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.
^ Kr + F2 -> KrF2
KrF2 + LA -> KrF+ + [LA-F]-
2KrF2 + LA -> Kr2F3+ + [LA-F]-
** 7KrF2 + 2Au -> 2[KrF+][AuF6-] + 5Kr
[KrF+][AuF6-] -> AuF5 + Kr + F2
^ Xe + F2 -> XeF2
^ Xe + 2F2 -> XeF4
^ Xe + 3F2 -> XeF6
Xe + XeF4 -> 2XeF2
3KrF2 + Xe -> XeF6 + 3Kr
2HF + SbF5 -> [H2F+][SbF6-]
XeF6 + 3H2O -> XeO3 + 6HF
KrF2 + SbF5 -> [KrF+][SbF6-]
*** AuF3 + 6Xe + 8[H2F+][SbF6-] -> [AuXe4(2+)][Sb2F11-]2 + 16HF + [Xe2 +][Sb4F21-]

Total 35 points.