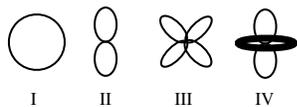


- 1) With an ideal gas, there is an expected relationship between pressure and volume when other variables are held constant. As the pressure increases, volume changes how?
- 2) Non-ideal behavior for a gas is most likely to be observed under which conditions?
- 3) What is the volume of 1.50mol of ideal gas with a pressure of 715mmHg and a temperature of 18.0°C?
- 3a,b,c) Rework Q3 to solve for pressure, temperature, and mol of gas.
- 3d) If the gas in Q3c is molecular oxygen, how many grams of gas are present?
- 4) Using the Ideal Gas Law as the model, how could you predict which gas would have least density?
- 5) An ideal gas initially has a volume of 2.7L and a pressure of 960mmHg. What is the **final volume** of gas when the final pressure is 640mmHg?
- 6) Initially, 1.2mol of an ideal gas has a volume of 2.7L and a pressure of 960mmHg. What is the **final number of moles of gas** when the final pressure is 640mmHg, and the volume is 7.7L?
- 7) Initially, a volume of 2.5L of an ideal gas is at a temperature of 27°C. The final conditions are a volume of 7.5L, temperature of 327°C, and pressure 640mmHg. What was the **initial pressure of gas**?
- 8) An ideal gas has an initial pressure of 755mmHg for 2.4mol of gas. What is the **final pressure** of a system that contains 5.6mol of gas?
- 9) Initially, 27mol of an ideal gas has a pressure of 810mmHg at 57°C. The final conditions for the gas are 23mol at 650mmHg. What is the **final temperature** of the gas?
- 10) What was the initial pressure of a system at 25°C if the final conditions are a pressure of 990atm and a temperature of 84°C?
- 11) What is the **initial number of moles of gas** when 120mL of an ideal gas gets final conditions with a volume of 75mL and 2.5mol of gas present?
- 12) An ideal gas initially has a volume of 2.2L with 1.1mol of gas present. The final conditions have 2.7L of gas at a temperature of 273K and 1.8mol of gas present. What would have been the **initial temperature** of the gas presuming that the pressure was held constant.
- 13) What was the initial volume of an ideal gas at 37°C if it gets a volume of 1500mL at 107°C?
- 14) What is the **final number of moles of gas** when 2.5mol of an ideal gas with a temperature of 350K gets a final temperature of 250K?
- 15) In the balanced chemical reaction, 2 moles of aluminum metal react with 6 moles of hydrochloric acid to produce 3 moles of hydrogen gas. Presume hydrogen gas has ideal gas behavior. What **mass in grams of aluminum metal** reacted if the temperature of the hydrogen gas collected was 25.0°C, the volume of gas collected was 45.5mL, and the pressure of the gas was 0.983atm?
- 16) Which of the colors of visible light has the **longest** wavelength?
- 17) Which of the colors of visible light has the **highest energy** per photon?
- 18) Which of the colors of visible light has the **highest frequency** per photon?
- 19) Which of the colors of visible light has the **highest energy** per mole of photons?
- 20) Which of the colors of visible light has the **highest frequency** per mole of photons?
- 21) What is the **energy in kJ** for one mole of photons with a wavelength of 228nm?
- 22) What is the **energy in J** for one mole of photons with a wavelength of 228nm?
- 23) What is the **energy in J** of a photon with a frequency of $1.20 \times 10^{16} \text{s}^{-1}$?

- 24) What is the **wavelength in nm** for a photon with an energy of $6.31 \times 10^{-19} \text{ J}$?
- 25) What is the **frequency in s^{-1}** for a photon with a wavelength of $1.00 \times 10^6 \text{ nm}$?
- 26) Which set of quantum numbers refers to an electron in an orbital with the highest energy?
- $n=4, \ell=3, m_\ell=0, m_s=+\frac{1}{2}$
 - $n=5, \ell=0, m_\ell=0, m_s=+\frac{1}{2}$
 - $n=4, \ell=1, m_\ell=0, m_s=+\frac{1}{2}$
 - $n=3, \ell=2, m_\ell=0, m_s=+\frac{1}{2}$
 - $n=2, \ell=2, m_\ell=0, m_s=+\frac{1}{2}$
- 27) Which set of above quantum numbers refers to an electron in an s orbital?
- 28) Which set of above quantum numbers refers to an electron in a p orbital?
- 29) Which set of above quantum numbers refers to an electron in a d orbital?
- 30) Which set of above quantum numbers refers to an electron in an f orbital?
- 31) Which set of above quantum numbers is not valid?
- 32) Which set of quantum numbers specifies **only one** of the 3d orbitals?
- $n=3$
 - $n=3, \ell=2$
 - $n=3, \ell=2, m_\ell=0$
 - $n=3, \ell=2, m_\ell=0, m_s=+\frac{1}{2}$
 - $n=3, \ell=3, m_\ell=0, m_s=1$
- 33) Which set of above quantum numbers specifies the **third** energy level?
- 34) Which set of above quantum numbers specifies all of the 3d orbitals?
- 35) Which set of above quantum numbers specifies an electron in one of the 3d orbitals?
- 36) Which set of above quantum numbers is not valid?
- 37) How many orbitals are specified by this set of quantum numbers? : $n = 4, l = 2$
- 38) What is the maximum number of electrons specified by this set of quantum numbers? : $n = 4, l = 2$
- 39) Which properties are associated with the value of the n quantum number?
- 40) Which properties are associated with the value of the l quantum number?
- 41) Which properties are associated with the value of the m_l quantum number?
- 42) Which properties are associated with the value of the m_s quantum number?
- 43) Which diagrams refer to an s orbital?



- 44) Which diagrams refer to a p orbital?
- 45) Which diagrams refer to a d orbital?
- 46) Name an s block element.
- 47) Which one has a ground state electron configuration of $1s^2 2s^2 2p^6$?
- Ne
 - O^{2-}
 - F^-
 - Na^+
 - All of the others
- 48) Which element or ion has a ground state electron configuration of $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5$?
- 49) What is the **electron configuration** for a copper atom in the ground state?

- 50) A sodium atom has how many valence electrons?
- 51) What orbital contains the valence electrons for a calcium atom in the ground state?
- 52) What are the quantum numbers for the orbital that contains the valence electrons in question 51?
- 53) Which electron configuration is correct for the ground state of **nitrogen**?

- | | 2s | 2p | | |
|-------------------------|----------------------|------------|------------|------------|
| a) $\uparrow\downarrow$ | $\uparrow\downarrow$ | \uparrow | \uparrow | \uparrow |
| b) $\uparrow\uparrow$ | \uparrow | \uparrow | \uparrow | \uparrow |
| c) $\uparrow\downarrow$ | \uparrow | \uparrow | \uparrow | \uparrow |
| d) \uparrow | $\uparrow\downarrow$ | \uparrow | \uparrow | \uparrow |
| e) $\uparrow\downarrow$ | $\uparrow\downarrow$ | \uparrow | \uparrow | \uparrow |

- 54) Which rules (if any) are violated by these ground state electron configurations of atoms?

- | | 5s | 4d | | | | | 5p | | | |
|---------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| I: $\uparrow\downarrow$ | $\uparrow\downarrow$ | $\uparrow\downarrow$ | $\uparrow\downarrow$ | $\uparrow\downarrow$ | $\uparrow\downarrow$ | $\uparrow\downarrow$ | $\uparrow\downarrow$ | $\uparrow\downarrow$ | $\uparrow\downarrow$ | $\uparrow\downarrow$ |
| II: $\uparrow\downarrow$ | $\uparrow\downarrow$ | $\uparrow\downarrow$ | $\uparrow\downarrow$ | $\uparrow\downarrow$ | $\uparrow\downarrow$ | \uparrow | \downarrow | \uparrow | \downarrow | \uparrow |
| III: $\uparrow\downarrow$ | $\uparrow\downarrow$ |
| IV: $\uparrow\downarrow$ | $\uparrow\downarrow$ | $\uparrow\downarrow$ | $\uparrow\downarrow$ | $\uparrow\downarrow$ | $\uparrow\downarrow$ | $\uparrow\downarrow$ | $\uparrow\downarrow$ | $\uparrow\downarrow$ | $\uparrow\downarrow$ | $\uparrow\downarrow$ |
| V: \uparrow | $\uparrow\downarrow$ |

- 55) If the ground state electron configuration of an element is $[\text{He}]2s^22p^4$, what is the typical charge on a monatomic anion of the element?
- 56) What is the **identity of the element** that has a -1 ion with the electron configuration of Na^+ ?
- 57) What is **identity of the element** that has a +2 ion with the electron configuration of $[\text{Ar}]3d^5$?
- 58) Which one of these arranges the elemental symbols of the atoms in the order of **increasing ionization energy** more to less
- $\text{Li} > \text{K} > \text{Na}$
 - $\text{K} > \text{Na} > \text{Li}$
 - $\text{K} > \text{Li} > \text{Na}$
 - $\text{Li} > \text{Na} > \text{K}$
 - $\text{Na} > \text{K} > \text{Li}$
- 59) Which one of the above arranges the elemental symbols of the atoms in the order of **increasingly negative electron affinity**?
- 60) Which one of the above arranges the elemental symbols of the atoms in the order of **increasing metallic character**?
- 61) Which one of the above arranges the elemental symbols of the atoms in the order of **increasing atomic radius**?
- 62) How many **unpaired electrons** does Ca have in the ground state?
- 63) How many **unpaired electrons** does Fe^{3+} have in the ground state?
- 64) Which one of these species has the most **unpaired electrons** in the ground state?
- K
 - Br
 - Be

d) B

e) Ni

65) Which of the above species would be **diamagnetic** in the ground state?

66) Which of the above species would be **paramagnetic** in the ground state?

67) Which of these molecules is symmetric according to VSEPR theory?

a) BF_3

b) AsCl_5

c) SF_4

d) CO_2

e) BrF_3

f) ICl_5

68) Which of the above molecules is not symmetric according to VSEPR theory?

69) What are the VSEPR molecular shapes of the molecules in 67?

70) What are the VSEPR electron-pair shapes of the molecules in 67?

71) Which of the molecules in 67 is polar?

72) Which of the molecules in 67 has polar bonds?

73) What are the formal charges of the bound atoms in the correctly-drawn Lewis structures for question 67?

74) Which molecules have double bonds in the correctly-drawn Lewis structures for question 67?

75) Which molecules have non-bonding electron pairs on the central atom in the correctly-drawn Lewis structures for question 67?

76) How many total bonds are there in the correctly-drawn Lewis structures for question 67?

77) What is the **other reactant** of this nuclear reaction: $\text{---} + \frac{4}{2}\alpha \rightarrow {}^{16}\text{O}$?

1(1/V or V^{-1}), 2(high pressure and low temperature, the conditions that approach the liquid or solid state of matter.), 3(38.1L. Use this answer with the question to practice solving for the other variables in 3a-c), 3d (48.0g of O_2) 4(the gas with the lowest molar mass because density of an ideal gas increases with increases molar mass), 5(4.1L), 6 (2.3mol), 7(960mmHg), 8(1800mmHg), 9(38°C), 10(830atm), 11(4.0mol), 12(360K), 13 (1200mL), 14(3.5mol), 15(0.0329g Al), 16(red, red>orange>yellow>green>blue>purple), 17(purple>blue>green>yellow>orange>red), 18(purple>blue>green>yellow>orange>red), 19(same as 17), 20(same as 18), 21(525kJ), 22(525,000J), 23($7.95 \times 10^{-18}\text{J}$), 24 (315nm), 25($3.00 \times 10^{11}\text{s}^{-1}$), 26a, 27b, 28c, 29d, 30a, 31e, 32c, 33a, 34b, 35d, 36e, 37(5), 38(10), 39(size, energy, shell), 40(shape, energy, angular momentum, subshell), 41 (orientation of orbital, orbital), 42(electron spin), 43(I), 44(II), 45(III and IV), 46(any of the alkali metals or alkaline earth metals), 47e, 48(Fe^{3+} , Co^{4+} , Mn^{2+} , Cr^{1+} would be uncommon, Ni^{5+} , as far as I know, has not been demonstrated.), 49 ($1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^9$), 50(1), 51(4s), 52($n=4$, $l=0$, $m=0$), 53(c), 54(I violates Hund's rule - fill singly with parallel spins before pairing electrons, II violates Hund's rule, III violates Pauli exclusion principle - no two electrons can have the same spin, IV is correct, V is an Aufbau - filling order - violation), 55(-2), 56(F^-), 57(Mn), 58d, 59d, 60b, 61b, 62(0), 63(5, the 4s electrons are lost first.), 64(e), 65(c), 66(a,b,d,e), 67(a, b, d), 68 (c, e, f), 69(trigonal planar, trigonal bipyramid, see saw, linear, t shaped, square pyramid), 70(trigonal planar, trigonal bipyramid, trigonal pyramid, linear, trigonal

pyramid, octahedral), 71(c,e,f), 72(all of them), 73(0 for all of them), 74(d), 75(c, e, f), 76
(3, 5, 4, 4, 3, 5), 77(¹²C)