

Nobility (Inorganic)

Gas **X**, while originally thought to be chemically inert, has been shown to form a variety of compounds. The first stable compound isolated, binary compound **A**, was discovered by reacting gas **X** and gas **Y** together, under electric discharge. (R1). **A** is a strong oxidizing agent owing to the relatively weak bonds within compound **A**, having a bond energy of only about 45 kJ/mol. When compound **A** is reacted with strong Lewis acids, cations **B+** and **C+** are formed, with a mass ratio of **B+ : C+ = 1 : 2.185**. (R2,R3). Further, when compound **A** reacts with metal **M**, a compound **D** containing metal **M** in a rare +5 oxidation state and containing cation **B+** is formed, with the release of gas **X** (R4). Compound **D**, when heated, decomposes into **X**, **Y**, and **E**, with compound **E** containing the metal **M** (R5). The mass percent of **M** in compound **D** is 47.61% and is 67.47% in compound **E**.

Gas **Z** was also originally thought to be chemically inert, but it has also been shown to form a variety of compounds. It forms three distinct binary compounds, **F**, **G**, **H**, when reacted with gas **Y** under UV light and heating (R6,R7,R8). Compound **F** can additionally be synthesized by reacting an equimolar amount of gas **Z** and compound **G** (R9). Compound **H** can also be synthesized by directly reacting gas **Z** with compound **A**, which also causes the release of gas **X** (R10).

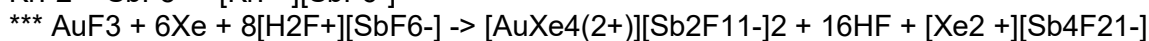
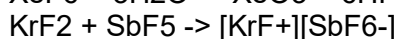
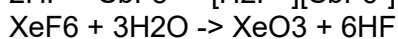
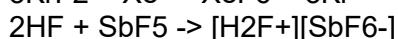
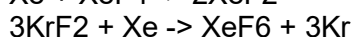
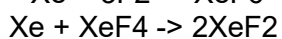
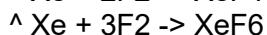
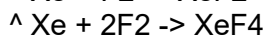
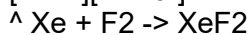
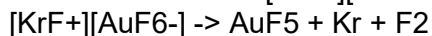
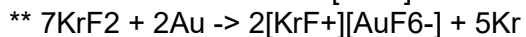
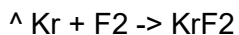
Superacid **I** can be synthesized by reacting compounds **J** and **K** in a 2 : 1 molar ratio, with **J** being a compound that is formed upon the dissolution of compound **H** in water (R11,R12). When Compound **A** reacts with **K**, a compound **L** containing cation **B+** is formed, with the mass percent of **X** in compound **L** being 24.75% (R13). Further, gas **Z** has also been shown to react with superacid **I** and a compound **N** which contains 77.56% mass percent **M**, forming a compound **O** containing metal **M** in a very rare oxidation state as part of a square planar complex with +2 charge, with the mass percent of **Z** within the compound being 32.28%. Further, a **Z**-NMR spectrum of compound **O** shows only one signal. The reaction also produces a compound **P** that contains gas **Z** in a (+0.5) oxidation state, with the mass percent of **Z** being 22.86%. (R14)

1. Identify **A**, **B+**, **C+**, **D**, **E**, **F**, **G**, **H**, **I**, **J**, **K**, **L**, **M**, **N**, **O**, **P**, **X**, **Y**, and **Z**.

2. Write balanced equations for all the reactions mentioned (you may use LA as an abbreviation for the Lewis acids in the reaction of formation of cations **B+** and **C+**). There are a total of 14 reactions.

A = KrF₂ (1 pt)
 B⁺ = KrF⁺ (1 pt)
 C⁺ = Kr₂F₃⁺ (0.5 pt)
 D = [KrF⁺][AuF₆⁻] (1.5 pt)
 E = AuF₅ (1 pt)
 F = XeF₂ (0.5 pt)
 G = XeF₄ (0.5 pt)
 H = XeF₆ (0.5 pt)
 I = [H₂F⁺][SbF₆⁻] (1 pt)
 J = HF (0.5 pt)
 K = SbF₅ (1 pt)
 L = [KrF⁺][SbF₆⁻] (1 pt)
 M = Au (1 pt)
 N = AuF₃ (0.5 pt)
 O = [AuXe₄(²⁺)][Sb₂F₁₁]⁻² (4 pt)
 P = [Xe₂⁺][Sb₄F₂₁]⁻ (1.5 pt)
 X = Kr (1 pt)
 Y = F₂ (1 pt)
 Z = Xe (1 pt)

Reactions marked with ^ are worth 0.5 points. Reactions marked with ** are worth 2 points. Reactions marked with *** are worth 3 points. All other reactions are worth 1 point.



Total 35 points.