

## Fruit Juice Inquiry: Sample Answers

### Introduction

Do you drink a glass of juice with your breakfast every day? Have you ever stopped and wondered if this is a healthy habit?



Source: <https://wellnessandequality.com/2012/01/>

Kidney stones are a painful medical condition caused by the formation of solid particles (stones) from waste products that have been filtered from the blood by the kidneys. When these kidney stones move into the urinary passages, they can cause blockages resulting in severe pain. Kidney stones can also damage the urinary passages, resulting in blood in the urine. Urine may also appear cloudy or have bad smells if there is also an infection.

The lifetime risk of developing kidney stones is one in ten for Australian men and one in 35 for women [Footnote <sup>§</sup>].

The most common types of kidney stones are those formed from calcium combined with oxalate or phosphate. The best way of lowering the risk of all types of kidney stones is to drink lots of water. Research indicates that juices, fruits and vegetables that are high in citrate or

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<sup>§</sup> Kidney Health Australia (2016), "Kidney stones: Who is at risk?", <[kidney.org.au/your-kidneys/detect/kidney-stones/who-is-at-risk-438](http://kidney.org.au/your-kidneys/detect/kidney-stones/who-is-at-risk-438)> (accessed 10 September 2016).

citric acid may lower the risk of forming calcium oxalate kidney stones [Footnote \*\*].



<http://www.freethunk.net/cartoon-funnies/freethunk-cartoons/kidney-stones-cartoon-14>

While fruit juices contain several types of food acids, the amount of citric acid in oranges, lemons, grapefruit, and limes is well approximated by the total acidity as determined by NaOH titration using phenolphthalein indicator [Footnote \*\*].

Your task in this investigation is to evaluate the advantages and disadvantages of consuming citric juice as part of a healthy diet, considering both the short term and long term impacts it has on your body. The focus of the investigation will be on the acidity levels of juice.

## Investigation Project Steps

Lesson 1 Investigation of the contents of citric juice *Individually*

\*\* Heilberg, I. P. (2000). Update on dietary recommendations and medical treatment of renal stone disease. *Nephrology Dialysis Transplantation*, 15(1), 117-123; Meschi, T., Maggiore, U., Fiaccadori, E., Schiavichi, T., Bosi, S., Adorni, G., . . . Borghi, L. (2004). The effect of fruits and vegetables on urinary stone risk factors. *Kidney International*, 66, 2402-2410.

†† W. B. Sinclair, E. T. Bartholomew and R. C. Ramsey, "Analysis of the organic acids of orange juice", *Plant Physiol.*, 1945, 20, 3-18 <[www.plantphysiol.org/content/20/1/3.citation](http://www.plantphysiol.org/content/20/1/3.citation)>.

Lessons 2 – 3	Investigating how to test the acidity in citric juice	<b>Group</b>
Lessons 4 – 5	Carry out investigation	<b>Group</b>
Lessons 6 – 7	Completing the Scientific Poster	<b>Individually</b>

## Lesson 1: Investigating the contents of citric juice

4. Look at the nutritional labels and the ingredient list on the containers of juice provided. Record all the information with a photo.
  - d. What information is given about all of the juices?
  - e. What do they have in common and what is different?
  - f. What type of acid is found in each of the juices?
  
5. All citric juices have acids as part of their chemical composition. Using the Internet, research the following information:
  - d. What acids are found in citric juice?
  - e. What impact do these acids have on the health of an individual?
  - f. Is it better to have a higher or a lower acidic content in your citric juice?
  
6. Use the information from the nutritional labels and ingredient and research from the Internet, complete the below comparison table.

Potential impacts on your health by drinking citric juice	
Advantages	Disadvantages
Citric acid inhibits kidney stone formation	Too much acidic juices can erode tooth enamel
Drinking any juice helps fluid intake	It can upset your stomach
Citrus fruits are an excellent source of vitamin C	Fruit juice is not as healthy as whole fruit
	Too much acidic juices can worsen existing stomach ulcers

## Lessons 2 – 3: Investigating how to test the acidity in citric juice

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- Working in your group:
7. Outline the type of practical investigation you can complete to measure the acidity of different orange juices.
  8. What type of data will you collect?
- Class discussion:
9. Discuss the advantages and disadvantages of the different types of practical investigations researched.
  10. Come a consensus on the best method for investigating the acidic concentration of orange juice.
- Working in your group:
11. Outline the investigation process to include the following:
    - Aim
    - Hypothesis
    - Variables:
      - Independent variable
      - Dependent variable
      - Controlled variables
    - Materials
    - Method
    - Safety considerations
  12. Show your investigation planning to your teacher to be approved.

## Lessons 4 – 5 Carry out investigation

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- Working in your group:
5. Carry out method from approved investigation planner.
  6. Record all results into suitable data tables.
  7. Complete any suitable calculations and graphs.
  8. Record and discuss any sources of error.

## Lessons 6 – 7 Completing the Scientific Poster

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- Working in your group:
6. Complete introduction:
    - One to two paragraph overview of the reason for completing the investigation, the scientific context and an explanation of the relevant scientific theory.

- This should be based on your research from lessons 1-3. All sources need to be acknowledged.
7. Complete the discussion section:
- Some guiding questions will be provided by your teacher.
  - Discuss whether the results support your research and explain their implications.
  - Were there any limitations to your investigation?
8. Complete the conclusion section:
- State your main result from your investigation.
  - State whether this supports or refutes your hypothesis.
9. Complete References and Acknowledgements.
10. Enter all information into the Scientific Poster Template provided by your teacher.

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