

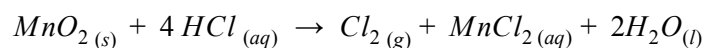
Midterm Preparation Worksheet

1. Write out and balance the following chemical reactions:

- a. Iron rusts in air as a result of a reaction with oxygen that produces iron (III) oxide (Fe_2O_3).

- b. Isopropyl alcohol (C_3H_8O), more commonly known as rubbing alcohol, combusts with oxygen to produce carbon dioxide and water vapor.

2. Manganese (IV) dioxide can be used to produce chlorine gas Cl_2 in the lab by the following reaction:



How many moles of Cl_2 can be produced when 20.0mL of a 12.0M HCl solution reacts with 1.74g of MnO_2 ?

- b. The photoelectric experiment became known as the photoelectric effect. What was the major conceptual change as a result of this experiment?

6. For each part of this question, the same metal was used in each experiment. The velocity of an electron emitted from this metal surface by a photon is 3.6×10^3 km/s.
- What is the wavelength of the ejected electron?
 - No electrons are emitted from the surface of the metal until the frequency of the radiation reaches 2.50×10^{16} Hz. How much energy is required to remove the electron from the metal surface?
 - In part a, what is the wavelength of the radiation that caused photoejection of the electron?
7. Write the subshell notation (3d, for instance) and the number of orbitals having the following quantum numbers:
- $n = 5, l = 2$
 - $n = 1, l = 0$
 - $n = 2, l = 1$

8. Nitrogen is found in many biological molecules including proteins and nucleic acids. Write the full electron configuration for nitrogen in the ground state and state the number of unpaired electrons.

9. Circle only two ions that are not isoelectronic with fluoride ion (F^-)

Li^+ Be^{2+} Mg^{2+} Ne O^- N^{2-} O^{2-} Na^+

10. Circle the atom that has the greatest first ionization energy.

Br Mg Kr Ca K

11. Experiments indicate that two resonance structures exist for the organic molecule, $(NH_2)COCH_3$. Draw them.

12. Which of the following ranks the following bonds from most polar to least polar?

a) $Mg-O > Cl-O > C-O > O-O$

c) $Cl-O > O-O > Mg-O > C-O$

b) $Cl-O > Mg-O > C-O > O-O$

d) $Mg-O > C-O > B-O > O-O$

13. Which of the following molecules has the largest dipole moment?

CO NO HI HBr HF

14. Fill in the blank for each below:

- When electrons are shared unequally, chemists characterize these types of bonds as _____.
- Chemical bonds formed by the attraction of oppositely charged ions are called _____.
- If atom X forms a diatomic molecule with itself, the bond is _____.

15. For each pair of compounds below, circle the compound that contains bonds with greater ionic character.

LiCl or LiBr

H_2S or HCl

AgF or AgI

16. Which compound has bonds with greater ionic character, CO_2 or CS_2 ?

17. Arrange the cations Rb^+ , Be^{2+} , Sr^{2+} in order of increasing polarizing power and explain your arrangement.

18. Which of the following species has a stronger bond? Why?

O_2 or CN^-