

Also, remember, the limiting reagent question(s) will be phrased 'Given this amount of these reactants, what is the final mass of all substances in the system, reactants AND products'

Study questions (all have answers in the back of your text):

3.19 3.57 3.63 3.71 3.73 3.75 5.26

1. Your 8th grade nephew adores you and looks up to you as a future scientist. He wants to grow up to be just like you and really likes science. He is learning about water pollution. His science teacher at school is sort of an environmental extremist and says that all human activity is ruining the water supply. He rants about something having to do with the oxygen going away. Your nephew asks you to explain how mankind affects the quality of the water. He also needs to know what a 'point source' and a non-point source' is. This is your opportunity to flex your intelligence and inspire the next generation. Remember that you are talking to a 8th grader, so be elementary in your discussion.

2. Explain how we (as scientists) determine chemical toxicity levels (both chronic and acute) and explain why it is erroneous.

You will also need to look at the following questions in your text. You might have to (gasp) do some reading of your text to get the answers. 18.10; 18.24; 9.59; 9.81

For each of the following compounds, draw the most stable Lewis structures, give electron domain geometry, molecular geometry, approximate bond angles, hybridization on central atom and indicate if there is an overall dipole moment.

1) H_3O^+ 2) IF_3 3) KrF_2 4) AsF_5 5) CS_2 6) PHCl_2 7) IF_5 8) PF_2^+ 9) BF_2^- 10) SiCl_2F_2 11) SO_2 12) XeF_4 13) BrO_3^- 14) ICl_4^-

1. Of the species NO_2 , NO_2^+ and NO_2^- . Which two species should have nearly the same bond lengths? Explain and justify your answer.

2. By looking at formal charges we can sometimes predict the most stable connectivity for a molecule. Consider for a moment NOCl . Cl is almost always a terminal atom, however, N and O can both be a 'central' atom. Draw the most stable Lewis structure for ONCl (N in the center) then draw all the possible Lewis structures for NOCl (O in center). For ALL the structures you just drew, indicate the formal charge on each atom. Then, explain which connectivity you expect. (Which connectivity is more stable) EXPLAIN WHY.

3. Consider a calcium ion and a sulfide ion.

a. Which species has a larger ionization energy? Explain using a complete sentence.

b. Which species is bigger? Explain using a complete sentence.

4. The SCN^- ion has many 'legitimate' Lewis structures. (C is central in all)

a. Draw all of them (more than 2, less than 7)

b. Clearly indicate the formal charge on every atom in each structure

c. Clearly indicate which structure you believe is the most stable, and defend your answer.

5. Consider the following elements: Oxygen, Phosphorus, Tellurium, Iodine, Boron.
- Which two (when bonded) would form the most polar bond? EXPLAIN
 - Which one has the smallest ionic radius? EXPLAIN
 - Which one would you expect to have the most exothermic electron affinity? EXPLAIN
6. a. Draw all possible Lewis structures of the nitrite ion.
 b. On each atom in each structure, clearly indicate the formal charge.
 c. Which of the structures is more energetically stable? Why?
 d. What is the bond order of each nitrogen-oxygen bond in the 'real' structure (not in each resonance structure) ?

Problems from text: 3.21 3.25 3.33 2.31 2.25 2.65 2.67

1. Which one of the following represents an acceptable possible set of quantum numbers (in the order n, l, m_l, m_s) for an electron in an atom?

A) 2, 1, -1, 1/2 B) 2, 1, 0, 0 C) 2, 2, 0, 1/2 D) 2, 0, 1, -1/2 E) 2, 0, 2, +1/2

- Give the electronic configuration for palladium (shorthand ok)
- Give the electronic configuration of a calcium ion. (shorthand ok)
- Give 3 species (atoms or ions) that have electronic configurations that 'end' with 3 half filled 4p orbitals.
- What two things is effective nuclear charge a function of?
- Bromine and gallium. Which is bigger? Why?
- Put the following in order, smallest to largest, then explain why you made the choices you did.
 - Indium, tellurium, sulfur
 - calcium ion, calcium, sulfide ion
- Why is the 'true' electronic configuration of gold different than what the 'normal' pattern would predict? (meaning, why is it an exception?)
- Using the periodic table, predict the charges of the ions of the following elements:
 Ga Sr As Br Se

You need to know the symbols for the first 54 elements as well as their common oxidation states.

- What is the frequency of light that has a wavelength of 1.23×10^{-6} cm ?
- Of the following transitions in the Bohr hydrogen atom, the _____ transition results in the emission of the highest-energy photon.

A) $n = 1 \rightarrow n = 6$ B) $n = 6 \rightarrow n = 1$ C) $n = 6 \rightarrow n = 3$ D) $n = 3 \rightarrow n = 6$ E) $n = 1 \rightarrow n = 4$
- Calculate the energy (J) change associated with an electron transition from $n = 3$ to $n = 6$ in a Bohr hydrogen atom.
- A spectrum containing only specific wavelengths is called a _____ spectrum.
- Your 7th grade nephew asks you why fireworks have different colors. Give him an appropriate explanation (using his level of words)
- The _____ quantum number defines the shape of an orbital.

8. There are _____ electrons that have $n=3$.
9. How many electrons have the following quantum number values in their 'address': $n=3$, $l=2$, $m_s = +1/2$
1. The density of ethanol is 0.7983 g/ml. What is the volume of 4.5 kg of ethanol?
2. What are the four tenets of Dalton's Atomic Theory?
3. A particular system did 45J of work on the surroundings. At the same time it absorbed 23 J of heat energy from the surroundings. What is the change in internal energy of the system?
4. What were the major atomic structure 'conclusions' from Rutherford's Experiment?
5. Give the complete chemical symbol for the following species:
- neutral zinc-66.
 - sodium-23 isotope in its common ionic state
 - bromine-81 in its common ionic state
6. Correctly name the ions in 5b and 5c above
7. Calculate the energy of a photon whose wavelength is 8.0 nm (n is metric prefix which means 1.0×10^{-9})
2. If matter is uniform throughout, cannot be separated into other substances by physical processes, but can be decomposed into other substances by chemical processes, it is called a (an) _____.
6. An object will sink in a liquid if the density of the object is greater than that of the liquid. The mass of a sphere is 9.83 g. If the volume of this sphere is less than _____, then the sphere will sink in liquid mercury (density = 13.6).
7. The output of a plant is 4335 pounds of ball bearings per week (five days). If each ball bearing weighs 0.0113 g, how many ball bearings does the plant make in a single day? (Indicate the number in proper scientific notation with the appropriate number of significant figures.)
8. What is the physical state in which matter has no specific shape but does have a specific volume?

Text problems 1.19, 1.35