1. Which two species are isoelectronic?
   - Ba\(^{2+}\) and Ba
   - Cl\(^{-}\) and Na\(^{+}\)
   - Sr\(^{2+}\) and Se\(^{2-}\)
   - Al\(^{3+}\) and Ar

   **Solution or Explanation**
   Se is in period 4; Sr is in period 5 and one atom loses 2 electrons, while the other gains 2 electrons (same electron configuration as Kr).

2. Which of the following has the largest radius?
   - Ca\(^{2+}\)
   - Cl\(^{-}\)
   - S\(^{2-}\)
   - Na\(^{+}\)

   **Solution or Explanation**
   The sulfur atom gains 2 electrons, more e-e repulsions and is below chlorine on the periodic table.

3. Which of the molecules shown is polar? (Select all that apply.)
   - (a)
   - (b)
   - (c)
   - (d)

4. Which one of the following has a dipole moment?
   - CO\(_2\)
   - ICl
   - Br\(_2\)
   - BeCl\(_2\)

   **Solution or Explanation**
Both atoms are different in EN values and linear.

What is the shape of the phosphate ion?

- triangular
- tetrahedral
- linear
- planar

Solution or Explanation
AX₄ class with four electron pairs.

Which one of the following molecules possesses a trigonal bipyramidal structure?

- BrF₃
- PF₆⁻
- PF₅
- SF₄

Solution or Explanation
Five electron pairs are present (AX₅).

7. Question DetailsBurdgeChem2 9.TB.010. [1412027]
According to VSEPR theory, which one of the following molecules should be nonlinear?

- SO₂
- BeCl₂
- KrF₂
- CO₂
- C₂H₂

Which one of the following best describes the F-S-F bond angle in F₂SO?

- 90° < angle < 109.5°<
- 109.5°
- 109.5° < angle < 120°
- 90°

Solution or Explanation
109.5 is indicated with a AX₃E class, but angle is a little less due to the lone electron pair on S.

A molecule has the formula ML₂. Atom M is the central atom and the L-M-L bond angle is 117°. What is the most likely classification of this molecule?
Which of the following is the best description of the geometry of the azide ion, $N_3^-$?
- triangular, $\angle 120\text{Å}^\circ$
- linear, $\angle 180\text{Å}^\circ$
- angular, $\angle 120\text{Å}^\circ$
- angular, $90\text{Å}^\circ$

Solution or Explanation

Closest to 120 bond angle of AX$_2$E class, with some strain a little less than 120.

A CN$_2^-$ ion has a structure that is best described as
- angular.
- linear.
- tetrahedral.
- planar.

Solution or Explanation

Linear based on Lewis structures and thus 180 degree angle.

Which of the following is a non-polar molecule having one or more polar bonds?
- PH$_3$
- CBr$_4$
- H$_2$
- HI

Solution or Explanation

CBr$_4$ is symmetrical and all the dipoles cancel out.

13. Question Details LairdUChem1 3.PracticeEx.02. [1063692]

Practice Exercise 3.2

Select the Lewis structure for formic acid (HCOOH).
14. Select the Lewis structure for the nitrite ion (NO$_2^-$).

15. Give the most reasonable Lewis structure of a molecule that contains a N atom, a C atom, and an H atom.

16. Indicate the formal charges for the nitrite ion (NO$_2^-$). (Type your answer using the format -1.)
17. Practice Exercise 3.6

Select the valid resonance structures for the nitrite ion (NO$_2^-$). (Select all that apply.)

![Resonance structures for NO$_2^-$](image)

18. Practice Exercise 3.7

Indicate the Lewis structure for BeF$_2$.

![Lewis structure for BeF$_2$](image)

19. Practice Exercise 3.11

Which of the following species has a longer bond length: F$_2$ or F$_2$? 

![Comparison of bond lengths](image)

20. Question DetailsLaindUChem1 3.EOCR.011. [1003654]

Four atoms are arbitrarily labeled D, E, F, and G. Their electronegativities are as follows: D = 3.8, E = 3.3, F = 2.8, and G = 1.3. If the atoms of these elements form the molecules DE, DG, EG, and DF, how would you arrange these molecules in order of increasing covalent bond character? (Use the appropriate $<$, $=$, or $>$ symbol to separate substances in the list.)

![Arrangement of molecules](image)
21. Question DetailsLairdUChem1 3.Practice.02. [1078650]

**Formal Charge Calculations**

(a) How many resonance structures can be drawn for the nitrate ion, NO$_3^-$?

- one
- two
- three
- four

**Hint**

(b) Consider one of the resonance structures of the nitrate ion, NO$_3^-$. What is the formal charge of nitrogen in this polyatomic ion?

- +2
- +1
- 0
- -1
- -2

**Hint**

(c) Consider one of the resonance structures of the nitrate ion, NO$_3^-$. What is the formal charge of the oxygen atom that is doubly bonded to nitrogen?

- +2
- +1
- 0
- -1
- -2

**Hint**

(d) Consider one of the resonance structures of the nitrate ion, NO$_3^-$. What is the formal charge of one of the oxygen atoms singly-bonded to nitrogen?

- +2
- +1
- 0
- -1
- -2

**Hint**

(e) What is the sum of the formal charges of all the atoms in the nitrate ion, NO$_3^-$?

- +2
- +1
- 0
- -1
- -2

**Hint**

22. Question DetailsChang10 8.Supp.3.02. [1133276]

Which of the following is the electronic configuration for a chlorine atom?
23. Question DetailsChang10 9.Sup.5.04. [1132224]
Which of the following possesses a polar covalent bond?
- SO$_2$(g)
- NaCl(s)
- Al(s)
- O$_2$(g)

Solution or Explanation
SO$_2$ contains two sulfur/oxygen bonds which are polar.

24. Question DetailsChang10 9.Sup.6.09. [1133621]
How many bond pairs (bp) and how many lone pairs (lp) should be shown in the Lewis structure for carbon monoxide?
- 2 bp and 3 lp
- 1 bp and 4 lp
- 4 bp and 1 lp
- 3 bp and 2 lp

Solution or Explanation
One triple bond is present, 3 bp and 2 lp.

25. Question DetailsChang10 9.Sup.6.18. [1133220]
Which one of the following species contains a triple bond?
- SO$_3^{2-}$
- NO$_2^+$
- SO$_2$
- CN$^-$

Solution or Explanation
Based on the octet rule the cyanide would show a triple bond.

What is the formal charge on the sulfur atom in the resonance structure of SO$_2$ that has one single bond and one double bond?
27. **Question Details** Chang10 9.Supply.8.07. [1133194]

How many equivalent resonance structures does the HCO$_2^-$ ion have?

- 1
- 3
- 4
- 2

**Solution or Explanation**

Only 2 oxygen's are present.


Which of the following Lewis structures best represents the cyanogen molecule, C$_2$N$_2$?

1. N=C=C=N
2. N  C-C  N
3. N-C  C-N
4. All of them in resonance.

**Solution or Explanation**

Based on formal charges and the octet rule, two C≡N and one C-C bond is the most stable.

29. **Question Details** Chang10 9.TB.042. [1135445]

The total number of bonding electrons in a molecule of formaldehyde (H$_2$CO) is

- 6
- 4
- 3
- 18
- 8

30. **Question Details** Chang10 9.TB.043. [1134784]

The total number of lone pairs in NCl$_3$ is

- 6
- 4
- 3
- 18
- 8
31. Which of the following molecules has a higher dipole moment?

- molecule (a)
- molecule (b)

![Molecules](image)

32. The CHBr₃ is a slightly polar molecule. What atom substitution could be performed to make the molecule non-polar?

- substitute an iodine (I) for the hydrogen (H)
- substitute a bromine (Br) for the hydrogen (H)
- substitute an iodine (I) for a bromine (Br)
- substitute a hydrogen (H) for a bromine (Br)

Solution or Explanation

Another bromine in place of hydrogen would allow the dipoles to cancel out.