Benzene

These are all called “Aromatic” compounds

Bromobenzene or phenyl bromide

Benzoic acid

Salicylic acid

Phenol

Acetylsalicylic acid

Aspirin

Functional groups - Alcohols

Methyl alcohol (methanol)

Ethyl alcohol (ethanol)

Slightly less acidic than water
Mixes with water at any concentration

If you add 100 grams of ethyl alcohol to 100 grams of water what is the final mass?

A. Less than 200 grams
B. 200 grams
C. more than 200 grams

If you add 100 mL of ethyl alcohol to 100 mL of water what is the final volume?

A. Less than 200 mL
B. 200 mL
C. more than 200 mL

Short alcohols are infinitely soluble in water

But larger alcohols are not very soluble in water

Methanol does not disrupt H₂O hydrogen bond very much

But greasy chain of longer alcohol is bad. Disrupt H₂O structure.

Formic formica ant
Acetic acetum vinegar
Propanoic propion (Greek) first fat
Butyric butyrum butter
Valeric valeriana a flowering plant

Valeriana officinalis
Solubilities of small acids are infinite, but larger ones are small.

How can you make it more soluble?

Solubility of 0.0007 g / 100 ml H₂O

Soap at work

Fat
Acetic acid is an acid

$$\text{H}_2\text{O} + \text{CH}_3\text{CO}_2\text{H} \rightleftharpoons \text{CH}_3\text{CO}_2\text{H}^- + \text{H}_2\text{O}^+$$

$$K_a = 10^{-4.76}$$

$$pK_a = 4.8$$

Ethyl alcohol is also an acid

$$\text{H}_2\text{O} + \text{CH}_2\text{CH}_2\text{OH} \rightleftharpoons \text{CH}_2\text{CH}_2\text{O}^- + \text{H}_2\text{O}^+$$

$$K_a = 10^{-16}$$

$$pK_a = 16$$

But not nearly as strong.

The lower the $pK_a$ the stronger the acid.

Acetic acid more than $10^{11}$ times more acidic.

**Why is acetic acid more acidic than ethanol?**

$$\text{H}_2\text{O} + \text{CH}_3\text{CO}_2\text{H} \rightleftharpoons \text{CH}_3\text{CO}_2\text{H}^- + \text{H}_2\text{O}^+$$

$$K_a = 10^{-4.76}$$

$$\text{H}_2\text{O} + \text{CH}_2\text{CH}_2\text{OH} \rightleftharpoons \text{CH}_2\text{CH}_2\text{O}^- + \text{H}_2\text{O}^+$$

$$K_a = 10^{-16}$$

**Draw Lewis Structures**

Equilibrium arrow

Resonance arrow

Negative charge spread out over both oxygens. More stable.

**Carbonyl group**

**Hydroxyl group**

**Ester**

Substitute an alkyl group for the hydroxyl hydrogen.

**Ether**

**Carbonyl group**

**Ester**

**What if you only have the carbonyl?**

**Ketone**

**Aldehyde**
**Amines**
- \( \text{NH}_2 \)
- \( \text{NH} \)

**Amide**
- \( \text{CONH}_2 \)

**Nitrile**
- "cyanide"

**Name the functional group**
- Alcohol
- Carboxylic Acid
- Ester
- Ether
- Ketone
- Aldehyde
- Amine
- Amide
- Nitrile

**Periodic Table of Elements**

**Nucleus**
- \( 10^{-13} \text{ cm} \)
- \( e^- \): \( 9.1 \times 10^{-31} \text{ kg} \)
- \( p^+ \): \( 1.67 \times 10^{27} \text{ kg} \)
- \( n^0 \): \( 1.67 \times 10^{27} \text{ kg} \)

**Atom**
- \( 10^{-9} \text{ cm} \)

**All carbon atoms must have**
- i. 6 electrons
- ii. 6 protons
- iii. 6 neutrons

Which is true?
- A i
- B ii
- C iii
- D i + ii
- E i + iii
- F ii + iii
- G all
Atomic Weight from Periodic table is 12.0107

This means

A. One mole of carbon as found on earth has an average mass of 12.0107 grams.

B. One atom of carbon has an exact mass of 12.0107 atomic mass units.

C. Both are true.

<table>
<thead>
<tr>
<th>Mass of one atom</th>
<th>fraction</th>
</tr>
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<tbody>
<tr>
<td>$^{12}\text{C}_6$</td>
<td>12 amu</td>
</tr>
<tr>
<td>$^{13}\text{C}_6$</td>
<td>13.0033548378(10) amu</td>
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<tr>
<td>$^{14}\text{C}_6$</td>
<td>14.003241989(4) amu</td>
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<td>$^{11}\text{C}_6$</td>
<td>11.0114336(10) amu</td>
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Half life of 20.33 minutes