

Lecture 15 CH101 A2 (MWF11:15 am) Fall 2017 Copyright © 2016 Dan Dill dan@bu.edu

[TP] Which of the following molecules are **not** polar?

17% 1.  $\text{BFCl}_2$ , whose shape is **trigonal-planar**, like that of  $\text{BF}_3$

17% 2.  $\text{SCl}_2$ , which is a **bent** molecule, like  $\text{H}_2\text{O}$

17% 3.  $\text{NH}_2\text{Cl}$ , whose shape is **trigonal-pyramidal**, like that of  $\text{NH}_3$

17% 4.  $\text{OCS}$ , which is a **linear** molecule, like  $\text{CO}_2$

17% 5. All of the above are **nonpolar**

17% 6. All of the above are **polar**

BOSTON UNIVERSITY

Response Counter

10 1

Lecture 15 CH101 A1 (MWF 9:05 am)  
Wednesday, October 11, 2017

For today ...


- Complete: Polarity
- Dipole-dipole versus temporary dipole attraction (dispersion)

Next lecture: Putting it all together: Relative boiling points; Practice: Intermolecular forces; Dissolving ionic solids; solubility rules (memorize solubility guidelines fig 6.28, p 181);

BOSTON UNIVERSITY

Lecture 15 CH101 A2 (MWF11:15 am) Fall 2017 Copyright © 2016 Dan Dill dan@bu.edu

The **more different the  $\chi$ 's, the more polar the bond**



- If two bonded atoms are **different**, the one with **larger  $\chi$**  gets **more** of the **shared electron cloud**
- Atom with **larger  $\chi$**  has net **negative** charge; atom with **smaller  $\chi$**  has net **positive** charge
- The larger the difference in  $\chi$ , the greater the charge separation (unequal sharing of electron cloud)
- Result is a **polar bonds**

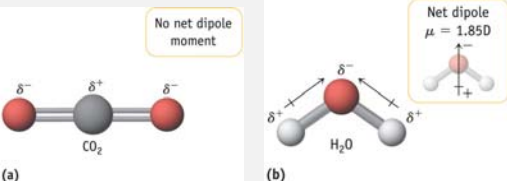
BOSTON UNIVERSITY

3

Lecture 15 CH101 A2 (MWF11:15 am) Fall 2017 Copyright © 2016 Dan Dill dan@bu.edu

Molecular polarity

- If bond dipoles **cancel**, molecule is **nonpolar**
- If bond dipoles **do not cancel**, molecule is **polar**



(a)  $\text{CO}_2$  (b)  $\text{H}_2\text{O}$

Let's illustrate, for  $\text{BF}_3$  and  $\text{BH}_2\text{F}$

BOSTON UNIVERSITY

4

Lecture 15 CH101 A2 (MWF11:15 am) Fall 2017 Copyright © 2016 Dan Dill dan@bu.edu

### Consider polarity of the following

- $\text{BFCl}_2$ , whose shape is **trigonal-planar**, like that of  $\text{BF}_3$
- $\text{SCl}_2$ , which is a **bent** molecule, like  $\text{H}_2\text{O}$
- $\text{NH}_2\text{Cl}$ , whose shape is **trigonal-pyramidal**, like that of  $\text{NH}_3$
- $\text{OCS}$ , which is a **linear** molecule, like  $\text{CO}_2$

BOSTON UNIVERSITY 6

Lecture 15 CH101 A2 (MWF11:15 am) Fall 2017 Copyright © 2016 Dan Dill dan@bu.edu

[TP] Which of the following molecules are **not** polar?

17% 1.  $\text{BFCl}_2$ , whose shape is **trigonal-planar**, like that of  $\text{BF}_3$

17% 2.  $\text{SCl}_2$ , which is a **bent** molecule, like  $\text{H}_2\text{O}$

17% 3.  $\text{NH}_2\text{Cl}$ , whose shape is **trigonal-pyramidal**, like that of  $\text{NH}_3$

17% 4.  $\text{OCS}$ , which is a **linear** molecule, like  $\text{CO}_2$

17% 5. All of the above are **nonpolar**

17% 6. All of the above are **polar**

BOSTON UNIVERSITY Response Counter 10 7

Lecture 15 CH101 A2 (MWF11:15 am) Fall 2017 Copyright © 2016 Dan Dill dan@bu.edu

[Quiz] Which of the following statements is true about carbon dioxide,  $\text{O}=\text{C}=\text{O}$ ?

25% 1.  $\text{CO}_2$  contains polar bonds and is a polar molecule

25% 2.  $\text{CO}_2$  contains polar bonds, but is not a polar molecule

25% 3.  $\text{CO}_2$  does not contain polar bonds and is not a polar molecule

25% 4.  $\text{CO}_2$  does not contain polar bonds but is a polar molecule

BOSTON UNIVERSITY Response Counter 10 8

Lecture 15 CH101 A2 (MWF11:15 am) Fall 2017 Copyright © 2016 Dan Dill dan@bu.edu

Dipole-dipole versus dispersion

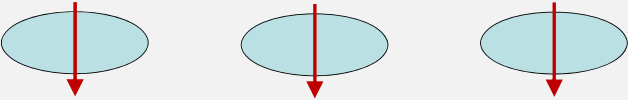
BOSTON UNIVERSITY 9

Lecture 15 CH101 A2 (MWF11:15 am) Fall 2017 Copyright © 2016 Dan Dill dan@bu.edu

### Permanent dipoles

Sketch a second molecule arranged so that it ...

attracts maximally      repels maximally      neither attracts nor repels



BOSTON UNIVERSITY 10

The diagram shows three light blue ovals, each representing a permanent dipole. A red arrow points downwards from the center of each oval. The ovals are arranged horizontally. The first oval is labeled 'attracts maximally', the second 'repels maximally', and the third 'neither attracts nor repels'. The ovals are identical in size and color, and the arrows are identical in length and direction.