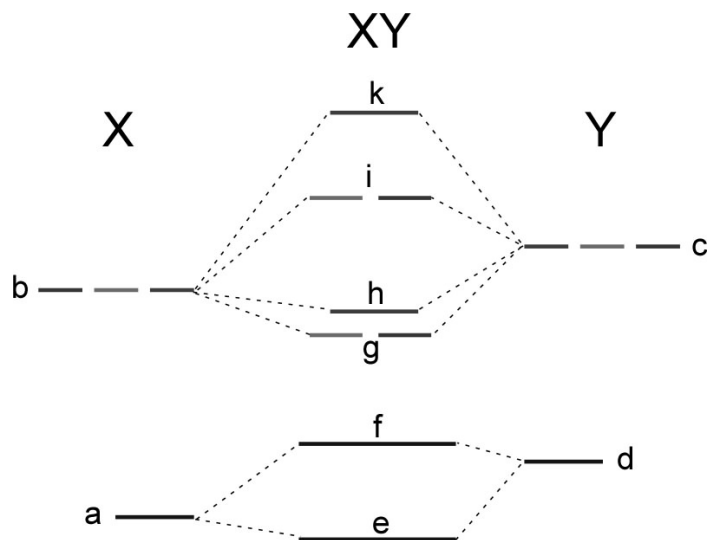


Questions 1 through 6 refer to the energy diagram below of a “first row” ($n=2$) diatomic:

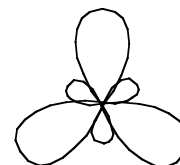


- The energy level denoted “a” refers to:
 - 1) a bonding molecular orbital
 - 2) a nonbonding molecular orbital
 - 3) an antibonding molecular orbital
 - 4) an atomic orbital
- The energy level denoted “i” refers to:
 - 1) sigma bonding molecular orbitals
 - 2) π bonding molecular orbitals
 - 3) atomic orbitals
 - 4) sigma antibonding molecular orbitals
 - 5) π antibonding molecular orbitals
- The electrons in the orbital represented by energy level “f”:
 - 1) are distributed more toward X
 - 2) are distributed more toward Y
 - 3) are equally distributed between X and Y
- If the letter designations represent energies of the orbitals, then:

a + d = 1) f - e 2) e - f 3) e + f 4) none of these
- The diatomic XY is CN^+ . What is the overall diatomic bond order?
 - 1) 1.0
 - 2) 1.5
 - 3) 2.0
 - 4) 2.5
 - 5) 3.0
- The diatomic XY is CN^+ . The nitrogen atomic orbitals are represented by:
 - 1) X
 - 2) Y
 - 3) XY

7. The picture at right depicts which type of orbital hybridization?

- 1) p 2) sp 3) sp^2 4) sp^3
 5) none of the above

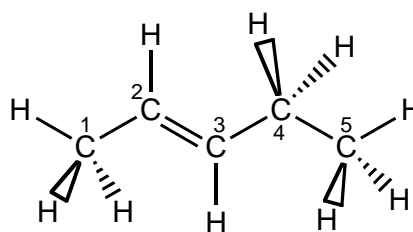


8. In the orbital hybridization *above*, how many atomic orbitals were used to create the resulting molecular orbitals?

- 1) 1 2) 2 3) 3 4) 4 5) 5

9. In the molecule 2-pentene, shown at right, the carbon labeled (4) has what hybridization?

- 1) sp 3) sp^3
 2) sp^2 4) sp^4



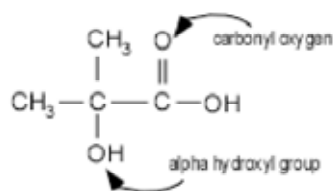
10. The angle describing $C_3-C_4-C_5$ (centered on carbon 4) is approximately:

- 1) 109.5° 2) 120° 3) 180° 4) 90°

11. A central atom in a molecule has an octahedral electron pair geometry. What is the orbital hybridization on that atom?

- 1) sp 2) sp^2 3) sp^3 4) sp^3d 5) sp^3d^2

12. Trendy anti-wrinkle creams advertise the presence of “alpha hydrox” as a key component. A structure of an alpha hydroxy acid is shown at right. In this molecule, what is the hybridization at the *carbonyl oxygen*? Hint: all C and O atoms have complete octets.



- 1) sp 2) sp^2 3) sp^3 4) sp^3d 5) sp^3d^2

Solubility Rules for some ionic compounds in water**Soluble Ionic Compounds**

1. All sodium (Na^+), potassium (K^+), and ammonium (NH_4^+) salts are SOLUBLE.
2. All nitrate (NO_3^-), acetate (CH_3CO_2^-), chlorate (ClO_3^-), and perchlorate (ClO_4^-) salts are SOLUBLE.
3. All chloride (Cl^-), bromide (Br^-), and iodide (I^-) salts are SOLUBLE -- EXCEPT those also containing: lead, silver, or mercury (I) (Pb^{2+} , Ag^+ , Hg_2^{2+}) which are NOT soluble.
4. All sulfate (SO_4^{2-}) salts are SOLUBLE -- EXCEPT those also containing: calcium, silver, mercury (I), strontium, barium, or lead (Ca^{2+} , Ag^+ , Hg_2^{2+} , Sr^{2+} , Ba^{2+} , Pb^{2+}) which are NOT soluble.

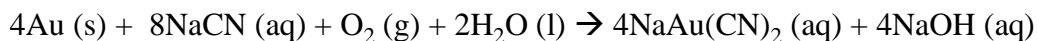
Not Soluble Ionic Compounds

5. Hydroxide (OH^-) and oxide (O^{2-}) compounds are NOT SOLUBLE -- EXCEPT those also containing: sodium, potassium, or barium (Na^+ , K^+ , Ba^{2+}) which are soluble.
6. Sulfide (S^{2-}) salts are NOT SOLUBLE -- EXCEPT those also containing: sodium, potassium, ammonium, or barium (Na^+ , K^+ , NH_4^+ , Ba^{2+}) which are soluble.
7. Carbonate (CO_3^{2-}) and phosphate (PO_4^{3-}) salts are NOT SOLUBLE -- EXCEPT those also containing: sodium, potassium, or ammonium (Na^+ , K^+ , NH_4^+), which are soluble.

13. Mixing $\text{Ag}(\text{NO}_3)_2$ with MgCl_2 in water leads to precipitation of:

- 1) a NO_3^- salt 2) an Ag^{2+} salt 3) a Mg^{2+} salt
4) everything precipitates 5) no precipitation

14. Gold can be dissolved from gold-bearing rock by treating the rock with sodium cyanide in the presence of oxygen.



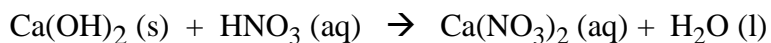
For this reaction, what is the oxidizing agent on the left side of the reaction?

- 1) O_2 2) NaCN 3) Au 4) H_2O 5) H^+

15. Ammonium sulfide, $(\text{NH}_4)_2\text{S}$, reacts with $\text{Hg}(\text{NO}_3)_2$ to produce HgS and NH_4NO_3
This reaction is best classified as:

- 1) oxidation-reduction 2) acid-base 3) precipitation
4) gas evolving 5) gas evolving and precipitation

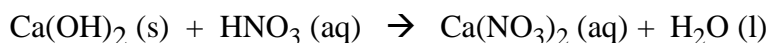
16. Consider the unbalanced reaction:



In the balanced, net ionic equation for this reaction, the coefficient preceding NO_3^- is:

- 1) 1 2) 2 3) 3
4) NO_3^- does not appear in the net ionic equation

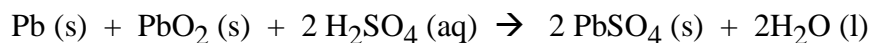
17. Consider the unbalanced reaction:



This reaction is best classified as:

- 1) oxidation-reduction 2) gas evolving 3) precipitation
4) acid-base 5) gas evolving and precipitation

18. Consider the following reaction that occurs within rechargeable “lead storage” batteries:



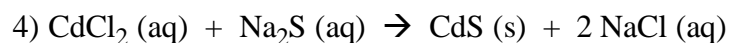
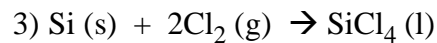
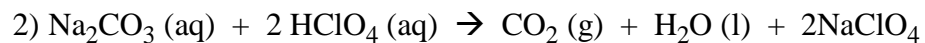
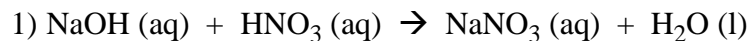
The oxidation number of Pb in PbO_2 is:

- 1) +1 2) +2 3) +3 4) +4 5) +5

19. In the above reaction, the reducing agent on the left side of the reaction is:

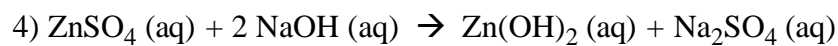
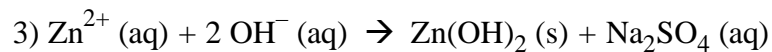
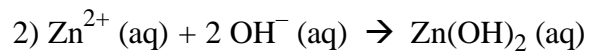
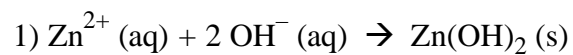
- 1) $\text{Pb} (\text{s})$ 2) $\text{PbO}_2 (\text{s})$ 3) H_2SO_4 4) this is not a redox reaction

20. Which reaction below is a redox reaction?



5) None of the above

21. The net ionic equation for the reaction of zinc sulfate and sodium hydroxide is:



5) No *net* reaction occurs

22. Even though it is only slightly soluble, dissolving MgO (assume that it does dissolve) in water leads to:
- 1) no change in pH of the solution
 - 2) a resulting acidic solution
 - 3) a resulting basic solution
23. You add sufficient 1 M HCl to 1.0 L of water to yield a final pH=4.0. Which statement below is true regarding the resulting solution?
- 1) $[\text{OH}^-] = 10^{-14}$ M
 - 2) $[\text{H}^+] = 4.0$ M
 - 3) $[\text{H}^+] = 10^4$ M
 - 4) $[\text{Cl}^-] = 0.1$ mM
 - 5) none of the above
24. Write the balanced, *net ionic equation* corresponding to the unbalanced equation:
- $$\text{AlCl}_3 + \text{Na}_3\text{PO}_4 \rightarrow \text{AlPO}_4 + \text{NaCl}$$
- The numerical coefficient preceding PO_4^{3-} (aq) is:
- 1) 1
 - 2) 2
 - 3) 3
 - 4) 4
 - 5) 0 (Na^+ doesn't occur in the net ionic equation)
25. What is the catalog number for this class?
- 1) 123
 - 2) 345
 - 3) 899
 - 4) 3.14159
 - 5) 111