only sigma bonds
- b) two sigma bonds and one pi bond
- c) three pi bonds
- d) one sigma bond and two pi bonds**
- e) 1.5 sigma and 1.5 pi bond

10. How many grams of copper are required to produce 25.0g of copper(I) oxide? The molar masses of copper and oxygen are 63.54 and $16.00 \text{ g}\cdot\text{mol}^{-1}$, respectively.

- a) 16.6 g
- b) 20.0 g**
- c) 11.1 g
- d) 22.2 g
- e) 18.0 g

11. Consider the reaction: $3 \text{Fe}_{(s)} + 4 \text{H}_2\text{O}_{(g)} \leftrightarrow 4 \text{H}_{2(g)} + \text{Fe}_3\text{O}_{4(s)}$

If the total pressure is increased suddenly by reducing the volume,

- a) more $\text{H}_2\text{O}_{(g)}$ is produced.
- b) no change occurs.**
- c) more $\text{H}_{2(g)}$ is produced.
- d) more $\text{Fe}_{(s)}$ is produced.
- e) more $\text{Fe}_3\text{O}_{4(s)}$ is produced

12. Which of the following are polar molecules?

- a) carbon tetrafluoride
- b) sulphur dioxide
- c) water
- d) sulphur hexafluoride
- e) b) and c)**

13. What is the structure of chlorine trifluoride?

- a) trigonal bipyramidal
- b) seesaw
- c) bent
- d) t-shaped**
- e) tetrahedral

14. Which of the following are insoluble in a solution?

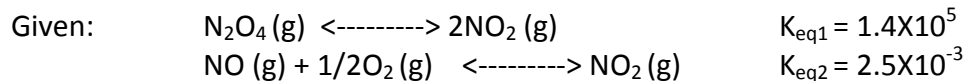
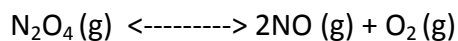
- a) KNO_3
- b) ZnCl_2
- c) CuBr
- d) Hg_2Br_2
- e) c) and d)**

15. Examine: $4\text{Sb (s)} + 3\text{O}_2 \text{ (g)} \rightarrow 2\text{Sb}_2\text{O}_3 \text{ (s)}$

In the above reaction 488 grams of Sb (s) is reacted with excess O_2 (g). How many molecules are formed?

- a) 4.00
- b) 6.00
- c) 1.20×10^{24}**
- d) 2.40×10^{24}
- e) 3.61×10^{24}

16. Find the equilibrium constant for:



- a) 3.5×10^2
- b) 5.6×10^7
- c) 1.4×10^5
- d) 2.8×10^7**
- e) 2.2×10^{10}

17. Which of the following pairs of ions **cannot be present simultaneously** in large concentrations of aqueous solution?

- a) Ba^+ and OH^-**
- b) H_3O^+ and ClO_4^-
- c) NH_4^+ and Cl^-
- d) Na^+ and CH_3CO_2^-
- e) H_3O^+ and F^-

18. Which of the following gives the most correct stoichiometric reaction?

- a) $2\text{Li}_{(s)} + 2\text{O}_{2(g)} \rightarrow 2\text{LiO}_{2(s)}$
- b) $2\text{Li}_{(s)} + \text{O}_{2(g)} \rightarrow 2\text{LiO}_{2(s)}$
- c) $4\text{Li}_{(s)} + \text{O}_{2(g)} \rightarrow 2\text{Li}_2\text{O}_{(s)}$**
- d) $6\text{Li}_{(s)} + 2\text{O}_{2(g)} \rightarrow 2\text{Li}_3\text{O}_{2(s)}$
- e) $2\text{Li}_{(s)} + \text{O}_{2(g)} \rightarrow 2\text{Li}_2\text{O}_{2(s)}$

19. Calculate the volume of 1.00 M $\text{Ca}(\text{OH})_{2(aq)}$ needed to react completely with 50.0 mL of 2.24 M $\text{HNO}_{3(aq)}$.

- a) 56.0 mL**
- b) 112 mL
- c) 224 mL
- d) 168 mL

20. How many liters of carbon dioxide measured at 25°C and 821 Torr would be produced by the combustion of 4.86 mol glucose, $\text{C}_6\text{H}_{12}\text{O}_6$?

- a) 55.4 L
- b) 136 L
- c) 110 L
- d) 661 L**

21. A 50.0-mL sample containing sulphuric acid was obtained from a lake near a mine and was titrated to the stoichiometric point with 17.52 of 0.0120 M $\text{NaOH}_{(aq)}$. What is the molarity of the sulphuric acid in the sample?

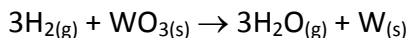
- a) 0.00420 M
- b) 0.000105 M
- c) 0.00526 M**
- d) 0.00210 M
- e) 0.00841 M

22. How many oxygen atoms are present in 2.00×10^{-3} moles of dinitrogen tetroxide, N_2O_4 ?

- a) 2.40×10^{21}
- b) 2.00×10^{20}
- c) 1.20×10^{21}

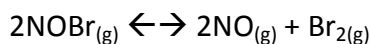
- d) 4.82×10^{19}
 e) 4.82×10^{21}

23. Consider the following reaction.



When 10.0 g of $\text{WO}_{3(s)}$ react with excess hydrogen, 6.55 g of $\text{W}_{(s)}$ are obtained. What is the % yield? (The molar masses of WO_3 and W are 231.85 and 183.85 g/mol, respectively.)

- a) 26.3%
 b) 40.3%
 c) 65.5%
 d) 79.3%
 e) 82.6%
24. A student places the following concentrations of gases in a closed container: $[\text{NOBr}] = 7.13 \times 10^{-2}$ mol/L, $[\text{NO}] = 1.58 \times 10^{-2}$ mol/L, $[\text{Br}_2] = 1.29 \times 10^{-2}$ mol/L. These gases then react:



At the temperature of the reaction, the equilibrium constant K is 3.07×10^{-4} . Calculate the reaction quotient, Q , from the initial concentrations and determine whether the concentration of NOBr increases or decreases as the reaction approaches equilibrium.

- a) $Q=6.33 \times 10^{-4}$; concentration of NOBr decreases
 b) $Q=6.33 \times 10^{-4}$; concentration of NOBr increases
 c) $Q=1.58 \times 10^{-4}$; concentration of NOBr increases
 d) $Q=4.65 \times 10^{-4}$; concentration of NOBr decreases
 e) $Q=4.65 \times 10^{-4}$; concentration of NOBr increases
25. The equilibrium constant, K_c , for a reaction is 9.05×10^{-3} . What is the value of K_c for the reverse reaction with double the coefficients?

- a) 1.10×10^{-2}
 b) 2.21×10^2
 c) 1.22×10^4
 d) 4.53×10^{-3}
 e) 8.19×10^{-5}

Part B: Short Answer

1. Write the electron configuration for:

a) Cr (Z=24)

b) Ca^{+2}

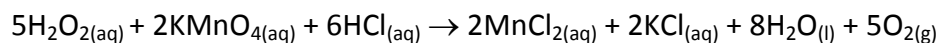
2. Answer the following questions for the following molecule: ICl_4^-

a) Draw the Lewis structure.

b) Predict the shape of the structure and potential bond angles (state both the framework and the geometry of the molecule)

c) Is the molecule polar? If so state the reason(s) why.

3. a) Write the formula of cesium carbonate _____
- b) Write the net ionic equation for any reaction that occurs when aqueous solutions of barium hydroxide and potassium sulfate are mixed. If no reaction occurs, write "no reaction." States are required.
4. Consider the reaction $16\text{H}_2\text{S}_{(g)} + 8\text{SO}_{2(g)} \rightarrow 3\text{S}_{8(s)} + 16\text{H}_2\text{O}_{(l)}$. How many moles of $\text{S}_{8(s)}$ are formed by the reaction of 10.0 g of $\text{H}_2\text{S}_{(g)}$ and 1.90 L of $\text{SO}_{2(g)}$ at 760 torr and 25°C ?
5. Suppose that a 1.00-g sample of a hair bleaching solution labelled "6% hydrogen peroxide", $\text{H}_2\text{O}_{2(aq)}$, is titrated with 0.0175 M $\text{KMnO}_{4(aq)}$ in acidic solution. If the titration requires 42.8 mL of $\text{KMnO}_{4(aq)}$ to react with all the $\text{H}_2\text{O}_{2(aq)}$, calculate the mass percentage of the $\text{H}_2\text{O}_{2(aq)}$ solution. The titration equation is:



Good Luck on Saturday!

DATA:

Gas constant, $R = 8.314 \text{ J mol}^{-1} \text{ K}^{-1}$
 mol^{-1}

Avogadro's Number = 6.022×10^{23}

$R = 8.314 \text{ kPa L mol}^{-1} \text{ K}^{-1}$

$c = 2.998 \times 10^8 \text{ m/s}$

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

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

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

$0^\circ\text{C} = 273.15 \text{ K}$

$1 \text{ nm} = 1 \times 10^{-9} \text{ m}$

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1 H																	2 He
2	3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
3	11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
4	19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
5	37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
6	55 Cs	56 Ba	57 La	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
7	87 Fr	88 Ra	89 Ac	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds								

Molar Masses (g/mol)

H	1.01	Ne	20.18	Cl	35.45	Co	58.93
Li	6.94	Na	22.99	Ar	39.95	Ni	58.69
C	12.01	Mg	24.30	K	39.10	Cu	63.54
N	14.01	Al	26.98	Ca	40.08	Ag	107.87
O	16.00	P	30.97	Cr	52.00	Sb	121.76
F	19.00	S	32.06	Fe	55.84	Ba	137.33

Solubility Rules for some ionic compounds in water

- All alkali metal and ammonium salts are SOLUBLE.
- All nitrate, acetate, chlorate and perchlorate salts are SOLUBLE.
- Most chloride, bromide & iodide salts are SOLUBLE -- EXCEPT for silver, lead or mercury (I) halides.
- Most sulfate salts are SOLUBLE -- EXCEPT for silver, lead, mercury (I), calcium, strontium or barium sulfates.
- Carbonate, phosphate & oxalate salts are NOT SOLUBLE -- EXCEPT for alkali metal or ammonium salts.
- Hydroxides, oxides and sulfides are NOT SOLUBLE -- EXCEPT for alkali metal, ammonium, calcium, strontium or barium salts.
- Chromate salts are NOT SOLUBLE -- EXCEPT for alkali metal, ammonium, calcium or magnesium chromates.