

Chemistry 20 - Intermolecular Forces Worksheet

Chemical Formula	Number of electrons	Boiling point (°C)	dipole-dipole forces?	London Dispersion?	hydrogen bonding?
1. F _{2(g)}	18	-188		✓	
2. Cl _{2(g)}	34	-35		✓	
3. Br _{2(l)}	70	59		✓	
4. I _{2(s)}	106	184		✓	
5. ClF _(g)	26	-101	✓	✓	
6. BrF _(g)	44	-20	✓	✓	
7. BrCl _(s)	52	5	✓	✓	
8. ICl _(s)	70	97	✓	✓	
9. IBr _(s)	88	116	✓	✓	
10. CH _{4(g)}	10	-162		✓	
11. C ₂ H _{6(g)}	18	-87		✓	
12. C ₃ H _{8(g)}	26	-45		✓	
13. C ₄ H _{10(g)}	34	-0.50		✓	
14. C ₅ H _{12(l)}	42	36		✓	
15. CF _{4(g)}	42	-129		✓	
16. CCl _{4(l)}	74	77		✓	
17. CBr _{4(s)}	146	189		✓	
18. CH ₃ F _(g)	18	-78	✓	✓	
19. CH ₃ Cl _(g)	26	-24	✓	✓	
20. CH ₃ Br _(g)	44	3.6	✓	✓	
21. CH ₃ I _(l)	62	43	✓	✓	
22. CH ₃ OH _(l)	18	65	✓	✓	✓
23. C ₂ H ₅ F _(g)	26	-38	✓	✓	
24. C ₂ H ₅ Cl _(g)	34	13	✓	✓	
25. C ₂ H ₅ Br _(l)	52	38	✓	✓	
26. C ₂ H ₅ I _(l)	70	72	✓	✓	
27. C ₂ H ₅ OH _(l)	26	78	✓	✓	✓

28. Following the example given in class, compare the boiling points of $\text{BrF}_{(g)}$ and $\text{C}_3\text{H}_{8(g)}$. Account for any differences.

	BrF	C_3H_8	BrF HIGHER BECAUSE OF STRONGER LDF & PRESENCE OF DIPOLE-DIPOLE FORCES
LDF	$44e^-$	$26e^-$	
DDF	YES	NO	
H BONDS	NO	NO	

29. Dimethyl ether, $(\text{CH}_3)_2\text{O}_{(g)}$ has a boiling point of -24.9°C . Compare with the boiling point of ethanol ($\text{C}_2\text{H}_5\text{OH}_{(l)}$) and account for the difference. **Hint:** Even though these compounds each have 2 C's, 6 H's and 1 O they are not the same compound! You will need to look at their structures and include them with your answer.

$\text{C}_2\text{H}_5\text{OH}$		$\text{C}_2\text{H}_5\text{OH}$	$(\text{CH}_3)_2\text{O}$
LDF		$26e^-$	$26e^-$
DDF		YES	YES
H BONDS		YES	NO
		EVERYTHING ELSE IS SAME BUT $\text{C}_2\text{H}_5\text{OH}$ HAS H BONDING	

30. The different **series** of substances in the table (separated by), in **general** have increasing boiling points with increasing numbers of electrons. Explain this in terms of number of electrons and strength of intermolecular forces.

AS #e⁻ ↑ → STRENGTH OF LDF ↑ → THEREFORE → BP ↑ **HIGHER**

31. Methanol, CH_3OH , and ethanol, $\text{C}_2\text{H}_5\text{OH}$, each have the least number of electrons but the highest boiling point in their respective **series**. Account for this.

THESE ARE THE ONLY ONES WITH HYDROGEN BONDING IN THEIR RESPECTIVE SERIES.

32. Explain the difference in boiling points between:

a) C_2H_6 and CH_3F

LDF	$18e^-$	$18e^-$	CH_3F HIGHER BECAUSE OF DIPOLE-DIPOLE FORCES
DDF	NO	YES	
H BONDS	NO	NO	

c) BrCl and $\text{C}_2\text{H}_5\text{F}$.

$52e^-$	$26e^-$	-LDF
YES	YES	-DDF
NO	NO	-H BONDS

b) HF (20°C) and C_4H_{10}

LDF	$10e^-$	$34e^-$
DDF	YES	NO
H BONDS	YES	NO
HF HIGHER BECAUSE OF HYDROGEN BONDING & DIPOLE-DIPOLE FORCES		

BrCl HIGHER BECAUSE OF STRONGER LDF