

CHEM1611 Worksheet 3 – Answers to Critical Thinking Questions

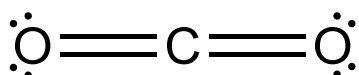
The worksheets are available in the tutorials and form an integral part of the learning outcomes and experience for this unit.

Model 1: Ionic Bonding

- +2
- 2
- 3
- Main group cations – lose electrons to form configuration of noble gas in previous period.
Main group anions – gain electrons to form configuration of noble gas in the same period.
- Iodine – 7 valence electrons so gains 1 electron to form I.
Sodium – 1 valence electron so loses 1 electron to form Na⁺.
Oxygen – 6 valence electrons so gains 2 electrons to form O²⁻.
Nitrogen – 5 valence electrons so gains 3 electrons to form N³⁻.
Tellurium – 6 valence electrons so gains 2 electrons to form Te²⁻.
Indium – 3 valence electrons so loses 3 electrons to form In³⁺.
Radon – 8 valence electrons so does not form cations or anions.
Tin – 4 valence electrons so loses 4 electrons to form Sn⁴⁺. In principle, it could also gain 4 electrons to become an anion but it is a metal so forms cations.
- Al₂O₃ – aluminium oxide
- Ba²⁺ O²⁻ → BaO.
- (a) sodium chloride (b) sodium nitride (c) tungsten carbide
(d) copper(II) oxide (e) copper(I) oxide (f) lithium sulfide
(g) calcium bromide

Model 2: Lewis Structures

- 4 (C) + 2 × 6 (O) = 16
- See below.
- See below.



- This structure conforms to the octet rule.
- See below.

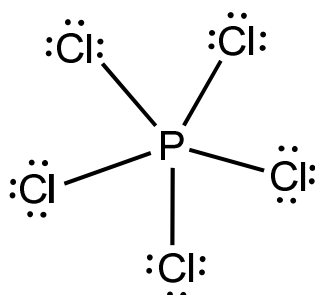


- The C-O bond in CO is a triple bond and which will be stronger than the double bonds in CO₂.
- See below.

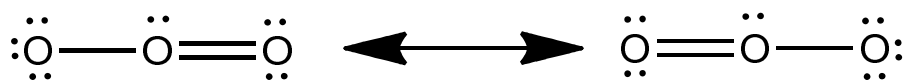


- They are analogous: there is a triple bond and a lone pair on each atom in both structures.

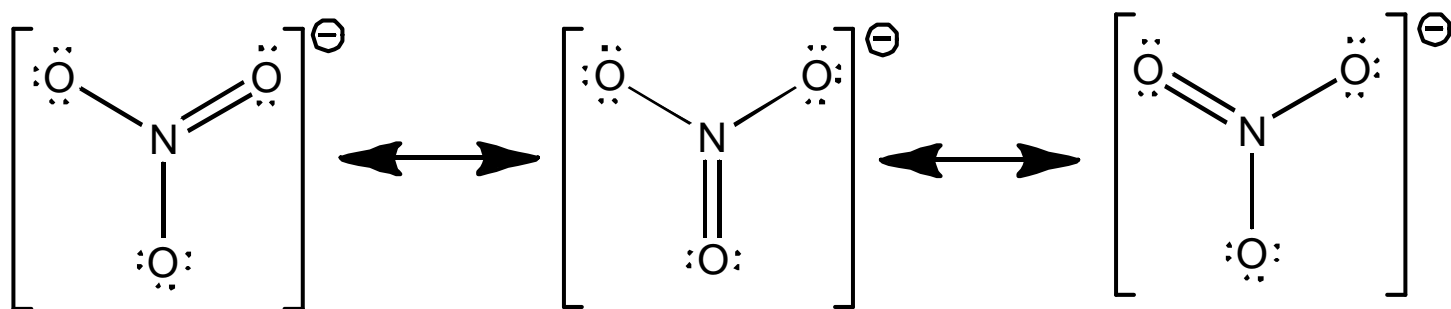
9. It is in 5th period of the Periodic Table.
10. An atom's electronegativity is its ability to attract electrons towards itself in a molecule. Across a period, electronegativity *increases*. Down a group, electronegativity *decreases*. As iodine is lower in group 17 than chlorine, it is *less* electronegative than chlorine.
11. See below.



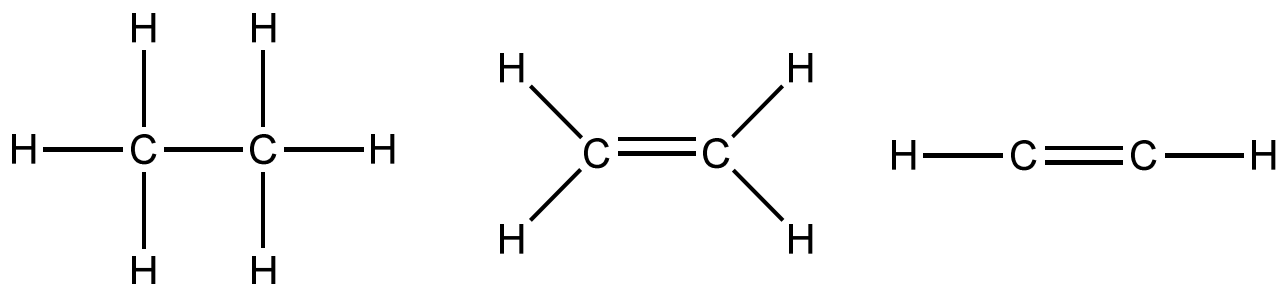
12. See below.



13. See below.



14. In order of increasing C-C bond strength: $C_2H_6 < C_2H_4 < C_2H_2$ (single < double < triple).

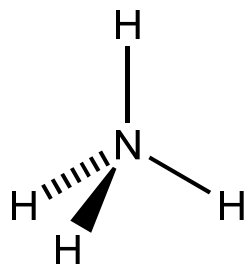


Model 3: Predicting Molecular Shape

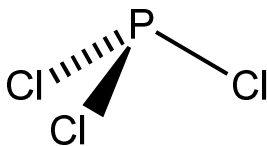
1. Linear:



2. NH_4^+ - tetrahedral:



PCl_3 - trigonal pyramidal (or just pyramidal)



3. Square planar (flat):

