CHAPTER 6

ACTIVITY IDEA 6A EXPERIMENT: HOW MANY DROPS OF OIL WILL FIT ON A PENNY?

You will need:
- an eye dropper for each student
- a penny for each student
- vegetable oil (perhaps a few different types of you have them on hand)
- a cup of water (as it is probably a good idea to revisit the first lab where we did water on a penny)

What to tell the students:

Way back in chapter one, we did an experiment where you found out how many drops of water would fit on top of a penny. We noted that water is a polar molecule and therefore creates hydrogen bonds between the molecules. These bonds are relatively weak, but are strong enough to hold the molecules together so that a fairly large drop of water can be created on top of a penny. In this chapter we discussed different kinds of vegetable oils, especially soybean oil. Oils are non-polar molecules and therefore don't experience hydrogen bonding. Will their lack of hydrogen bonding prevent them from being able to form a large droplet on a penny?

What to do:
1) Give each student a penny, an eye dropper and access to a cup of water.
2) Have them do the water drop challenge again. They will likely get 30 or more drops to fit.
3) Dry off the penny and gives them access to the vegetable oil. Have them count drops of oil till the oil slides off the penny. They will probably get less than 20, perhaps even less than 15.

EXTENSION: Ask them to draw a rough picture of what the oil molecules look like. (They should draw long lines, perhaps zigzag lines, or even curved lines. They might include the letters C and H. Drawing triglycerides with three legs would also be acceptable.)

ACTIVITY IDEA 6B LAB: DISSECT AN EGG (NOTE: Activity 6C will suggest one way to use your cracked eggs.)

You will need:
- an egg
- a small plate
- optional: craft sticks or dull table knives (for poking and prodding egg)
- optional: magnifying glass for looking at shell (highest power possible)
- optional: craft knife with very sharp point (for supervising adult, or for older students)

What to tell the students:

We crack eggs and use them in baking all the time. But have you ever stopped to really look at them? In this activity you will do a scientific examination of an egg and try to find the parts shown in the diagram on the first page of this chapter.

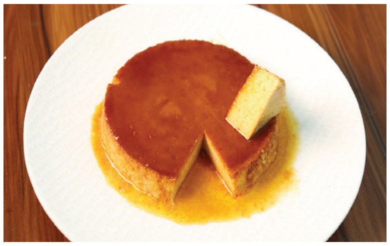
How to prepare:
1) Buy extra large or jumbo eggs. If you can get some farm-fresh eggs, that's even better.

What to do:
1) If you have a magnifier, look at the shell. Is the texture very smooth or does it look rougher at higher magnification? (The actual pores in the shell are microscopic.) If your egg has never been washed, it will still have its natural cuticle coating that helps to keep bacteria out. Fresh eggs do not need to be refrigerated. If your egg is from a store, it has probably been washed so the cuticle layer is gone. Washed eggs need to be kept cold.
1.5) OPTION: You may want to tap a tiny hole in the large end of the shell. This requires a small pointed object, such as the tip of an X-Acto knife. If working with younger students, the supervising parent or teacher might want to do this operation on each egg. If done properly, the hole should open into the air space and you will be able to hold the egg with the hole pointed down and nothing will leak out. You can see why this works of you look at the picture of the egg anatomy. The air sac is sealed off from the contents of the egg. (Only the large end will have this air space.)
2) GENTLY crack the egg and allow the insides to slip out onto a plate. Try not to injure any of the inside parts as you do this.

3) Examine the shell. Look at the large end and find the air pocket. As an egg ages, this air space grows larger. Examine the thin membrane that covers the inside of the shell. Peel off a bit of the membrane and give it a tug. It will be surprisingly strong. There are actually two membranes there, but we see them as one.
4) Observe the egg white, also called the albumen. Can you see any variation in the clear gel? Very gently poke various places around the white. Are there places that seem more firm? Places that seem more runny? The albumen actually has several distinct sections, but because all these sections are clear, they are hard to differentiate just by looking.
5) The chalaza will be easy to find. Observe both sides. Is one longer than the other? If you tug on it gently, can you see that it is attached to the yolk?
6) Observe the yolk carefully without breaking it. Can you find a spot? In some eggs there might be a fleck of red or orange on the yolk, but in other eggs it could be just a lighter spot. This is the germinal disc, where a chick would grow IF the egg was fertilized by a rooster and IF the egg is kept at the right temperature.
7) The yolk is surrounded by a thin membrane called the vitelline membrane. Vitelline means "glass-like" (clear). Gently poke the vitelline membrane in one place. Can you see a hole open up? The liquid yolk will come out through that hole.
8) The eggs can then be cooked and eaten as a snack, or you can use them in the recipe below.

EXTENSION: Find some other types of eggs to compare to a chicken egg (duck, quail, goose, etc.) If you don't live in a rural area, try an Asian grocery store, as they often sell specialty eggs.

ACTIVITY IDEA 6C COOKING ACTIVITY: MAKE "FLAN" (also known as "crème caramel")



This dessert originated in Europe but is now served all over the world. The word "flan" comes from an old French word for "flat cake." Each country has its own variation; sometimes only yolks are used, sometimes sweetened condensed milk is used, some prefer coconut flavoring instead of vanilla, some like their flans to have a thin texture, others prefer thick. (For a complete list of regional variations, see the Wikipedia article on "Crème Caramel.")

You can use the recipe listed here, or you can surf the Internet, or a video steaming service, to find one more to your liking. (NOTE for those of you who don't consume sugar: You can't make caramel using a sugar substitute, but if you need a sugar-free option, you can skip making the caramel yourself and look for a sugar-free caramel sauce at your grocery store. Pour this on the bottom of your pan. You can use a sugar substitute in the egg and milk mixture.)

This activity reinforces the information about eggs (pages 100-101), and the information about caramel (pages 110-111).

You will need:
- a medium-sized shallow baking dish
- a large, shallow pan that the baking dish will fit into
- a non-stick, or stainless steel, frying pan (medium size) for making the caramel sauce
- a serving platter larger than the bottom of your baking dish
- optional: a pastry brush and a bowl of water
- 3/4 cup (150 grams) granulated sugar
- 4 eggs (you can use the eggs you dissected)
- 1/2 cup (100 grams) granulated sugar
- pinch salt
- 2 teaspoons (10 ml) imitation vanilla, or 1 teaspoon (5 ml) real vanilla extract (real vanilla tends to be stronger)
- 2 cups (500 ml) milk (or a combination of cream and milk)

What to do:
NOTE: If you'd like to simply follow a video instead of these written instructions, video streaming services (e.g. YouTube) have many posts that show people making flan.
1) Pre-heat oven to 350º F (175º C).
2) Pour 3/4 cup (150 grams) granulated sugar into the frying pan. Some people don't add any water, they just cook the sugar as is. This can be an interesting science phenomenon to watch, as the dry sugar crystals melt into a liquid. However, you can also add 1/4 cup (60 ml) water. Pour the water slowly, distributing it as evenly as possible around the sugar. You can tip the pan and try to swirl the mixture a bit, but don't stir.
3) Set the pan on a burner with medium heat. You can shake the pan back and forth, or swirl it around, as the sugar cooks, but you are not supposed to stir. You can dip the pastry brush into water and brush around the inside edge of the pan, just above the cooking sugar. However, I watched some videos where they did not use a brush and their results were fine, too.

4) The sugar will become more liquid and begin to boil. Swirl the mixture but don't stir and let it cook like this until it turns light brown. Remove from heat and pour the sauce into the bottom of your baking dish. (You can use a scraper to get all of the caramel out of the pan.)
5) Put the eggs, 1/2 cup (100 grams) sugar, a pinch of salt, and the vanilla into a blender, or into a bowl if you are using a hand mixer. Beat for half a minute or so.
6) Add 2 cups (500 ml) of milk (or a mixture of milk and cream) and beat for another half minute or so.
7) Pour this mixture into the baking dish, on top of thin layer of caramel sauce.
8) Set the baking dish inside a larger pan and add water to the large pan until half the height of the baking dish is covered.
9) Place in oven and allow to bake for about 45-50 minutes. (Remember, at the top of page 101 we discussed how egg yolks slow down the coagulation process and therefore egg-thickened desserts must bake for a longer time than other recipes.) Begin to check it at the 40 minute mark, and every 5 minutes or so after that. The flan is done when you can insert a knife and it looks clean when you pull it out. If it comes out with white or yellow on it, let the flan bake a little longer.
10) Allow the flan to cool for a short time. Take a knife and slide it around the top edge of the flan to loosen the edges from the baking dish. Then put the serving platter on top of the baking dish and carefully turn them over so the baking dish is upside down on the platter. Carefully lift the baking dish. The flan should now be on the platter with its caramel sauce on the top. Allow to cool before serving. The flan can be stored in the refrigerator, but don't cover with plastic wrap, as the wrap will stick to the caramel and pull it off when you remove the wrap.

ACTIVITY IDEA 6D EDIBLE EXPERIMENT: AN ENZYME THAT PREVENTS GELATINIZATION

The fact that fresh pineapple contains an enzyme (bromelain) that prevents jello from thickening is well-known and likely you or your students may have experimented with this already. I will suggest a few extra unknown factors that will enable you to use the idea even with students who already know what bromelain does to jello.

You will need:

- collagen-based gelatin, either sweetened and flavored (ex: Jell-O®) or plain (ex: Knox® unflavored gelatin packets)
- agar (also called "agar agar") which can be ordered online from places like Amazon, or purchased from Asian groceries
- optional: a Kosher (fish-based) gelatin, or a vegan gelatin mix
- a fresh pineapple
- another type of fresh fruit (NOTE: Papaya and kiwi will give similar results to fresh pineapple, so you might want to choose something like bananas, apples or oranges. However, using papaya and kiwi could add another layer of complexity for students who have already done pineapple.)
- meat tenderizer
- hot water
- small containers, or a few ice cube trays (Ice cube trays work well when you have many students who will all want to sample the final results.)

What to tell the students:

In this activity, you will experiment with an enzyme that breaks down proteins, including the collagen found in jello. You will find out if heat has any effect on the enzyme, and you will test whether this enzyme affects non-collagen gelatins.

What to do:
1) Chop the pineapple into bite-sized pieces.
2) Put a few dozen pieces into boiling water and let them cook for 5 minutes. Drain and cool.
3) Mix your gelatin(s) according to package directions. (The directions on my bag of agar suggest using 1 teaspoon (5 ml) of powdered agar for each cup (250 ml) of water. Allow the agar powder to soften and dissolve completely.)
4) Label your containers or cubes with the following categories. (The number of cubes slots for each category is up to you.)

1) plain gelatin (your "control")
2) gelatin with fresh pineapple
3) gelatin with cooked pineapple
4) gelatin with another type of fruit
5) plain agar
6) agar with fresh pineapple
7) agar with cooked pineapple
8) agar with other fruit
9) gelatin with meat tenderizer added
10-12) optional-- another type of gelatin plain, with fresh pineapple, with cooked pineapple

5) Pour the correct solutions into each container and refrigerate all of them until the plain gelatin in #1 is firm.
6) Pull all samples out of the refrigerator and observe them. Which ones did not gel?

EXPECTED RESULTS: The collagen-based gelatin (jello) with the fresh pineapple will not gel. This is because pineapple contains an enzyme called bromelain that breaks down proteins including collagen. Bromelain cuts the long collagen strings into short pieces. The gelling process requires the collagen to form long strings in order to hold the water. Bromelain prevents this from happening. Like many enzymes, bromelain is affected by heat. The heat denatures the enzyme and makes it unable to do its job. Therefore, the cooked pineapple sample should gel. Meat tenderizer contains bromelain, so that sample should yield the same results as the fresh pineapple. Agar is not made of collagen, so we can expect it to gel even with the fresh pineapple. Kiwi and papaya also contain protein-digesting enzymes so if you used these fruits, they will probably not gel, or will form only a weak, watery gel.

ACTIVITY IDEA 6E COOKING ACTIVITY: MAKE MERINGUE

Find a recipe in a cookbook or online, and experience the science of meringue for yourself. You can put your meringue on top of a pie (perhaps a lemon meringue?) or just enjoy it as a fluffy treat.

ACTIVITY IDEA 6F SNACK: MAKE ICE CREAM IN A PLASTIC BAG

There are many videos online showing how to do this activity. Basically, you put two cups of a milk liquid of your choice (milk, cream, half & half, coconut milk, almond milk, etc.), some sweetener of your choice, and some flavoring of your choice into a gallon size "ziplock" bag. Fill another gallon size ziplock bag with ice cubes (2/3 full) and add half a cup of salt (rock salt works best but table salt will be okay, too). Make sure the milk bag is zipped tightly shut, then place it in the middle of the ice cubes, then zip the ice bag shut. Put a towel around the ice bag so your hands don't get too cold, and shake the bag vigorously for about 5 minutes. When you open the milk bag you should find frozen ice cream.

ACTIVITY IDEA 6G COOKING ACTIVITY: MAKE "POPPING BOBA" (gelatinized spheres, the kind in bubble tea)

This activity requires some special chemicals that you will have to order. Amazon carries them, but Asian groceries or science supply companies may also, as well. These ingredients are a little expensive, so you will have to decide whether it is worth it for you. If you want a less expensive lab that is very similar and uses things you probably have on your shelf, see activity 6F. (NOTE: Some bubble teas use tapioca spheres instead of sodium alginate. This type of sphere is chewy and does not pop.)

Instead of trying to reprint all the instructions I've read on various sites, it is probably better for you to read them yourself. Try one of these addresses, or use key words "popping boba" in an Internet search engine, or search YouTube or another video streaming service.

https://www.honestfoodtalks.com/popping-boba-diy-recipe/ (LOTS of information, pictures, and embedded video clips.)
https://kitchenpantryscientist.com/tag/popping-boba/ (This site has less info, but suggests also making larger bubble that they call edible water balloons.)

You will need:
- calcium chloride or calcium lactate (special order it)
- sodium alginate (special order it) This is a natural chemical derived from seaweed.
- distilled water
- a large dropper or syringe (can use a baster)
- a slotted spoon
- fruit juice

ACTIVITY IDEA 6H LAB: ALTERNATIVE RECIPE FOR GELATIN SPHERES (technically edible, but not designed for eating)

This alternative to making "popping boba" doesn't require any specialized ingredients, but is more like a lab experiment, not a snack. The fact that oil and water do not mix is a key to forming the gelatin into spheres.

You will need:
- 5 packets unflavored gelatin (or 2 tablespoons agar powder)
- distilled water
- vinegar
- food coloring
- very cold vegetable oil (put in freezer until cloudy but not frozen)
- several empty squeeze bottles (or basters or syringes)
- optional: strainer for rinsing off spheres
- optional: purple cabbage water for coloring-changing spheres

How to prepare:
1) Pour vegetable oil into a tall container and put into the freezer until it turns cloudy but is still liquid, not solid.

What to do:
1) Dissolve 5 packets gelatin powder (or 2 T. agar powder) into 1 cup (250 ml) hot water. Add 2 teaspoons (10 ml) vinegar. Heat and stir till dissolved.
FOR COLORING CHANGING SPHERES, do not add the vinegar and use 1 cup of purple cabbage water instead of plain water.
2) Pour into a few smaller containers and add drops of food coloring to each, so you have several colored gelatin mixes to work with. Allow to cool a bit, so that it is not dangerously hot. Do not allow to cool completely.
3) Pour each colored mix into an empty squeeze bottle (or whatever you are using).
4) Slowly squeeze out small amount of the mixture into the cold oil. The drops should form a marble-sized blob that will become round as it sinks in the cold oil. Allow these spheres to cool at the bottom of the oil for about 30 seconds, then pull them out. Rinse the spheres with water.
5) Try squeezing two colors out at the same time for multi-colored spheres.
6) The sphere can be allowed to dry on a plate overnight, and can then be rehydrated with water the next day.
7) For COLOR CHANGING spheres, drop them into vinegar or baking soda water to see them turn pink or blue/green.

ACTIVITY IDEA 6I COOKING ACTIVITY: TRY MAKING AN ASPIC

You might want to search the Internet for a few aspic recipes to find a blend of meat/egg/vegetables that sounds particularly appealing to you.

You will need:
- agar powder
- boiling water or broth
- your choice of meat, vegetable, egg, etc.
- a pan or jello mold

What to do:
1) Check the directions on your package of agar. Mine said to use 1 teaspoon (5 ml) agar powder for one cup (250 ml) of liquid.
2) Mix the agar and water/broth. Bring to a boil for one minute, then turn off heat and let it cool for a few minutes.
3) Pour warm agar into your dish and then add your layers of meat/egg/vegetables.
4) The aspic will harden even without chilling, but chilling can speed up the process. Once gelled, the agar will stay firm even without refrigeration (as we read in the chapter). However, I advise keeping it chilled if it needs to be stored overnight or longer.

<u>ACTIVITY IDEA 6J</u> COOKING ACTIVITY: HOW FATS AFFECT A CAKE RECIPE

This activity explores the role of fats in baked goods such as cakes and cookies. You will be making small cakes using various types of fats. You will keep all other variables in the recipe the same, so the only difference between the cakes will be type of fat used. You can use the recipe given here, or you can use any recipe that suits you (gluten-free, sugar-free, egg-free, etc.) as long as you keep everything the same in each cake except for the type of fat. If using your own recipe, you will probably want to cut it in half (or even in thirds, if possible) so that you won't end up producing more cake than you can possibly eat. Usually, the limiting factor in reducing a recipe is the number of eggs, since it is hard to use half an egg. Therefore, if your recipe calls for three eggs, it will be easy to make a one-egg recipe and divide the measurements of the other ingredients by three. A two-egg recipe should be divided in half.

OPTIONAL: You might also want to make a cake that has no fat, and see what happens.

<u>What to tell the students</u>:

We've read about a number of fats in this book. Some are solid at room temperature, such as butter and shortening, and others, such as olive oil or vegetable oils, are liquids at room temperature. Fats are what give baked goods their enjoyable texture. They contribute to the stability of dough or batter so it can hold the air bubbles produced by the leavening agent. They also help to hold moisture, which makes the baked good more tender.

*Professional bakers have a special term for how a baked good feels in your mouth as you chew. They called it "**mouthfeel**." Pie crust gives a soft and flaky mouthfeel. Cookies have a tender and crumbly mouthfeel. Cake gives you a soft, fluffy mouthfeel. The type of fat used in a recipe contributes substantially to the mouthfeel of the final product. In this activity you will experiment with different types of fat to see how they affect the mouthfeel of a cake.*

<u>You will need:</u>

- a cake recipe that suits you, if you can't use the one listed below
- flour (can substitute gluten-free if you need to)
- a sweetener (if using a sugar substitute, figure out how much of your sweetener equals 1/3 cup (67 g) sugar)
- baking powder
- baking soda
- eggs (if you can't use eggs, consider a plant-based egg substitute)
- milk (can use dairy-free milk such as almond or soy)
- vegetable oil (any mild-tasting oil)
- butter
- shortening
- optional: another type of fat (or you can use an extra egg for your fat)
- small baking dishes, or cupcake molds and/or papers

<u>Recipe (for a yield of small cakes):</u>

1/4 cup (50 g) sugar	1 large egg
1 teaspoon (5 ml) vanilla	3/4 cup (96 g) flour
3/4 teaspoon (4 g) baking powder	1/4 cup (60 ml) milk

one of these fats:

1/4 cup (58 g) butter
1/4 cup (58 g) shortening
1/4 cup (60 ml) vegetable oil (such as corn oil, safflower oil, sunflower oil, or mild-tasting olive oil)
1 extra egg (or other type of fat if you want to try something like coconut oil)

<u>What to do:</u>

1) Set oven at 350 degrees F (175 degrees C).
2) Put the sugar and fat into a bowl and use an electric mixer, or hand whisk, to "cream" the fat and the sugar. Beat until fluffy, but do no over-beat. Note that the liquid oil won't "cream" in the same way, so don't over beat it.
3) Add the egg (or eggs if using an extra egg as your fat) and the vanilla and beat briefly.
4) Put the flour into a separate bowl and add the baking powder. Mix well. If you a have a sifter, sift the dry ingredients into the wet ingredients bowl. If not using a sifter, just make sure the baking powder is thoroughly mixed before adding. Blend the dry and wet ingredients well.
5) Add the milk and blend until thoroughly mixed.
6) Pour the batter into the dish (or cupcake molds) and make sure you mark them so you can keep track of which is which.
7) Bake until the top of each cake springs back when touched. The number of minutes will depend on the size of your cakes.
8) Sample each cake and compare the textures. Which type of fat made the texture you like best? Least?

ACTIVITY IDEA 6K   MOLECULE MAT for chapter 6

You will need:
- a copy of the Molecule Mat chapter 6 pattern page
- toothpicks
- the materials for the atoms

What to do:
1) Put your chosen materials inside the boxes on the left side of the page (or in small dishes if they won't fit inside the boxes). Toothpicks can be set in a dish, or simply in a pile, within the students' reach.
2) Let the students work on their own as much as possible.
3) The molecules may or may not all fit onto the page. Xylitol can be done separately, and the materials from the other molecules can be recycled.
4) Note that for xylitol, the students will have to "read" the diagram and figure out where the invisible C's and H's are.

ACTIVITY IDEA 6L   TASTE TESTING SUGAR SUBSTITUTES

NOTE: All artificial sweeteners are considered "safe" unless you are allergic to them (or have a very rare and unusual non-allergic sensitivity). While I would not recommend consuming artificial sweeteners every day for a very long time, tasting a sample in science class is perfectly harmless (barring any allergies). Some students could be overly concerned about tasting something "artificial" and might need reassurance that doing this scientific taste test will not cause them any harm. We need to remember that even natural sugar can be very harmful to our health, and is definitely a contributing factor to many chronic illnesses.

You will need:
- a variety of sugar substitutes (can also include one or more natural sweeteners such as monk fruit, stevia, or xylitol)
- sugar
- paper cups
- some packets of flavoring that contain only color and flavor (ex: Kool-Aid®) If you want to avoid artificial colors, you can use any type of flavoring that does not contain any sweetener
- marker or pen (if you want to use one cup per sample)
- NOTE: If you want to use a minimum number of cups, you can make pitchers of the drinks and provide each student with one cup that you will rinse and refill for each type of drink.

What to do:
1) Each student will need a set of small cups. (In my class I used five cups per student, one for sugar and four for the substitutes, but you can do more.) Or, if you want to avoid using a lot of cups, you can give one cup to each student and have everyone taste the same sample at the same time, emptying the cup (maybe even rinsing?) the cups between samples.
2) If using a cup per sample, label each cup with the name of one type of sweetener.
3) Mix pictures of "juice" solutions, with the same amount of flavoring but a different sweetener in each.
5) Pour the juice solutions into the labeled cups.
(Optional: Provide one cup with just the flavor and no sweetener at all.)
6) Have the students try each cup, sipping slowly and tasting carefully. Ask follow-up questions. Which drink was their least favorite? Did any of the samples produce an "after taste"? Did any of the samples taste bitter? Which sample came closest to giving the same effect as sugar? If you could no longer eat sugar, which substitute would you choose?

Splenda® = sucralose   Nutrasweet® = aspartame
Equal® = aspartame   Sweet N Low® = saccharin
Sugar Twin® = saccharin

ACTIVITY IDEA 6M   OPTIONAL: REVIEW/TEST

You can use the following pages (after the molecule mat) as a final exam, or just as a final review activity. Or skip it and just end with the dessert activities. If you decide to use it as an exam, and you want to have the students study ahead of time, tell them the best way to prepare is to read over the review questions at the end of each chapter, and to make sure they know the definitions of the words printed in ***bold italic.*** The questions are very basic and are mostly about the types of molecules.

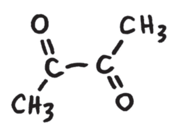
Consider giving partial credit for answers that are spelled incorrectly. If you make each question worth two points, then it is very easy to give partial credit and calculate a final score based on 100 percent.

H - hydrogen

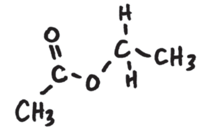
O - oxygen

C - carbon

--------------------Caramelization molecules---------------------



diacetyl



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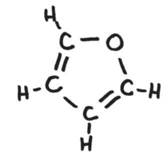
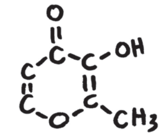
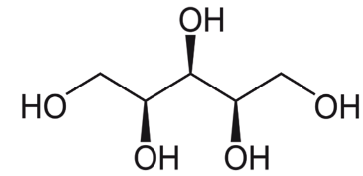


furan



maltol



xylitol
(There are 5 carbons, and 7 hydrogens not shown. Remember, carbon always makes 4 bonds!)

MOLECULE MAT Chapter 6

DISSECT YOUR DINNER **Final review/quiz** **Name ___________________________**

1) What do you call the electrical attraction between the positive and negative sides of water molecules? _____________ bonding

2) In salt water, which is the "solute," salt or water? _______________

3) What do you call the things that enzymes bring together or tear apart? s_____________________

4) Molecules that end in "-ose" are probably: a) fats b) proteins c) sugars d) polar molecules e) enzymes

5) What molecule is often used to "patch" the broken ends of molecules that have been cut apart by an enzyme? __________

6) Which one of these is NOT a factor when trying to put a lot of carbon dioxide into water (to carbonate it)?
a) cold temperature b) high pressure c) amount of sugar d) large surface area

7) Which one of these would you be LEAST likely to find in a can containing a sweetened fizzy drink?
a) potassium benzoate b) sodium acetate c) phosphoric acid d) caffeine

8) Where would you find the bacteria called *Lactobacillus*? ___________

9) What number on the pH scale is neutral? _______

10) When you mix an acid and a base, you get water and a ______. a) salt b) sugar c) crystal d) liquid

11) The process of heating milk to kill bacteria is called ________________________.

12) The process of pushing milk through a sieve to make all the fat globules the same size is called __________________.

13) A triglyceride's "tails" are made of __________ _________.

14) Proteins are made of individual units called __________ _________.

15) The primary protein in milk is called ______________.

16) When a water molecule breaks apart, the parts are called: ________________ ion, and _______________ ion.
(OH-) (H+)

17) Butter is yellow because it contains this molecule: ______________________

18) Bacteria produce lactic acid during the process of ______________________.

19) When an acid is put into milk, it will cause it to ______________.

20) Yeast makes bread rise by producing bubbles of ____________ _______________.

21) When you make cheese, the watery stuff left over is called ______________________.

22) Amylose and amylopectin are types of ________________.

23) When broken pieces of protein and sugar molecules join together (due to heat) this is called:
a) caramelization b) gelatinization c) Maillard reaction d) curdling e) denaturing

24) Where do pyruvate molecules come from? a) glycine b) triglycerides c) glucose d) acids

25) If your quick bread recipe calls for baking soda, what will be needed to make it work? (to make gas bubbles)
a) an acid b) a base c) water d) milk e) carbon dioxide

26) A substance that can hold on to both polar and non-polar molecules is called an ____________________.

27) Name the molecule in leaves that makes them green: __________________

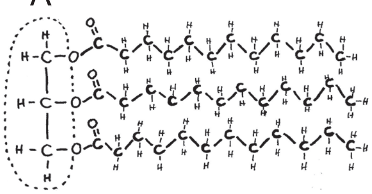
28) Cell membranes (in either plant or animal cells) are made of 2-legged molecules called:
a) diglycerides b) phospholipids c) carotenes d) thylakoids e) chlorophyll

29) What type of salad green has the most vitamin K, C, B2, B9, magnesium, calcium, and phosphorus? ____________

30) Which plant pigment is responsible for red and blue colors?
a) anthocyanin b) beta-carotene c) chlorophyll d) xanthophyll

Match the molecules with the names.

31) beta-carotene _____ 32) chlorophyll _____ 33) triglyceride_____ 34) amino acid _____ 35) glucose _____

A


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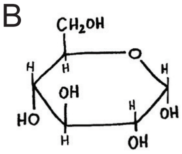

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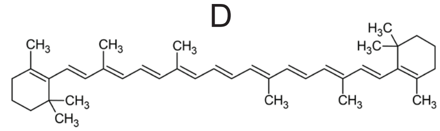

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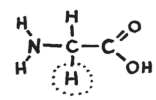

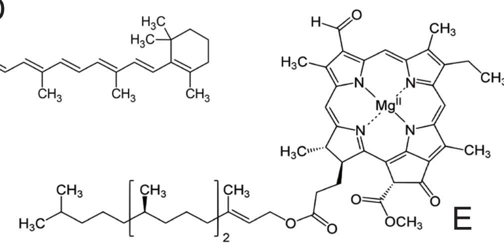
E

36) Polyphenol chemicals are produced by plants as:
a) sources of nutrition b) scents to attract birds c) molecules that collect light d) pesticides

37) Which vitamin cured scurvy? a) vitamin A b) one of the B vitamins c) vitamin C d) vitamin D

38) Which vitamin is associated with "pernicious anemia," has a cobalt atom in its chemical structure, makes red crystals when it is purified, and is found in meat, diary products, and shellfish (crabs, lobsters)? a) B6 b) B12 c) C d) D

39) Which of these vitamins is water-soluble (not fat-soluble)? a) A b) B1 c) K d) D

40) You can't digest cellulase. What living thing CAN digest it? _______________

41) Which of these molecules is toxic? a) chlorophyll b) raffinose c) capsaicin d) solanine

42) Phytohemagglutinin is a toxin found in: a) beans b) potatoes c) red meat d) starch

43) What is starch made of? strings of _________________ molecules

44) Where do you find myofibrils, actin and myosin? ____________________

45) What is it called when heat "ruins" the shape of a protein and causes it to unfold? d____________________

46) Which is more likely to be solid at room temperature? a) saturated fats b) unsaturated fats

47) "Trans" is Latin for "across." In trans fats, what is located across (on opposite sides of) the molecule?
a) carbon atoms b) hydrogen atoms c) oxygen atoms d) double bonds

48) Which of these is NOT used to thicken desserts?
a) agar b) pectin c) collagen d) carrageenan e) eggs f) starch g) gluten

49) Sucrose can be separated into glucose and fructose by two of these. Which one is not used? a) heat b) cold c) enzymes

50) Which of these was not discovered by accident? a) aspartame b) stevia c) saccharin d) sucralose

ANSWER KEY TO final review

1) hydrogen bonding
2) salt
3) substrates
4) c) sugars
5) water
6) c) amount of sugar
7) b) sodium acetate
8) milk
9) 7
10) a) salt
11) pasteurization
12) homogenization
13) fatty acids
14) amino acids
15) casein
16) hydroxide ion, hydrogen ion
17) beta-carotene
18) fermentation
19) curdle
20) carbon dioxide
21) whey
22) starch
23) c) Maillard reaction
24) c) glucose
25) a) an acid

26) emulsifier
27) chlorophyll
28) b) phospholipids
29) spinach
30) a) anthocyanin
31) D
32) E
33) A
34) C
35) B
36) d) pesticides
37) c) vitamin C
38) b) B12
39) b) B1
40) bacteria
41) d) solanine
42) a) beans
43) glucose
44) muscles
45)denaturing
46) a) saturated fats
47) b) hydrogen atoms
48) g) gluten
49) b) cold
50) b) stevia