



health**CARE**TM

(Cultivating **A**cceptance and **R**espect through **E**ducation)

Unit 1: Understanding Diabetes

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For information on the Cleveland Clinic Office of Civic Education Initiatives, please visit: <http://www.clevelandclinic.org/CivicEducation>

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Program Overview

healthCARE™ (Cultivating Acceptance and Respect through Education) is a dynamic educational program designed to teach children ages 5 through 10 about diversity and individual differences. Developed by the Cleveland Clinic Theatre Company and the Office of Civic Education Initiatives, the program provides free educational resources, including the script and the video of the award-winning children's play *Tall Tale*, as well as an accompanying lesson plan that meets state and national standards in a variety of subjects. healthCARE™ also offers disease-specific lessons so teachers can address diversity and individual differences as they relate to specific medical conditions.

The **Cleveland Clinic Theatre Company** is an award-winning theatre troupe devoted to educating and entertaining audiences of all ages through the use of the performing arts. Since it was established as a program of the Community Relations Department in the spring of 2004, the Company has written, performed and produced an impressive body of work, including interactive educational plays, radio and TV public service announcements, children's theatre programs, improvisational performances, and an educational CD. As a part of Cleveland Clinic's new Office of Civic Education Initiatives, the group has taken on even larger, more ambitious projects, including the video production of *Tall Tale*.

The **Office of Civic Education Initiatives** was established to fulfill the Cleveland Clinic's commitment to promote education throughout Northeast Ohio. In partnership with area schools, local businesses, and fellow nonprofit organizations, the Office creates innovative programs designed to enhance children's learning in the areas of math, science, health and wellness, the arts, and innovation.

Cleveland Clinic, located in Cleveland, Ohio, is a not-for-profit multispecialty academic medical center that integrates clinical and hospital care with research and education. Cleveland Clinic was founded in 1921 by four renowned physicians with a vision of providing outstanding patient care based upon the principles of cooperation, compassion and innovation. U.S. News & World Report consistently names Cleveland Clinic as one of the nation's best hospitals in its annual "America's Best Hospitals" survey. Approximately 1,500 full-time salaried physicians at Cleveland Clinic and Cleveland Clinic Florida represent more than 100 medical specialties and subspecialties. In 2005, 2.7 million patients came for treatment from every state and 100 countries. Cleveland Clinic's website address is www.clevelandclinic.org.

Understanding Diabetes

Whether a child has Type I or Type II diabetes, the disease is one that must be managed with constant attention to diet, activity level and careful monitoring of blood sugar levels. A student in the classroom with diabetes may need to visit the nurse frequently for blood sugar checks or correction of low or high blood sugars, or may need to pause in their activities to check their blood sugar in the classroom. The student may need to inject insulin or adjust their insulin pump before eating and may need to eat at unscheduled times to raise their blood sugar level. Other students will be curious as to what the student is doing and may ask a lot of questions. Some students may worry that they will "catch" diabetes through close association with this student. Others may think it unfair that the diabetic student is allowed to eat a snack during class or wonder why the student must sit out an activity when experiencing a low blood sugar. The following activities will teach students some basic facts about diabetes and familiarize students with the measures the diabetic student must take to stay healthy.

Objectives: *Students will*

- *Learn about Types I and II diabetes*
- *Learn how sugar is metabolized in the body*
- *Understand how sugar metabolism is affected by Types I and II diabetes*
- *Become familiar with steps diabetics must take to control the disease*

Students will also meet a many state and national standards in science, social studies, math, language arts and fine arts as listed at the end of this unit.

Pre-Assessment:

Before beginning this lesson, students will need to know a few facts about diabetes. Many students may already be familiar with some aspects of diabetes, given its prevalence in today's society. A short class discussion will demonstrate what students already know about this disease and allow the teacher to clear up any misconceptions before beginning the lesson. During the discussion, the teacher may want to sort facts and fallacies about diabetes on the board to help students sift through the information. Use the resources listed below for in depth information and additional activities for students.

Resources: Websites

- <http://www.clevelandclinic.org/health/>
Search this website for information on a wide variety of topics, including diabetes
- http://www.kidslearnaboutdiabetes.org/what_is.html
Excellent interactive diabetes site

- <http://www.diabetes.org/youthzone/fun-games.jsp>
Fun, educational activities for kids
- http://www.childrenwithdiabetes.com/d_0q_421.htm
Information for students about dealing with classmates with diabetes
- <http://www.bced.gov.bc.ca/specialed/awareness/40.htm>
Information on dealing with low and high blood sugars for teachers
- http://kidshealth.org/teen/diseases_conditions/growth/diabetes_erika.html
Story about teen with diabetes – good for sixth grade and above.

Books

- **Taking Diabetes to School** by Kim Gosselin and Moss Freedman. ISBN 1-891383-00-0. Available from <http://www.jayjo.com/> for \$11.95. Jayson, a boy with diabetes talks about how he manages his disease at school. Includes Ten Tips for Teachers and Kid's Quiz.
- **The Best Year of My Life, Book 1** by Jed Block, Jeff Block and Caitlin Block. ISBN 0-9672728-0-7. Available from <http://www.jedblock.com/DiaBook.html> for \$10.95. Seven-year-old Caitlin gets diabetes and learns to make the best of it.
- **Lara Takes Charge** by Rocky Lang and Sally Huss. ISBN 0-9754184-0-8. Available at <http://www.hlpibooks.com/> for \$12.95. About a young girl with diabetes and how she tells her friends about her disease.

Lesson 1: Language Arts Activity

There are a number of great books available about diabetes, but very few that are available for free. The website www.grandmasandy.com has a wonderful story for children with diabetes that was written specifically to be downloaded and shared. While the story was written to explain diabetes to children with the disease, it can be very informative for classmates of a student with diabetes. The story, called "My Own Type I Diabetes Book", can be printed onto cardstock to make a book to be read to or by students. While the story itself is written very simply, some of the vocabulary may be difficult for younger students to read on their own. Review the story and choose either the "Teacher Read" or "Student Read" lesson below.

Teacher Read: Tell your students that this story will give them an idea of what it would be like to live with Type I diabetes. Listening to the story will help them to understand everything their classmate with diabetes must do to stay healthy. As you read the story, emphasize the sections that apply to everyone, not just those with diabetes. When you have finished reading the story and answering the children's questions, have them complete the vocabulary exercise below.

Student Read: Divide the class into reading groups of four or five. Give each group a copy of the book to share, emphasizing that this story will give them an idea of what it would be like to live with Type I diabetes. Have students take turns reading one or two pages at a time. Tell students to keep a word list, recording all the words they don't know to review during the vocabulary exercise.

Vocabulary Exercise: Write the following word groups on the board:

- | | |
|---|----------------------------|
| 1. diabetes, Type I, Type II | 5. insulin, hormone |
| 2. carbohydrates, starches, grains | 6. pancreas, organs, cells |
| 3. glucose, glucose tablets, artificial sweetener | 7. inject, injection |
| 4. lancet, test strip, glucose meter | 8. energy, exercise |
| 5. hyperglycemia, hypoglycemia | 10. pump, infusion site |

Assign each word group to a pair of students. Allow the students time to become familiar with the word meanings by studying the vocabulary sheet provided (Handout 1). When students are ready, choose one pair of students at a time to either act out (charades style) or draw on the board (pictionary style) the meanings of the words in their word group. Have the other students raise their hands to guess which word group is being illustrated or acted out.

Check for Understanding: Venn Diagram Activity

This activity can be done together as a class or in groups of 3 – 5 students. To do this as a class activity, copy the Venn diagram from Handout 2 onto the board and give each student a copy of the Diabetes Fact Sheet. Have students take turns writing one fact from the fact sheet into the appropriate circle on the diagram. If another student disagrees with the placement of the fact, have that student explain the reason the placement is wrong, and move the fact to the correct spot on the diagram. If students will be completing the activity in groups, each group must be provided with a copy of the diagram and a fact sheet. Students can discuss the proper placement of each fact, and then take turns writing the facts onto the diagram.

Fine Arts Extension – Finding Balance

The book emphasizes keeping balance in your life. Ask students to think about all the aspects of their lives that need to be balanced, not just diet and exercise. For example, students need to balance their need for fun and relaxation with time for homework and chores. Everyone needs to balance time for sleep with time for all that needs to be done each day. It's also important to balance time spent with family and time spent with friends. Have students make mobiles as described below.

Materials: plastic or wire coat hangers, one per student; string, card stock, tape

Instruction: Help each student to choose a theme for their mobile, an area of their life requiring balance. Next, have students draw symbols or pictures that illustrate the opposing aspects of that theme. Tell students to cut out each illustration and tape or glue it to a piece of string. Finally, have students assemble the mobile by tying opposing aspects to opposite ends of the hanger. The mobiles can be balanced by moving the strings closer to or further away from the center of the hanger. Display these mobiles around the classroom to remind students to keep their life in balance.

Lesson 2: Science Activity

Modeling the Effects of Type I and Type II Diabetes on the Blood

Materials: (per group of 4 students) 25 mini marshmallows, 6 toothpicks, 2 disposable cups with prepared lids (disposable coffee cups with lids can be purchased at the grocery store), clock or watch with visible second hand

Lid preparation: *using pointed scissors, cut a hole into the center of each lid. Make half the holes approximately one inch in diameter and the other half approximately one half inch in diameter. Give each group one of each type of lid.*

Instruction:

Divide class into groups of four and distribute materials. Tell students they are going to make models of what happens in the body when sugar enters the bloodstream. The first model will demonstrate what happens in Type I diabetes and the second will model Type II diabetes. In both models, the cup represents a cell in need of fuel (sugar), the lid represents the opening in the cell membrane that allows sugar to enter the cell, the toothpicks represent the insulin that pushes sugar into the cell and the marshmallows represent the sugar. Have students label the lid with the larger hole "Type I" and the lid with the smaller hole "Type II". Designate one student as "timer", one as "pancreas", one as "bloodstream" and one as "cell" within each group.

Normal Blood Sugar: With the "Type I" lid fitted on the cup, have each student practice stabbing a marshmallow with the toothpick and inserting it in the cup. Explain that this process represents what normally happens when insulin (the toothpick) from the pancreas helps sugar molecules (marshmallows) into a cell. Ask students to time how many marshmallows they can get into the cup in fifteen seconds and record that number in their lab notebook. Have the timer count the seconds out loud so the whole group can hear. ***Important: in the bloodstream, each insulin molecule has a limited lifespan. To mimic this, students may use a toothpick for only three seconds before setting it aside and getting another one. The "pancreas" must hand a new toothpick to the "bloodstream" every three seconds.*** Make sure students record the number of marshmallows in the cup and the number still left in the "bloodstream" after each trial.

Type I: Now tell students that their patient model is developing Type I diabetes. Therefore, they can produce very little insulin. Now, although each insulin molecule (toothpick) can only be used for three seconds, the "pancreas" can only supply a new insulin molecule to the "bloodstream" every five seconds. After students have completed this trial, have them see what happens if the "pancreas" can only produce one molecule (toothpick) every ten seconds. Be sure students are recording their results after each trial. As the insulin production becomes more limited, students should notice that there is more and more sugar outside the cell and less and less in the cell. Eventually, the cell will begin to starve and the level of sugar in the bloodstream will become toxic.

Type II: In this scenario, the lid with the smaller hole is used. In Type II diabetes, the pancreas initially produces a lot of insulin, but it is harder to get the insulin into the cell. You may want to have the students switch roles for this trial. As before, have the "timer" count out fifteen seconds while the "pancreas" hands a new toothpick to the "bloodstream" every three seconds to help the sugar (marshmallows) get into the cell (cup). Since the opening in the membrane (lid) is smaller, it takes a lot longer for sugar to get into the cell. This increases the amount of sugar in the blood and eventually can starve the cell.

Check for Understanding:

Have each group share the results of their experiments. Have students make a bar graph of their results, with separate bars for the "normal" trial, the "Type I" trial and the "Type II" trial. To compare results between groups of students, create a large chart on the board showing each group's results for each trial. Ask students why they think there might be variations in the results each group got.

Just like in the activity, patients with diabetes vary tremendously in their body's response to the disease. Some patients with Type II diabetes are able to control their blood sugar with exercise and diet for many years while others must use oral medications or insulin right from the start. All patients with Type I diabetes must use insulin to control their blood sugars, but vary in the amount of insulin they need each day.

Math Extension– Choose several problems from the 'Diabetes Brain Teasers' (Handout 3) for the students to work on either in groups or individually. These could be assigned for homework.

Lesson 3: Social Studies - Career Profiles

Comprehensive diabetes care requires help from a wide range of professionals. Patients recently diagnosed with diabetes are sometimes overwhelmed with all the information they must learn and the changes to their daily routines and lifestyles they must undertake. Patients are often quite resistant to changing their eating and exercise routines at first. Healthcare professionals must work together with patients to craft a diet, exercise and drug regimen that the patient can follow for the rest of their lives.

Although students may be unaware of the variety of professions that make up the healthcare industry, many will know someone who has had to change their lifestyle on the advice of their doctor. This activity will introduce students to the many healthcare professionals who work with diabetic patients to help them to manage their disease and avoid serious complications. Before beginning the activity, discuss some of the barriers to implementing the lifestyle changes these professionals may recommend. During the activity, students will be role-playing a diabetic visiting an expert in diabetes care. Encourage students to bring up some of these barriers in their skits.

Materials: For this lesson, you must download the profiles of healthcare professionals involved in diabetes care from the healthCARE website:
www.clevelandclinic.org/civiceducation/healthCARE.asp

Activity:

1. Divide the class into groups of four or five. In this activity, students will role-play a scenario of a patient with diabetes visiting a healthcare professional for a particular problem. Assign a healthcare profession to each group. Give each group copies of the career profile for their assigned profession and have students work together to learn about the profession.
2. Write a list of all the profiled professions where all the students can see it. Tell the students that the class is going to play a game in which two people from each group will act out a visit to a healthcare professional and the class must guess which type of healthcare professional the patient is visiting. To prepare for the game, students will create a short dialog showing the type of conversation that might take place between the professional and the patient.
3. When the students are ready, choose a pair of students from one of the groups to perform the dialog for the class. Do not let students guess the profession before the dialog is complete. If students cannot guess the profession represented, have one of the actors give a small hint.
4. Continue choosing pairs of students to perform until all the professions have been represented.

Technology Extension – Each of the professions represented above makes use of technology to help their patients. Have students learn about the technology through the technology spotlight section of the career profiles and then research the uses of this technology on the Internet. Have students suggest a way to make the technology even better. Ask students to draw a diagram of the new and improved technology, complete with labels and an explanation of how their technology would further improve the life of a patient with diabetes.

DIABETES VOCABULARY

Instructions: Cut out and distribute one word groups to each pair or triplet of students. Tell the students to read over the definitions of the words in their word group and ask for clarification if they are still not sure of their meanings. When students are clear about the definitions of the words in their word group, have them come up with a way to convey the meanings of the word in their group by either acting them out, as in charades, or drawing them on the board, as in Pictionary. Students may not speak while conveying the meanings of their words. You may want to write all of the words on the board before the game begins and then have students choose from the words on the board.

Word Groups: Diabetes, Type I and Type II; Insulin and hormone; Carbohydrate, starch and grains; Glucose, glucose tablet and artificial sweetener; Energy and exercise; Pancreas, organ and cell; Inject and injections; Lancet, test strip and glucose meter; Pump and infusion site; Hyperglycemia and hypoglycemia

Group 1: Diabetes, Type I and Type II

Diabetes: A disease where the patient has too much sugar in their blood

Type I: The form of diabetes more common in children where the pancreas can't make insulin

Type II: The form of diabetes more common in adults where the cells can't use insulin properly

Group 2: Insulin and Hormone

Insulin: a kind of hormone that moves sugar from the bloodstream into the cells

Hormone: an important substance in the body that help certain reactions to happen

Group 3: Carbohydrate, starch and grain

Carbohydrate: a kind of food molecule that gives the body quick energy

Starch: the kind of carbohydrate found in bread, pasta, rice and other foods made with grain

Grain: the seeds of certain plants such as wheat or corn that have lots of edible starch

Group 4: Energy and exercise

Energy: what makes us have the ability and desire to get up and move around a lot

Exercise: an activity that helps our bodies stay strong, healthy and fit

Group 5: Glucose, glucose tablet and artificial sweetener

Glucose: a kind of sugar used for quick energy by the body; it is a type of carbohydrate

Glucose tablet: a tablet made of flavored sugar (glucose) used by diabetics to raise their blood sugar

Artificial sweetener: any manmade chemical used to make food taste sweet without a lot of carbohydrates

Group 6: Pancreas, organ and cell

Pancreas: the part of the body that makes insulin to control blood sugars

Organ: a groups of cells all working together to perform the same task in the body

Cells: the small units that make up the bodies of all living things

Group 7: Inject and injections

Inject: to use a needle to get medicine into the body

Injection: the act of using a needle to get medicine into the body

Group 8: Lancet, test strip and glucose meter

Lancet: a small machine that is used to prick a finger for testing blood sugar

Test strip: a small plastic strip inserted into a meter to test blood sugar

Glucose meter: a machine that can tell you how much sugar you have in your blood

Group 9: Insulin pump and infusion site

Insulin pump: a machine that continuously sends a small amount of insulin into the body of a person with diabetes

Infusion site: the place where the tube from the insulin pump goes into the body

Group 10: Hypoglycemia and hyperglycemia

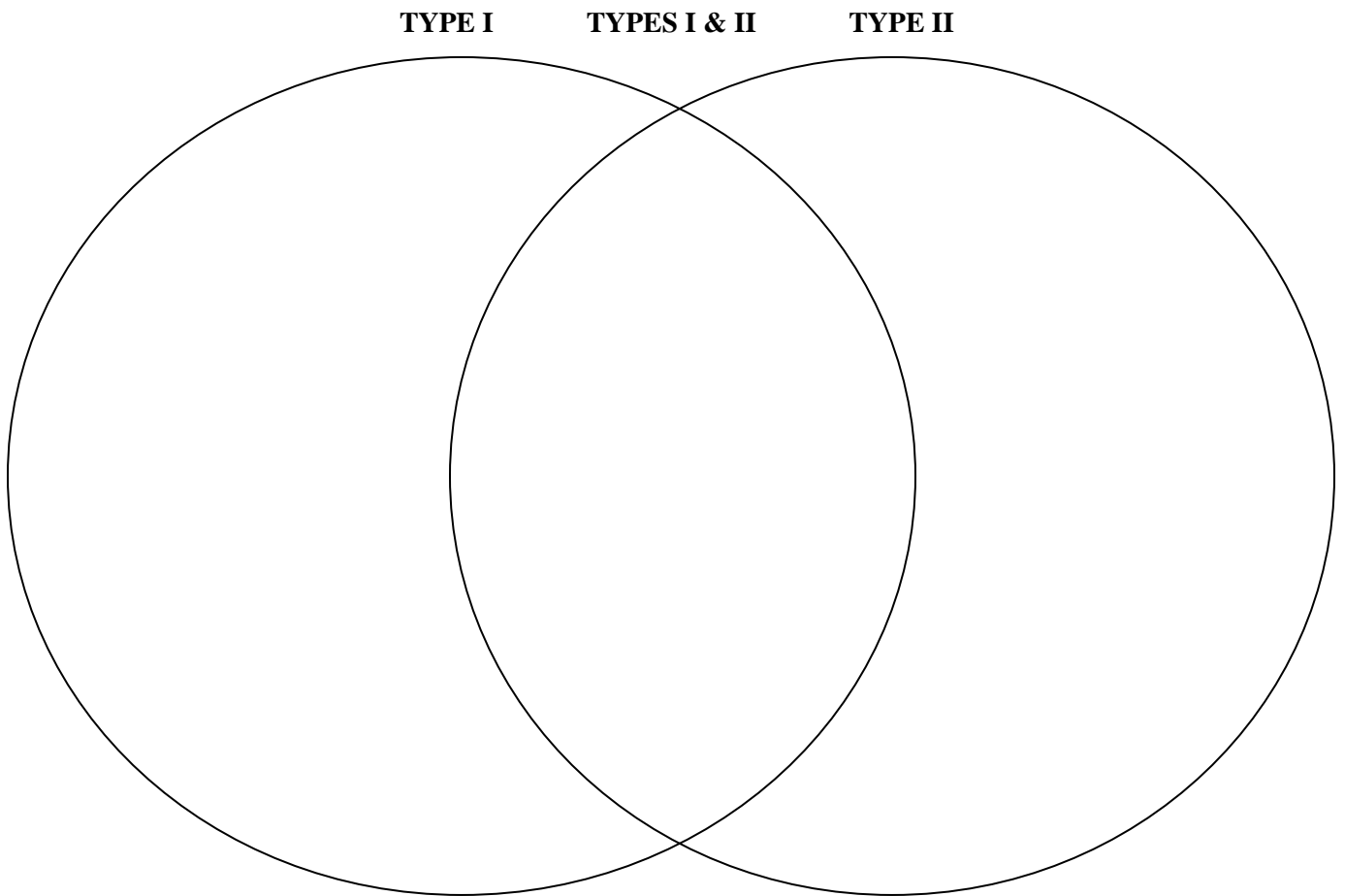
Hypoglycemia: not having enough sugar in your blood; also called "low blood sugar"

Hyperglycemia: having too much sugar in your blood; also called "high blood sugar"

~ An easy way to remember the difference between hypoglycemia and hyperglycemia is that children who act like they have too much energy are often called "hyper". However, people with hyperglycemia do not usually act "hyper", even though they have too much sugar in their blood.

DIABETES: TYPES I AND II

Cut out facts from the diabetes fact sheet and place in the correct spot on the diagram below. Discuss with fellow group members the placement of each fact.



Diabetes Facts

1. Usually strikes after age 35
2. Usually strikes before age 35
3. Most patients are overweight
4. Is not contagious
5. May be controlled with pills
6. Accounts for >90% of cases
7. Cells are "insulin resistant"
8. Causes excess sugar in blood
9. Can cause serious complications
10. Can be deadly
11. Must be treated with insulin
12. Accounts for <10% of cases
13. Pancreas cannot make insulin
14. May be controlled by diet and exercise

DIABETES BRAIN TEASERS

One side effect of diabetes that is not well known is that diabetics become very good at solving math problems in their head. Whether a person has Type I or Type II diabetes, he or she must count the carbohydrates in the food they are going to eat before each meal. Diabetics who take insulin must also calculate the amount of insulin they will need to cover the food they will be consuming throughout the day. Since exercise can affect the action of insulin, some diabetics even account for the exercise they will be getting throughout the day when calculating insulin dosages.

The following math problems involve the kind of mathematical thinking required to adequately control blood sugars. The problems range in difficulty from quite simple to very complex. Students may have more success solving the problems in groups. Be sure each student can explain how the answer was obtained. Choose the problems you feel will be right for your students and assign accordingly.

Beginner Level

1. Maria is going to have a snack after school. She knows her diet plan will allow her to have 20 grams of carbohydrate for her snack. Her favorite cookie contains 10 grams of carbohydrate. How many cookies can Maria have?

2. John needs one unit of insulin to cover the carbohydrates in 8 ounces of juice, but the juice bottle he has contains 16 ounces of juice. How much insulin must he take if he wants to drink the entire bottle of juice?

3. Deante has a package of fruit snacks that he is going to share with a friend. The whole package contains 50 grams of carbohydrates. Deante wants to know how many carbohydrates are in half of the package. How can he solve this problem?

4. Keisha is planning on a healthy lunch. The list below shows how many carbohydrates are in all the foods Keisha plans to eat. Add up all the carbohydrates in Keisha's lunch.

Tuna fish sandwich	20 grams
5 Pretzels	15 grams
5 baby carrots with dip	5 grams
Jello cup	10 grams
<u>8 ounces of milk</u>	<u>12 grams</u>
	Total

5. Keisha's friend has offered to share her Baby Ruth bar. One half of a Baby Ruth bar has 18 grams of carbohydrate. Keisha knows she is allowed to have up to 80 grams of carbohydrate at lunchtime. Using your answer to question 4, find out if she should eat the half a Baby Ruth bar her friend offered. If she doesn't have the Jello cup, could she eat the whole Baby Ruth bar?

Intermediate Level

6. Lisa tries to keep her blood sugar levels below 120. When Lisa tested her blood sugar after school yesterday, it was 200. When her blood sugar is too high, Lisa often tries to lower it with exercise. Usually, twenty minutes of brisk walking will reduce her blood sugar by 40 points. How long will Lisa have to walk to bring her blood sugar down to an acceptable level? Draw a bar graph to show Lisa's blood sugar levels before she walks, after 20 minutes of walking and after 40 minutes of walking. What would her blood sugar level be if she walked for half an hour?

7. Andre plays soccer for his school's varsity team. He knows that his blood sugar must be at least 150 before practice in order to get through the whole practice without having to stop for a snack. When he tested his blood sugar today before practice, it was 70. He plans to drink a sports drink containing 30 grams of carbohydrate before practice. If every 10 grams of carbohydrate raises Andrew's blood sugar by 30 points, will this sports drink raise his blood sugar enough to get him through practice?

8. Elena always eats between 80 and 100 grams of carbohydrate for dinner. Tonight, she will be eating at a sandwich shop that provides the carbohydrate count for all their foods. She can choose any combination of items from the menu below, so long as the total carbohydrate count is between 80 and 100 grams. Choose a meal for Elena to have. If Elena decides to have a coke and a chocolate chip cookie, which sandwich must she choose?

Sandwiches		Snacks		Drinks	
Roast beef sub	41 g	Potato Chips	14 g	Berry Smoothie	27 g
Turkey sub	42 g	Cheetos	11 g	Peach Smoothie	26 g
Chicken teriyaki sub	55 g	Chocolate Chip cookie	29 g	Small Coke	41 g
Ham deli sandwich	33 g	Peanut Butter cookie	25 g	White milk	12 g
Low Carb Tuna wrap	10 g	Oatmeal Raisin cookie	28 g	Chocolate milk	24 g

9. David's mother is cooking spaghetti for dinner. The box says that a full serving of spaghetti has 42 grams of carbohydrate. One serving of sauce for the spaghetti has 6 grams of carbohydrate. David is not too hungry and plans on eating only a half serving of each. He will be having a glass of milk containing 12 grams of carbohydrate with his meal. He needs one unit of insulin for every 12 grams of carbohydrate he eats. How many units of insulin does David need to cover his dinner?

10. Rudy forgot to take his insulin at lunchtime. When he came home from school, his blood sugar level was 310. He needs to bring his blood sugar down to between 80 and 120. If every unit of insulin brings his blood sugar down by 50 points, how much insulin does he need to take?

Advanced Level

11. Jose knows that one cup of popcorn has 6 grams of carbohydrate. A medium bag of popcorn at the movies contains 16 cups of popcorn. Jose plans to split a medium popcorn and a package of Starbursts with his friend. A whole package of Starbursts contains 32 grams of carbohydrates. Jose needs one unit of insulin for every 8 grams of carbohydrate he eats. How many units of insulin must he take to cover the popcorn and candy?

12. Michelle's mother is cooking a package of rice to go with roasted chicken and vegetables for dinner. The nutrition facts label on the rice box says that each serving of rice will have 36 grams of carbohydrate. The label also says that the box contains five servings. Michelle's mother plans on cooking the entire package to split evenly between four people; Michelle, her brother, her father and herself. How many grams of carbohydrate will be in each serving of rice?

13. When Breanne tested her blood sugar this morning, she discovered that it was 60, well below her blood sugar target range of 100 - 120. She is planning on having a bagel (35 g), some grapes (10 g) and hot chocolate (30 g) for breakfast. She knows that 15 grams of carbohydrate will raise her blood sugar by 50 points. She also knows that one unit of insulin will cover 10 grams of carbohydrate. How many units of insulin must she take to allow her blood sugar to come up to her target range and cover the extra carbohydrates she is consuming?

14. Pedro is trying to lose weight by burning off calories through exercise. Using the chart below, figure out how many calories Pedro burned while walking for fifteen minutes, biking for twenty minutes and shooting hoops for 25 minutes. Draw a pie chart to show how much time Pedro spent doing each exercise.

<u>Calories Burned</u>	
Walking	5 cal/min
Biking	7 cal/min
Basketball	8 cal/min

15. Kim's doctor has told her to follow a diet where 50% of her calories come from carbohydrates, 30% of her calories come from protein and 20% of her calories come from fat. Kim knows that both carbohydrates and proteins have 4 calories per gram of food and fats have 9 calories per gram of food. If she plans to eat a 2000 calorie per day diet, how many grams of carbohydrates, fat and protein does she need to eat?

16. Corinne tests her blood sugar five times a day. She tries very hard to make sure her blood sugars are always between 80 and 180. The chart below shows Corinne's average blood sugar levels for the month of July. Draw a line graph of the blood sugar levels and answer the following questions: a) At what point in the day does Corinne need to take more insulin to keep her levels between 80 and 180? b) When should Corinne be using less insulin?

<u>8 am</u>	<u>12 pm</u>	<u>3 pm</u>	<u>6 pm</u>	<u>10 pm</u>
120	72	148	169	195

Math Answer Key

1. Maria can have 2 cookies.
2. John will need 2 units of insulin.
3. Deante should divide the number of grams of carbohydrate in the whole package (50g) by 2 to get the number of grams in half the package (25g).
4. Keisha's lunch adds up to 62 grams of carbohydrates.
5. Yes, Keisha can eat the half a Baby Ruth bar ($62\text{g} + 18\text{g} = 80\text{g}$), but even if she forgoes the Jello cup, she can't eat the whole Baby Ruth bar ($52 + 18 + 18 > 80$).
6. Lisa needs to lower her blood sugar by 80 points ($200 - 120$). To lower her blood sugar by 80 points, she will need to walk for 40 minutes (2×20). If she walks for half an hour (30 minutes), her blood sugar will be 140.
7. Yes. The 30 grams of carbohydrates in the drink will raise his blood sugar by 90 points (30×3). Adding 90 points to his current blood sugar level of 70 will bring him to just over his target number of 150 points ($70 + 90 = 160$).
8. Answers will vary. If Elena has the coke and the chocolate chip cookie, she must get the low carb tuna wrap ($41 + 29 = 70$ so her sandwich must be less than 30g).
9. David will be eating 24 grams of carbohydrates from the spaghetti and sauce ($42\text{g} + 6\text{g} = 48\text{g}$. Half of $48\text{g} = 24\text{g}$). Adding the carbohydrates from the milk (12g) brings his meal to 36 grams. $36\text{g} \div 12\text{ g/unit} = 3$ units of insulin.
10. Rudy needs to bring his blood sugar down by 200 points ($320 - 120$). $200\text{ points} \div 50\text{ points/unit} = 4$ units of insulin.
11. Jose will need 8 units of insulin. ($3\text{ cups of popcorn} \times 16\text{ g/cup} = 48\text{g}$ in half a bag of popcorn. $32\text{g} \div 2 = 16\text{g}$ in half a package of starbursts. $48\text{g} + 16\text{ g} = 64\text{g}$ total for Jose's snack. $64\text{g} \div 8\text{ grams/unit of insulin} = 8$ units of insulin.)
12. Michelle's rice will contain 45 grams of carbohydrate. ($36\text{ g/serving} \times 5\text{ servings} = 180\text{g}$ total in the box. $180\text{g} \div 4\text{ servings} = 45\text{ g/serving}$).
13. Breanne will be eating 75 grams of carbohydrate ($35\text{g} + 10\text{g} + 30\text{g}$). If she lets 15 grams of her breakfast work to bring her into her target range, she must take enough insulin to cover the other 60 grams of carbohydrates ($75\text{g} - 15\text{g} = 60\text{g}$). Thus, she must take 6 units of insulin ($60\text{g} \div 10\text{g /unit} = 6$ units).
14. Pedro burned off 415 calories: $15\text{ min} \times 5\text{ cal/min} = 75\text{ calories}$. $20\text{ min} \times 7\text{ cal/min} = 140\text{ calories}$. $25\text{ min} \times 8\text{ cal/min} = 200\text{ calories}$. $75 + 140 + 200 = 415\text{ calories}$
15. Kim should eat 250g of carbohydrate, 150g of protein and 44.4g of fat. See below:
Carbohydrate: $50\% \times 2000\text{ cal} = 1000\text{ cal}$. $1000\text{ cal} \div 4\text{ cal/g} = 250\text{g carb}$
Protein: $30\% \times 2000\text{ cal} = 600\text{ cal}$. $600\text{ cal} \div 4\text{ cal/g} = 150\text{g protein}$
Fat: $20\% \times 2000\text{ cal} = 400\text{ cal}$. $400\text{ cal} \div 9\text{ cal/g} = 44.4\text{g fat}$
16. Corinne needs to take more insulin at dinnertime (6 pm) to keep her blood sugar level from going over 180. She should be using less insulin at breakfast (8 am) to keep her noon reading from being too low.

EDUCATIONAL STANDARDS MET

Ohio Language Arts Standards:

READING

CONTENT STANDARD

Phonemic Awareness
 Acquisition of Vocabulary
 Reading Process
 Reading Applications: Informational Text

BENCHMARKS ACHIEVED

GRADES K – 3

A, B
 A, B, C, D
 A, B, C, D, E, F
 A, B, C, D

GRADES 4 - 7

A, B, C, D, E
 A, B, C, D
 A, C, E

National Language Arts Standards:

NL-ENG.K-12.1 Reading for perspective
 NL-ENG.K-12.2 Understanding the human experience
 NL-ENG.K-12.3 Evaluation strategies
 NL-ENG.K-12.4 Communication skills
 NL-ENG.K-12.9 Multicultural understanding
 NL-ENG.K-12.12 Applying language skills

Ohio Fine Arts Standards: Visual Arts

Creative Expression and Communication
 Analyzing and Responding
 Connections, Relationships and Applications

GRADES K – 4

A, B, C, D
 A, B
 A, B, C

GRADES 5 – 8

A, B, C, D, E
 B
 A, C

National Fine Arts Standards: Visual Arts, Grades K-4, 5-8

Standard 1: Understanding and applying media, techniques, and processes
 Standard 3: Choosing and evaluating a range of subject matter, symbols, and ideas
 Standard 6: Making connections between visual arts and other disciplines

Ohio Science Standards:

Life Sciences
 Scientific Inquiry
 Scientific Ways of Knowing

GRADES K – 2

B, C
 B, C
 A, C

GRADES 3 - 5

B
 B, C
 B, C, D

National Science Standards:

Unifying Concepts and Processes

 Science as Inquiry

 Life Science

 Science in Personal & Social Perspectives
 History and Nature of Science

GRADES K – 4 and 5-8

Systems, order and organization
 Evidence, models and explanation
 Change, constancy and measurement
 Form and function
 Abilities to do necessary scientific inquiry
 Understanding about scientific inquiry
 Characteristics of organisms (K-4)
 Structure and function in living systems (5-8)
 Regulation and behavior (5-8)
 Personal health
 Science as a human endeavor

Ohio Math Standards:

	<u>GRADES K – 2</u>	<u>GRADES 3 – 4</u>	<u>GRADES 5 - 8</u>
Number, Number Sense and Operations	C, F – M	A – C, H – M	C, D, F, I
Patterns, Functions and Algebra	D, E	B, C	B, F
Data Analysis and Probability	C	A, B, C, G, H	A, B
Mathematical Processes	A – I	A – K	A–C, E–H, J, L

National Math Standards: All grade levels

Numbers and Operations	<ul style="list-style-type: none"> *Understand numbers, ways of representing numbers and number systems *Understand meanings of operations and how they relate to one another *Compute fluently and make reasonable estimates
Algebra	<ul style="list-style-type: none"> *Understand patterns, relations and functions *Use mathematical models to represent and understand quantitative relationships *Analyze change in various contexts
Data Analysis	<ul style="list-style-type: none"> *Collect, organize and display relevant data *Develop and evaluate inferences that are based on data
Problem Solving	<ul style="list-style-type: none"> *Build new mathematical knowledge through problem solving *Solve problems that arise in mathematics and in other contexts *Apply and adapt a variety of strategies to solve problems *Monitor and reflect on the process of problem solving
Reasoning and Proof	<ul style="list-style-type: none"> *Make and investigate mathematical conjectures *Develop and evaluate mathematical arguments and proofs *Select and use various types of reasoning and methods of proof
Communication	<ul style="list-style-type: none"> *Organize and consolidate their mathematical thinking through Communication *Communicate their mathematical thinking coherently and clearly to peers, teachers, and others *Analyze and evaluate the mathematical thinking and strategies of others *Use the language of mathematics to express mathematical ideas precisely
Connections	<ul style="list-style-type: none"> *Recognize and apply mathematics in contexts outside of Mathematics
Representation	<ul style="list-style-type: none"> *Create and use representations to organize, record, and communicate mathematical ideas *Use representations to model and interpret physical, social, and mathematical phenomena

The math problems associated with this unit are particularly effective at developing student cognitive skills in the applying (problem solving) and reasoning domains.

Ohio Social Studies Standards:
Economics

GRADES K – 2
B

GRADES 3 - 5
B

National Social Studies Standards:

IV. Individual Development and Identity
V. Individuals, Groups and Institutions
VII. Production, Distribution and Consumption
VIII. Science, Technology and Society

Early Grades
e, g, h
a, b, c
d, e
a, c

Middle Grades
c, g
b, c
d, e
a, c

Ohio Technology Standards:

Technology and Society Interactions
Design
Designed World

GRADES K - 2
A
A, B
C

GRADES 3 - 5
A
A, B
C

National Technology Standards: All grade levels

Social, Ethical and Human Issues	*Students understand the ethical, cultural, and societal issues related to technology *Students develop positive attitudes toward technology uses that support lifelong learning, collaboration, personal pursuits, and productivity
Technology Research Tools	*Students use technology to locate, evaluate, and collect information from a variety of sources
Technology Problem-Solving and Decision-Making Tools	*Students employ technology in the development of strategies for solving problems in the real world