

Chemistry I Unit 2 Review Guide - 2008

Use these problems as a guide to help you prepare for the Unit 2 exam. Be sure that you can show all work and calculations used in arriving at your answer. All calculations should include the appropriate numbers of significant figures and correct units. If you are having trouble with a particular type of problem or question, use the assignments from this past unit to practice more of that type of problem.

Significant Figures and Units: Perform the following calculations. Give your answer with the correct number of significant figures and units.

1. $32.1 \text{ cm} + 3.113 \text{ cm}$
2. $4.32 \text{ m} \times 5.4 \text{ m} \times .0113 \text{ m}$
3. $1.35 \times 10^3 \text{ min} \times 1 \text{ hr}/60\text{min}$
4. $1.003 \text{ m} - .11\text{m}$
5. $34 \text{ m} / 3.42 \text{ m}$
6. $4.118 \text{ cm} + 23.21 \text{ cm}$
7. $2.31 \text{ m} \times 4.2 \text{ cm} \times .0214\text{m}$
8. $2.82 \times 10^3 \text{ sec} \times 1 \text{ min}/60 \text{ sec}$
9. $3.004 \text{ m} - .00001 \text{ m}$
10. $15 \text{ mm} / 3.65 \text{ mm}$

Make the following metric conversions:

1. 232 m to km
2. 3.41 cm to m
3. 6.04 kg to mg
4. 645.3 mL to L
5. $5.34 \times 10^2 \text{ km}$ to mm
6. 145 m to km
7. 34.8 cm to mm
8. 7.02 kg to g
9. 362.1 mL to cm^3
10. $3.41 \times 10^3 \text{ cm}$ to km

11. Use the following data to calculate the average atomic mass of sulfur. Give your answer with the appropriate number of significant figures. Compare your answer with the atomic mass on the periodic table.

<i>Isotope</i>	<i>Mass (AMU)</i>	<i>% Abundance</i>
^{32}S	31.9720707	94.93
^{33}S	32.9714585	0.76
^{34}S	33.9678668	4.29
^{36}S	35.9670809	0.02

Frequency, Wavelength and Energy: Perform the following calculations. Show all work and give the correct significant figures and units for each answer.

12. Calculate the frequency of a photon with a wavelength of .344 nm.
13. Calculate the frequency of a photon with an energy of $3.44 \times 10^{-18} \text{ J}$.
14. Calculate the energy of a photon with a wavelength of 2,456 nm.
15. A photon has an energy of $5.46 \times 10^{-19} \text{ J}$. Calculate the wavelength of the photon in nanometers.

16. Describe the mathematical relationship between the energy and the wavelength of electromagnetic radiation. Use this relationship to tell which photon has higher energy : a photon with a wavelength of 240 nm and a photon with a wavelength of 4.50×10^{-7} m. Explain your choice.

17. List and describe all of the atomic models that we have learned so far this year. For each model, tell which feature is still considered to be correct.

18. What is meant by the statement: "The energy of electrons is quantized." Describe the experimental evidence that supports this statement.

19. Explain what causes atoms to emit radiation when they are excited by electricity or a flame. Use any illustrations necessary for your explanation.

20. Draw an orbital diagram for chlorine. In your orbital diagram, identify the following terms:

principal energy level energy sublevel orbital electron spin

21. Make an orbital diagram for nitrogen and show how you used each of these rules to determine the correct orbital diagram for this element.

Aufbau Principle Pauli Exclusion Principle Hund's Rule

Write the abbreviated electron configuration for:

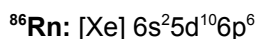
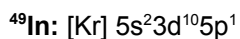
- | | | | | |
|----------------|---------------|------------|-------------|-------------------|
| 22. carbon | 23. germanium | 24. nickel | 25. calcium | 26. manganese |
| 27. promethium | 28. americium | 29. gold | 30. xenon | 31. rutherfordium |

32. through 41. For each of the above atoms, tell how many electrons are in the highest principle energy level. Identify them by their principal quantum number and sublevel.

42. Draw pictures of an **s**, **p_x** and a **d_{xy}** orbital. Explain what an orbital is and why it is important in determining the electron configuration of an atom.

43. An atom has a total of 5 electrons in its 4p sublevel. Use your periodic table to quickly identify the element.

44. What is wrong with the following electron configurations?:



45. Identify the units that you will be left with when you perform the following operations:

a. $\frac{\frac{m}{s}}{m}$

b. $(\text{J} \cdot \text{s}) \cdot \text{s}^{-1}$

c. $\frac{\frac{m}{s}}{\text{s}^{-1}}$

d. $\frac{\frac{m}{s}}{\text{nm}}$

Solutions to Review Guide for Unit 2 - 2008

Significant Figures and Units

1. $32.1 \text{ cm} + 3.113 \text{ cm} = 35.2 \text{ cm}$
2. $4.32 \text{ m} \times 5.4 \text{ m} \times .0113 \text{ m} = .26 \text{ m}^3$
3. $1.35 \times 10^3 \text{ min} \times 1 \text{ hr}/60\text{min} = 22.5 \text{ hr}$
4. $1.003 \text{ m} - .11\text{m} = .89 \text{ m}$
5. $34 \text{ m} / 3.42 \text{ m} = 9.9$
6. $4.118 \text{ cm} + 23.21 \text{ cm} = 27.33 \text{ cm}$
7. $2.31 \text{ m} \times 4.2 \text{ cm} \times .0214\text{m} = 2100 \text{ cm}^3$
8. $2.82 \times 10^3 \text{ sec} \times 1 \text{ min}/60 \text{ sec} = 47.0 \text{ min}$
9. $3.004 \text{ m} - .00001 \text{ m} = 3.004 \text{ m}$
10. $15 \text{ mm} / 3.65 \text{ mm} = 4.1$

1. $232 \text{ m to km} = .232 \text{ km}$
2. $3.41 \text{ cm to m} = .0341 \text{ m}$
3. $6.04 \text{ kg to mg} = 6.04 \times 10^6 \text{ mg}$
4. $645.3 \text{ mL to L} = .6453 \text{ L}$
5. $5.34 \times 10^2 \text{ km to mm} = 5.34 \times 10^8 \text{ mm}$
6. $145 \text{ m to km} = .145 \text{ km}$
7. $34.8 \text{ cm to mm} = 348 \text{ mm}$
8. $7.02 \text{ kg to g} = 7.02 \times 10^3 \text{ g}$
9. $362.1 \text{ mL to cm}^3 = 362.1 \text{ cm}^3$
10. $3.41 \times 10^3 \text{ cm to km} = 3.41 \times 10^{-2} \text{ km}$

11. 32.07 amu 12. $8.72 \times 10^{17} \text{ s}^{-1}$ 13. $5.19 \times 10^{15} \text{ s}^{-1}$ 14. $8.10 \times 10^{-20} \text{ J}$ 15. 364 nm

16. $E = \frac{hc}{\lambda}$, where E is energy, λ is wavelength of radiation in meters, $c = 3.00 \times 10^8 \text{ m/s}$ and $h = 6.63 \times 10^{-34} \text{ J} \cdot \text{s}$. Since $240 \text{ nm} = 2.40 \times 10^{-7} \text{ m}$, it is a shorter wavelength than $4.50 \times 10^{-7} \text{ m}$ and will have greater energy because wavelength varies inversely with energy, meaning greater wavelength equals lower energy.

17. See chapters 4 and 12 in your chemistry book for a description of each model. Here are the features that are still considered to be correct:

Dalton: Atoms are the smallest particle of an element that retains the properties of that element.

Thomson: All of the above features +: Atoms are made of positively and negatively charged particles.

Rutherford: All of the above features +: The positive charge and almost all of the mass of an atom resides in the nucleus of the atom. The negatively charged particles are located in the rest of the atom, which is most of the volume of the atom.

Bohr: All of the above features +: Electrons in an atom are located in quantized energy levels.

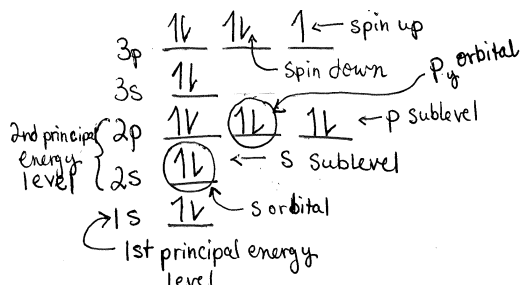
Modern Quantum Mechanical Model: All of the above features +: The electrons in an atom do not have a definite location, but instead the atom has certain regions where they are most likely to be found called "probability clouds".

18. The statement: "The energy of electrons is quantized." means that electrons in an atom are at specific energy levels and are never found at energies in between these energy levels. When elements such as hydrogen are excited, radiation of specific energies is emitted. The energy of this radiation corresponds to the energy differences between those energy levels in the atom. When elements such as hydrogen are excited, only light of specific energies is emitted, corresponding to the above mentioned energy differences.

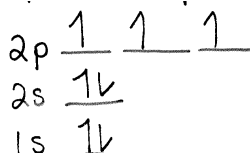
19. When atoms are excited, they absorb the energy which causes the electrons to move to a higher energy state. When the electrons go from this high energy state back to their ground state, the difference in energy between the excited and ground state is emitted in the form of radiation of that energy difference.

Answers to Review Guide for Unit 2 - 2008 - cont.

20.



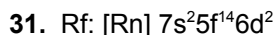
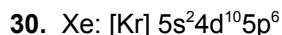
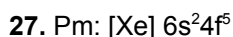
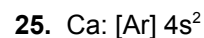
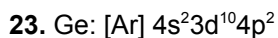
21.



Aufbau Principle: All of the electrons are in the lowest possible energy levels.

Pauli Exclusion Principle: No 2 electrons have identical energy level, sublevel, orbital and spin.

Hund's Rule: The electrons at the 2p sublevel do not pair up in the same orbital, but instead spread out into the 3 orbitals which are all of equivalent energy.



32. 4 electrons in the n=2 energy level. 2 in the 2s sublevel and 2 in the 2p sublevel.

33. 4 electrons in the n=4 energy level. 2 in the 4s sublevel and 2 in the 4p sublevel.

34. 2 electrons in the n=4 energy level. 2 in the 4s sublevel.

35. same as #34.

36. same as #34.

37. 2 electrons in the n=6 energy level. 2 in the 6s sublevel.

38. 2 electrons in the n = 7 energy level. 2 in the 7s sublevel.

39. same as #37.

40. 8 electrons in the n = 5 energy level. 2 in the 5s sublevel and 6 in the 5p sublevel.

41. 2 electrons in the n=7 energy level. 2 in the 7s sublevel.

42. See pp. 327 - 328 for pictures. (Better than I can draw.)

43. Br

44. **Al:** Abbreviated electron configurations must start with the first noble gas before the element that you are writing the configuration for.

In: The 4d sublevel comes after the 5s sublevel.

Rn: Missing the 4f sublevel.

45.

a. $\frac{1}{s}$ or s^{-1} b. J c. m d. $\frac{m}{s \cdot nm}$