Class Assignment
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Questions (20 pts):

Q1. Determine the point groups for a-p

a. Ethane, CH_3-CH_3, (staggered conformation)

D3d: It has a principal C3 axis, a perpendicular C2 axis, and multiple vertical mirror planes within the C3 axis

b. Ethane (eclipsed conformation)

D3h: It has a principal C3 axis, a perpendicular C2 axis, and a horizontal plane perpendicular to the C3 axis

c. Chloroethane (staggered conformation)

Cs: Only one mirror plane, no rotational axis

d. 1,2-Dichloroethane (staggered *anti* conformation)

The point group is C_{2h}. Has C_2 rotational axes passing through the mid point of the C-C bond and perpendicular to the Cl-C-C-Cl plane.It has one diamond h plane perpendicular to the C_2 rotational axis.

e. Ethylene

Belongs to **D_{2h} point group**. Has 3 C_2 rotation axes and 3σ planes of symmetry

f. Acetylene

Acetylene is a linear molecule. It has C infinite rotational axis along the molecule axis. The principle axis is C infinite and it has an infinite number of C_2 rotational

axes perpendicular to the principal axis.It also has σh perpendicular to the principal axis. **The point group is $D_{\infty h}$.**

g. Naphthalene

Principal axis is C_2
2 perpendicular axes - D group
Horizontal mirror plane - D_{nh}
C_2 so -> **D_{2h}**

h. 1,8-dichloronaphthalene

Principal axis is C_2
No perpendicular axis - C group
No horizontal mirror plane, but has mirror plane that contains principal axis-> **C_{2v}**

i. 1,5-dichloronaphthalene

Principal axis is C_2
No perpendicular C_2 axes so C group
Has a horizontal mirror plane -> **C_{2h}**

j. 1,2-Dichloronaphthalene

No rotational axis, only one mirror plane of molecule → **C_s**

k. Cyclohexane (in chair conformation)

C_3 is the principal axis with 3 C_2 axes perpendicular to the C_3 axis. Also has mirror plane containing principle axis → **D_{3d}**

l. 1,1' – Dichloroferrocene

C_2 is the principal axis, and a horizontal plane is present that is perpendicular to the C_2 axis. Also, no C_2 axis perpendicular to the principal axis. Thus, its point group --> **C_{2h}**.

m. Cis-$[PtCl_2(NH_3)_2]$

C_2 rotation axis and two vertical planes

C_{2v} molecule

n. Trans-$[PtCl_2(NH_3)_2]$

C_2 rotation axis, three vertical planes, and inversion center

D_{2h} molecule

o. Diborane

Three perpendicular C_2 axes and three perpendicular mirror planes

D_{2h} molecule

p. Dibenzenechromium (eclipsed conformation)

C_6, C_3, C_2 perpendicular axes to the rings, six perpendicular C_2 axes, horizontal plane

D_{6h} molecule