

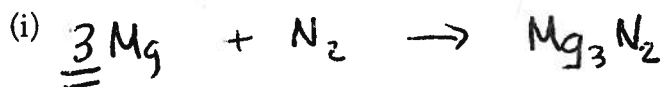
(Change # C to ~~Hydroxide~~ or ~~ammonium~~.)

AP Chemistry  
Reaction Practice  
Day 3

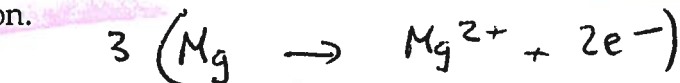
Name Key 2011  
Date \_\_\_\_\_ Period \_\_\_\_\_

For each of the following three reactions, in part (i) write a BALANCED equation and in part (ii) answer the question about the reaction. In part (i), coefficients should be in terms of lowest whole numbers. Assume that solutions are aqueous unless otherwise indicated. Represent substances in solutions as ions if the substances are extensively ionized. Omit formulas for any ions or molecules that are unchanged by the reaction.

1. A strip of magnesium metal is heated strongly in pure nitrogen gas.



(ii) How many electrons are transferred in this reaction? Show your work by writing at least one half reaction.

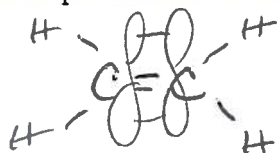


So 6 mol  $e^-$

2. Ethene is burned in air.

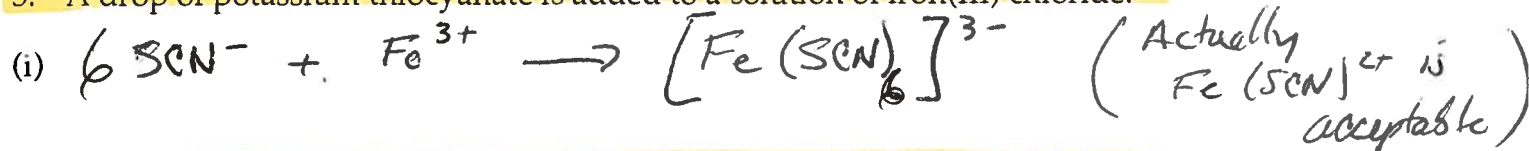


(ii) How many sigma and pi bonds are in a molecule of ethene?



5 sigma + 1 pi

3. A drop of potassium thiocyanate is added to a solution of iron(III) chloride.



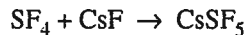
(ii) What is the geometric shape and coordination number of the product formed?

This is octahedral and  $\text{CN} = 6$

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Question 7 (continued)

(b) The compounds  $SF_4$  and  $CsF$  react to form an ionic compound according to the following equation



(i) Draw a complete Lewis structure for the  $SF_5^-$  anion in  $CsSF_5$ .

|  |  |
|--|--|
|  | <p>One point is earned for the correct Lewis structure (the structure must include lone pairs of electrons, which may be represented as dashes).</p> |
|--|--|

(ii) Identify the type of hybridization exhibited by sulfur in the  $SF_5^-$  anion.

|           |  |
|-----------|--|
| $sp^3d^2$ | One point is earned for the correct hybridization. |
|-----------|--|

(iii) Identify the geometry of the  $SF_5^-$  anion that is consistent with the Lewis structure drawn in part (b)(i).

|                  |  |
|------------------|--|
| Square pyramidal | One point is earned for the correct shape. |
|------------------|--|

(iv) Identify the oxidation number of sulfur in the compound  $CsSF_5$ .

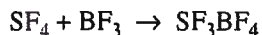
|     |   |
|-----|---|
| + 4 | One point is earned for the correct oxidation number. |
|-----|---|

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Question 7

7. Answer the following questions about the structures of ions that contain only sulfur and fluorine.

(a) The compounds  $\text{SF}_4$  and  $\text{BF}_3$  react to form an ionic compound according to the following equation.



(i) Draw a complete Lewis structure for the  $\text{SF}_3^+$  cation in  $\text{SF}_3\text{BF}_4$ .

|  |  |
|--|--|
| $\left[ \begin{array}{c} \text{:F:} \quad \text{:S:} \quad \text{:F:} \\ \text{:F:} \quad \text{:} \quad \text{:F:} \\ \quad \quad \text{:F:} \end{array} \right]^+$ | <p>One point is earned for the correct Lewis structure (the structure must include lone pairs of electrons, which may be represented as dashes).</p> |
|--|--|

(ii) Identify the type of hybridization exhibited by sulfur in the  $\text{SF}_3^+$  cation.

|        |  |
|--------|--|
| $sp^3$ | One point is earned for the correct hybridization. |
|--------|--|

(iii) Identify the geometry of the  $\text{SF}_3^+$  cation that is consistent with the Lewis structure drawn in part (a)(i).

|                    |  |
|--------------------|--|
| Trigonal pyramidal | One point is earned for the correct shape. |
|--------------------|--|

(iv) Predict whether the  $\text{F-S-F}$  bond angle in the  $\text{SF}_3^+$  cation is larger than, equal to, or smaller than  $109.5^\circ$ . Justify your answer.

|  |   |
|--|---|
| <p>The <math>\text{F-S-F}</math> bond angle in the <math>\text{SF}_3^+</math> cation is expected to be slightly <u>smaller</u> than <math>109.5^\circ</math> because the repulsion between the nonbonding pair of electrons and the <math>\text{S-F}</math> bonding pairs of electrons "squeezes" the <math>\text{F-S-F}</math> bond angles together slightly.</p> | <p>One point is earned for stating that the angle is smaller, with justification.</p> |
|--|---|