

CHM 2045 Exam 2 – Broward Exam Review

- 1) A rigid chamber is initially filled with 4.00 atm of N_2 gas and 3.00 atm of O_2 gas. After these react to form $\text{N}_2\text{O}(\text{g})$ and the chamber returns to its original temperature, the final pressure in the chamber is:
A) 3.0 atm
B) 4.0 atm
C) 5.0 atm
D) 6.0 atm
E) 7.0 atm
- 2) A mixture of $\text{Xe}(\text{g})$ and $\text{O}_2(\text{g})$, formed by the complete decomposition of $\text{XeO}_4(\text{g})$, is collected over water at 34°C at a total pressure of 760 mmHg. If the vapor pressure of water is 40 mmHg at 34°C , what is the partial pressure of O_2 ?
A) 360 mmHg
B) 380 mmHg
C) 480 mmHg
D) 510 mmHg
E) 720 mmHg
- 3) If 1000. g of boiling water (at $100.^\circ\text{C}$) was placed in an 1800. g cast iron skillet initially at 25°C , and the final equilibrium temperature of the water and the skillet was 88°C , estimate the specific heat capacity of the skillet. Assume this is a closed system and that the specific heat capacity of water is $4.184 \text{ J}/^\circ\text{C}\cdot\text{g}$.
A) $0.247 \text{ J}/^\circ\text{C}\cdot\text{g}$
B) $0.443 \text{ J}/^\circ\text{C}\cdot\text{g}$
C) $0.833 \text{ J}/^\circ\text{C}\cdot\text{g}$
D) $0.452 \text{ J}/^\circ\text{C}\cdot\text{g}$
E) $0.185 \text{ J}/^\circ\text{C}\cdot\text{g}$
- 4) Which of the following is incorrect?
I. For $n=2$ the maximum electron capacity is 8
II. There are 3 different orbitals with $n=2$ and $l=1$
III. For $n=3$, the largest value of l is 1
IV. There can be two electrons in a configuration with quantum numbers $n=1$ and $l=0$
V. There can be one electron in each configuration with $n=2$ and $m_s=+1/2$
A) I and II
B) I, III, V
C) II, III, IV
D) III and V
E) Only V
- 5) Which are the correct quantum numbers for the electron removed to form Cu^+ ?
A) 3, 0, 0
B) 4, 0, 0

- C) 3, 2, 0
D) 4, 1, 0
E) 4, 2, 0
- 6) Which of the following statements are true for the electronic configuration of magnesium?
- I. The 2s electrons are more difficult to remove than the 3s
 - II. The 2s electrons shield the 3s electrons from nuclear charge
 - III. The 2s electrons feel a higher effective nuclear charge than the 3s electrons
- A) Only I
B) Only II
C) I and II
D) II and III
E) I, II, and III
- 7) Which statement is incorrect regarding internal energy (U, E) and the first law of thermodynamics?
- A) The first law of thermodynamics states that energy must be conserved.
 - B) When the system gains heat and performs work, then $\Delta\{U, E\}$ for the system must be positive.
 - C) The first law of thermodynamics does not imply that heat can't be converted to work.
 - D) When the system loses heat and performs work, then $\Delta\{U, E\}$ for the system must be negative.
 - E) When its $\Delta\{U, E\}$ increases, then the system must gain heat or have work performed on it, or both.
- 8) Deterioration of buildings, bridges, and other structures through the rusting of iron costs millions of dollars a day. The enthalpy of formation of rust, $\text{Fe}_2\text{O}_3(\text{s})$, is -826.0 kJ/mol . How much heat is released (in kJ) when 0.500 kg of Fe reacts with 200. g of O_2 , forming $\text{Fe}_2\text{O}_3(\text{s})$?
- A) 3442 kJ
B) 3696 kJ
C) 6864 kJ
D) 7392 kJ
E) 1650 kJ
- 9) When 50.0 ml of 0.200 M AgNO_3 and 50.0 ml of 0.100 M CaCl_2 , both at 25.0°C , are reacted in a coffee-cup calorimeter, the temperature of the reacting mixture increases to 26.0°C . Calculate ΔH in kJ per mole of AgCl produced. Assume the density of the solution is 1.05 g/ml and the specific heat capacity of the solution $4.20 \text{ J/g}^\circ\text{C}$.
- A) -88 kJ/mol
B) -42 kJ/mol
C) -440 kJ/mol
D) -22 kJ/mol
E) -44 kJ/mol

- 10) The rate law for $2 \text{NO(g)} + \text{O}_2\text{(g)} \rightarrow 2 \text{NO}_2\text{(g)}$ was experimentally determined to be rate = $k[\text{NO}]^2[\text{O}_2]$. Based on this information, which of the following are plausible mechanisms for this reaction?

I:	$2 \text{NO(g)} \rightleftharpoons \text{N}_2\text{(g)} + \text{O}_2\text{(g)}$ (slow equilibrium step) $\text{N}_2\text{(g)} + 2 \text{O}_2\text{(g)} \rightarrow 2 \text{NO}_2\text{(g)}$ (fast second step)
II:	$2 \text{NO(g)} \rightleftharpoons \text{N}_2\text{O}_2\text{(g)}$ (fast equilibrium step) $\text{N}_2\text{O}_2\text{(g)} + \text{O}_2\text{(g)} \rightarrow 2 \text{NO}_2\text{(g)}$ (slow second step)
III:	$2 \text{NO(g)} + \text{O}_2\text{(g)} \rightarrow 2 \text{NO}_2\text{(g)}$ (one step)

- A) Only I
B) Only II
C) I and III
D) II and III
E) I, II, and III

- 11) The growth of Pseudomonas bacteria is a first-order process with rate constant $k = 0.035 \text{ min}^{-1}$ at 37°C . The time it takes to approximately double the population of these bacteria at 37°C is

- A) 5.0 minutes
B) 10. minutes
C) 20. minutes
D) 30. minutes
E) 60. Minutes

- 12) Select the true statement(s)

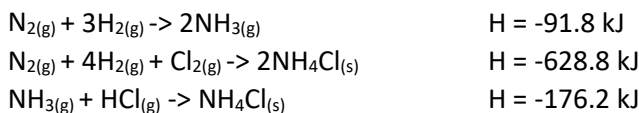
- I. Photons of green light have greater energy than photons of red light
II. The light emitted from an $n=4$ to $n=2$ transition will have greater energy than light from an $n=3$ to $n=1$ transition
III. The energy of a photon is directly related to its frequency and inversely related to its wavelength
IV. There are only 2 subshells associated with the $n=2$ energy level
V. In accordance with Hund's rule, the ground state phosphorous atom contains 3 unpaired electrons in the p sublevel

- A) I and II
B) II, III, and IV
C) I and III
D) III only
E) I, III, IV, and V

- 13) If 150. grams of iron ($0.450 \text{ J/g}^\circ\text{C}$) at 100°C is combined with 150. grams of water at 20°C in an insulated container, what will be the final temperature of the water?

- A) 10.4°C
B) 27.8°C
C) 30.8°C
D) 34.5°C
E) 60.0°C

14) Find the heat of formation of gaseous HCl

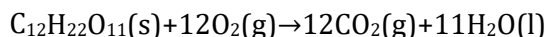


- A) -92.3 kJ
- B) -184.6 kJ
- C) -87.6 kJ
- D) -445 kJ
- E) -574.4 kJ

15) A pure gold ring ($C=0.128 \text{ J/g}^\circ\text{C}$) and pure silver ring ($C=0.235 \text{ J/g}^\circ\text{C}$) have a total mass of 15.3g. The two rings are heated to 62.1°C and dropped into a 13.1mL of water at 20.9°C . When equilibrium is reached, the temperature of the water is 22.9°C . What was the mass of the gold ring?

- A) 17.6 g
- B) 10.3 g
- C) 7.5 g
- D) 5.2 g
- E) 3.4 g

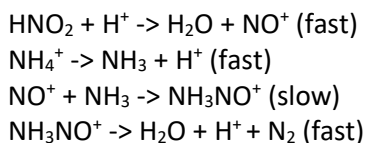
16) Consider the reaction



in which 10.0 g of sucrose, $\text{C}_{12}\text{H}_{22}\text{O}_{11}$, was burned in a bomb calorimeter with a heat capacity of $7.50 \text{ kJ/}^\circ\text{C}$. The temperature increase inside the calorimeter was found to be 22.0°C . What is the heat of this reaction per mole of sucrose?

- A) 5649 kJ/mol
- B) 56507 kJ/mol
- C) 1650 kJ/mol
- D) 4125 kJ/mol
- E) 3300 kJ/mol

17) Find the rate law for the following reaction mechanism



- A) Rate = $k [\text{NO}^+] [\text{NH}_3]$
- B) Rate = $k [\text{NO}^+] [\text{NH}_4^+] [\text{H}^+]^{-1}$
- C) Rate = $k [\text{NO}^+] [\text{NH}_4^+] [\text{H}^+]$
- D) Rate = $k [\text{HNO}_2] [\text{NH}_4^+] [\text{H}_2\text{O}]^{-1}$
- E) Rate = $k [\text{NH}_3] [\text{H}^+] [\text{HNO}_2] [\text{H}_2\text{O}]^{-1}$