

Lewis structures, shapes and hybridization of molecules

AP Chemistry · Test

Name: _____ Date: _____ Class: _____ Mark: ____ / 20

This test covers Lewis structures, formal charge, resonance, shapes, polarity and hybridization. It has 8 questions worth 20 marks. No hints are given, and a periodic table is allowed.

Level: AP Chemistry · **Curriculum:** AP Chem Unit 2

Time: 40 minutes · 8 questions · Total: 20 marks · Calculator allowed

Question 1 Lewis structure of PCl_3 (3 marks)

Phosphorus trichloride has 26 valence electrons.

- Describe its Lewis structure, including lone pairs. (1 mark)
- State the molecular shape and the approximate bond angle. (1 mark)
- State the hybridization of phosphorus. (1 mark)

Question 2 Formal charges in carbon monoxide (3 marks)

The Lewis structure of CO is $\text{C}\equiv\text{O}$ with one lone pair on each atom.

- Calculate the formal charge on C. (1 mark)
- Calculate the formal charge on O. (1 mark)
- Explain why this structure is still the best one. (1 mark)

Question 3 Resonance in carbonate (2 marks)

- State how many resonance structures carbonate has. (1 mark)
- Calculate the average C-O bond order. (1 mark)

Question 4 Sulfur tetrafluoride (3 marks)

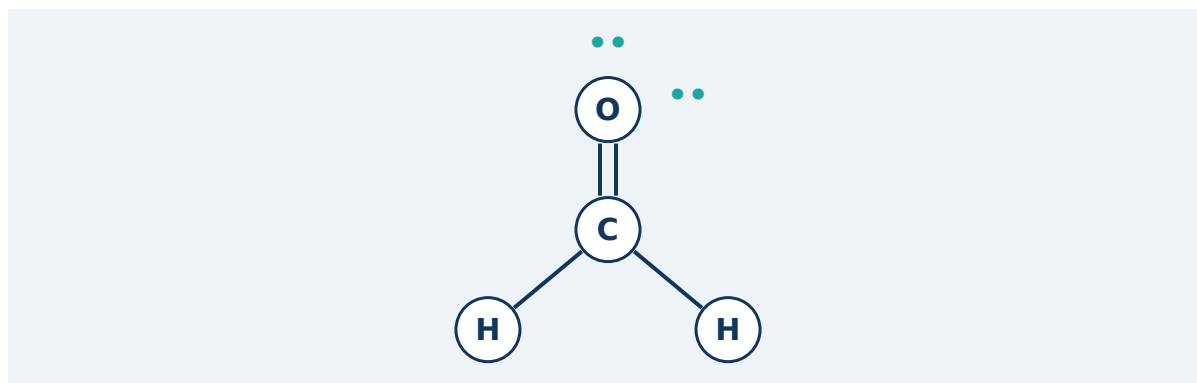
SF_4 has 34 valence electrons.

- State the number of lone pairs on sulfur. (1 mark)
- Name the electron geometry and the molecular shape. (1 mark)
- State whether the molecule is polar and give a reason. (1 mark)

Question 5 Methanal (3 marks)

The figure shows methanal.

- Count the σ and π bonds. (1 mark)
- State the hybridization of carbon. (1 mark)
- Predict the H-C-H angle compared with 120° and give a reason. (1 mark)



Methanal, CH_2O .

Question 6 Polarity of CF_4 and CHF_3 (2 marks)

Explain why CF_4 is nonpolar but CHF_3 is polar. (2 marks)

Question 7 Bond strength (2 marks)

The C-O bond length is 143 pm in methanol and 120 pm in methanal.

- Identify the stronger bond. (1 mark)
- Explain the difference in length. (1 mark)

Question 8 Spot the error (2 marks)

A student states that ammonia is planar with 120° angles because nitrogen forms three bonds. Identify the error and give the correct shape and angle. (2 marks)