

# STEM PATHWAYS

## Glucose Detective **STEM** Challenge!

### The Problem

Jason has diabetes, which means his blood contains abnormal levels of glucose, a sugar. If Jason were to experience low blood sugar, he would need to eat or drink something with a high level of glucose immediately, so he does not pass-out.

### The Challenge:

Help Jason identify which of the items he should consume containing the highest level of glucose.

### Find a Measurable Solution

ASK: What is your hypothesis?

HYPOTHESIZE: Identify your variables.

TEST: Conduct an experiment.

ANALYZE: Results, draw conclusions, try again!

COMMUNICATE: Findings & make recommendations.

### Things to Consider

1. Glucose is a major source of energy for cells in our body. Hormones made in the body, such as insulin, help control blood glucose levels.
2. Hypothesis: Which item do you think will contain the most glucose? Why?
3. Why would Jason need a food high in glucose rather than a food containing more complex sugars, if his blood sugar is low?
4. A digital glucose meter helps people gauge their glucose levels. The meter measures glucose in mg/dL or milligrams of glucose per deciliter of solution.

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What is Your Hypothesis?

What are the variables in your hypothesis?

### Identify the Independent and Dependent Variables

- Fruit juice (orange, lemon, apple)
- Fresh produce (apple, pear, pineapple, cucumber, tomato)
- Processed foods and beverages (soda, sports drinks, salad dressings, sauces, peanut butter, chips)
- Level of Glucose



#### SAFETY ALERT:

Be aware of food allergies! Ask participants if they are allergic to any foods before beginning.



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**TIME: 30 MINUTES**

### Materials & Supplies

- 3 ounce disposable cups
- Food and beverage samples
- Water
- Plastic Spoons
- Pipets
- Aluminum Foil
- Digital glucose meters with test strips or paper glucose test strips
- Graph paper and pens or pencils
- Hand sanitizer

### Design Space

- One table for each group, cover tables for easy clean-up.
- Glucose meter: Read instructions for proper set-up and use.
- Food & Beverage samples: add 1 to 2 T of a different sample to a cup. Add water to dry food or thick liquids and stir to make the consistency of blood, dissolving the dry food. Include water in a cup as your control.
- Results Card: Record each food and beverage sample with the corresponding number on a card.
- Keep food & beverage containers for reference later by the groups.



**SAFETY ALERT:** Be aware of food allergies! Ask participants if they are allergic to any foods before beginning.

- Did you accept or reject your hypothesis?
- What changes will you make?
- What questions do you still want to explore?

### Engage the Learner

- Which foods can contribute to weight gain? *Foods high in fat, sugar and carbohydrates*
- What sugary foods could you remove from your diet to reduce your caloric intake?
- Where can you locate the sugar content of a food? *Food labels and dietary references*
- What agricultural crops high in sugar could be used to produce ethanol, a renewable fuel source? *Most ethanol is produced by breaking down the starch into simple sugars and fermenting.*

### Observations & Conclusions

- What other foods may have high glucose levels that could be tested?
- Which foods that you have tested should Jason eat if his blood glucose levels are becoming too high?
- How might you test for more complex sugars?

**Note:** People with diabetes also suffer from high blood glucose levels.

### STEM Career Path... Nutritionist

- Who else might be involved? *Agricultural producers, endocrinologist, food scientist, biomedical engineer, and marketers.*
- Who benefits? *People with diabetes, current and future consumers with more nutritional food options, governments and businesses incurring less health-related costs through preventative care.*
- What other issues are nutritionists helping to solve? *Preventing & treating illnesses, increasing life span; enhancing bodily development in babies & children; and improving health of pregnant women and older people.*

Refer to Career Focus Card for more details.



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### Each group will ...

Step 1: Create a bar graph to capture your data on your experiment record. Label the y-axis "Glucose content", range 0-600 mg/dL in 50 mg/dL intervals. Label the x-axis with each mixture's number.

Step 2: Place a strip of aluminum foil in front of each numbered cup.

Step 3: Using the glucose meter, test your control – the water. Remove test strip from vial immediately and insert the strip into the meter. The meter should turn on depending on the meter's manufacturer.

Step 4: Using the pipet, place a few drops of water on the aluminum foil strip in front of the water cup. Gently touch the tip of the strip to the water and allow the water drop to be drawn into the strip. Some meters may beep to indicate the meter has received the mixture and is analyzing the water. Record your water glucose reading, which should be near 0.

Step 5: Now test each sample with the glucose meter. Use a new strip for each test. Remove test strip from vial, recap vial immediately, and insert the strip into the meter. Using the pipet, place a few drops of the sample on the aluminum foil strip. Gently touch the tip of the strip to a drop of the mixture and allow the drop to be drawn into the strip. Read the glucose meter result displayed on the meter and record it on the graph in the appropriate column.

Step 6: Analyze and compare results. Guess the contents of the cups based on your results. Ask the facilitator to share the food or beverage in each cup.

Step 7: Look at the sugar content of the foods and beverages you tested. Read the labels on the foods and beverage containers. Were your predictions and results close?



### Make Your Predictions

### Test Your Samples

### Record Your Results

### Share Your Findings



**What are your independent & dependent variables?**

**What is your hypothesis?**



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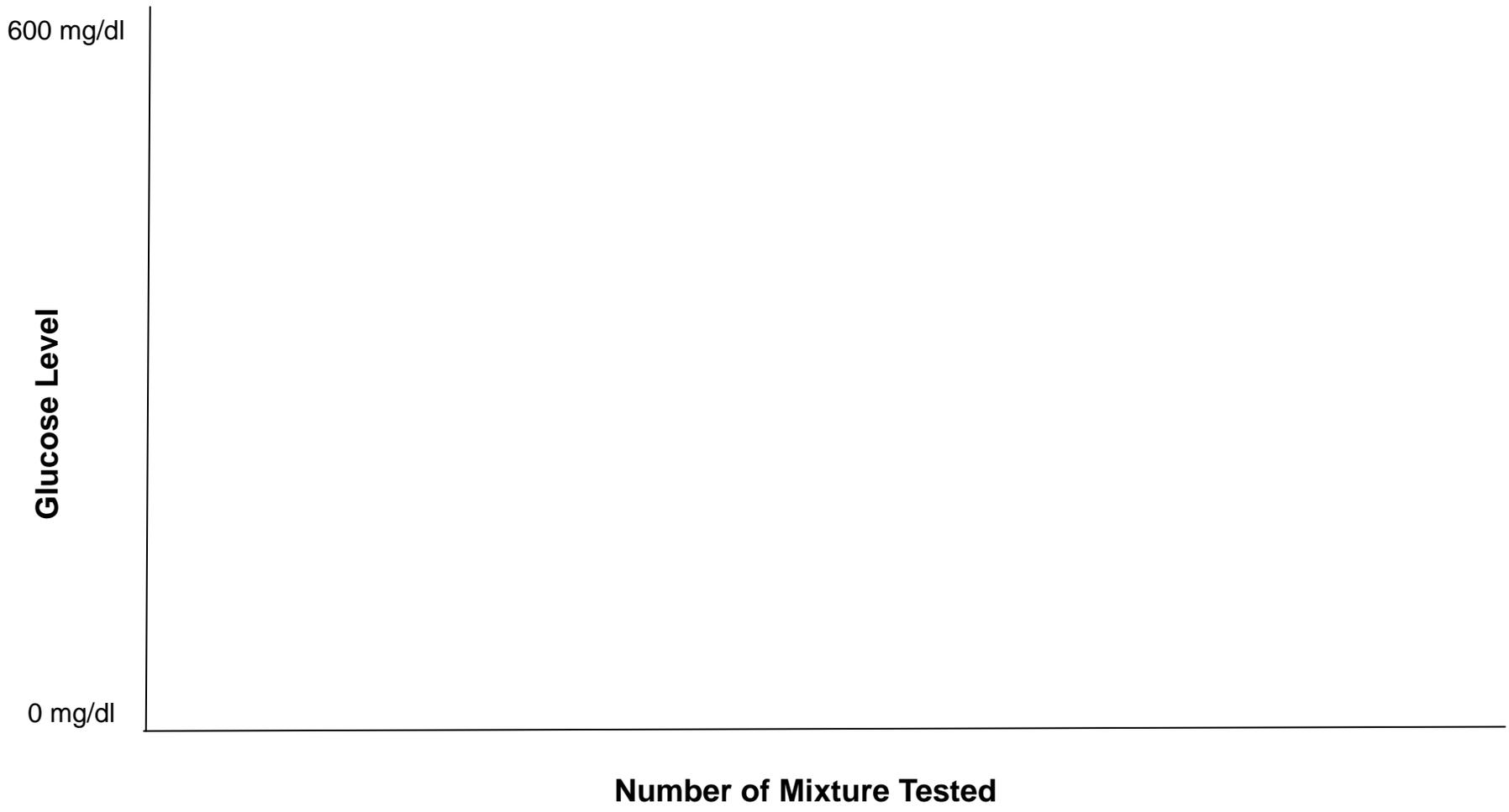


# STEM PATHWAYS Glucose Detective Challenge Bar Graph Data Sheet

Hypothesis: \_\_\_\_\_

Accepted  Rejected

Independent Variable: \_\_\_\_\_ Dependent Variable: \_\_\_\_\_



Your Recommendation for Jason:



## STEM PATHWAYS

career

## Glucose Detective STEM Challenge

Did You Know? For processed foods, the labels on most products list total sugar, which is a mixture of the following sugars: sucrose, fructose and glucose.

## SCIENCE

Food Scientist

**How can foods be produced that are healthier, safer, more abundant and less expensive?**

- Calories are a tool used to measure the energy content from a food's or beverage's carbohydrates, fats and proteins. Boys and girls between the ages of 9-13 years old need at least 1600-1800 calories a day.
- Adding fats and sugars during processing can make a food or beverage more appealing, but it also adds calories.
- Salt is used to preserve and modify the flavor of foods, but too much salt in the diet increases the risk of high blood pressure, which raises the odds of heart disease and stroke.

## TECHNOLOGY

Endocrinologist

**What new technologies can be designed to treat diabetes?**

- An endocrinologist is a doctor focusing on the internal function of the body, especially our body's production and use of hormones.
- The pancreas makes the hormone insulin, which the body typically releases while eating to help the body use the glucose it gets from food.
- Diabetes is a group of diseases characterized by high blood glucose levels that result from the body's inability to produce and/or use insulin.
- Insulin is delivered to diabetics through injections and pumps. What other methods could be pursued to help control glucose levels and/or deliver insulin to diabetics?

## ENGINEERING

Biomedical Engineer

**How might a meter be engineered that measures glucose, but does not require a drawing blood?**

- Currently, many people with diabetes measure the amount of glucose in their blood by pricking or lancing their finger and squeezing out a drop of blood. Sometimes a diabetic may have to measure their glucose levels multiple times a day, including before and after meals.
- Glucose can also be measured through urine, but it is not as accurate as blood glucose levels.
- Things to consider when designing a glucose meter include cost, functions, size, memory or ability to store results, and accuracy.

## MATH

Nutritionist

**What combination of physical activity and nutrition could help prevent diabetes or reduce its severity in a person?**

- Approximately 79 million people in the United States, or 25% of the population, may have pre-diabetes.
- The American Diabetes Association suggests that a non-pregnant adult with diabetes should aim for a blood glucose target of 154 mg/dL.
- Someone in the United States is diagnosed with diabetes every 17 seconds. Estimate how many people will be diagnosed with diabetes in the next minute.



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### Nutritionist

#### Finding Solutions For...

- Healthy lifestyles
- Achieving specific health-related goals

#### Job Forecast Looks Like...

- **Median Income:** \$55,240 per year
- **Job Outlook:** 21% growth from 2012-2022
- **Job Environment:** Nutritionists work in many settings including hospitals, cafeterias, nursing homes and schools. Some are self-employed with their own practice.
- **Expected Growth Areas:** employment of dietitians and nutritionists is expected to increase faster than the average of all occupations.

#### Skill Set Needed...

- **High School Courses:**
  - Math: algebra and calculus
  - Science: biology, chemistry
  - Specialized: health and food science
- **Analytical:** interpret and communicate research
- **Organizational:** balance nutritional needs and food costs
- **Interpersonal:** motivational and trustworthy to help people achieve goals
- **Communication:** good written and speaking skills to help educate people

#### Education and Training Required...

- **Entry Level Jobs:** Require Bachelor's degree, participation in internships. Most states require a license or certification requiring passing an exam.
- **Additional Training and Certifications:** Advanced degrees to enhance earning potential and management roles.



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Sources:  
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