

Worksheet 6 – Answers to Critical Thinking Questions

Model 1: Simple Compounds of C, N, O and F

1.

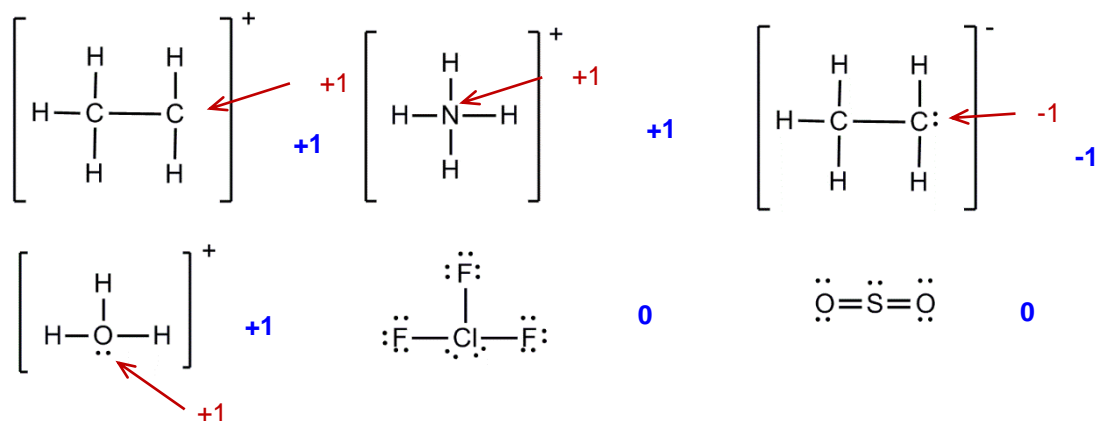
Compound	Number of single bonds	Number of double bonds	Number of triple bonds	Number of lone electron pairs
	4	0	0	0
	2	1	0	0
$\text{H}-\text{C}\equiv\text{P:}$	1	0	1	0
	3	0	0	1
	1	1	0	1
$:\text{N}\equiv\text{N:}$	0	0	1	1
	2	0	0	2
$:\text{O}=\text{N}-\text{H}$	0	1	0	2
$:\ddot{\text{F}}-\text{H}$	1	0	0	3

2.

Atom	Number of lone electron pairs	Total number of bonds
C	0	4
N	1	3
O	2	2
F	3	1

Model 2: Formal Charge

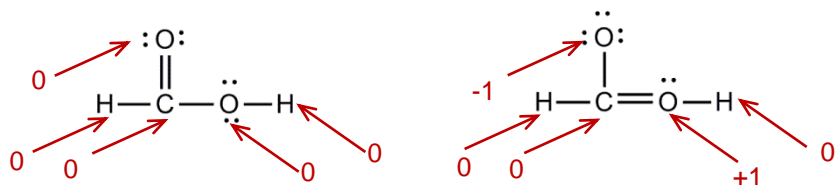
3. Unless otherwise indicated, all atoms have a formal charge of 0.



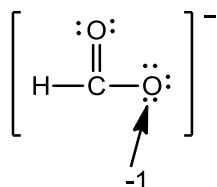
4. Sums of formal charges are in blue on the structures above. The sum of the formal charges of individual atoms is equal to the overall charge on the compound.

Model 3: Lewis Structures

5. The structure on the left has minimised formal charges for each atom, so it is the preferred structure.

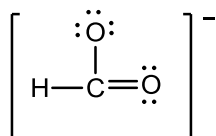


6.

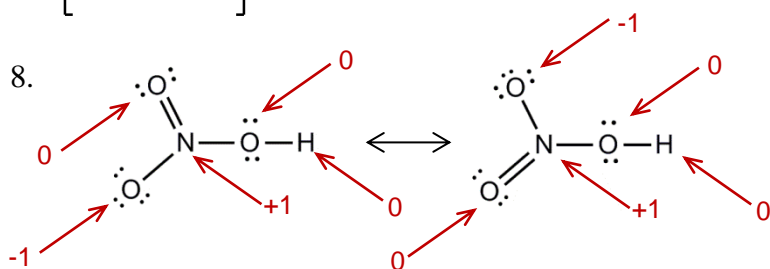


All other formal charges are 0

7.

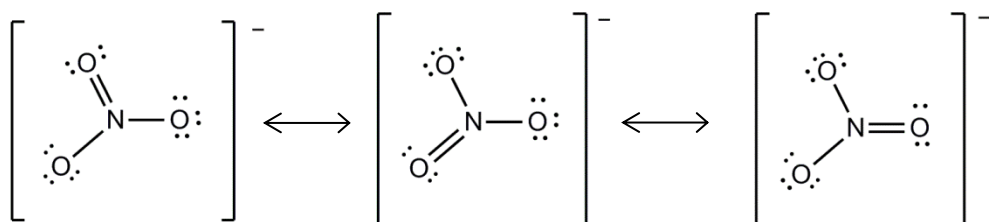


8.



9. The two N-O bonds have bond orders of 1.5, the N-OH bond has a bond order of 1

10.



Model 4: Lewis Structures for Organic Molecules

11.

	Lewis Structure
(a) C_3H_8	$ \begin{array}{ccccc} & \text{H} & \text{H} & \text{H} & \\ & & & & \\ \text{H} & - \text{C} & - \text{C} & - \text{C} & - \text{H} \\ & & & & \\ & \text{H} & \text{H} & \text{H} & \end{array} $
(b) H_2CO	$ \begin{array}{c} \text{H} \\ \diagdown \\ \text{C} = \ddot{\text{O}}: \\ \diagup \\ \text{H} \end{array} $
(c) CH_3OCH_3	$ \begin{array}{ccccc} & \text{H} & & \text{H} & \\ & & & & \\ \text{H} & - \text{C} & - \ddot{\text{O}} & - \text{C} & - \text{H} \\ & & & & \\ & \text{H} & & \text{H} & \end{array} $

12.

$ \begin{array}{c} \text{H} \\ \\ \text{H} - \text{N} - \text{C} - \text{C} = \text{O} \\ \quad \quad \quad \\ \text{H} \quad \text{H} \quad \text{O} \quad \text{H} \\ \quad \quad \quad \cdot \quad \cdot \\ \quad \quad \quad \text{O} \quad \text{O} \end{array} $	$ \begin{array}{c} \text{O} \\ \\ \text{H} - \text{N} - \text{C} = \text{C} - \text{N} - \text{H} \\ \quad \quad \quad \\ \text{H} \quad \text{N} \quad \text{C} = \text{N} \quad \text{C} - \text{H} \\ \quad \quad \quad \\ \text{H} \quad \text{H} \quad \text{N} \quad \text{H} \end{array} $	$ \begin{array}{c} \text{H} \\ \\ \text{H} - \text{C} = \text{C} - \text{C} - \text{H} \\ \quad \quad \quad \\ \text{H} \quad \text{C} = \text{C} - \text{C} - \text{O} - \text{C} - \text{H} \\ \quad \quad \quad \quad \\ \text{O} \quad \text{O} \quad \text{O} \quad \text{O} \quad \text{H} \end{array} $
--	--	--