

Functional Groups Worksheet

Name: _____

Using the online activity on [Functional Groups](#) , complete the worksheet.

Molecular Interactions

1. The most common elements in living things are listed below. Complete the table.

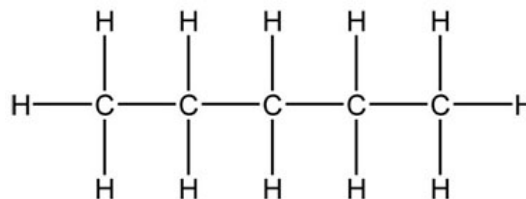
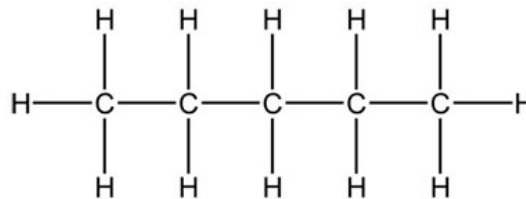
Element		# Valence Electrons	Number of bonds it can form
Name	Abbreviation		
Carbon	C		
Hydrogen	H		
Oxygen	O		
Nitrogen	N		
Phosphorus	P		
Sulfur	S		

2. Using the elements listed in the table above, which of the elements is most electronegative?

3. In each compound below, circle the electronegative elements and write polar or nonpolar next to each.

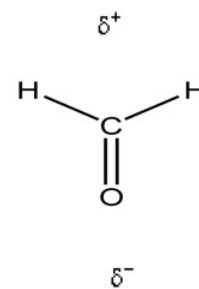
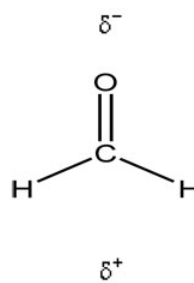
Compounds	Polar or nonpolar
$\begin{array}{c} \text{H} \\ \\ \text{H}-\text{C}-\text{H} \\ \\ \text{H} \end{array}$	
$\begin{array}{c} \text{H} \quad \text{H} \\ \diagdown \quad / \\ \text{O} \end{array}$	
$\begin{array}{c} \text{O} \\ \\ \text{H}-\text{C}-\text{C}-\text{H} \\ \\ \text{H} \end{array}$	
$\begin{array}{c} \text{H} \quad \text{H} \\ \quad \\ \text{H}-\text{C}-\text{C}-\text{O}-\text{H} \\ \quad \\ \text{H} \quad \text{H} \end{array}$	
$\begin{array}{c} \text{H} \quad \text{O} \quad \text{H} \quad \text{H} \\ \quad \quad \quad \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{C}-\text{H} \\ \quad \quad \quad \\ \text{H} \quad \quad \text{H} \quad \text{H} \end{array}$	

4. Are the molecules at the right polar or nonpolar?



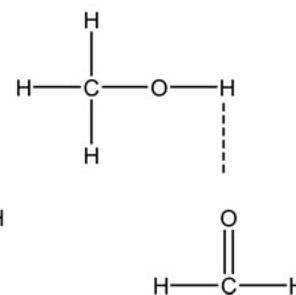
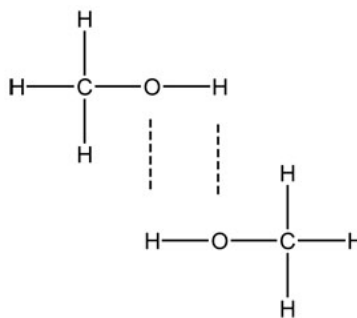
5. Would both polar and nonpolar molecules have London dispersion, induced dipole-induced dipole forces or not?

6. Are the molecules at the right polar or nonpolar?



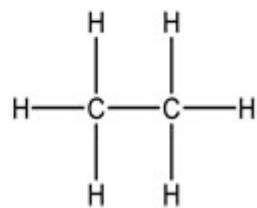
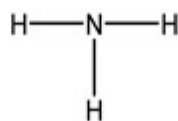
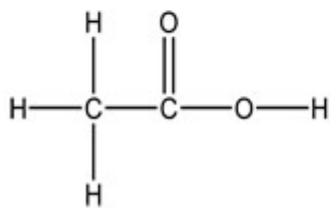
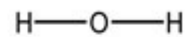
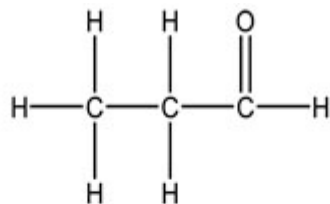
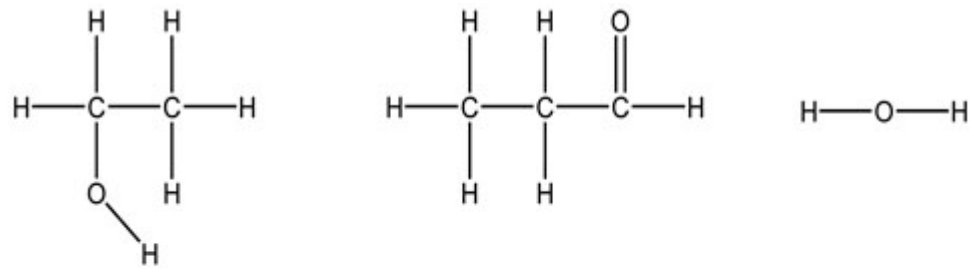
7. Would London dispersion or induced dipole-induced dipole forces also occur in the molecules at the right? If so why?

8. Are the molecules at the right polar or nonpolar?

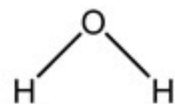
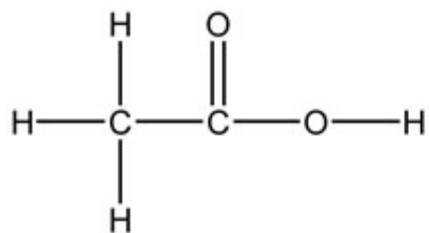
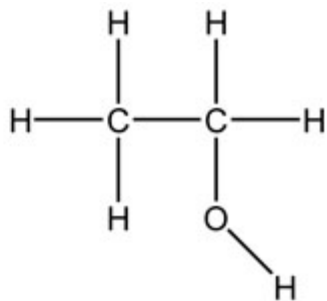
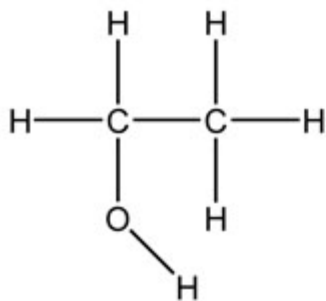


9. Would London dispersion or induced dipole-induced dipole forces also occur on these molecules? If so why?

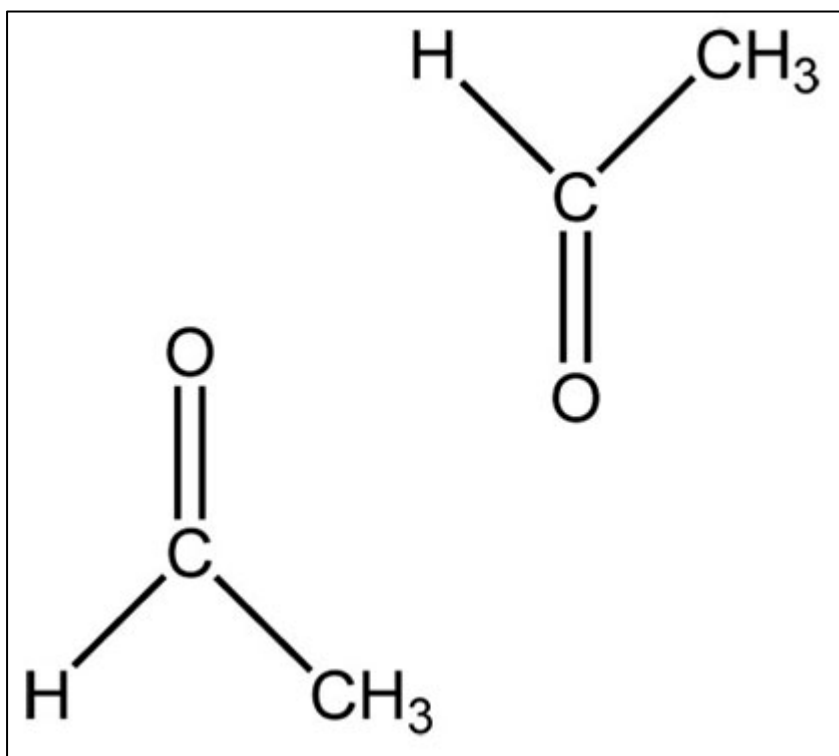
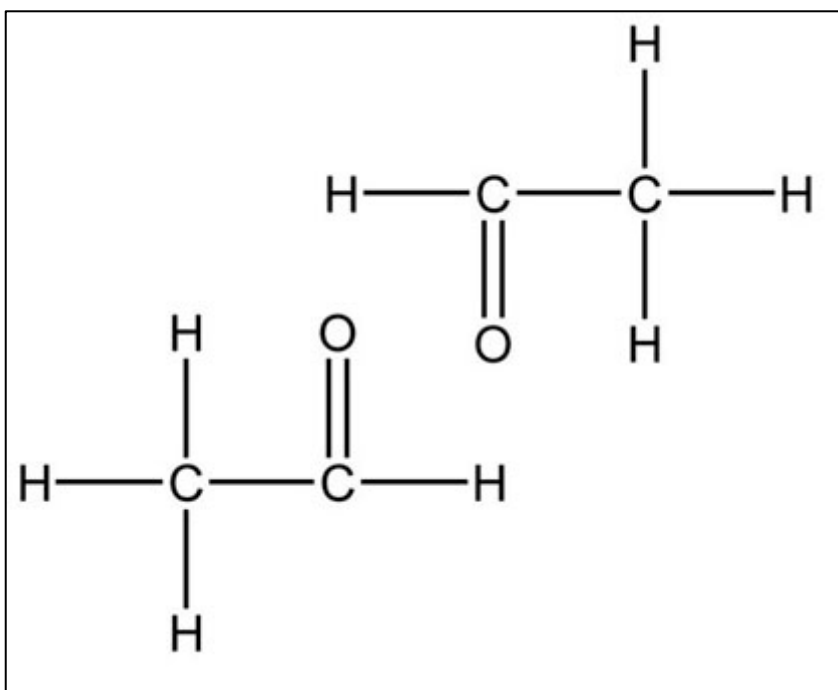
10. In the following molecules circle any polar hydrogens.

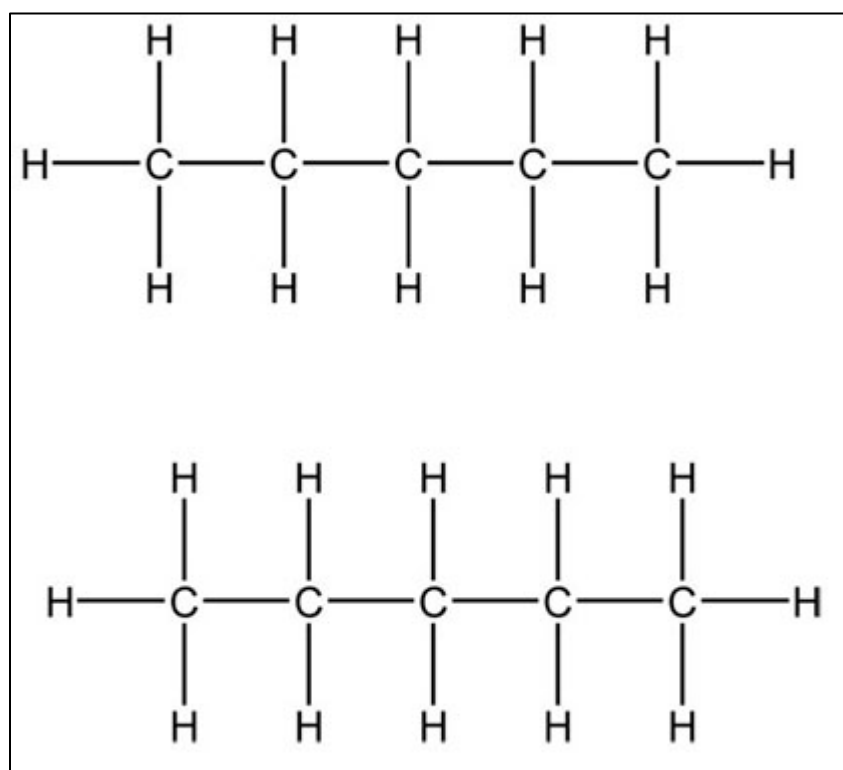
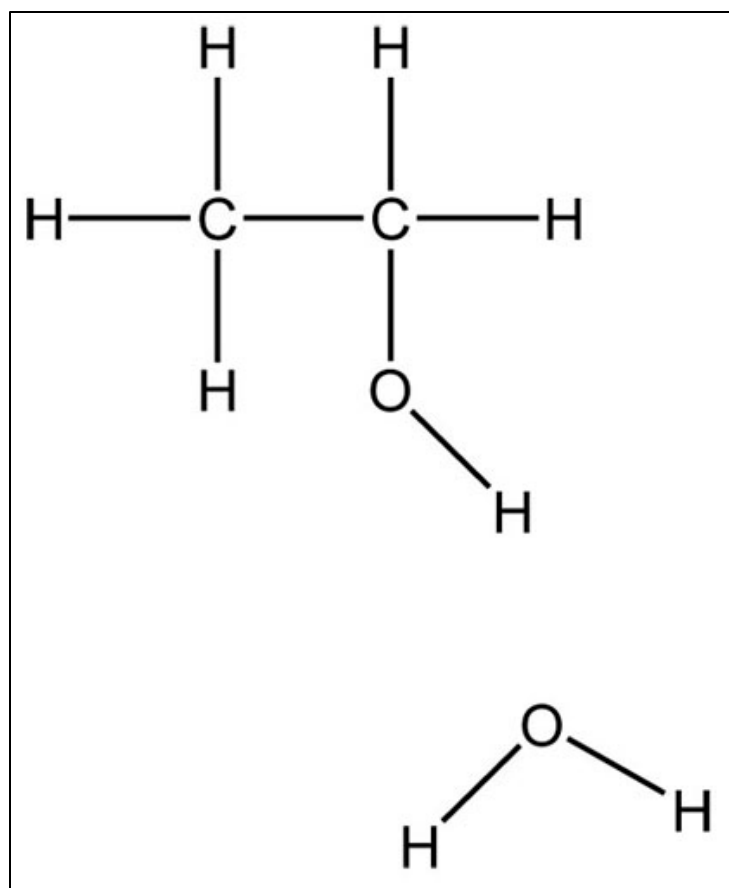


11. In the following molecules draw any hydrogen bonds that could form.



12. In the following sets of molecules, label the intermolecular attractions: dipole-dipole, hydrogen bonds, and London dispersion or induced dipole-induced dipole.





Organic Functional Groups

Alkanes

13. What elements are present in alkanes?
14. Are these molecules polar or nonpolar?
15. What types of intermolecular forces will occur between multiple copies of these molecules? Why?

Alcohols

16. What is the molecular formula of the alcohol functional group?
17. Is the alcohol functional group polar or nonpolar? How do you know?
18. Are there any polar hydrogens in the alcohol functional group? Why?
19. Can an alcohol hydrogen bond with other alcohol molecules?
20. Can alcohols hydrogen bond with water?

Aldehydes

21. What is the molecular formula of an aldehyde?
22. Are aldehydes polar or nonpolar? How do you know?

23. Do aldehydes have any polar hydrogens? Why?
24. Can an aldehyde hydrogen bond with other aldehydes?
25. Can aldehydes hydrogen bond with water? Is the hydrogen on the carbon with the double bonded oxygen polar or nonpolar?
26. What other type of intermolecular interaction can occur between two aldehydes?

Ketones

27. What is the molecular formula of a ketone functional group?
28. Is a ketone polar or nonpolar? How do you know?
29. Do ketones have any polar hydrogens? Why?
30. Can a ketone hydrogen bond with other ketones?
31. Can ketones hydrogen bond with water?
32. What other intermolecular interaction can occur between two ketones?

Carboxylic Acids

33. What is the molecular formula of a carboxylic acid?
34. Are carboxylic acids polar or nonpolar? How do you know?
35. Do carboxylic acids have any polar hydrogens? Why?
36. Do carboxylic acids hydrogen bond with water?
37. What other type of intermolecular interaction can occur between carboxylic acids?

Esters

38. What is the molecular formula of an ester?
39. Is an ester polar or nonpolar? How do you know?
40. Does an ester have any polar hydrogens? Why?
41. Can an ester hydrogen bond with another ester?
42. Can esters hydrogen bond with water?
43. What other type of intermolecular interaction can occur between ester molecules?

Amines

44. What is the molecular formula of an amine?
45. Are amines polar or nonpolar? How do you know?
46. Do amines have any polar hydrogens? Why?
47. Can amines hydrogen bond with other amines?
48. Can amines hydrogen bond with water?

Amides

49. What is the molecular formula of an amide?
50. Are amides polar or nonpolar? How do you know?
51. Do amides have any polar hydrogens? Why?
52. Can an amide hydrogen bond with other amides?
53. Can amides hydrogen bond with water?
54. What other intermolecular interaction can occur between two amides?

Practice

55. What functional group is shown in example 1?
56. What functional group is shown in example 2?
57. What functional group is shown in example 3?
58. What functional group is shown in example 4?
59. What functional group is shown in example 5?
60. What functional group is shown in example 6?
61. What functional group is shown in example 7?
62. Which functional groups contain oxygen atoms?
63. Which functional groups contain nitrogen atoms?
64. Do you think that having more than one functional group affects the physical and chemical properties of molecules? Why?