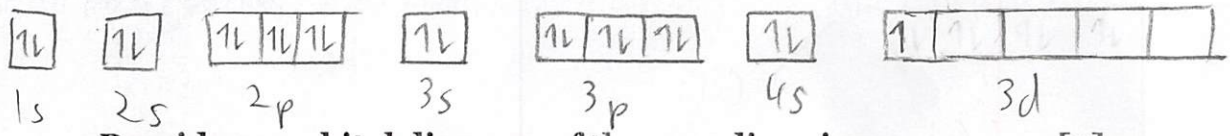
Date: Oct 13 Name(s): Andrew Pun

SCH4U	Assignment
Structure and Properties of Matter	/30

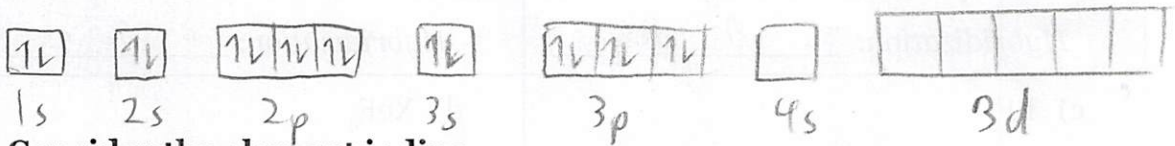
1. Consider the element scandium.
   a. Complete the table below by providing a set of quantum numbers for the last two electrons in a scandium atom. [4]

e⁻	Principle quantum number	Orbital-shape quantum number	Magnetic quantum number	Spin quantum number
1	3	2	−2	$+\frac{1}{2}$
2	4	0	0	$-\frac{1}{2}$

   b. Provide an orbital diagram of the scandium atom. [2]



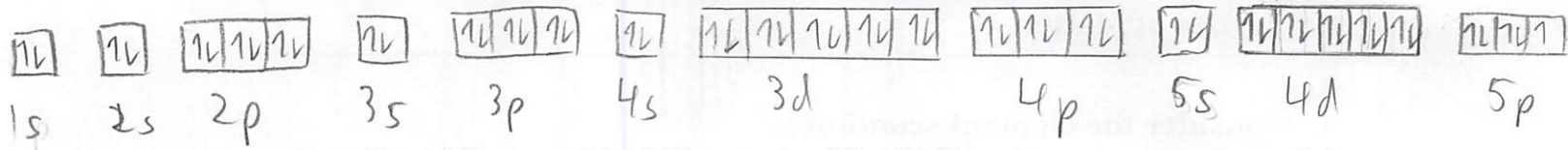
   c. Provide an orbital diagram of the scandium ion. [2]



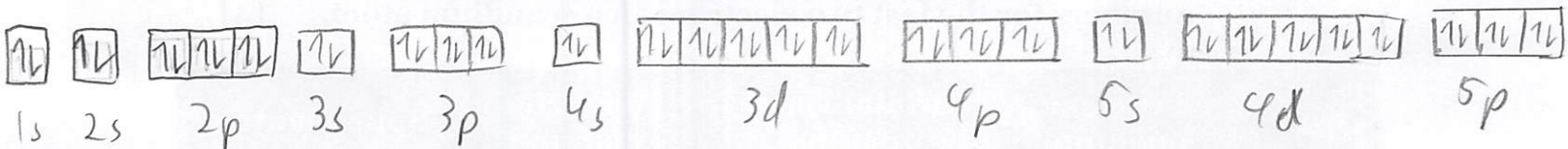
2. Consider the element iodine.
   a. Complete the table below by providing a set of quantum numbers for the last three electrons in an iodine atom. [6]

e⁻	Principle quantum number	Orbital-shape quantum number	Magnetic quantum number	Spin quantum number
1	5	1	0	$-\frac{1}{2}$
2	5	1	−1	$-\frac{1}{2}$
3	5	1	+1	$+\frac{1}{2}$

b. Provide an orbital diagram of the iodine atom. **[2]**

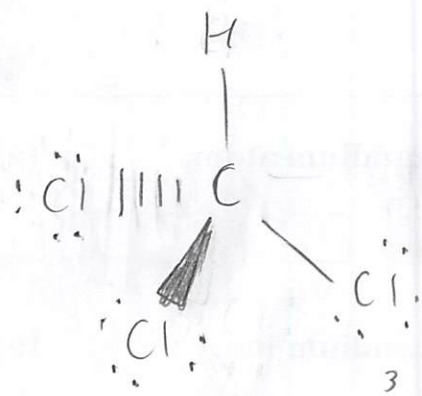


c. Provide an orbital diagram of the iodine ion. **[2]**



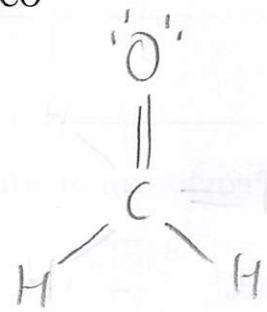
3. For each of the following, draw the correct Lewis structure and provide the hybridization of the central atom. **[8]**

a) $CHCl_3$



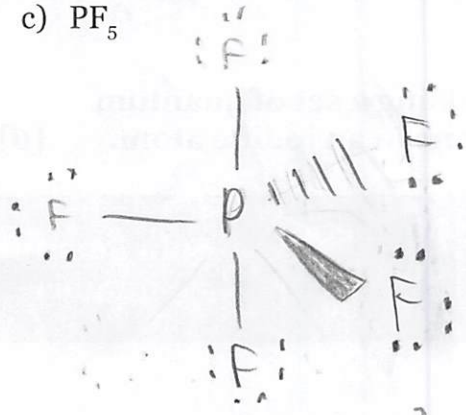
Hybridization: sp^3

b) H_2CO



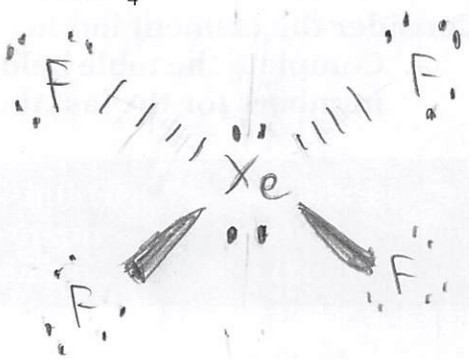
Hybridization: sp^2

c) PF_5



Hybridization: dsp^3

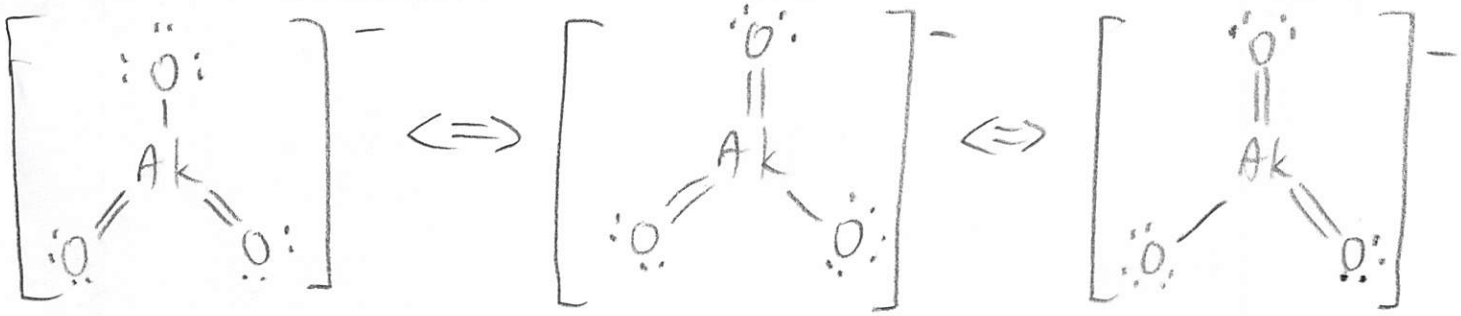
d) XeF_4



Hybridization: d^2sp^3

4. **A new element is discovered years in the future on a distant planet. Scientists choose to name it Akirium (Ak). Upon initial study of akirium, some preliminary data indicates the following:**
   - **Akirium has five valence electrons**
   - **Akirium is located above period 2**
   - **Akirium bonds with three oxygen atoms to form a polyatomic ion with a 1- charge, AkO_3^-**

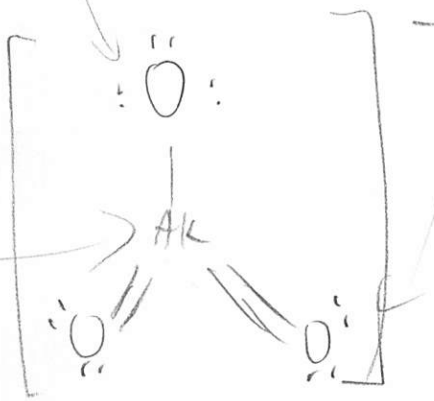
   Draw the correct Lewis structure for the akirium polyatomic ion AkO_3^- and include ALL resonance structures. **[4]**



$FC_{Ak} = 5 - 5 = 0$

$FC_O = 6 - (4+2) = 0$

$FC_O = 6 - (5-1) = -1$



5
+18
+1
24
−10
14
−12
−4
0