

1. (2 points) Why do small molecules such as water and ethanol have high boiling points compared to other molecules such as methane and ethane?

- (a) Alcohols will always have a higher boiling point than alkanes
- (b) Alcohols can hydrogen bond
- (c) Alcohols are ionic compounds
- (d) Alcohols have London dispersion forces
- (e) Alcohols are spirited molecules

(b) (2 points) Alcohols can hydrogen bond

2. (2 points) What molecule is responsible for alcohol poisoning when an individual consumes too much wine?

- (a) Acetaldehyde
- (b) Acetic Acid
- (c) Ethanol
- (d) Formaldehyde
- (e) Methanol

(c) (2 points) Ethanol is responsible for alcohol poisoning.

3. (2 points) When methanol is consumed (don't EVER do this!!) what molecule causes blindness?

- (a) Acetic Acid
- (b) Ethanol
- (c) Formaldehyde
- (d) Formic Acid
- (e) Methanol

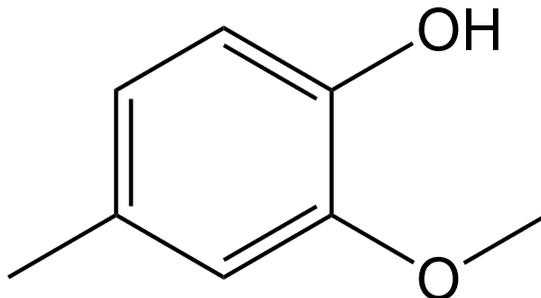
(d) (2 points) Formic acid is responsible for causing blindness.

4. (2 points) Why is vodka (water-ethanol mixture) a homogeneous mixture?

- (a) Ethanol and water participate in intermolecular hydrogen bonds
- (b) Ethanol and water mix only when cooled
- (c) Ethanol and water mix only when heated
- (d) Ethanol and water mix only when superheated
- (e) Ethanol and water mix when under pressure (greater than 5 atm)

(a) (2 points) Ethanol and water participate in intermolecular hydrogen bonds

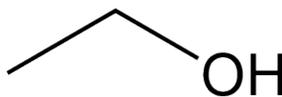
5. (1 points) Shown below is one of the molecules responsible for smoke taint in wine. Does the molecule have an alcohol functional group?



- (a) Yes
(b) No

(a) (1 point) The molecule is 2-methoxy-4-methylphenol (also called 4-methylguaiacol). It has an OH group so it is an alcohol.

6. (2 points) A glass of wine is 150. mL. Knowing that wine is 12% ethanol (v/v), calculate how many ethanol molecules are consumed in one glass of wine. Note, the density of ethanol is: $\rho_{\text{ethanol}} = 0.789 \frac{\text{g}}{\text{mL}}$ and $N_A = 6.023 \times 10^{23} \frac{\text{units}}{\text{mol}}$.



Ethanol

- (a) 1.52×10^{22} ethanol molecules
(b) 9.90×10^{22} ethanol molecules
(c) 1.86×10^{23} ethanol molecules
(d) 1.54×10^{24} ethanol molecules
(e) 3.43×10^{23} ethanol molecules

(c) (1 point)

First, we need to know the molar mass of ethanol.

$$M_{\text{C}_2\text{H}_6\text{O}} = 2(M_{\text{C}}) + 6(M_{\text{H}}) + 1(M_{\text{O}})$$

$$M_{\text{C}_2\text{H}_6\text{O}} = 2 \left(12.01 \frac{\text{g}}{\text{mol}} \right) + 6 \left(1.01 \frac{\text{g}}{\text{mol}} \right) + 1 \left(16.00 \frac{\text{g}}{\text{mol}} \right)$$

$$M_{\text{C}_2\text{H}_6\text{O}} = 46.08 \frac{\text{g ethanol}}{1 \text{ mol ethanol}}$$

Since only 12% of the volume is ethanol this means (150 mL)(0.12) = 18 mL is pure ethanol.

$$N_{\text{Ethanol}} = 150 \text{ mL wine} \times \frac{12 \text{ mL ethanol}}{100 \text{ mL wine}} \times \frac{0.789 \text{ g ethanol}}{1 \text{ mL ethanol}} \times \frac{1 \text{ mol ethanol}}{46.08 \text{ g ethanol}} \times \frac{6.023 \times 10^{23} \text{ ethanol molecules}}{1 \text{ mol ethanol}}$$

$$N_{\text{Ethanol}} = 1.86 \times 10^{23} \text{ ethanol molecules}$$