Bio 111 Handout for Chemistry 1

This handout contains:
1. Today's iClicker Questions
2. Some Atomic Structure Practice Problems and Solutions

iClicker Question #8A - <u>before</u> lecture

Consider Campbell figure 2.4; which of the following statements is/are **<u>false</u>**?

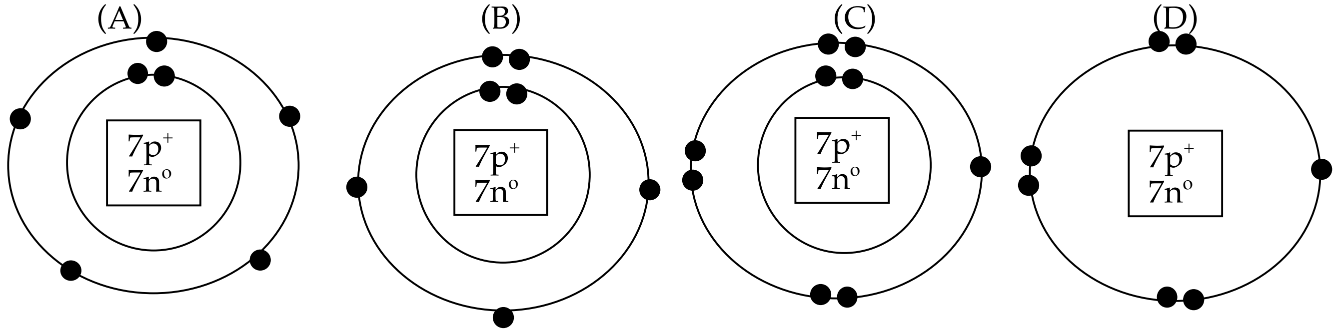
A. Electrons have a positive charge.
B. Neutrons have a negative charge.
C. Protons have a negative charge.
D. Electrons are found in the nucleus of an atom.
E. More than one of the above is false.

---

iClicker Question #8B - <u>after</u> lecture

Given that Nitrogen has 7 protons and 7 neutrons in its nucleus, which of the following is the correct electron configuration for Nitrogen. (filled circles represent electrons).

(A) (B) (C) (D)



E) I don't know.

<u>Beaming in your answers</u>
1. Figure out your answer and select the appropriate letter (A-E).
2. Turn on your iCliker by pressing the "ON/OFF" button; the blue "POWER" light should come on. If the red "LOW BATTERY" light comes on, you should replace your batteries soon.
3. Transmit your answer as follows:
   a. Press the button corresponding to the answer you've selected (A thru E).
   b. The "STATUS" light will flash green to indicate that your answer has been received. If the "STATUS" light flashed red, your answer was not received; you should re-send it until you get a green "STATUS" light.

Atomic Structure Practice Problems

1) Atomic Structure, electronegativity, & polarity

For each of the following groups of elements:

i) Draw out their electronic configuration like in Campbell figure 2.8.

ii) Predict the number of covalent bonds the element could form. The number of covalent bonds an element can form is (for the purposes of Bio 111) the <u>lower</u> of these two numbers:

- the number of electrons in its outermost shell

or: • the number of electrons required to complete the outermost shell

iii) Rank the three elements in order of increasing electronegativity.

iv) Draw a molecule using these three elements and label the bonds as either polar or nonpolar.

a) Lithium (Li, 3 electrons), Fluorine (F, 9 electrons), and Carbon (C, 6 electrons).

b) Hydrogen (H, 1 electron), Beryllium (Be, 4 electrons), Nitrogen (N, 7 electrons), and Oxygen (O, 8 electrons).

Solutions to Atomic Structure Practice problems

1) Atomic Structure, electronegativity, & polarity

a) Lithium has 2 electrons in its inner shell and 1 in its outer shell. Therefore, it will form 1 covalent bond – it has only one electron to share. That outer electron "sees" a kernal charge of (+3)[nucleus] + (-2)[inner electrons] or +1, so Li is not very electronegative.

Fluorine has 2 electrons in its inner shell and 7 in its outer shell. Therefore, it will form 1 covalent bond – it only needs one electron to fill its outer shell. The outer electrons "see" a kernal charge of (+9)[nucleus] + (-2)[inner electrons] or +7, so F is very electronegative.

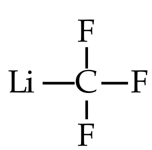
Carbon has 2 electrons in its inner shell and 4 in its outer shell. Therefore, it will form 4 covalent bonds – it has only 4 electrons to share and/or it only needs 4 electrons to fill its outer shell. The outer electrons "see" a kernal charge of (+6)[nucleus] + (-2)[inner electrons] or +4, so C has an intermediate electronegativity.

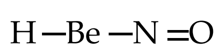
b) Beryllium has 2 electrons in its inner shell and 2 in its outer shell. Therefore, it will form 2 covalent bonds – it has only 2 electrons to share. The outer electrons "see" a kernal charge of (+4)[nucleus] +
(-2)[inner electrons] or +2, so Be is not very electronegative.

Oxygen has 2 electrons in its inner shell and 6 in its outer shell. Therefore, it will form 2 covalent bonds – it only needs two electrons to fill its outer shell. The outer electrons "see" a kernal charge of (+8)[nucleus] + (-2)[inner electrons] or +6, so O is very electronegative.

Nitrogen has 2 electrons in its inner shell and 5 in its outer shell. Therefore, it will form 3 covalent bonds - it only needs 3 electrons to fill its outer shell. The outer electrons "see" a kernal charge of (+7)[nucleus] + (-2)[inner electrons] or +5, so N has an intermediate electronegativity.

Here are some sample (hypothetical - most of these would not be stable, but that is beyond the scope of Bio 111) molecules. All the bonds would be polar.





Bio 111 Handout for Chemistry 2

This handout contains:
1. Today's iClicker Questions
2. A handout on Electronegativity
3. Information for Exam 1

iClicker Question #9A - before lecture

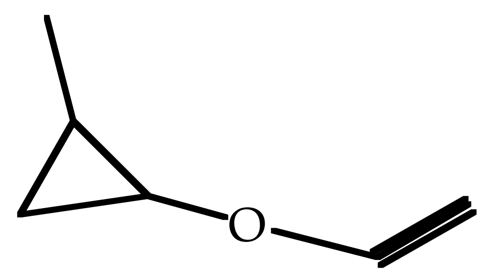
Which of the following statement(s) is/are true?

A) A covalent bond is where one atom removes an electron from another atom.
B) A covalent bond is where two atoms share a pair of electrons.
C) A covalent bond is where the nuclei of two atoms join together.
D) All are true.
E) None are true.

iClicker Question #9B - after lecture

How many hydrogen atoms are there in this molecule?

A) none of these
B) 6 hydrogens
C) 7 hydrogens
D) 8 hydrogens
E) I don't know



Beaming in your answers

1. Figure out your answer and select the appropriate letter (A-E).
2. Turn on your iClicker by pressing the "ON/OFF" button; the blue "POWER" light should come on. If the red "LOW BATTERY" light comes on, you should replace your batteries soon.
3. Transmit your answer as follows:
   a. Press the button corresponding to the answer you've selected (A thru E).
   b. The "STATUS" light will flash green to indicate that your answer has been received. If the "STATUS" light flashed red, your answer was not received; you should re-send it until you get a green "STATUS" light.

Atomic structure, kernel charge, & electronegativity

Several questions came from students regarding the previous lecture.

(1) How do you know the number of neutrons in the nucleus?

The rules are:

- atomic number = # of protons in nucleus
- since an atom by itself is neutral (no net charge)
  atomic number = # protons in nucleus = total # of electrons in all shells.
- the atomic weight = # protons + # neutrons
  the # of neutrons is roughly = # of protons, but it need not be so.

So for example, the most common form of nitrogen has

atomic number = 7
atomic weight = 14
therefore:
- in the nucleus 7 protons + 7 neutrons (7+7=14)
- 7 electrons orbiting the nucleus
  = 2 in the inner shell
  + 5 in the outer shell
  = one lone pair
  + 3 unpaired (so it makes 3 covalent bonds)

(2) Kernel charge, what is it?

Here's the scoop. In Bio 111, we only care about the outer shell electrons, since they are the only ones involved in bonding with other atoms. Later on, we will want to know how tightly each atom holds on to these outer shell electrons - this is electronegativity. Highly electronegative atoms hold their electrons tightly. How tightly they are held depends on two factors:

- the charge that the outer electrons "see" from the combination of the nucleus and inner electrons. This is the kernel charge. The higher the kernel charge, the more tightly the electrons are held, the higher the electronegativity.
- how far the outer electrons are from the nucleus. The farther they are from the nucleus, the weaker they are held, the lower the atom's electronegativity. We won't worry about this factor in Bio 111.

For example, look at figure 2.8 in Campbell.
– Look at lithium. Since its atomic number is 3 (that's what the 3 in $_3$Li means), it has 3 protons in the nucleus and 3 electrons in orbit. The outer shell electron orbits the +3 in the nucleus. (Maybe it would help to write "+3" in the gray nucleus and "-1" by each of the blue electrons). However this +3 charge this is shielded by the 2 inner electrons. Since the inner electrons move so fast, they neutralize some of the nucleus' + charge. Thus the outer electron actually "sees" (that is, it is attracted by) a kernel charge of only +1 ([+3] + [-2] = +1). So the outer electron of lithium is held only weakly and therefore, lithium has a very low electronegativity.

– Look at Fluorine. Since its atomic number is 9 (that's what the 9 in $_9$F means), it has 9 protons in the nucleus and 9 electrons in orbit. The outer shell electrons orbit the +9 in the nucleus. However this +9 charge this is shielded by the 2 inner electrons. Since the inner electrons move so fast, they neutralize some of the nucleus' + charge. Thus each outer electron actually "sees" (that is, it is attracted by) a kernel charge of +7 ([+9] + [-2] = +7). So the outer electrons of fluorine are held very tightly and therefore, fluorine has a very high electronegativity.

Bio 111: Information for Exam I

<u>Basic Facts</u>

• The exam will be held in Lipke Auditorium
• The exam will consist of roughly 6 questions in two parts:
  – Part 1 on a Friday {see syllabus for date} from 12:30 to 1:20 & will have ~3 questions.
  – Part 2 on Monday {see syllabus for date} from 12:30 to 1:20 & will have ~3 questions.

⇒ These will not be multiple choice; they will be problem-solving. A typical problem starts with a simple question, and then gets harder.

• Since Lipke will be very crowded, I will hand out two different exams to prevent cheating. The two exams will contain virtually-identical problems; students sitting in adjacent seats will receive different exams.
• No talking or communication of any kind between students is permitted once the exam begins. If you have a question, ask me or your TA. Anyone caught talking will be removed from the class.
  – For a rough idea of what the exam might be like, work through the problems assigned in Chapter 1 of APAIB. The easiest problems on the exam will be like #'s 1.1.2 - 1.1.4. The hardest problems would be like #'s 1.3.5, 1.3.10 and 3.8. Problems as difficult as 3.9 will not be found on the exam.
  – A copy of exam 1 from a previous year is near the end of the Lab Manual.
  – You need to know how to solve problems involving:
    • one gene
    • two or more alleles
    • sex-linked & autosomal traits
    • simple-/co-/incomplete-dominance
    • probability & risk
    • pedigrees
    • XX/XY and ZZ/ZW sex-linkage
    • the overall processes of mitosis & meiosis like you did for the Mitosis lab report
    • how chromosomes look in interphase before duplication, metaphase, and at telophase of mitosis, meiosis I and meiosis II (ONLY)
• You will need to know how blood-type and hemophilia are inherited in humans (the genes, alleles, and contributions to phenotype).

• I will list the sexes of various individuals in a problem whether the trait is sex-linked or not.

– You **<u>do not</u>** need to know:
  • the details of any genetic disease or trait (except blood-type & hemophilia in humans)
  • chemistry

• You may bring in a single sheet of (8 1/2 x 11 inch) paper with any notes you want. You may write on either or both sides.

<u>Tips</u>

• The best way to learn genetics is to work the problems in APAIB. You should work through all of these that I have assigned. Solutions can be found on the CD-ROM that came with the book; you should look at the solutions - they provide very useful problem-solving tips - **<u>BUT</u>** you should work through the problems and write out answers **<u>before</u>** looking at the solutions.

• Almost all of the questions will ask you to explain your reasoning or justify your answer. In general, the majority of the points on any question will be for the explanation rather than the answer itself. As a result:

- – Explain yourself carefully and thoroughly; this will increase your chances of part credit.
- – Be careful not to write more than necessary; you will be penalized for extra added wrong answers.
- – Be careful to make your choice of answer clear. If you write, "dominant unless it is recessive" (for example) you will get no credit.
- – Try to use the terms correctly and use standard genotype notation; this will make it easier for the graders to read and therefore more likely to get part credit.

• **<u>Be extremely careful about the genotype symbols you use!</u>** If you choose the wrong symbols, it makes your answer hard to understand and it will be very difficult to give you credit for your work. Here are some common mistakes:

- – using sex-linked allele symbols (X^D, etc.) for an autosomal model (and vice-versa); this will cost you at least 50% of the points on a question.
- – defining one set of symbols at first but using different symbols later on in the same problem (unless the problem specifically tells you to use new symbols); in this case, you will get little or no credit for your work.
- – giving <u>genotypes</u> when we ask for <u>alleles</u>. For example, in the familiar table:

allele	contribution to phenotype
A	tall (dominant)
a	short (recessive)

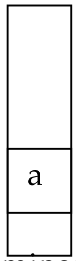
is correct, however:

allele	contribution to phenotype
AA	tall
Aa	tall
aa	short

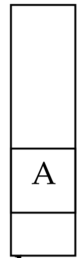
is **<u>not</u>** correct since "AA" is a <u>genotype</u>, not an <u>allele</u>.

Solutions to Fall 2000 Exam I

1) a) Aa b) i)



ii)



2) a) autosomal dominant

b)

allele	**contribution**
D	disease (dominant)
d	normal (recessive)

c) #1: Nn #2: nn #3: Nn #4: Nn

d) Nn X Nn gives 1NN:2Nn:1nn or 3:1 diseased: normal. Therefore, there is a 75% chance that she will be affected.

3) a) Tom must be I^AI^B and Ann is I^AI^A or I^Ai. They can have type A and AB children for sure. They may be able to have type B children if Ann is I^Ai. They can't have a type O child. Therefore, they are not Rodger's parents.

Peter and Sally are either I^BI^B or I^Bi. They can have type B children for sure, and, if they are both I^Bi, a type O child. They can't have a type A child. Therefore, they are not Cathy's parents.

b) Since Ann's parents are both I^AI^B, she must be I^AI^A. Therefore, with Tom (I^AI^B), she can only have type A or AB children; they cannot have a type B child. Therefore, they must be Cathy's parents.

c) Since Peter's parents are I^B? and ii, he must be I^Bi. Since Sally's parents are both I^AI^B, she must be I^BI^B. Therefore, while they can have a type B child, they cannot have a type O child. Therefore, they are Steve's parents.

4) a) Autosomal recessive: NO. It is possible, but it requires 4 unrelated individuals to bring in the disease allele (#s 1, 2, 3, & 6) so it is less likely than sex-linked recessive, which requires only 2 unrelated individuals (#s 1 & 3) to bring in the disease allele. Since the disease is rare, unrelated individuals with the disease are also rare.

b) Autosomal Dominant: NO. It is impossible. In AD, for a child to be affected, at least one of his/her parents must be affected. In this case, #9 is affected but neither of his parents is affected so the disease cannot be inherited in an AD manner.

c) Sex-linked recessive. YES

allele	**contribution**
X^D	normal (dominant)
X^d	disease (recessive)
Y	none

#1: X^dX^d #3: X^DX^d #5: X^dY #7: X^DX^d #9: X^dY

d) #6 (X^DY) X #7 (X^DX^d) --> the sons will be 50% X^DY (normal) and 50% X^dY (diseased). SO the chance that their next son will be affected is 50%.

5) a)

allele	**contribution**
P	purple (dominant)
p	blue (recessive)

b)

allele	**contribution**
P	purple (dom to all)
B	blue (dom to red; rec to purple)
r	red (rec to all)

c) 1: PB or Pr 2: PP

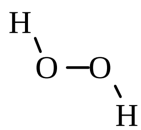
3: PB 4: Pr 5: BB

Bio 111 Handout for Chemistry 3

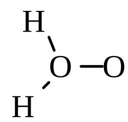
This handout contains:
1. Today's iClicker Questions
2. A handout for today's lecture

iClicker Question #10A - <u>before</u> lecture

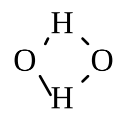
Which of the following structure(s) would be correct for hydrogen peroxide (H_2O_2)?
(Note that I have left out the lone pairs for simplicity).



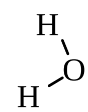
(A)



(B)



(C)



(D)

(E) None of the above.

iClicker Question #10B - <u>after</u> lecture

Which of these molecules is most likely to be the most viscous in pure form?

$H_3C-CH_2-CH_2-CH_2$-SH
(A)

H_3C-CH_2-OH
(B)

HO$-CH_2-CH_2$-OH
(C)

H_3C-CH_2-SH
(D)

(E) I don't know.

<u>Beaming in your answers</u>

1. Figure out your answer and select the appropriate letter (A-E).
2. Turn on your iClicker by pressing the "ON/OFF" button; the blue "POWER" light should come on. If the red "LOW BATTERY" light comes on, you should replace your batteries soon.
3. Transmit your answer as follows:
   a. Press the button corresponding to the answer you've selected (A thru E).
   b. The "STATUS" light will flash green to indicate that your answer has been received. If the "STATUS" light flashed red, your answer was not received; you should re-send it until you get a green "STATUS" light.

The Billiard-Ball Hydrogen Bond Demonstration

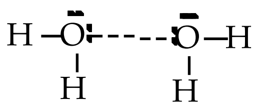
Bio 111 Handout for Chemistry 4

This handout contains:
1. Today's iClicker Questions
2. The handout for today's lecture.
3. Summary of Basic Chemistry Lectures

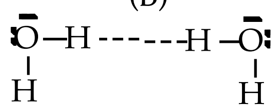
iClicker Question #11A - <u>before</u> lecture

Which of the following dotted lines shows a possible hydrogen bond?

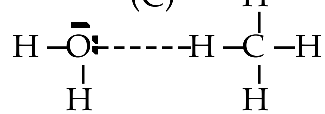
(A)



(B)



(C)

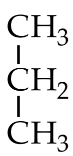


D) All three are possible hydrogen bonds.
E) None of the three are possible hydrogen bonds.

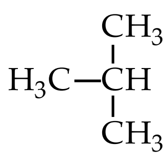
iClicker Question #11B - <u>after</u> lecture

Which is the MOST hydro<u>PHOBIC</u> molecule?

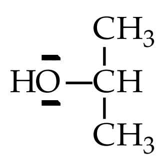
(A)



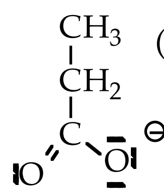
(B)



(C)



(D)



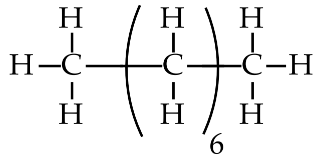
E) I don't know

<u>Beaming in your answers</u>
1. Figure out your answer and select the appropriate letter (A-E).
2. Turn on your iClicker by pressing the "ON/OFF" button; the blue "POWER" light should come on. If the red "LOW BATTERY" light comes on, you should replace your batteries soon.
3. Transmit your answer as follows:
    a. Press the button corresponding to the answer you've selected (A thru E).
    b. The "STATUS" light will flash green to indicate that your answer has been received. If the "STATUS" light flashed red, your answer was not received; you should re-send it until you get a green "STATUS" light.

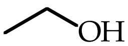
Bio 111 Hydro*phobic* & Hydro*philic* Molecules

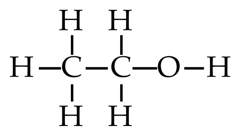
Abbreviated Structure | Complete structure | Cartoon

octane

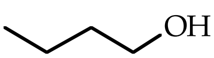


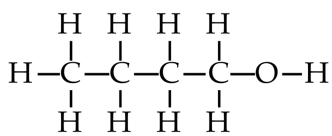
ethanol (ethyl alcohol)



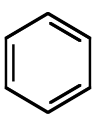


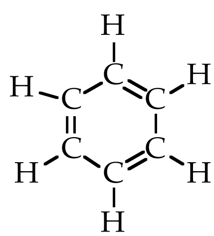
butanol (butyl alcohol)



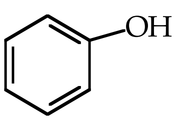


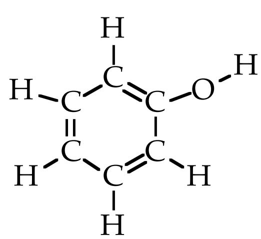
benzene



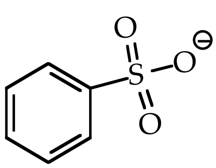


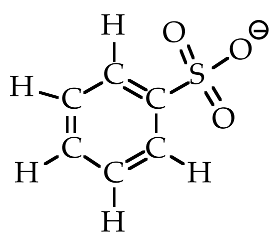
phenol





benzene sulfonic acid





(note sulfur making 6 bonds - an exception)

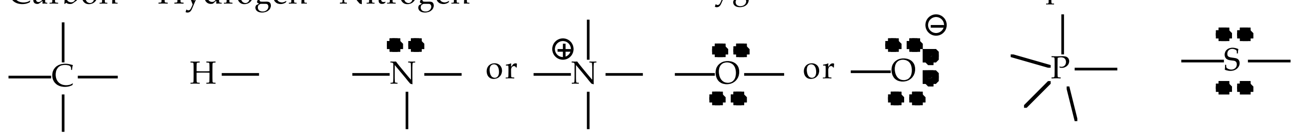
Bio 111 Basic Chemistry Summary

This is intended to summarize the basic chemistry you need to know in Biol 111. This material was covered in the three Chemistry lectures.

<u>(1) Atoms</u>:

- These are the atoms you'll need to know about in Biol 111; they show the number of **<u>covalent bonds</u>** each atom can make.
- Each line (–) represents a **<u>covalent bond</u>** to another atom.
- The double dots (:) represent lone pairs of electrons; these are **<u>not</u>** involved in forming covalent bonds. Note that they are not always shown. On oxygen or nitrogen, the lone pairs can form **<u>hydrogen bonds</u>**.

Carbon Hydrogen Nitrogen Oxygen Phosphorus Sulfur



<u>(2) Covalent Bonds</u>: A **<u>covalent bond</u>** involves sharing of a pair of electrons between two atoms.

- If the atoms have similar electronegativities, the electrons are shared equally and the bond is **<u>non-polar</u>**.
  - – Non-polar bonds covalent will be represented by a line: –.
  - § Portions of molecules with many non-polar bonds will tend to be **<u>hydrophobic</u>**.
- If the atoms have different electronegativities, the electrons are shared un-equally and the bond is **<u>polar</u>**.
  - – Polar covalent bonds will be represented by an arrow pointing towards the slightly negative atom (the one with the higher electronegativity): $\delta^{+}\rightarrow\delta^{-}$.
  - § Portions of molecules with polar bonds will tend to be **<u>hydrophilic</u>**.

	C	H	N	O	P	S
C	**C–C** **– non-polar** **§ 'phobic**	**C–H** **– non-polar** **§ 'phobic** **(¶ H<u>cannot</u> form H-bonds)**	C→N – polar § 'philic ¶ H-bonds to lone pair on N	C→O – polar § 'philic ¶ H-bonds to lone pair on O	not seen in Bio 111	**S–C** **– non-polar** **§ 'phobic**
H		**H–H** **– non-polar** **§ 'phobic**	H→N – polar § 'philic ¶ H-bonds to lone pair on N ¶ H <u>**can**</u> form H-bond.	H→O – polar § 'philic ¶ H-bonds to lone pair on O ¶ H <u>**can**</u> form H-bond.	not seen in Bio 111	**S-H** **– non-polar** **§ 'phobic** **(¶ H <u>cannot</u> form H-bonds)**
O					P→O – polar § 'philic ¶ H-bonds to lone pair on O	S→O – polar § 'philic ¶ H-bonds to lone pair on O

<u>Note</u>: Bonds not listed in the table (C–P, etc.) are not seen in Bio 111.

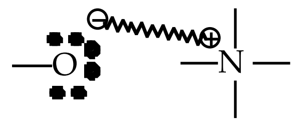
3) Non-covalent Bonds: There are three kinds we will encounter in Bio 111:

a) Ionic (or electrostatic) bonds: These are based on the principle: "unlike charges attract".

They **only** occur between fully-charged atoms – that is atoms marked by a ⊕ or a ⊖ (**not** between partially-chaged atoms like δ^{+} or δ^{-}).

Note: like charges repel - that is, two ⊖ charges or two ⊕ charges would repel.

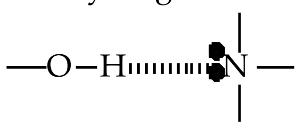
- The symbol for an ionic bond is a wavy line:
- In proteins, virtually all ionic bonds are between:
  - (+) a nitrogen making 4 bonds
  - (–) an oxygen making 1 bond



b) Hydrogen Bonds: ("H-bonds") These involve two partners:

- a hydrogen donor: a hydrogen attached by a covalent bond to an oxygen or a nitrogen
- a hydrogen acceptor: a lone pair of electrons on an oxygen or nitrogen
- the symbol for a hydrogen bond is a dashed line:

For example:



Note: hydrogens attached to carbon **can not** form hydrogen bonds.

c) Hydrophobic effect: This is where hydrophobic parts of molecules stick together to avoid contact with water. See below for a discussion of hydrophobic/hydrophilic.

d) van der Walls (VDW) interactions: Any two atoms, as long as they are close enough, are attracted by a van der Waals interaction.

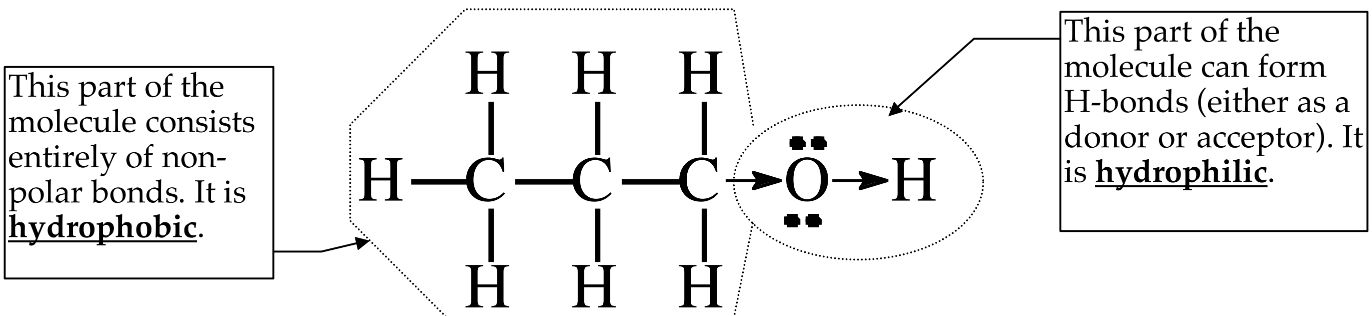
Relative strengths:	strongest:	ionic
		hydrogen
		hydrophobic
	weakest:	van der Waals

4) Hydrophobic & Hydrophilic

• Hydro**phobic** - parts of molecules that have only non-polar bonds.
  – these parts would 'prefer' not to be in water
  – molecules that are mostly hydrophobic are not water-soluble

• Hydro**philic** - parts of molecules that can make hydrogen bonds or are fully-charged (⊕ or ⊖).
  – charged parts of molecules are more hydrophilic that those that can just make H-bonds
  – these parts can form bonds with water and would therefore 'prefer' to be in water.
  – only a small fraction of hydrophilic parts will make a molecule water-soluble

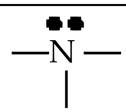
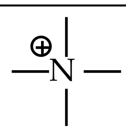
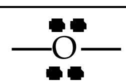
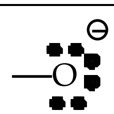
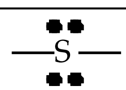
Note: you **cannot** predict if a molecule will be soluble or not, but you **can** predict relative solubilities.



Note: with rare exceptions, you cannot say "this molecule is hydrophobic" or "this molecule is hydrophilic". The exceptions are molecules that are entirely non-polar (CH_4 for example) or entirely hydrophilic (NH_3 for example). For molecules which have both parts, there is no rule for how much 'philic stuff is required to make it 'philic overall. In general, however, even one 'philic part will overcome the 'phobic tendencies of all but the largest hydrophobic regions.

Summary Chart: “How to read chemical structures”

- See previous pages for details & exceptions.
- This information holds for the molecules we’ll see in Bio 111. It is not guaranteed to be complete in more advanced classes.
- Bonds not listed in the table (C–P, etc.) are not seen in Bio 111.

If you see.. **Part of molecule**	You should think.... **Properties**				
	Bond is polar or non-polar.	Contributes to making a region hydrophobic or hydrophilic.	Can make ionic bonds.	Can make hydrogen bonds.	Can make a hydrophobic interaction.
C–C	non-polar	‘phobic	no	no	yes
C–H	non-polar	‘phobic	no	no	yes
C–N	polar	‘philic	[a]	‡	no
C–O	polar	‘philic	[a]	‡	no
C–S	non-polar	‘phobic	no	no	yes
O–H	polar	‘philic	[a]	yes	no
N–H	polar	‘philic	[a]	yes	no
P–O	polar	‘philic	[a]	‡	no
S–H	non-polar	‘phobic	no	no	yes
S–O	polar	‘philic	[a]	‡	no
	§	‘philic	no	yes	no
	§	‘philic	yes	no	no
	§	‘philic	no	yes	no
	§	‘philic	yes	yes	no
	§	‘phobic	no	no	yes

Notes:
* Assuming a suitable partner is nearby.
[a] If the O or N is charged, “yes”; if not “no”.
‡ Yes, if the N or O has a lone pair available.
§ Since this is an atom, not a bond, it is neither polar nor non-polar.

- van der Waals interactions are always possible.

Bio 111 Handout for Chemistry 5

This handout contains:
1. Today's iClicker Questions
2. The handouts for today's lecture.

iClicker Question #12A - before lecture

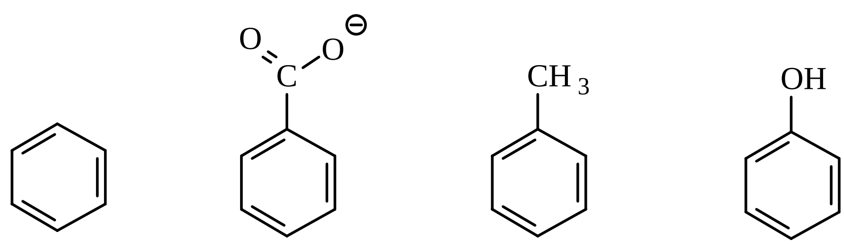
Consider the structures of pyridoxine (Vitamin B6) and tocopherol (Vitamin E). You can find them on the web (try googling 'pyridoxine structure' and 'tocopherol structure'). Based on this information, which of the following is true?

A) Neither vitamin B6 nor vitamin E are likely to be water-soluble.
B) Vitamin B6 is likely to be water soluble; vitamin E is not.
C) Vitamin E is likely to be water soluble; vitamin B6 is not.
D) I don't know.

---

iClicker Question #12B - after lecture

Which is the MOST hydroPHILIC molecule?



(A) (B) (C) (D)

5) I don't know

Beaming in your answers

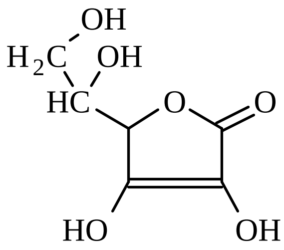
1. Figure out your answer and select the appropriate letter (A-E).
2. Turn on your iClicker by pressing the "ON/OFF" button; the blue "POWER" light should come on. If the red "LOW BATTERY" light comes on, you should replace your batteries soon.
3. Transmit your answer as follows:
    a. Press the button corresponding to the answer you've selected (A thru E).

b. The “STATUS” light will flash green to indicate that your answer has been received. If the “STATUS” light flashed red, your answer was not received; you should re-send it until you get a green “STATUS” light.

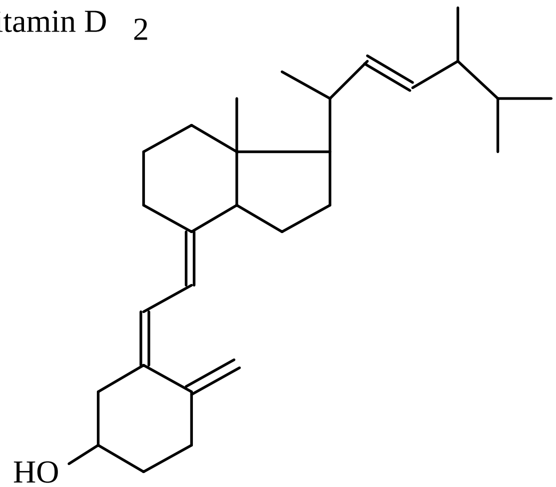
Abbreviated Structure

Cartoon

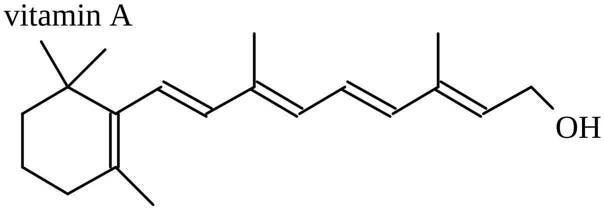
vitamin C



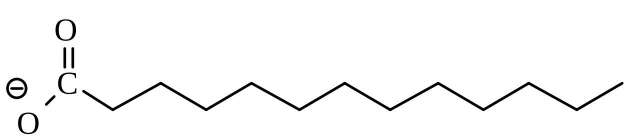
vitamin D 2



vitamin A



soap



Bio 111 Soap Molecules

All soap and detergent molecules have a hydrophilic head and a hydrophobic tail.
The structures of several soap molecules are shown below:

Hydrophilic "head" | Hydrophobic "tail"

<u>Simple soap</u>

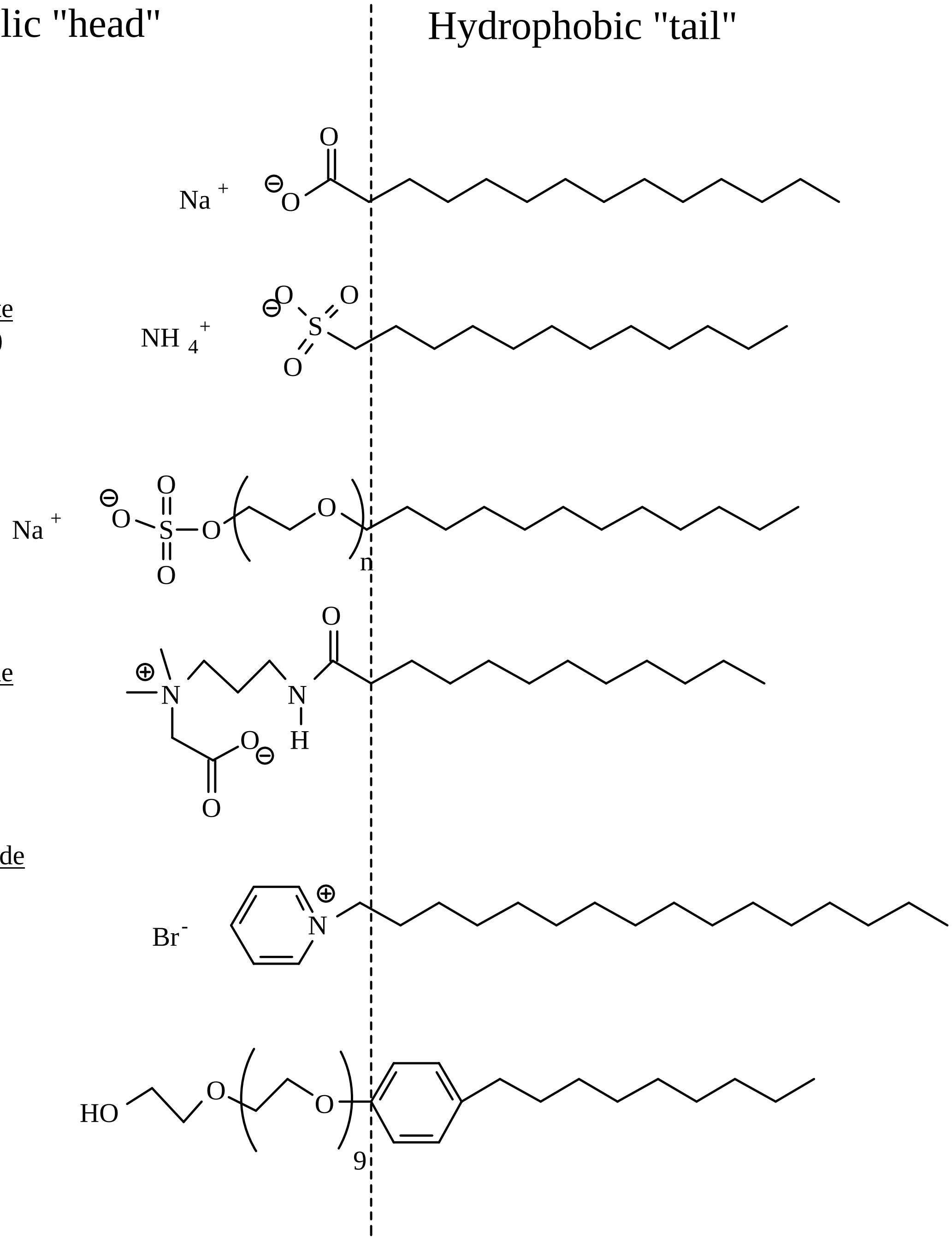
<u>ammonium lauryl sulfate</u>
(shampoo & toothpaste)

<u>sodium laureth sulfate</u>
(shampoo)

<u>cocamido-propyl betaine</u>
(shampoo)

<u>cetyl-pyridinium bromide</u>
(mouthwash)

<u>nonoxynol 9</u>
(spermicide)



Bio 111 & Home Economics (Washing Dishes)

The animation of soap washing dishes can be found on the course website.

Key parts of the animation:

(hydrophobic)

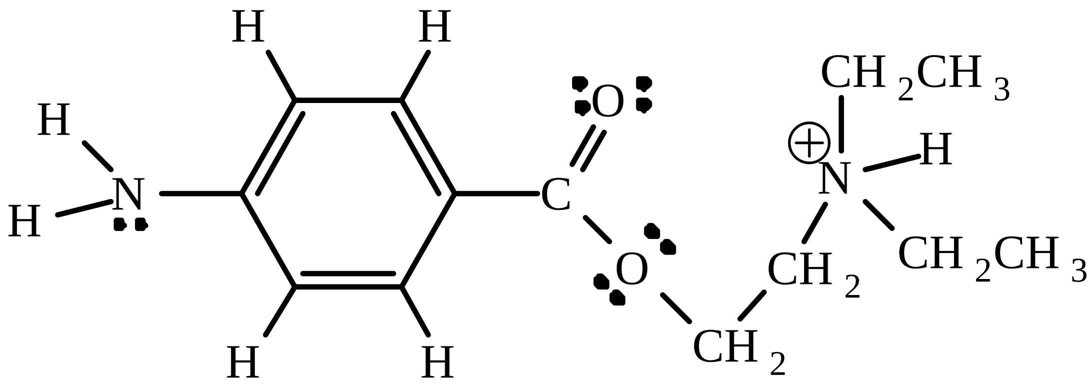
1) The hydrophobic grease on the dish does not dissolve in the water & sticks to the dish.

hydro**philic** "head"

hydro**phobic** "tail"

Thanks to *Evelyne Tschibelu* for the animation.

Novocain



Structures from last week's ClassTalk Problem