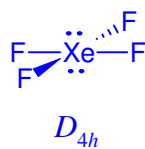
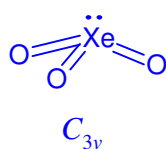


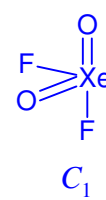
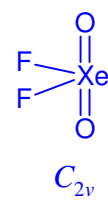
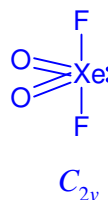
Question 1

Although generally considered inert, the heavier noble gasses will form compounds with highly electronegative elements. For the following xenon molecules, predict the VSEPR shape, then determine the point group.

- (i) XeO₃ (ii) XeF₄ (iii) XeO₂F₂ (pick any two isomers)

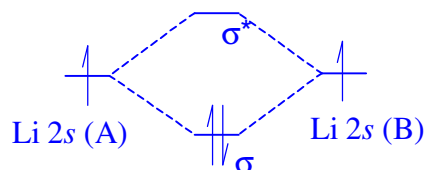


two of:



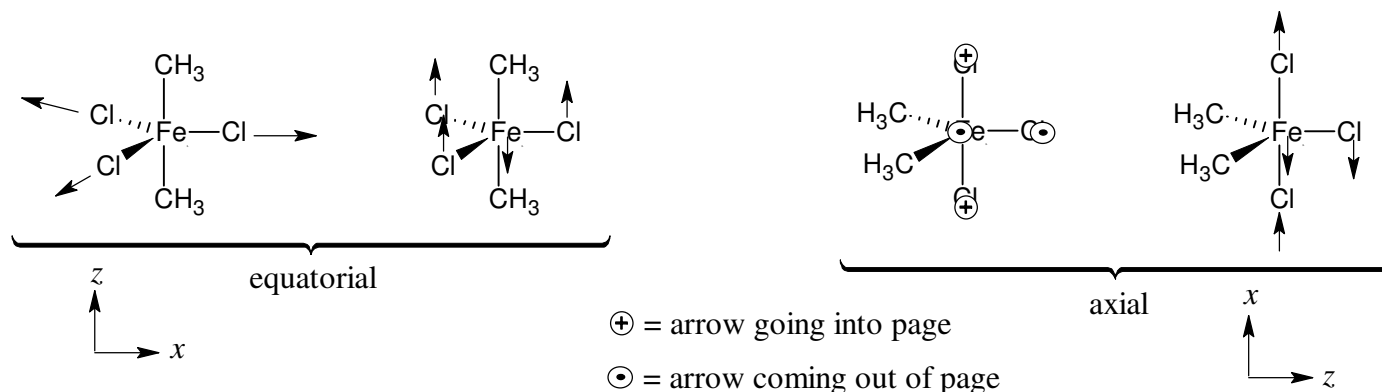
Question 3

Star Trek's *Enterprise* uses “dilithium crystals” as part of the energy-delivery system in its warp engines. Using the molecular orbital diagram for H₂ as a guide, predict the actual structure and properties of dilithium, Li₂.



This picture is essentially identical to that of H₂, using 2s instead of 1s. Therefore, the properties of Li₂ are likely to be similar to those of H₂ – *i.e.* a diatomic gas (not an extremely high-melting crystal like in the Star Trek universe).

Question 2 The species $\text{Fe}(\text{CH}_3)_2\text{Cl}_3$ has one ^1H NMR line. Therefore, the methyls could both be in the axial positions (the *trans* species) or equatorial (*cis*). IR and/or Raman is available to determine which complex has been made by looking at the Fe-Cl bonds. For each of the following FeCl-only vibrations, determine whether it is Raman or IR active. Note: the z -axis is coincident with the principle (C_n) axis, and the plane of the paper is the x - z plane.



The equatorial isomer is D_{3h} , the axial is C_{2v} (of course!).

