

CHEM 121 Practice Exam #3

Spring 2012

NAME _____

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

- 1) Convert 1.25 atm to mm Hg. 1) _____
A) 875 mm Hg
B) 1520 mm Hg
C) 760 mm Hg
D) 950 mm Hg
E) 1000 mm Hg
- 2) The volume of a gas is proportional to the temperature of a gas is known as 2) _____
A) Ideal Gas Law
B) Charles's Law
C) Dalton's Law
D) Boyle's Law
E) Avogadro's Law
- 3) What volume will a balloon occupy at 1.0 atm, if the balloon has a volume of 7.6 L at 3.8 atm? 3) _____
A) 2.0 L B) 35 L C) 29 L D) 5.0 L E) 17 L
- 4) A sample of 0.300 moles of nitrogen occupies 0.600 L. Under the same conditions, what number of 4) _____
moles occupies 1.200 L?
A) 1.50 moles B) 6.00 moles C) 0.33 moles D) 0.600 moles
- 5) To what volume will a sample of gas expand if it is heated from 50.0 °C and 2.33 L to 500.0 °C? 5) _____
A) 5.58 L B) 10.3 L C) 4.38 L D) 9.74 L E) 17.9 L
- 6) A gas is at 35.0 °C and 4.50 L. What is the temperature at 9.00 L? 6) _____
A) 1.16 °C B) 343 °C C) 17.5 °C D) 70.0 °C E) 616 °C
- 7) A syringe initially holds a sample of gas with a volume of 285 mL at 355 K and 1.88 atm. To what 7) _____
temperature must the gas in the syringe be heated/cooled in order to have a volume of 435 mL at
2.50 atm?
A) 466 K B) 721 K C) 572 K D) 139 K E) 175 K
- 8) What pressure (in atm) will 0.44 moles of CO₂ exert in a 2.6 L container at 25 °C? 8) _____
A) 0.35 atm B) 3.6 atm C) 8.6 atm D) 4.1 atm E) 4.7 atm

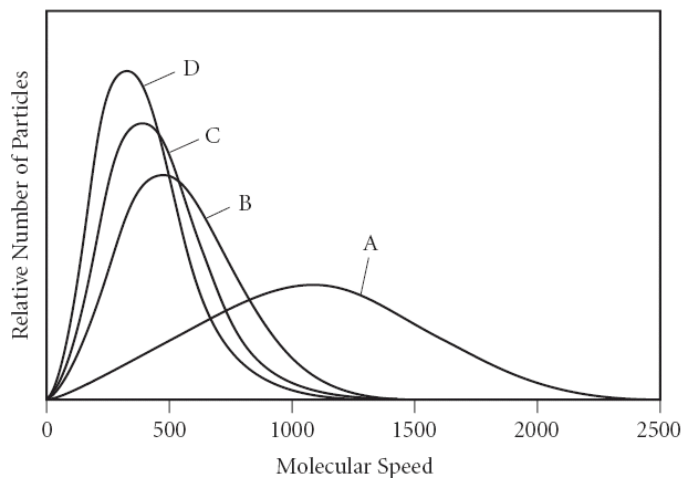
9) Which of the following gas samples would be most likely to behave ideally under the stated conditions?

9) _____

- A) CO at 200 atm and 25°C
- B) O₂ at 400 atm and 25°C
- C) N₂ at 1 atm and -70°C
- D) SO₂ at 2 atm and 0 K
- E) Ne at STP

10) Using the graph below, determine the gas that has the lowest density at STP.

10) _____



- A) D
- B) A
- C) B
- D) C
- E) All of the gases have the same density at STP.

11) Determine the density of CO₂ gas at STP.

11) _____

- A) 1.80 g/L
- B) 4.46 g/L
- C) 1.96 g/L
- D) 5.10 g/L
- E) 2.24 g/L

12) A 0.334 g sample of an unknown halogen occupies 109 mL at 398 K and 1.41 atm. What is the identity of the halogen?

12) _____

- A) Br₂
- B) Ge
- C) Cl₂
- D) I₂
- E) F₂

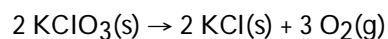
13) A mixture of He, Ne and Ar has a pressure of 7.85 atm. If the Ne has a mole fraction of 0.47 and Ar has a mole fraction of 0.23, what is the pressure of He?

13) _____

- A) 3.7 atm
- B) 1.8 atm
- C) 5.5 atm
- D) 4.2 atm
- E) 2.4 atm

14) Determine the volume of O₂ (at STP) formed when 50.0 g of KClO₃ decomposes according to the following reaction. The molar mass for KClO₃ is 122.55 g/mol.

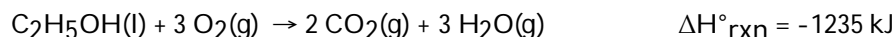
14) _____



- A) 14.6 L
- B) 12.3 L
- C) 8.22 L
- D) 13.7 L
- E) 9.14 L

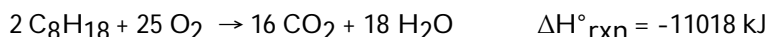
- 15) Which of the following signs on q and w represent a system that is doing work on the surroundings, as well as losing heat to the surroundings? 15) _____
- A) $q = +$, $w = +$
 - B) $q = -$, $w = -$
 - C) $q = -$, $w = +$
 - D) $q = +$, $w = -$
 - E) None of these represent the system referenced above.
- 16) Calculate the change internal energy (ΔE) for a system that is giving off 45.0 kJ of heat and is performing 855 J of work on the surroundings. 16) _____
- A) -45.9 kJ
 - B) -9.00×10^2 kJ
 - C) -44.1 kJ
 - D) 44.1 kJ
 - E) 9.00×10^2 kJ
- 17) Define heat capacity. 17) _____
- A) the quantity of heat required to raise the temperature of 1 g of a substance by 1°F
 - B) the quantity of heat required to raise the temperature of 1 liter of a substance by 1°C
 - C) the quantity of heat required to raise the temperature of 1 mole of a substance by 1°C
 - D) the quantity of heat required to raise the temperature of 1 gram of a substance by 1°C
 - E) the quantity of heat required to change a system's temperature by 1°C
- 18) Which of the following substances (with specific heat capacity provided) would show the greatest temperature change upon absorbing 100.0 J of heat? 18) _____
- A) 10.0 g ethanol, $C_{\text{ethanol}} = 2.42 \text{ J/g}^\circ\text{C}$
 - B) 10.0 g Fe, $C_{\text{Fe}} = 0.449 \text{ J/g}^\circ\text{C}$
 - C) 10.0 g Au, $C_{\text{Au}} = 0.128 \text{ J/g}^\circ\text{C}$
 - D) 10.0 g H_2O , $C_{\text{H}_2\text{O}} = 4.18 \text{ J/g}^\circ\text{C}$
 - E) 10.0 g Ag, $C_{\text{Ag}} = 0.235 \text{ J/g}^\circ\text{C}$
- 19) 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 $2.42 \text{ J/g}^\circ\text{C}$. 19) _____
- A) 57.0 kJ
 - B) 12.9 kJ
 - C) 28.4 kJ
 - D) 16.6 kJ
 - E) 73.6 kJ
- 20) Determine the specific heat capacity of an alloy that requires 59.3 kJ to raise the temperature of 150.0 g alloy from 298 K to 398 K. 20) _____
- A) $4.38 \text{ J/g}^\circ\text{C}$
 - B) $2.29 \text{ J/g}^\circ\text{C}$
 - C) $2.53 \text{ J/g}^\circ\text{C}$
 - D) $1.87 \text{ J/g}^\circ\text{C}$
 - E) $3.95 \text{ J/g}^\circ\text{C}$
- 21) Identify what a bomb calorimeter measures. 21) _____
- A) measures ΔE for combustion reactions
 - B) measures ΔH for oxidation solutions
 - C) measures ΔT for hydrolysis solutions
 - D) measures ΔE for reduction reactions
 - E) measures ΔH for aqueous solutions
- 22) Calculate the change in internal energy (ΔE) for a system that is absorbing 35.8 kJ of heat and is expanding from 8.00 to 24.0 L in volume at 1.00 atm. (Remember that $101.3 \text{ J} = 1 \text{ L} \cdot \text{atm}$) 22) _____
- A) +51.8 kJ
 - B) +34.2 kJ
 - C) -29.3 kJ
 - D) -15.8 kJ
 - E) -16.6 kJ

- 23) A 21.8 g sample of ethanol ($\text{C}_2\text{H}_5\text{OH}$) is burned in a bomb calorimeter, according to the following reaction. If the temperature rises from 25.0 to 62.3°C, determine the heat capacity of the calorimeter. The molar mass of ethanol is 46.07 g/mol. 23) _____



- A) 15.7 kJ/°C B) 5.65 kJ/°C C) 33.1 kJ/°C D) 4.99 kJ/°C E) 63.7 kJ/°C

- 24) Using the following equation for the combustion of octane, calculate the heat of reaction for 100.0 g of octane. The molar mass of octane is 114.33 g/mole. 24) _____

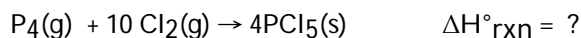


- A) $9.64 \times 10^3 \text{ kJ}$ B) $4.82 \times 10^3 \text{ kJ}$ C) $1.26 \times 10^4 \text{ kJ}$ D) 4.82 kJ

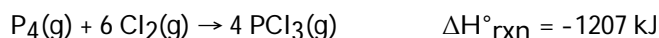
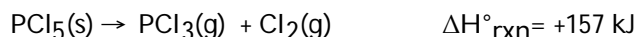
- 25) A student is preparing to perform a series of calorimetry experiments. She first wishes to determine the calorimeter constant (C_{cal}) for her coffee cup calorimeter. She pours a 50.0 mL sample of water at 345 K into the calorimeter containing a 50.0 mL sample of water at 298 K. She carefully records the final temperature of the water as 317 K. What is the value of C_{cal} for the calorimeter? 25) _____

- A) 99 J/K B) 19 J/K C) 76 J/K D) 28 J/K E) 21 J/K

- 26) Use the standard reaction enthalpies given below to determine $\Delta H^\circ_{\text{rxn}}$ for the following reaction: 26) _____



Given:



- A) -1786 kJ B) -1835 kJ C) -2100. kJ D) -1364 kJ E) -1050. kJ

- 27) Choose the reaction that illustrates $\Delta H^\circ_{\text{f}}$ for $\text{Ca}(\text{NO}_3)_2$. 27) _____

- A) $\text{Ca}(\text{NO}_3)_2(\text{aq}) \rightarrow \text{Ca}^{2+}(\text{aq}) + 2 \text{NO}_3^-(\text{aq})$
 B) $\text{Ca}^{2+}(\text{aq}) + 2 \text{NO}_3^-(\text{aq}) \rightarrow \text{Ca}(\text{NO}_3)_2(\text{aq})$
 C) $\text{Ca}(\text{NO}_3)_2(\text{s}) \rightarrow \text{Ca}(\text{s}) + \text{N}_2(\text{g}) + 3\text{O}_2(\text{g})$
 D) $\text{Ca}(\text{s}) + \text{N}_2(\text{g}) + 3\text{O}_2(\text{g}) \rightarrow \text{Ca}(\text{NO}_3)_2(\text{s})$
 E) $\text{Ca}(\text{s}) + 2 \text{N}(\text{g}) + 6 \text{O}(\text{g}) \rightarrow \text{Ca}(\text{NO}_3)_2(\text{s})$

28) Use the ΔH°_f information provided to calculate $\Delta H^\circ_{\text{rxn}}$ for the following:

28) _____

ΔH°_f (kJ/mol)	$\text{SO}_2\text{Cl}_2(\text{g}) + 2 \text{H}_2\text{O}(\text{l}) \rightarrow 2 \text{HCl}(\text{g}) + \text{H}_2\text{SO}_4(\text{l})$	$\Delta H^\circ_{\text{rxn}} = ?$
$\text{SO}_2\text{Cl}_2(\text{g})$	-364	
$\text{H}_2\text{O}(\text{l})$	-286	
$\text{HCl}(\text{g})$	-92	
$\text{H}_2\text{SO}_4(\text{l})$	-814	

- A) -62 kJ B) -422 kJ C) +161 kJ D) -256 kJ E) +800. kJ

29) Place the following types of electromagnetic radiation in order of increasing wavelength.

29) _____

ultraviolet light gamma rays radio waves

- A) radio waves < ultraviolet light < gamma rays
B) ultraviolet light < gamma rays < radio waves
C) gamma rays < ultraviolet light < radio waves
D) gamma rays < radio waves < ultraviolet light
E) radio waves < gamma rays < ultraviolet light

30) Which of the following visible colors of light has the highest frequency?

30) _____

- A) green B) red C) yellow D) orange E) blue

31) Calculate the wavelength (in nm) of a the red light emitted by a neon sign with a frequency of 4.74×10^{14} Hz.

31) _____

- A) 142 nm B) 466 nm C) 158 nm D) 704 nm E) 633 nm

32) How many photons are contained in a burst of yellow light (589 nm) from a sodium lamp that contains 609 kJ of energy?

32) _____

- A) 3.06×10^{30} photons
B) 3.37×10^{19} photons
C) 1.80×10^{24} photons
D) 4.03×10^{28} photons
E) 2.48×10^{25} photons

33) Calculate the wavelength of an electron ($m = 9.11 \times 10^{-28}$ g) moving at 3.66×10^6 m/s.

33) _____

- A) 5.03×10^{-10} m
B) 1.99×10^{-10} m
C) 2.76×10^{-9} m
D) 5.52×10^{-9} m
E) 1.81×10^{-10} m

34) Which of the following transitions (in a hydrogen atom) represent emission of the longest wavelength photon?

34) _____

- A) $n = 1$ to $n = 2$
B) $n = 3$ to $n = 4$
C) $n = 3$ to $n = 1$
D) $n = 5$ to $n = 4$
E) $n = 4$ to $n = 2$

- 35) For $n = 3$, what are the possible sublevels? 35) _____
A) 0 B) 0, 1, 2 C) 0, 1 D) 0, 1, 2, 3
- 36) Each of the following sets of quantum numbers is supposed to specify an orbital. Which of the following sets of quantum numbers contains an error? 36) _____
A) $n = 3, l = 0, m_l = 0$
B) $n = 4, l = 2, m_l = 0$
C) $n = 2, l = 1, m_l = -1$
D) $n = 3, l = 3, m_l = -2$
E) $n = 1, l = 0, m_l = 0$
- 37) How many orbitals are contained in the third principal level ($n=3$) of a given atom? 37) _____
A) 7 B) 5 C) 9 D) 3 E) 18
- 38) Which of the following quantum numbers describes the shape of an orbital? 38) _____
A) angular momentum quantum number
B) Schrödinger quantum number
C) spin quantum number
D) magnetic quantum number
E) principal quantum number
- 39) How many different values of m_l are possible in the 3d sublevel? 39) _____
A) 3 B) 2 C) 1 D) 5 E) 7
- 40) Give the value of l for a 3p sublevel. 40) _____
A) -2 B) 0 C) -1 D) 2 E) 1