HW02 - Gases

This homework covers Chapter 1 and 2 in Chembook from sections 1.10-2.11.
Some helpful videos for the challenge questions on this homework include:

- Gas Law Stoichiometry
- Reaction Stoichiometry Limiting Reagent
- Ideal Gas Law

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1 2 points

Consider the following **unbalanced** reaction:

$$AgNO_3 + K_3PO_4 \rightarrow Ag_3PO_4 + KNO_3$$

What is the sum of the coefficients in the balanced reaction?
Note: If there is no coefficient, the coefficient is an understood 1.

○ 8
○ 5
○ 6
○ 3
○ 4
○ 10

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2 2 points

Hydrogen peroxide (H_2O_2) liquid decomposes into hydrogen gas and oxygen gas. Which of the following represents this reaction?
Note: phases are omitted in the answer choices, but do remember the standard state of hydrogen and oxygen gas.

○ $H_2O_2 \rightarrow H_2 + O_2$
○ $H_2 + O_2 \rightarrow H_2O_2$
○ $2H_2 + O_2 \rightarrow 2H_2O_2$
○ $2H_2O_2 \rightarrow 2H_2 + O_2$
○ $H_2O_2 \rightarrow 2H + 2O$

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3 2 points

In which state of matter are the molecules all spread out? This means the distance between the molecules is much larger than the size of the molecules themselves.

○ gas
○ liquid
○ solid

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4 4 points

What are the key physical properties of solids?

☐ the molecules are very close to each other
☐ molecules are in static positions relative to neighboring molecules
☐ molecules are in constant translational motion relative to each other
☐ molecules are very far apart from each other
☐ molecules are very close to each other but also move considerably among themselves

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5 2 points

Which of the following substances listed has the smallest percentage in the make up of the typical composition of air here in Austin, TX on a humid day?

○ argon (Ar)
○ nitrogen (N_2)
○ oxygen (O_2)
○ carbon dioxide (CO_2)
○ water (H_2O)

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6 2 points

Which of the following layers of the atmosphere is closest to the ground?

○ Troposphere
○ Ozone
○ Stratosphere
○ Mesosphere

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7 4 points

Which of the following simple ratios of nitrogen to oxygen is the most accurate for describing the air on this planet.
(ratios are all written as nitrogen : oxygen)

○ 4 : 1
○ 1 : 2
○ 2 : 1
○ 3 : 2
○ 3 : 1

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8 4 points

Which of the following substances is most variable in our atmosphere?

○ Water vapor
○ Carbon dioxide
○ Nitrogen
○ Argon

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9 4 points

What is the name and the approximate molar mass of C_5H_{12}?

○ Heptane, 74 g/mol
○ Pentane, 68 g/mole
○ Hexane, 72 g/mol
○ Pentane, 72 g/mol
○ Pentane, 74 g/mol
○ Hexane, 86 g/mol
○ Pentonium, 72 g/mol

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10 4 points

Which carbon compound contains the fewest carbon atoms?

○ Methane
○ Hexane
○ Propane
○ Chlorobutane

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11 2 points

According to Boyle's Law, pressure and volume have a(n)...

○ indirect relationship
○ direct relationship
○ inverse relationship
○ none of these are correct

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12 2 points

An inflated balloon has a volume equal to 2.3 L at 20˚C. When the temperature is reduced to 10˚C, the volume...

○ doubles
○ is halved
○ decreases by a small amount
○ increases by a small amount

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13 4 points

A small quantity of neon gas is held in a 150 mL container at 1.11 atm and 27 ˚C. How many moles of gas are in this container?

○ 8.87×10^{-6} mol
○ 7.51×10^{-2} mol
○ 6.76×10^{-3} mol
○ 4.50 mol
○ 200. mol

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14 2 points

Catalytic converters reduce the amount of _____ in car exhaust.

○ CO
○ O_3
○ CO_2
○ N_2

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15 4 points

The two most abundant gases in an inhaled breath are...

○ Nitrogen and oxygen
○ Nitrogen and water vapor
○ Oxygen and carbon dioxide
○ Carbon dioxide and nitrogen

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16 4 points

The air we exhale contains about 100 times more of which gas than the air we breathe from the atmosphere?

○ Carbon dioxide
○ Argon
○ Oxygen
○ Nitrogen

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17 2 points

Which pollutant is present as a solid particulate in air?

○ Soot
○ Ozone
○ Carbon monoxide
○ Sulfur dioxide

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18 2 points

Which of the following pollutants **cannot** be detected by odor?

○ CO
○ O_3
○ NO_x
○ SO_x

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19 4 points

Refer to the graph of elevation vs pressure foundhere. What is the approximate pressure (in kPa) at 4500 m altitude?

○ 57 kPa
○ 50 kPa
○ 60 kPa
○ 63 kPa
○ 45 kPa

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20 4 points

The hike from Mt. Everest basecamp straight to the summit is only about 13 miles. However, when you consider the need to gradually acclimate to intense increases in altitude, summiting Mt. Everest takes over a month and a half to complete. How does this make sense with our discussion about the atmosphere?

○ As you go up in elevation, the trend in air pressure is inconsistent. The body needs to adjust to the inconsistency in air pressure.
○ As you go up in elevation, the air pressure decreases. When the available oxygen decreases, the body needs time to adjust.
○ As you go up in elevation, the air pressure increases. When the available oxygen increases, the body needs time to adjust.

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21 4 points

A pitfall (or slight plot hole) of Dr. Mann's planet in the movie Interstellar was that it had an ammonia-rich atmosphere. A lethal concentration of ammonia (NH_3) is about 5,000 ppm or a mole fraction of only 0.005. Use Dalton's Law to calculate the *lethal* partial pressure in atm of NH_3 if the ambient pressure of Dr. Mann's planet is 2.52 atm. variable
Answer to 4 decimal places.

Type your answer...

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22 4 points

One of the coolest science experiments ever done is the Miller-Urey experiment, where the gases of the primordial earth were combined in a closed system to see if the building blocks of life (amino acids, RNA, etc.) could have been created by natural forces several billions of years ago. These gases are H_2O, CH_4, NH_3, and H_2. What is the total pressure of a gas mixture containing 0.501 atm H_2O, 0.211 atm CH_4, 0.119 atm NH_3 and 0.0551 atm H_2? Assume no reaction occurs.

○ 0.886 atm
○ 0.662 atm
○ 1.000 atm
○ 1.551 atm
○ 1.382 atm

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23 4 points

A 34 L container holds 0.80 moles of gas at 300 K. What is the pressure (in atm)?

○ 0.58 atm
○ 20 atm
○ 440 atm
○ 1.2 atm

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24 4 points

A gas is expanded from 3.60 L and 76.8 kPa to 8.10 L at constant temperature. What is the final pressure?

○ 2240 kPa
○ 34.1 kPa
○ 173 kPa
○ 68.2 kPa
○ 9.48 kPa
○ 86.4 kPa

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25 4 points

An industrial tube used to transport methane has an internal temperature equal to 18 ˚C. When high quantities of methane are transported, the pressure increases to 3.6 atm in 12 L of tubing. How many moles of methane (n) are present in this 12 L tubing?

○ 0.038 moles
○ 29 moles
○ 3.6 moles
○ 1.8 moles

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26 4 points

SF_6 is a unique compound because it has a relatively high density (6.17 g/L, to be exact) despite being a gas at room temperature. How many moles are present in a 48.0 L container filled with SF_6?

○ 1.56 mol
○ 7.78 mol
○ 4.44 mol
○ 2.03 mol
○ 0.328 mol
○ 18.8 mol

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27 4 points

Consider the following **unbalanced** environmental reaction:

$$NO_2(g) + H_2O(\ell) \rightarrow HNO_3(aq) + NO(g)$$

First balance the reaction. Then calculate the volume of NO gas produced when 0.952 moles of NO_2 are reacted to completion with excess H_2O at STP.
Reminder: STP is 0 ˚C and 1 atm pressure. One mole occupies 22.4 L at STP.

○ 4.80 L
○ 7.11 L
○ 43.8 L
○ 32.7 L
○ 85.7 L

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28 4 points

Your friend is using the ideal gas law to solve a question. Your friend's work is shown below:

$$PV = nRT$$
$$(3.7\ \text{atm})(4.3\ \text{L}) = (0.5\ \text{moles})(R)(387.77\ \text{K})$$

What is the proper R value to complete the equation?

○ 0.08206 L Torr / mol K
○ 0.08206 L atm / mol K
○ 8.314 J / mol K
○ 62.36 L Torr / mol K
○ 62.36 L atm / mol K

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29 4 points

Esther goes on a camping trip. Just before sunset, she inflates her air mattress to a total volume of 3.80 L. Overnight, the temperature drops from a pleasant 24 ˚C to a colder 12 ˚C. What is the approximate volume of Esther's air mattress when the temperature drops to 12 ˚C?

○ 3.96 L
○ 3.65 L
○ 1.90 L
○ 7.60 L
○ 3.54 L

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30 4 points

Write and balance the chemical equation for the combustion of octane to the lowest whole number coefficients. What are the reactants and products of this reaction (**including coefficients of the chemical equation when balance**)?

○ Reactants: 2 octane, 25 oxygen
Products: 16 carbon dioxide, 18 water

○ Reactants: 1 octane, 1 oxygen
Products: 1 carbon dioxide, 1 water

○ Reactants: 2 octane, 25 carbon dioxide
Products: 16 oxygen, 18 water

○ Reactants: 25 octane, 2 oxygen
Products: 18 carbon dioxide, 16 water