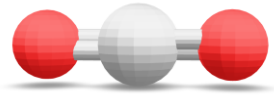
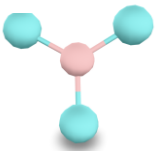
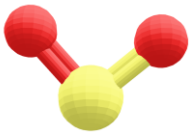
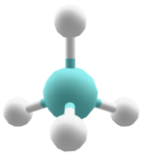
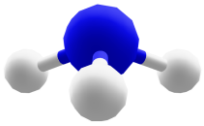
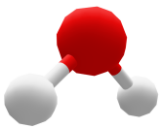
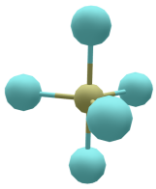
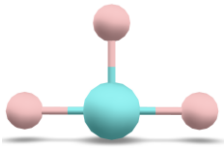
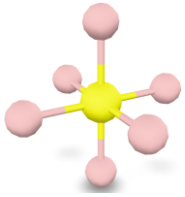
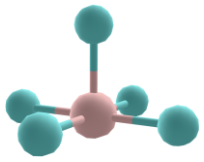
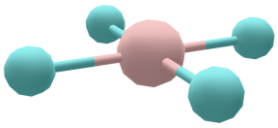
Section_____ **Date**_____ **Preferred Name**_____ **Student ID**_____ **Seat No.** _____
Preferred Name_____ **Student ID**_____ **Seat No.** _____
Preferred Name_____ **Student ID**_____ **Seat No.** _____

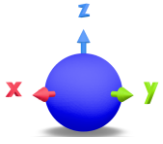
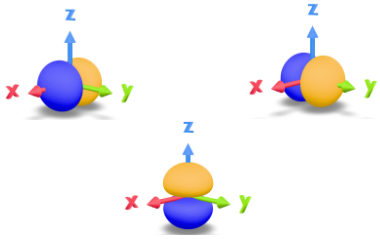
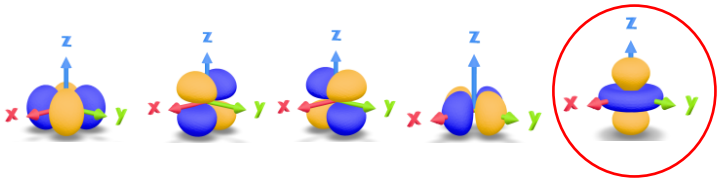
1. Basic molecular geometries: Insert pictures of molecules CO_2, BCl_3, SO_2, CH_4, NH_3, H_2O, PCl_5, SF_4, ClF_3, SF_6, BrF_5, XeF_4 in the table.

steric number (hybridization and bond angle)	lone pairs		
	0	1	2
2 (sp 180°)	$D_{\infty h}$  (linear)		
3 (sp^2 120°)	D_{3h}  (trigonal planar)	C_{2v}  (bent)	
4 (sp^3 ~109.5°)	T_d  (tetrahedral)	C_{3v}  (trigonal pyramidal)	C_{2v}  (bent)
5 (dsp^3 90°/120°)	D_{3h}  (trigonal bipyramidal)	C_{2v}  (seesaw)	C_{2v}  (t-shaped)
6 (d^2sp^3 90°)	O_h  (octahedral)	C_{4v}  (square pyramidal)	D_{4h}  (square planar)

VSEPR stands for Valence Shell Electron Pair Repulsion.

- VSEPR predicts the trend lp-lp > lp-bp > bp-bp for repulsions where lp=lone pair/bp=bond pair.
- For steric number > 4, d orbitals are involved so the number of electrons can exceed the octet rule in hypervalent molecules.

2. Atomic orbitals: Insert pictures of atomic orbitals of an H atom for the orbitals in the table.

s (sharp)	p (principle)	d (diffuse)
		 (circle d_{z^2})

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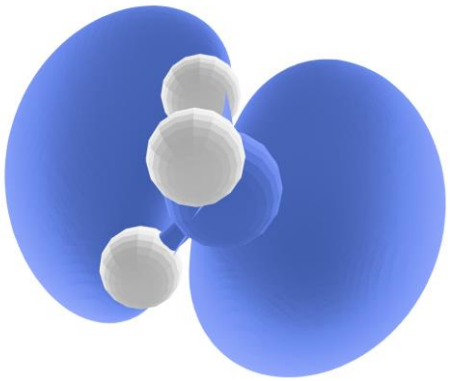
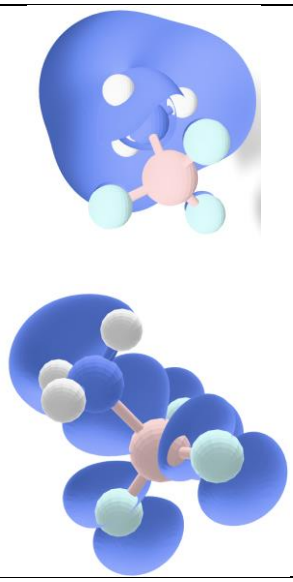
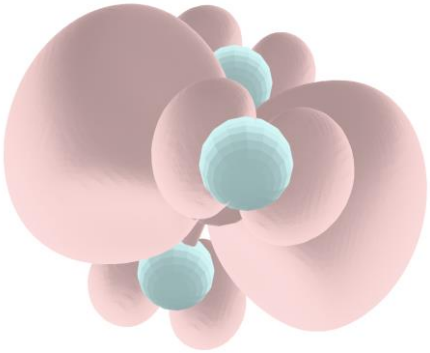
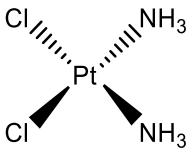
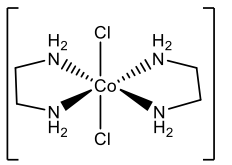
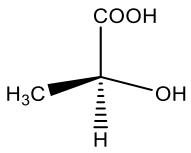
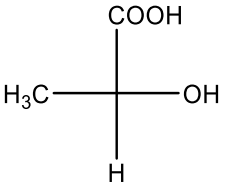
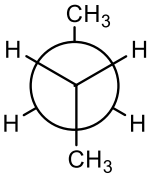
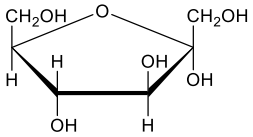
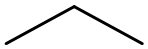
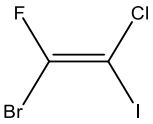
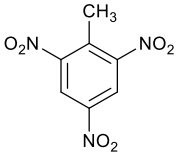
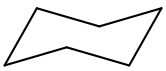
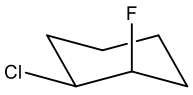
3. **Molecular orbitals:** Insert pictures of molecular orbitals in the table. (HOMO for base, LUMO for acid and both for the product)

Lewis base is NH_3.	Product is BNH_6	Lewis acid is BH_3.
 HOMO stands for highest occupied molecular orbital		LUMO stands for lowest unoccupied molecular orbital 

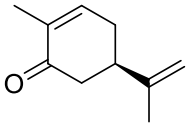
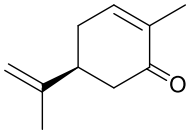
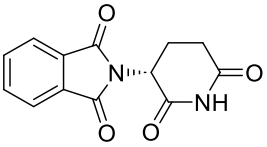
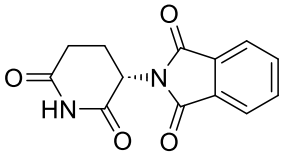
- For more information see the link https://www.youtube.com/watch?v=l3Oq0rAejiU&t=590s

4. Matching 3D structures with skeletal structures: Give one letter alphabet that corresponds to the structures in the table.

Wedge-and-dash projection			Fischer projection	Newman projection	Haworth projection
					
H	**C**	**M**	**M**	**R**	**F**

Bond-line structures					
					
I	**V**	**S**	**N**	**O**	**Y**

BONUS: Write the name and properties of the compounds below.

	(*R*)-(−)-carvone MW:150.22 g/mol bp: 231 °C density: 0.96 g/mL at 25 °C sweetish minty smell, like spearmint leaves		(*S*)-(+)-carvone MW:150.22 g/mol bp: 231 °C density: 0.96 g/mL at 25 °C spicy aroma with notes of rye, like caraway seeds.
	(*S*)-thalidomide MW: 258.23 g/mol The (*S*) is a teratogen. In in 46 countries, more than 10,000 children were born with deformities between late 1950s and early 1960s due to this compound.		(*R*)-thalidomide MW: 258.23 g/mol The (*R*)-enantiomer has the desired sedative effect for morning sickness. However, it can be converted to (*S*)-isomer in human body.

Refs: https://en.wikipedia.org/wiki/Carvone https://en.wikipedia.org/wiki/Thalidomide

Enantiomers are pairs of compounds with the same connectivity; one enantiomer cannot be superimposed on the other and are mirror images of each other.