4. Ionic: KI, MgS (metal + nonmetal)
   Covalent: CS₂, P₄O₁₀ (all nonmetals)

24. Molecular geometry refers only to the relative positions of the nuclei, whereas e-pair geometry refers to the orientation of valence shell electrons. For example, H₂O has a bent molecular geometry, but a tetrahedral e-pair geometry (4 e-pairs).

30. | Group | 3A | 4A | 5A | 6A | 7A |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td># bonds in octet</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>EX</td>
<td>H-B-H</td>
<td>H₂C⁻H</td>
<td>H⁻N-H</td>
<td>H⁻O⁻H</td>
<td>H⁻Cl⁻</td>
</tr>
</tbody>
</table>

37. The smaller the ionic separation, the greater the force of coulombic attraction (and the more heat required to break apart). The order of melting temperature:
   a. NaCl > RbCl
   b. MgO > BaO
   c. MgS > NaCl (higher charge = greater attraction)
@ SO₂
18 valence e- total.

2 "good" resonance structures

There are good because
1. not expanded valence shell short S
2. no unpaired e-
3. low formal charge.

There are 3 poor resonance structures.

BAD because
1. unpaired e-
2. expanded octet.

(b) NO₂⁻
17 valence e- total.

Good

BAD (O has deficient octet)

NOTE: N & O cannot expand their valence shell!

(c) SCN⁻
6 + 4 + 5 - 1 = 16 valence e-

BAD resonance form, since it has a high level of charge separation.
46) Formal charge: 0

47) $\text{N} - \text{O} - \text{H}$

48) (D) B - O

50) C - O  B - O  P - Cl  B - F

56) $\text{N}_2\text{O}$

60) $\text{H}^+ - \text{C}^0$  B: $\text{S} = 0$  C: $\text{N}^+ \text{O}^-$  D: $\text{O}^-$

62) B - Cl  C - O  P - O  C = O

Shorter bonds reflect smaller atomic radii
(Bond length $\approx \Sigma \sigma_1 + \sigma_2$)
This chain (along the bond between the ... is not linear due to the fact that each carbon has approximately tetrahedral geometry.

BeCl₂: This can actually be a molecule despite the fact that it consists of a metal + nonmetal. The molecule will be linear, and therefore nonpolar.

Polar due to large ΔX (C vs Cl)

HBF₂: This is a planar, trigonal molecule. Polar.

This is a planar, trigonal molecule. Nonpolar.

[O=N=O]⁻ vs [O=N=O]⁺

18e⁻ \rightarrow 16e⁻

O–N–O \nearly 120°
\[
2\text{H}_{\text{g}} + 3\text{O}_{\text{g}} \rightarrow 2\text{O} = \text{O}_{\text{g}} + 4\text{H} - \text{O} - \text{H}_{\text{g}}
\]

Break: \[86\text{C-H}\]

<table>
<thead>
<tr>
<th>Bond</th>
<th>D (kJ/mol)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6\times 413</td>
<td></td>
</tr>
<tr>
<td>2\times 359</td>
<td></td>
</tr>
<tr>
<td>2\times 463</td>
<td></td>
</tr>
<tr>
<td>3\times 498</td>
<td></td>
</tr>
<tr>
<td>5614 kJ/mol</td>
<td></td>
</tr>
</tbody>
</table>

Make: \[4\text{C} = \text{O} + 8\text{O} - \text{H}\]

<table>
<thead>
<tr>
<th>Bond</th>
<th>D (kJ/mol)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4\times 745</td>
<td></td>
</tr>
<tr>
<td>8\times 463</td>
<td></td>
</tr>
<tr>
<td>[6689]</td>
<td></td>
</tr>
</tbody>
</table>

"D" is the energy required to break a given bond

\[
(\text{A-B}_{\text{g}} \rightarrow \text{A}_{\text{g}} + \text{B}_{\text{g}}) \quad \Delta H = -D_{\text{A-B}}
\]

So, \(-D\) is the energy given off if a bond is created

\[
(\text{A}_{\text{g}} + \text{B}_{\text{g}} \rightarrow \text{A-B} \quad \Delta H = -D_{\text{A-B}})
\]

a) \[\Delta H_{\text{rxn}} = \sum D_{\text{(React)}} - \sum D_{\text{(Prod)}} = -1070 \text{kJ/mol CH}_3\text{OH}
\]

b) \[\Delta H_{\text{rxn}} = \sum \Delta H_{\text{f}}^{\circ}_{\text{Prod}} - \sum \Delta H_{\text{f}}^{\circ}_{\text{React}} \quad (\text{See p.231})
\]

\[
\begin{align*}
2\times 393.51 + 3\times 241.83 & = 2\times 238.9 + 3\times 0 \\
\text{or} & = 2\times 393.51 + 4\times 241.83 - (2\times 238.9 + 3\times 0) = -1277.54 \text{kJ} \\
& = -639.77 \text{kJ/mol CH}_3\text{OH}
\end{align*}
\]

The agreement is not very good, in this case. Which results likely be closest to the experimentally observable \(\Delta H_{\text{rxn}}\)?
The resonance form is most reasonable (follows electronegativity principle) most closely.

Fulminates unstable because it has a buildup of negative charge on carbon, which is not very electronegative.

The $\text{H-N-H}$ angle is between $109^\circ$ (resonance form I) and $120^\circ$ (resonance form II) because both resonance structures reflect the electron distribution in the molecule. Resonance structure I is closer to the truth (it is a dominant structure), but structure II is a minor contributor.

The double bond is stronger.

The single bond is longer.

Ethylene is non-polar, acrolein is polar.

\[ \Delta H_{\text{rxn}} = ( D_{\text{C-H}} + D_{\text{C=O}} - D_{\text{C-C}} - D_{\text{C-H}} - D_{\text{C=O}} ) = -415 \text{ kJ/mol} \]