

Ryerson University
Department of Chemistry and Biology

CHY 102, General Chemistry
Midterm #1, October 2012

Version B

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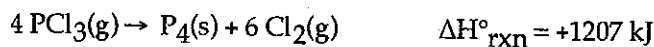
Instructions:

1. The complete examination consists of 21 multiple choice questions worth one mark each.
2. All questions are to be answered. Only ONE answer is correct for each question.
3. Answer each question by filling in the corresponding bubble on the TRS form **using pencil only**.
4. There are 4 different versions of this test. **Fill in the corresponding version in question # 100 on the TRS form.** The TRS form will not be marked unless the test version is identified in question # 100.
5. Fill in your answers as you do the test. **You will not be given additional time to fill in answers.**
6. At the conclusion of the test hand in the TRS form. Failure to submit the TRS form will result in a grade of zero (0) for the test.
7. Answers recorded on the TRS form are considered final.
8. A periodic table and data is supplied on the back page of the exam.

Enter All Answers in the Scantron Sheets

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

- 1) How much energy is required to decompose 765 g of PCl_3 , according to the reaction below? The molar mass of PCl_3 is 137.32 g/mol and may be useful.



*765 g = 5.57 mol \times 6
137.32*

- A) 2.34×10^5 kJ
- B) 1.68×10^3 kJ**
- C) 2.69×10^4 kJ
- D) 6.72×10^3 kJ
- E) 5.95×10^3 kJ

4 mol PCl_3 = +1207 kJ

$\frac{1207}{4} \times 5.57 = 1.68 \times 10^3$

- 2) A student performs an experiment to determine the density of a sugar solution. She obtains the following results: 1.71 g/mL, 1.73 g/mL, 1.67 g/mL, 1.69 g/mL. If the actual value for the density of the sugar solution is 1.40 g/mL, which statement below best describes her results?

- A) Her results are neither precise nor accurate.
- B) Her results are accurate, but not precise.
- C) Her results are both precise and accurate
- D) Her results are precise, but not accurate.**
- E) It isn't possible to determine with the information given.

- 3) Write the formula for copper (II) sulfate pentahydrate.

- A) $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$**
- B) $\text{Cu}_2\text{SO}_3 \cdot \text{H}_5$
- C) $\text{Cu}_2\text{S} \cdot \text{H}_2\text{O}$
- D) $(\text{CuSO}_4)_5$
- E) $\text{CuS} \cdot 5\text{H}_2\text{O}$

- 4) Determine the name for TiCO_3 . Remember that titanium forms several ions.

- A) titanium (II) carbonate**
- B) titanium (I) carbonate
- C) titanium carbide
- D) titanium (II) carbonite
- E) titanium carbonite

Enter All Answers in the Scantron Sheets

5) Which of the following signs on q and w represent a system that is doing work on the surroundings, as well as losing heat to the surroundings? exo

- A) $q = -$, $w = -$
- B) $q = +$, $w = +$
- C) $q = +$, $w = -$
- D) $q = -$, $w = +$
- E) None of these represent the system referenced above.

6) Determine the volume of an object that has a mass of 455.6 g and a density of 19.3 g/cm^3 .

- A) 31.2 mL
- B) 23.6 mL
- C) 18.5 L
- D) 87.9 L
- E) 42.4 mL

7) Which of the following are examples of physical change?

- A) coffee is brewed - hydrate
- B) ice (solid water) melts - physical
- C) sugar is dissolved in water - physical
- D) dry ice sublimates - physical
- E) All of these are examples of physical change.

8) Calculate the atomic mass of element "X", if it has 2 naturally occurring isotopes with the following masses and natural abundances:

X-45	44.8776 amu	32.88%
X-47	46.9443 amu	67.12%

- A) 46.34 amu
- B) 44.88 amu
- C) 45.91 amu
- D) 46.26 amu
- E) 46.94 amu

Enter All Answers in the Scantron Sheets

9) Calculate the amount of heat (in kJ) required to raise the temperature of a 79.0 g sample of ethanol from 298.0 K to 385.0 K. The specific heat capacity of ethanol is 2.42 J/g°C.

- A) 57.0 kJ
- B) 2.84 kJ
- C) 16.6 kJ
- D) 2.11 kJ
- E) 73.6 kJ

$$385 - 298 = 87$$

$$16,632.66$$

10) Calculate the molar mass of $\text{Ca}_3(\text{PO}_4)_2$.

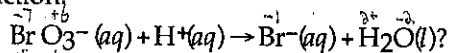
- A) 310.18 g/mol
- B) 215.21 g/mol
- C) 87.05 g/mol
- D) 279.21 g/mol
- E) 246.18 g/mol

$$3(40.08) + 2(30.97 + 4(16.00))$$

$$120.24 + 2(94.97)$$

$$120.24 + 189.94$$

11) What is the change in the oxidation number for the bromine atom in the following unbalanced reduction half reaction:



- A) +7
- B) +6 -
- C) -7
- D) -6 -
- E) The oxidation state of bromine does not change in this half reaction.-

halides are (-)
which are oxides
H halides
O

halides - higher up the table oxygen only -1 for peroxides

oxygen has been reduced

12) How many liters of a 0.0550 M KCl solution contain 0.163 moles of KCl?

- A) 8.97 L
- B) 1.12 L
- C) 1.48 L
- D) 2.96 L
- E) 3.37 L

13) Determine the empirical formula for a compound that contains C, H and O. It contains 52.14% C and 34.73% O by mass.

- A) $\text{C}_2\text{H}_6\text{O}$
- B) CH_3O
- C) $\text{C}_4\text{H}_{13}\text{O}_2$
- D) CH_4O_3
- E) CHO

$$\frac{52.14}{12.01} = 4.3414$$

$$\frac{34.73}{16} = 2.1706$$

$$\frac{13.13}{1.01} = 13$$

x3

x3

x3

$$\frac{13}{6.51}$$

$$\frac{6.51}{6.51}$$

$$\frac{39}{6.51}$$

$$= 2$$

$$1$$

$$6$$

$$3 \begin{matrix} 4.3 \\ \times 6 \\ \hline 25.8 \end{matrix}$$

$$2.17 \begin{matrix} \times 6 \\ \hline 12 \end{matrix}$$

$$13 \begin{matrix} \times 6 \\ \hline 78 \end{matrix}$$

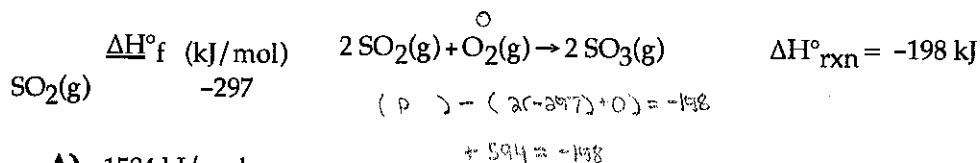
$$2$$

$$1$$

$$6$$

Enter All Answers in the Scantron Sheets

14) Use the ΔH°_f and ΔH°_{rxn} information provided to calculate ΔH°_f for $\text{SO}_3(\text{g})$:



- A) -1584 kJ/mol
- B) -396 kJ/mol
- C) -792 kJ/mol
- D) -248 kJ/mol
- E) -495 kJ/mol

15) Write the formula for the compound formed between potassium and sulfur.

- A) K_2SO_3 K_2S $\text{K}^+ \text{S}^{2-}$
- B) KS_2
- C) K_2S
- D) K_3S_2
- E) KS

16) How many argon atoms are contained in 7.66×10^5 mmol of argon?

- A) 4.61×10^{29} Ar atoms
- B) 9.23×10^{26} Ar atoms
- C) 7.86×10^{20} Ar atoms
- D) 1.15×10^{28} Ar atoms
- E) 4.61×10^{26} Ar atoms

17) A 4.98 g sample of aniline ($\text{C}_6\text{H}_5\text{NH}_2$, molar mass = 93.13 g/mol) was combusted in a bomb calorimeter with a heat capacity of 4.25 kJ/°C. If the temperature rose from 29.5°C to 69.8°C, determine the value of $\Delta H^\circ_{\text{comb}}$ for aniline.

- A) -7.81×10^3 kJ/mol
- B) -3.20×10^3 kJ/mol
- C) $+1.71 \times 10^2$ kJ/mol
- D) -1.71×10^2 kJ/mol
- E) $+7.81 \times 10^3$ kJ/mol

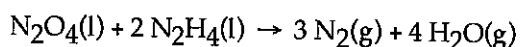
$\Delta T = 40.3^\circ\text{C}$
 $C = 4.25 \text{ kJ/}^\circ\text{C}$
 $q = C \Delta T$
 $q = 171.275 \text{ kJ}$
 $\frac{4.98}{93.13} = 0.05347 \text{ mol}$
 $\frac{171.275 \text{ kJ}}{\text{mol}} = 3203$

Enter All Answers in the Scantron Sheets

18) In which of the following sets do all species have the same number of protons?

- A) Ge, Se²⁻, Br⁻
- B) Br, Br⁻, Br⁺
- C) F⁻, Ne, Mg²⁺
- D) K⁺, Rb⁺, Cs⁺
- E) All of the above.

19) Determine the limiting reactant (LR) and the mass (in g) of nitrogen that can be formed from 50.0 g N₂O₄ and 45.0 g N₂H₄. Some possibly useful molar masses are as follows: N₂O₄ = 92.02 g/mol, N₂H₄ = 32.05 g/mol.



$$\begin{aligned} \text{N}_2\text{O}_4 &= .5434 \text{ mol} & \text{N}_2\text{H}_4 &= 1.4041 \text{ mol} \\ & & \div 2 &= .7020 \text{ mol} \end{aligned}$$

$$.5434 \times 2$$

$$1.6302 \text{ mol} \times 28.02$$

- A) LR = N₂O₄, 45.7 g N₂ formed
- B) LR = N₂O₄, 15.2 g N₂ formed
- C) LR = N₂H₄, 39.3 g N₂ formed
- D) No LR, 45.0 g N₂ formed
- E) LR = N₂H₄, 59.0 g N₂ formed

20) In an acid-base neutralization reaction 38.74 mL of 0.500 M potassium hydroxide reacts with 50.00 mL of sulfuric acid solution. What is the concentration of the H₂SO₄ solution?

- A) 0.775 M
- B) 0.0969 M
- C) 1.29 M
- D) 0.194 M
- E) 0.387 M

$$.5 \times .03874$$



$$= \frac{.01937 \text{ mol}}{2} = 9.685 \times 10^{-3} \times .05$$

$$=$$

$$n = M \times V$$

$$n = .5 \times .03874 = .01937 \text{ mol}$$

$$.01937 \text{ mol} \times \frac{\text{H}_2\text{SO}_4}{2\text{KOH}} = \frac{9.685 \times 10^{-3} \text{ mol}}{.05}$$

21) Which of the following pairs of aqueous solutions will form a precipitate when mixed?

- A) $\text{Hg}_2(\text{NO}_3)_2 + \text{LiI} \rightarrow \text{Hg}_2\text{I}_2 + 2 \text{LiNO}_3 \checkmark$
- B) $\text{AgC}_2\text{H}_3\text{O}_2 + \text{Cu}(\text{NO}_3)_2 \rightarrow \text{AgNO}_3 + \text{CuC}_2\text{H}_3\text{O}_2 \checkmark$
- C) $\text{NH}_4\text{NO}_3 + \text{Li}_2\text{CO}_3 \rightarrow \text{NH}_4\text{CO}_3 + \text{LiNO}_3 \checkmark$
- D) $\text{NaCl} + \text{Li}_3\text{PO}_4 \rightarrow \text{Na}_3\text{PO}_4 + 3 \text{LiCl} \checkmark$
- E) None of the above solution pairs will produce a precipitate.

useful constants and conversions:

$$1 \text{ amu} = 1.66054 \times 10^{-24} \text{ g}$$

$$1 \text{ L} = 1 \text{ dm}^3$$

$$\text{gas constant } R = 8.314 \text{ J/mol}\cdot\text{K} = 0.0821 \text{ L}\cdot\text{atm/mol}\cdot\text{K}$$

$$\text{Avogadro's number } N_a = 6.022 \times 10^{23}$$

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

$$0 \text{ }^\circ\text{C} = 273 \text{ K}$$

$$1 \text{ atm} = 760 \text{ torr} = 760 \text{ mm Hg} = 101325 \text{ Pa}$$

Equations Chapter 1-4

$$n = \frac{m}{M_w} \quad M = \frac{n}{V} \quad \text{mass}\% = \frac{\text{mass sample}}{\text{Total mass}} \times 100\% \quad \% \text{ yield} = \frac{\text{actual}}{\text{theor.}} \times 100\%$$

$$M_i V_i = M_f V_f \quad \text{pH} = -\log[H^+]$$

Equations Chapter 6

$$E_k = \frac{1}{2}mv^2 \quad \Delta U = U_{\text{final}} - U_{\text{initial}} \quad \Delta E = q + w \quad \Delta H = H_{\text{final}} - H_{\text{initial}} = q_{\text{rxn}}$$

$$q = nC_m \Delta T \quad q = C_{\text{cal}} \Delta T \quad q = ms\Delta T = mC_s \Delta T$$

$$\Delta H_{\text{rxn}}^\circ = \sum n \Delta H_f^\circ (\text{products}) - \sum m \Delta H_f^\circ (\text{reactants})$$