Exercises

The Mole & Solns FB Key

1. We will use ammonium carbonate to answer the following questions.

a) What is the chemical formula for ammonium carbonate?

$(NH_4)_2CO_3$

b) What is the molar mass of ammonium carbonate?

$2N + 8H + C + 3O$

96.11g/mole

c) What is the mass of 0.950 mol of ammonium carbonate?

$$0.950\,\text{mol}\,(NH_4)_2CO_3 \left| \frac{96.11\,\text{g}}{1\,\text{mol}\,(NH_4)_2CO_3} \right. = 91.3\,\text{g}\,(NH_4)_2CO_3$$

d) How many moles of ammonium carbonate are present in 0.475 g?

$$0.475\,\text{g}\,(NH_4)_2CO_3 \left| \frac{1\,\text{mol}}{96.11\,\text{g}\,(NH_4)_2CO_3} \right. = 0.00494\,\text{mol}\,(NH_4)_2CO_3$$

or

$4.94 \times 10^{-3}\,\text{mol}\,(NH_4)_2CO_3$

e) How many carbonate ions are present in 0.25 moles of ammonium carbonate?

$$0.25\,\text{mol}\,(NH_4)_2CO_3 \left| \frac{1\,\text{mol}\,CO_3^{2-}}{1\,\text{mol}\,(NH_4)_2CO_3} \right| \frac{6.02 \times 10^{23}\,CO_3^{2-}\,\text{ions}}{1\,\text{mol}\,CO_3^{2-}} =$$

$1.5 \times 10^{23}\,CO_3^{2-}$ ions

f) How many ammonium ions are present in 0.25 moles of ammonium carbonate?

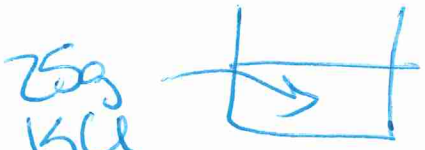
$$0.25\,\text{mol}\,(NH_4)_2CO_3 \left| \frac{2\,\text{mol}\,NH_4^+}{1\,\text{mol}\,(NH_4)_2CO_3} \right| \frac{6.02 \times 10^{23}\,NH_4^+\,\text{ions}}{1\,\text{mol}\,NH_4^+} =$$

$3.0 \times 10^{23}\,NH_4^+$ ions

g) How many moles of ammonium ions are present in 2.30 g of ammonium carbonate?

$$2.30\,\text{g}\,(NH_4)_2CO_3 \left| \frac{1\,\text{mol}\,(NH_4)_2CO_3}{96.11\,\text{g}} \right| \frac{2\,\text{mol}\,NH_4^+}{1\,\text{mol}\,(NH_4)_2CO_3} = 0.048\,\text{mol}\,NH_4^+$$

2. We have a 25 g sample of potassium chloride and a 25 g sample of magnesium chloride. Which sample contains the most chloride ions? Show the calculations to support your answer.



25g KCl

$KCl \rightarrow K^+ + Cl^-$

74.55 g/mol

$25\,g\,KCl \left| \frac{1\,mol\,KCl}{74.55\,g} \right| \frac{1\,mol\,Cl^-}{1\,mol\,KCl}$

$0.34\,mol\,Cl^-$

25g $MgCl_2$

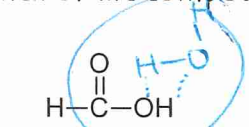
$MgCl_2 \rightarrow Mg^{2+} + 2Cl^-$

95.21 g/mol

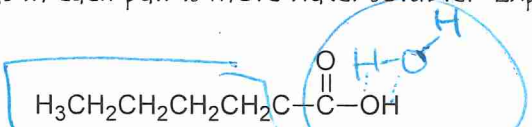
$25\,g\,MgCl_2 \left| \frac{mol\,MgCl_2}{95.21\,g} \right| \frac{2\,mol\,Cl^-}{1\,mol\,MgCl_2}$

$0.53\,mol\,Cl^-$

3. Which of the compounds in each pair is more water soluble? Explain your reasoning.

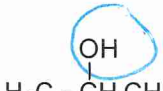
a) 
methanoic acid

or

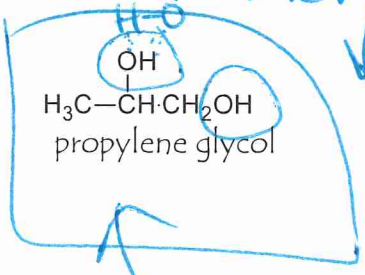

hexanoic acid

larger hydrophobic non-polar region ↓ H_2O solubility

H_2O soluble

b) 
isopropanol

or

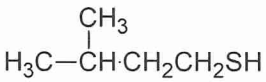

propylene glycol

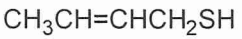
2 hydrophilic hydroxyl groups

* update for Sp 14

AR?

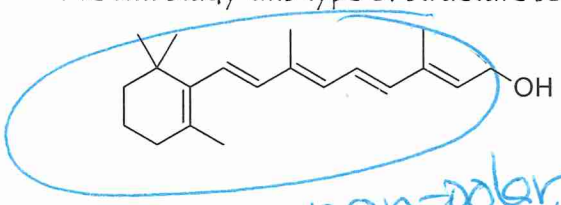
4. Skunk spray contains the two molecules below. Based on the structures, explain why skunk spray is hard to rinse off with water alone.





Low polarity creates low H_2O solubility.

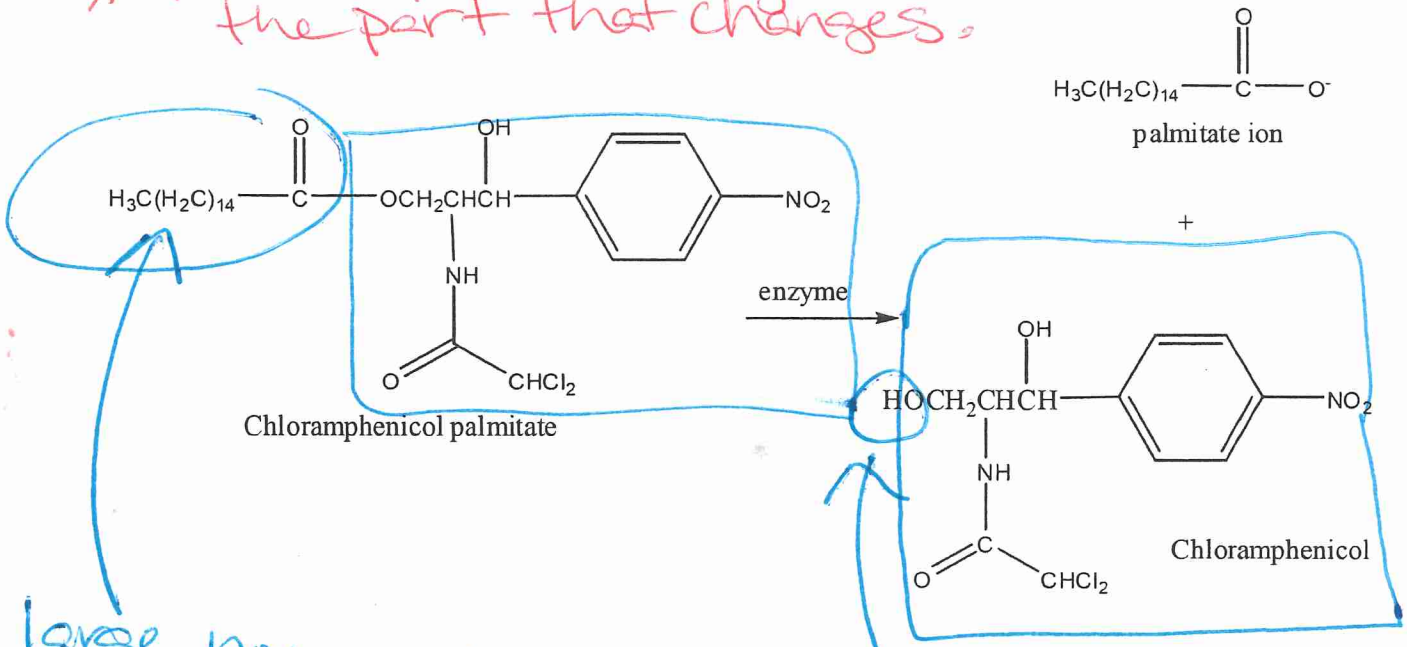
5. The structure of vitamin A is shown below. Vitamin A is not water soluble. Explain why. Each corner and the end of each line represent a carbon atom. The H atoms are understood. We will study this type of structure soon.



large non-polar region ↓ H_2O solubility

6. Why is chloramphenicol palmitate less water soluble than chloramphenical?

* Box the part that stays the same & circle the part that changes.



large non-polar region ↓ H_2O solubility VS small H atom ↑ H_2O solubility