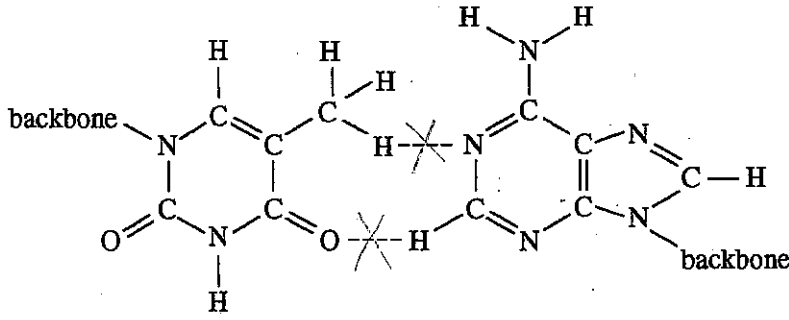
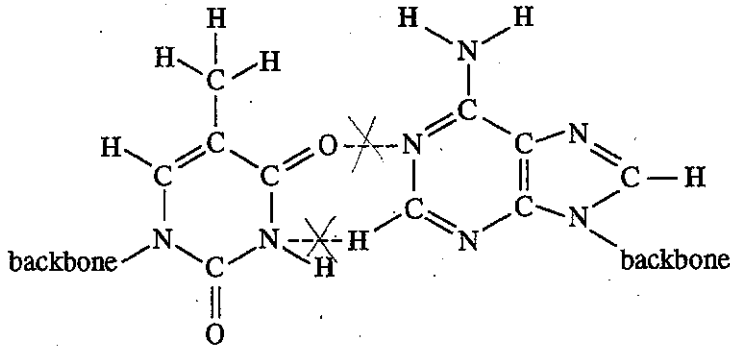


30. Thymine and adenine form a base pair in the DNA molecule. These two bases can form a connection between two strands of DNA via two hydrogen bonds. Which of the following diagrams shows the correct representation of the hydrogen bonding (denoted by dashed lines) between thymine and adenine base pairs? (In each diagram, thymine is shown at the left and adenine is shown at the right. The bases are attached to the backbone portion of the DNA strands.)

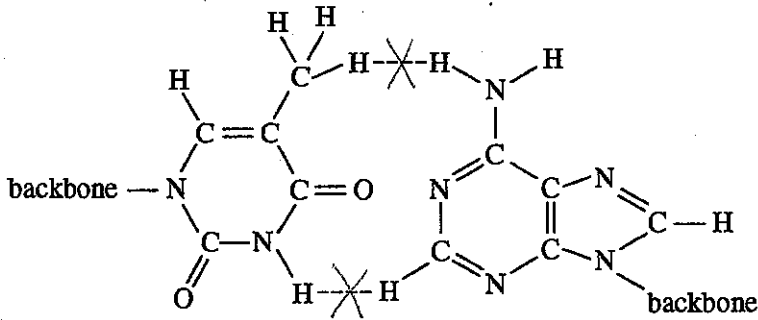
(A)



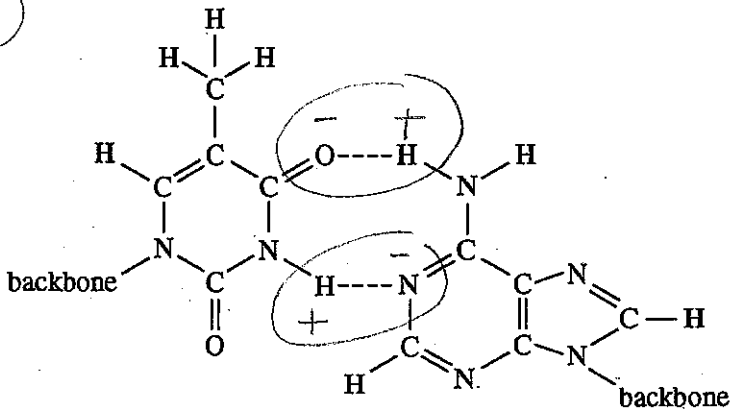
(B)



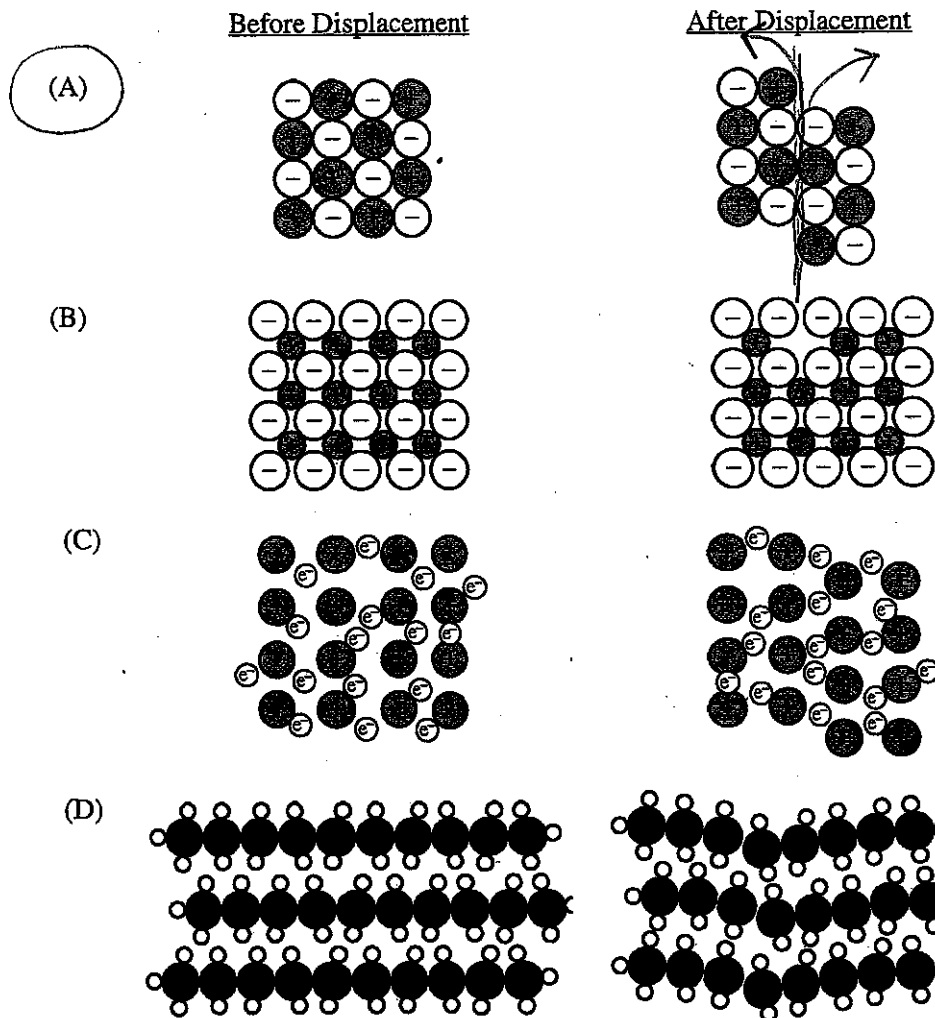
(C)



(D)



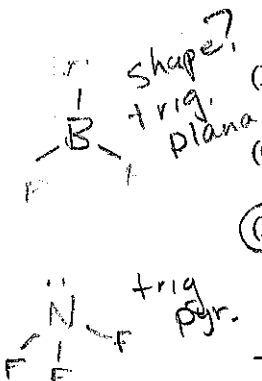
47. Which of the following diagrams best illustrates how a displacement in an ionic crystal results in cleavage and brittleness?



metal with sea of electrons malleable ductile

35. The BF_3 molecule is nonpolar, whereas the NF_3 molecule is polar. Which of the following statements accounts for the difference in polarity of the two molecules?

- (A) In NF_3 , each F is joined to N with multiple bonds, whereas in BF_3 , each F is joined to B with single bonds.
- (B) N-F bonds are polar, whereas B-F bonds are nonpolar.
- (C) NF_3 is an ionic compound, whereas BF_3 is a molecular compound.
- (D) Unlike BF_3 , NF_3 has a nonplanar geometry due to an unshared pair of electrons on the N atom.



charges

$$E = \frac{(q_1)(q_2)}{r}$$

← inter nuclear distance

2. The lattice energy of a salt is related to the energy required to separate the ions. For which of the following pairs of ions is the energy that is required to separate the ions largest? (Assume that the distance between the ions in each pair is equal to the sum of the ionic radii.)

- (A) $\text{Na}^+(\text{g})$ and $\text{Cl}^-(\text{g})$ $+1 -1$
- (B) $\text{Cs}^+(\text{g})$ and $\text{Br}^-(\text{g})$ $+1 -1$
- (C) $\text{Mg}^{2+}(\text{g})$ and $\text{O}^{2-}(\text{g})$ $+2 -2$
- (D) $\text{Ca}^{2+}(\text{g})$ and $\text{O}^{2-}(\text{g})$ $+2 -2$

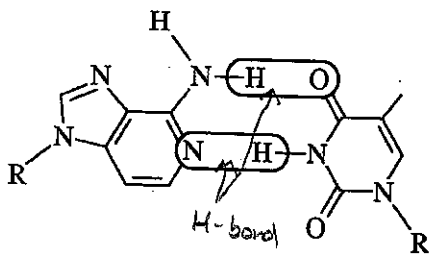
Mg is smaller than Ca

Name	Structural Formula	Molar Mass (g/mol)
Acetone <i>Ketone</i>	$ \begin{array}{c} \text{H} \quad \text{O} \quad \text{H} \\ \quad \quad \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{H} \\ \quad \quad \\ \text{H} \quad \text{H} \quad \text{H} \end{array} $ <p><i>polar dipole Dipole</i></p>	58.1
1-propanol <i>alcohol</i>	$ \begin{array}{c} \text{H} \quad \text{H} \quad \text{H} \\ \quad \quad \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{O}-\text{H} \\ \quad \quad \\ \text{H} \quad \text{H} \quad \text{H} \end{array} $ <p><i>H-bond</i> <i>polar</i></p>	60.1
Butane <i>alkane</i>	$ \begin{array}{c} \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \\ \quad \quad \quad \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{C}-\text{H} \\ \quad \quad \quad \\ \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \end{array} $ <p><i>LDFs nonpolar</i></p>	58.1

Similar MM so similar LDFs

49. The table above shows the structural formulas and molar masses for three different compounds. Which of the following is a list of the compounds in order of increasing boiling points?

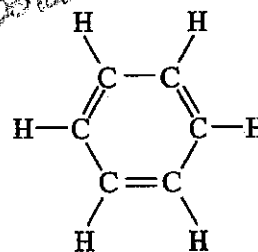
- (A) Butane < 1-propanol < acetone
 (B) Butane < acetone < 1-propanol
 (C) 1-propanol < acetone < butane
 (D) Acetone = butane < 1-propanol



5. Which of the following is the strongest type of interaction that occurs between the atoms within the circled areas of the two molecules represented above?

- (A) Polar covalent bond
 (B) Nonpolar covalent bond
 (C) Hydrogen bond
 (D) London dispersion forces

resonance non polar



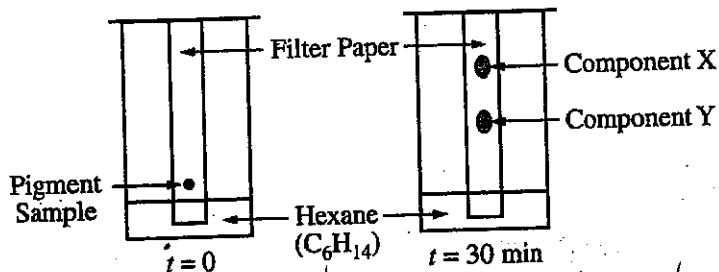
21. Benzene, C_6H_6 , has the structure shown above.

Considering the observation that benzene is only sparingly soluble in water, which of the following best describes the intermolecular forces of attraction between water and benzene?

- (A) Benzene is nonpolar, therefore there are no forces between water and benzene.
 (B) The H atoms in benzene form hydrogen bonds with the O atoms in water.
 (C) Benzene is hydrophobic, therefore there is a net repulsion between water and benzene.
 (D) There are dipole-induced dipole and London dispersion interactions between water and benzene.

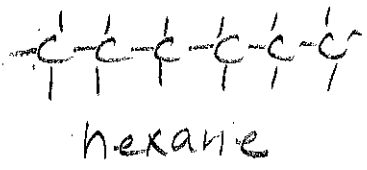
oil is water

H₂O induces a dipole in benzene



distillation → hp
 filtration → solubility (particle size)
 centrifugation → mass
 chromatography → affinity for the solvent + substrate
 ↓
 mobile phase
 ↓
 stationary phase

49. In a paper chromatography experiment, a sample of a pigment is separated into two components, X and Y, as shown in the figure above. The surface of the paper is moderately polar. What can be concluded about X and Y based on the experimental results?



- (A) X has a larger molar mass than Y does.
- (B) Y has a larger molar mass than X does.
- (C) X is more polar than Y.
- (D) Y is more polar than X.

3. Which of the following correctly identifies which has the higher first-ionization energy, Cl or Ar, and supplies the best justification?

- (A) Cl, because of its higher electronegativity
- (B) Cl, because of its higher electron affinity
- (C) Ar, because of its completely filled valence shell
- (D) Ar, because of its higher effective nuclear charge

Cl and Br?
 ↓
 less shielding effect

Element	First Ionization Energy (kJ/mol)	Atomic Radius (pm)
B	801	85
C	1086	77
N	1400	75
O	1314	73
F	1680	72
Ne	2080	70

	Ionization Energy (kJ/mol)
First	801
Second	2,430
Third	3,660
Fourth	25,000
Fifth	32,820

Handwritten notes: x3, x 1 1/2, x 7 or 8, x 1 1/2

12. The first five ionization energies of a second-period element are listed in the table above. Which of the following correctly identifies the element and best explains the data in the table?

- (A) B, because it has five core electrons
- (B) B, because it has three valence electrons
- (C) N, because it has five valence electrons
- (D) N, because it has three electrons in the p sublevel

12. The table above shows the first ionization energy and atomic radius of several elements. Which of the following best helps to explain the deviation of the first ionization energy of oxygen from the overall trend?

- (A) The atomic radius of oxygen is greater than the atomic radius of fluorine.
- (B) The atomic radius of oxygen is less than the atomic radius of nitrogen.
- (C) There is repulsion between paired electrons in oxygen's 2p orbitals.
- (D) There is attraction between paired electrons in oxygen's 2p orbitals.

