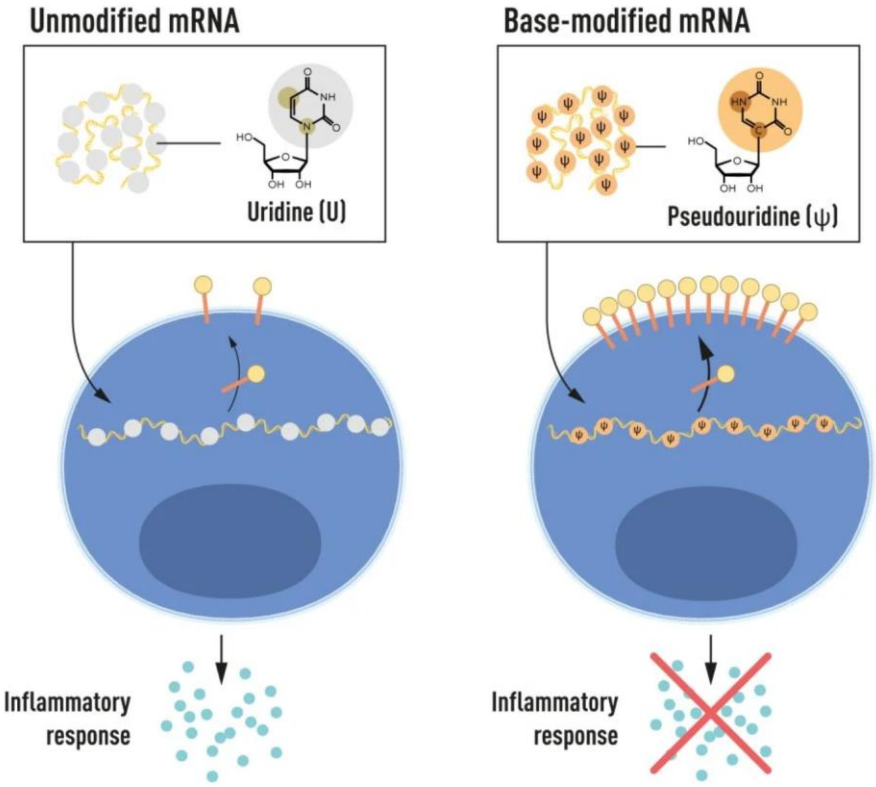
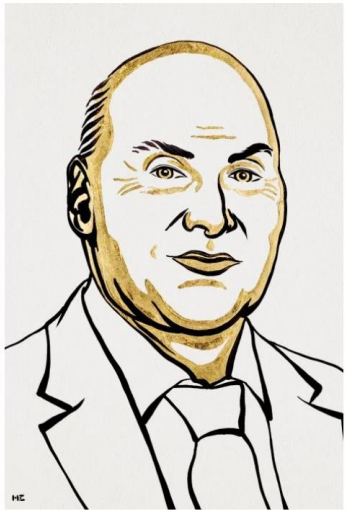
Nobel Prize in Physiology (mRNA vaccines): 2023



Ill. Niklas Elmehed © Nobel Prize Outreach

Katalin Karikó

Prize share: 1/2



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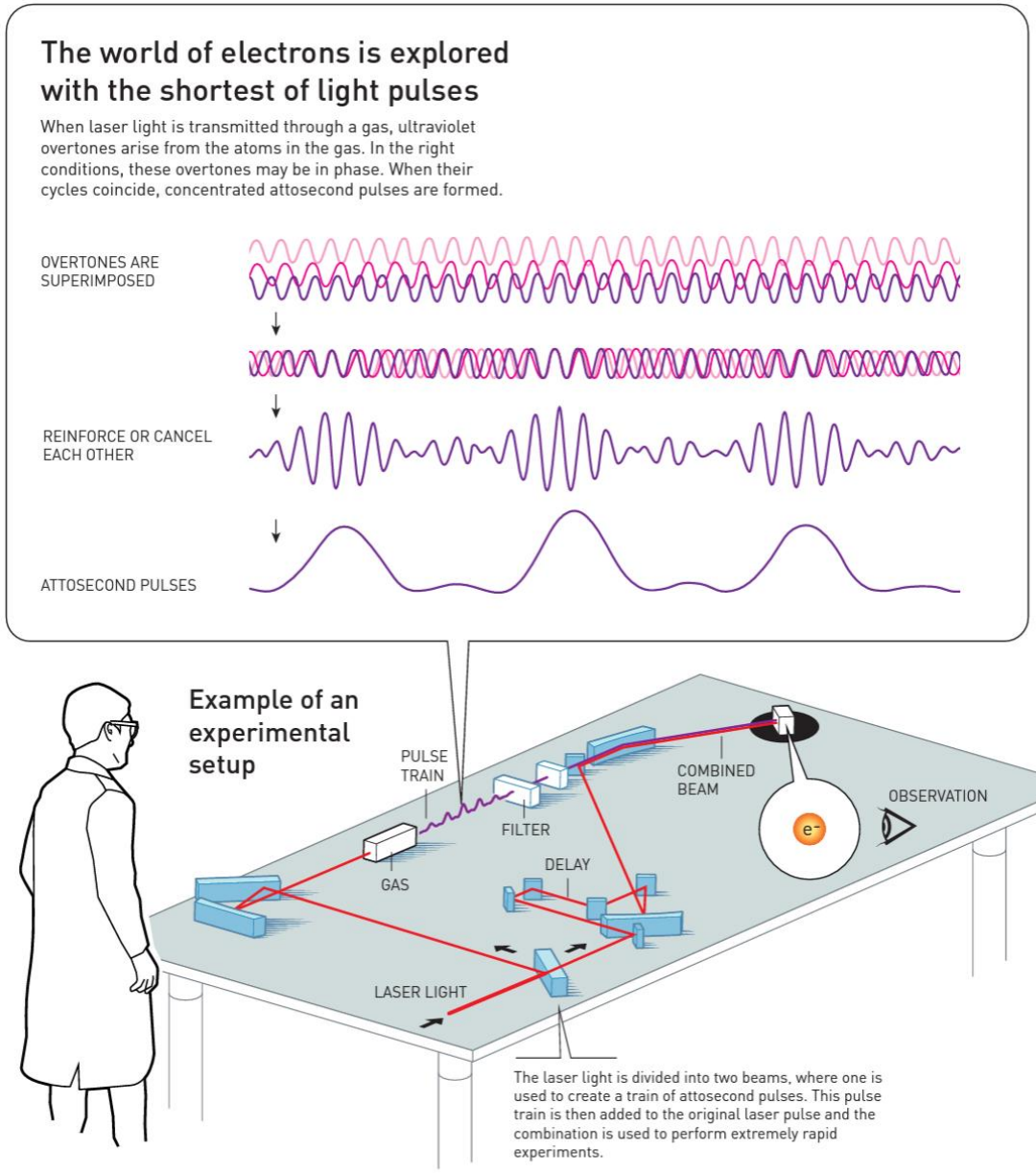
Drew Weissman

Prize share: 1/2

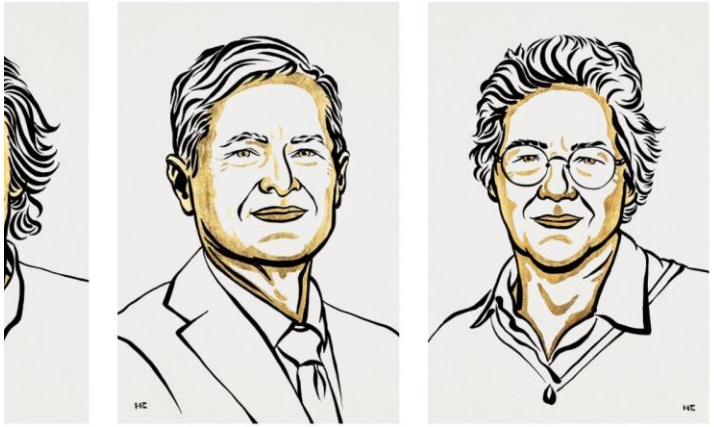
https://www.nobelprize.org/prizes/medicine/2023/summary/

The Nobel Prize in Physiology or Medicine 2023 was awarded jointly to Katalin Karikó and Drew Weissman "for their discoveries concerning nucleoside base modifications that enabled the development of effective mRNA vaccines against COVID-19"

Nobel Prize in Physics (Electron movement):2023



©Johan Jarnestad/The Royal Swedish Academy of Sciences



bel Prize

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Ferenc Krausz

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Anne L'Huillier

Prize share: 1/3

ents with light capture the shortest of
's

bel Laureates in Physics 2023 are being recognised for their , which have given humanity new tools for exploring the world inside atoms and molecules. Pierre Agostini, Ferenc Krausz and ier have demonstrated a way to create extremely short pulses of be used to measure the rapid processes in which electrons nge energy.

://www.nobelprize.org/prize
ysics/2023/summary/

This week in Chem110

We have now built upon our understanding of the atom, to explain why compounds form ionic or covalent bonds

This week (and next), we are going to focus on molecules with covalent bonds only

We will learn how to:
Represent these molecules two dimensionally (formal charge/drawing Lewis Structures)

Determine the shape of these molecules i.e. three dimensional shape (Applying VSEPR Theory; counting electron groups and bonding groups/lone pairs)

Determine the effect of the shape on certain properties of these molecules

Assigning Formal Charge (FC)

1. Draw Lewis Structure
2. Determine neutral valence of each atom
3. Assign each atom half of bonding electrons + lone pairs
4. FC = valence electrons – lone pair electrons – (1/2) bonding electrons

ex. $[NH_4]^+$

Practice Question 2

Write the Lewis structure for the following formula:

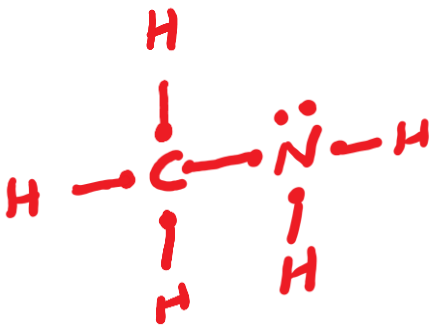
CH_5N

$C_2H_4O_2$

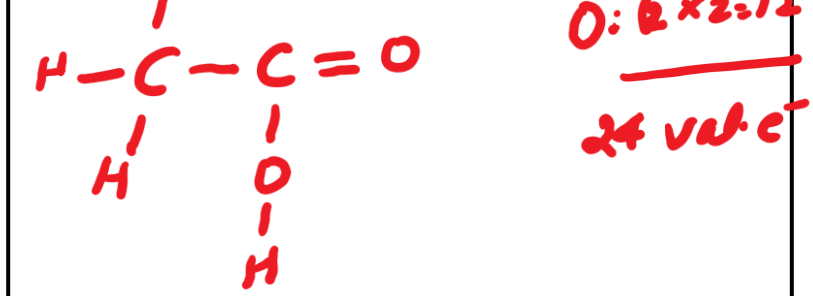
Practice Question 2

Write the Lewis structure for the following formula:

CH_5N

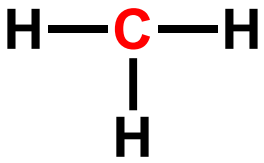


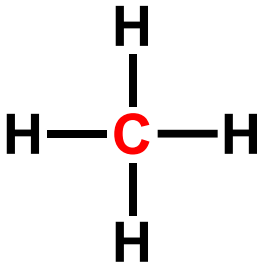
$C_2H_4O_2$

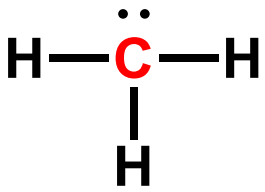


Practice Question 3

Predict the formal charge on each of the highlighted C atom



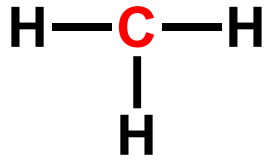




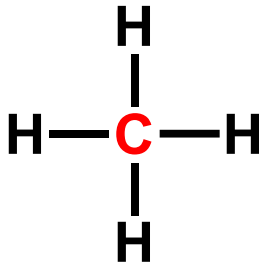
Practice Question 3

Predict the formal charge on each of the highlighted C atom

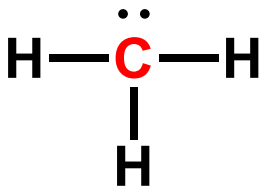
(A)



(B)



(C)



FORMAL CHARGE = valence e^- − lone pair − $\frac{1}{2}$ (bonded e^-)

(A) : $4 - 0 - \frac{1}{2}(6) = +1$

(B) : $4 - 0 - \frac{1}{2}(8) = 0$

(C) : $4 - 2 - \frac{1}{2}(6) = -1$

Practice Question 4

Write the Lewis structure for the following formula:

H_3PO_4

Practice Question 4

Write the Lewis structure for the following formula:

H_3PO_4

No O–O

Practice Question 5

Draw the resonance structures for the following molecules. Circle the most contributing structure – describe why this is most contributing?

If all the structures are equally contributing then circle all the resonance structures

NO_3^-

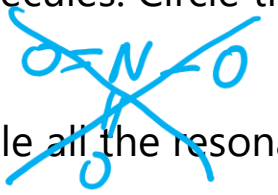
SO_2

O_3

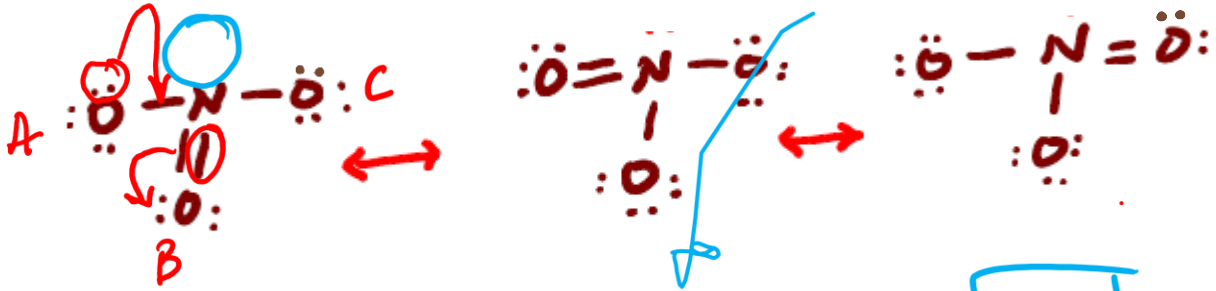
Practice Resonance Question (Concept Video 15)

Draw the resonance structures for the following molecules. Circle the most contributing structure – describe why this is most contributing?

If all the structures are equally contributing then circle all the resonance structures



NO_3^-



$n=2$

C, N, O, F

2s / 2p

2e⁻ 6e⁻

PH_3

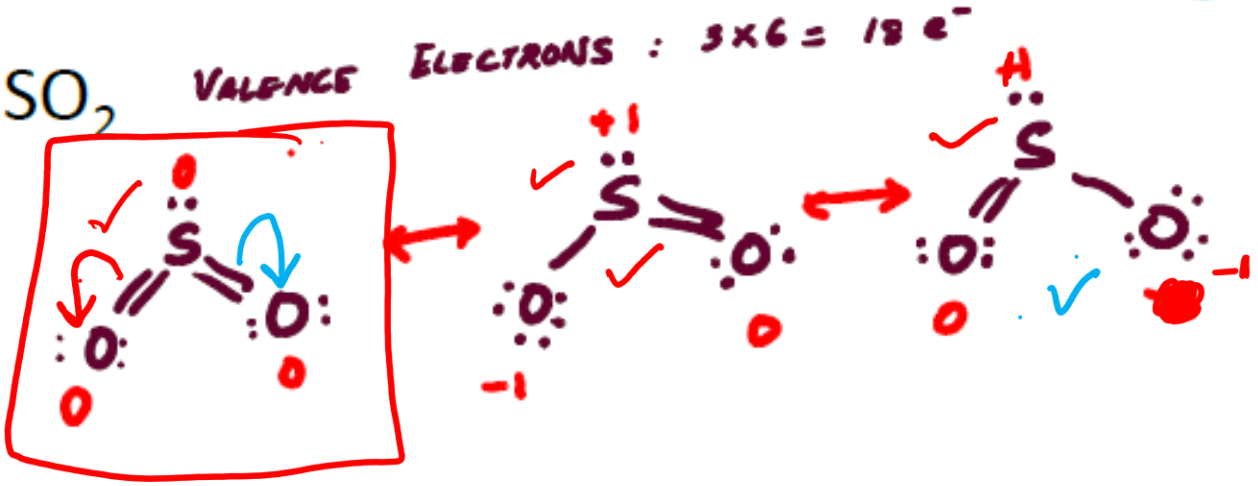
Si, P, S, Cl

$n=3$

3s / 3p / 3d

18 e⁻

SO_2



Practice VSEPR Question 6

Draw Lewis Structure, and determine the **geometry around the central atom** of the following molecule

HCN

2 EG

2 e⁻ groups

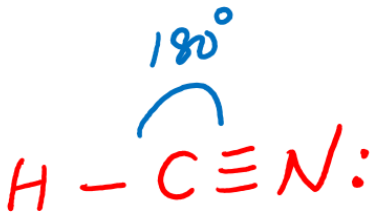
e⁻ groups : • lone pairs
• single bond / double bond / triple bond
• radicals

NO_2^-

Practice VSEPR Question

Draw Lewis Structure, and determine the **geometry around the central atom** of the following molecule

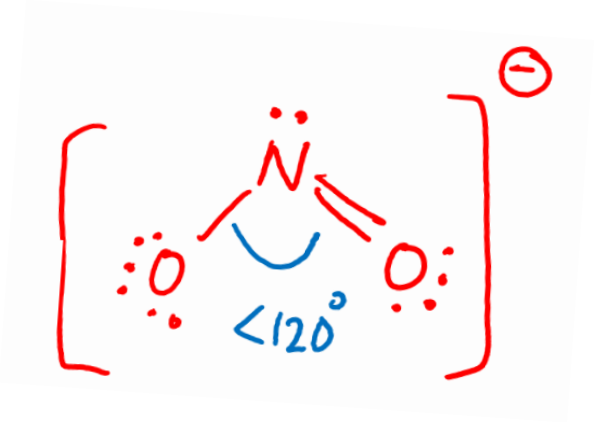
HCN



EG = 2
BG = 2

linear

NO_2^-



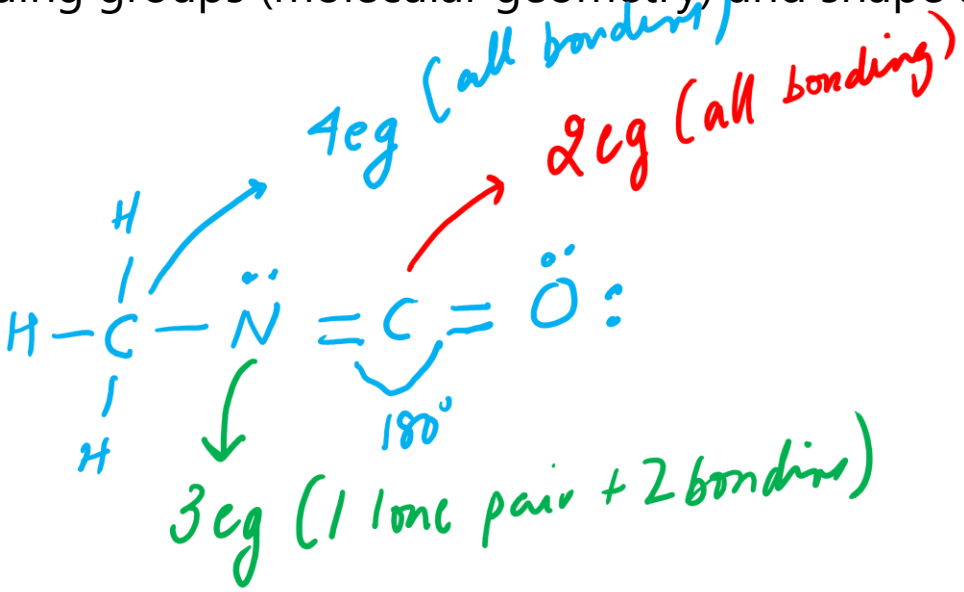
EG = 3 — e⁻ groups.
BG = 2 → bonding
LP = 1 → lone pairs.

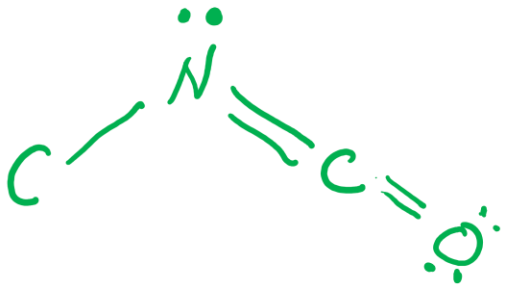
Bent

Practice VSEPR Question 7

Draw the most stable Lewis Structure, determine electron groups (electron geometry), bonding groups (molecular geometry) and shape around highlighted C and N atoms.

$CH_3\mathbf{NC}O$

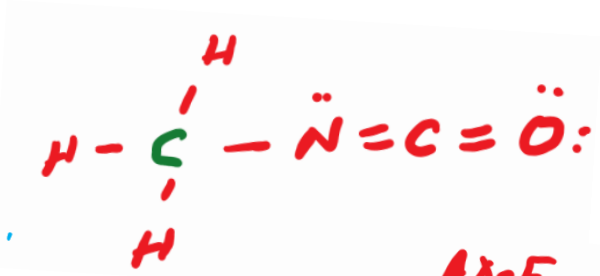




Practice VSEPR

Draw Lewis Structure, determine electron groups (electron geometry), bonding groups (molecular geometry) and shape

CH_3NCO



AX_4 Around C

Electron groups = 4

Bonding = 4

tetrahedral

AX_2E Around N

Electron g = 3

Bonding = 2

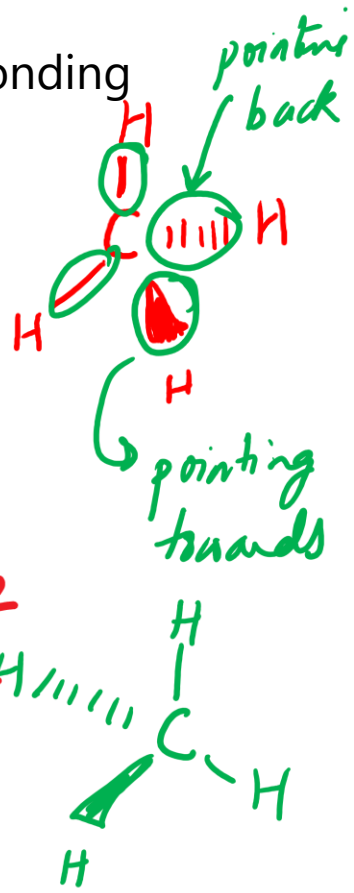
Bent

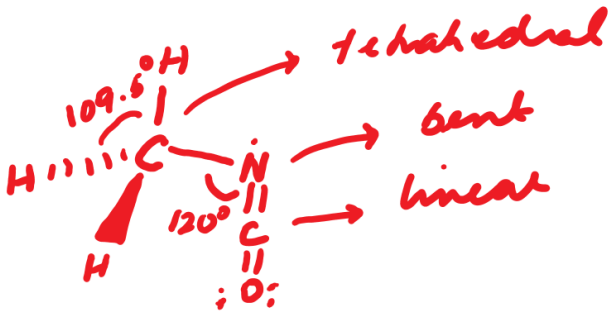
AX_2 Around C

Electron g = 2

Bonding = 2

Linear





4 eg all bonds tetrahedral

4 eg (1 lone pair) trigonal pyram.

Practice VSEPR Question 8

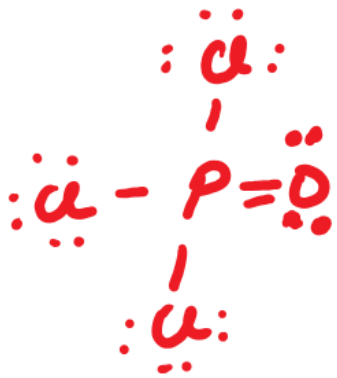
Draw Lewis Structure, determine electron groups (electron geometry), bonding groups (molecular geometry) and shape (P is the central atom)

$POCl_3$

Practice VSEPR 8

Draw Lewis Structure, determine electron groups (electron geometry), bonding groups (molecular geometry) and shape

$POCl_3$

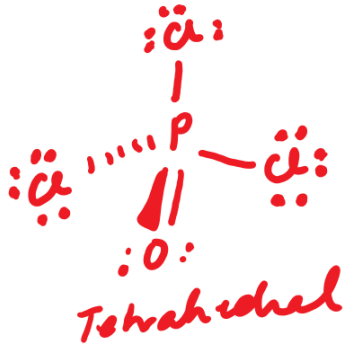


Electron groups = 4

Bonding groups = 4

Geometry around P → tetrahedral

AX_4



Practice VSEPR 9 (Concept Video 15)

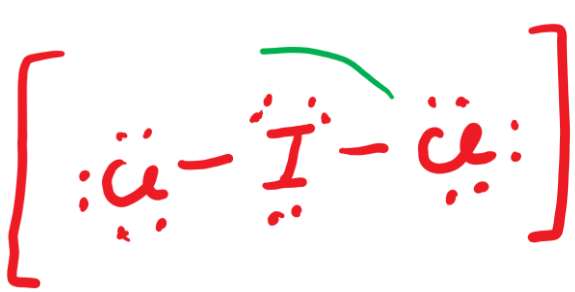
Draw Lewis Structure, determine electron groups (electron geometry), bonding groups (molecular geometry) and shape

$[ICl_2]^-$

Practice VSEPR 9 (Concept Video 15)

Draw Lewis Structure, determine electron groups (electron geometry), bonding groups (molecular geometry) and shape

$[ICl_2]^-$



AX_2E_3

Electron groups = 5

Bonding groups = 2

Geometry → linear

Practice Question 10 (Concept Video 15)
Which of the following molecules have a net dipole moment?

Cl—Cl

Non polar

$CHCl_3$

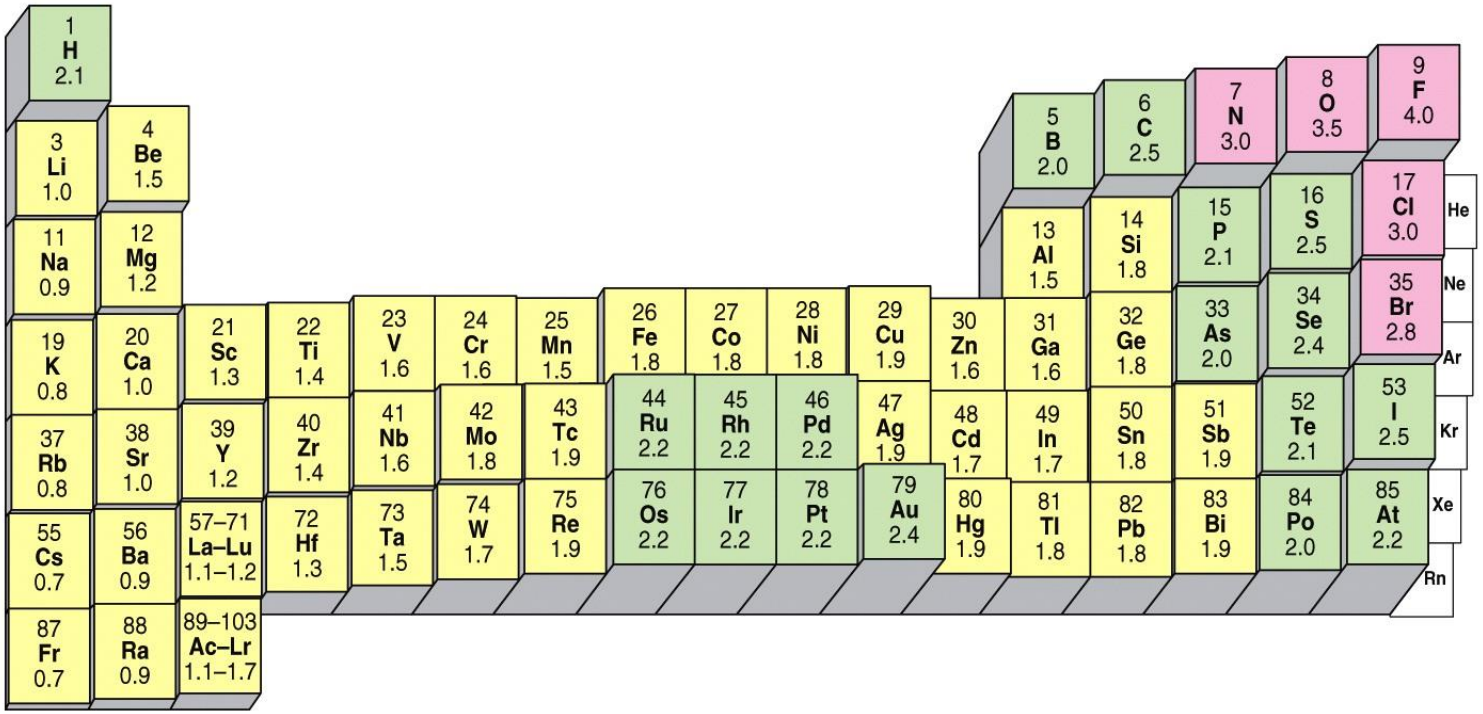
Polar

C_2H_4

Non polar

PCl_5

Non polar



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The following are plausible resonance structures of CH3NCO

ⓘ Start presenting to display the poll results on this slide.