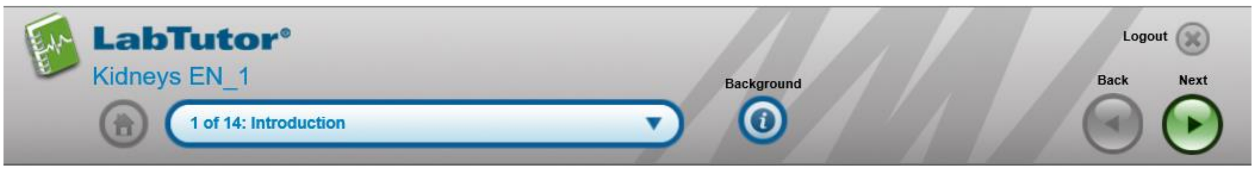
Kidneys



Introduction:

In this experiment, you will investigate how the kidneys handle fluid loads. These include water alone, and isosmotic salt and monosaccharide solutions, as well as a hyperosmotic monosaccharide solution.

Claude Bernard (1813 - 1867) - the first to express the concept of the constancy of the internal environment.

Carl Ludwig (1816 - 1895) - a pioneer of renal physiology.

Learning Objectives

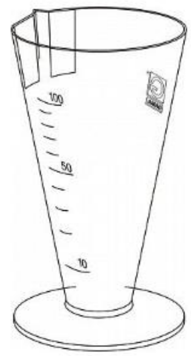
By the end of today's laboratory you will be able to:

- Describe how the kidneys handle a water load
- Distinguish between the handling of water and isosmotic salt loads
- Explain the pattern of fluid excretion following isosmotic and hyperosmotic monosaccharide loads
- Discuss the relationship between urine osmolarity and specific gravity and how osmolarity is affected by changes in urine flow rates

Refractometer RUR2-ATC

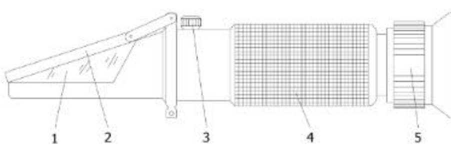
Equipment:

Refractometer, urine collection container, urine transfer pipette to refractometer, test strips, measuring container and paper napkins.



Urine collection container

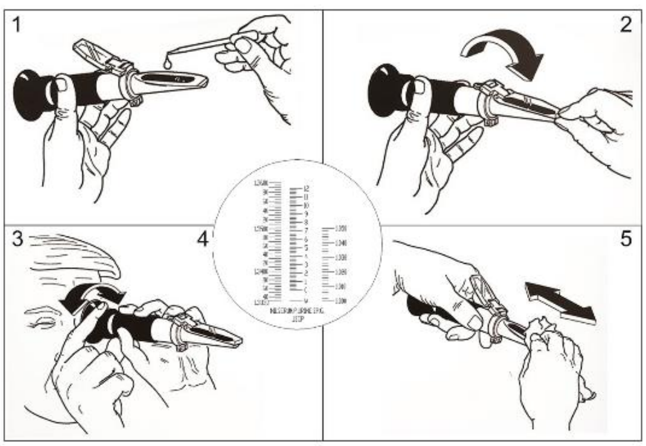
Test strips



1. Optical prism
2. Translucent cup
3. Calibration screw
4. Rubber handle
5. Eyepiece with focus

Pipete

Urine measuring container



1. Applying a drop of urine to the prism of the refractometer.
2. Covering the prism with a transparent cup.
3. Reading the measured value from the scale.
4. Cleaning the prism (be careful not to scratch the prism).

Procedure:

This laboratory involves the collection of urine at various time intervals and measurement of its volume and specific gravity (an indication of osmolarity). There are four different protocols, each requiring a different volunteer.

Volunteer preparation

The establishment of the diuresis depends upon fairly rapid absorption of the water so it is important not to start with a full stomach. Just eat a light meal and drink normally in the 3 to 4 hours before the laboratory starts. In addition, avoid fluids containing caffeine (coffee, tea, cola drinks) for at least 3 hours prior to the laboratory.

Be sure to note the time at which you last urinated prior to coming to the laboratory.

Refractometer measurement

1. Preparation for measurement (handle the device with care and do not touch optical lens).
Set direction of the refractometer transparent cup against the light, look into the eyepiece and sharpen the image to improve readability.
You will see a circular space with a measuring scale .

2. Refractometer calibration.
Open the transparent cup, put **1 to 2 drops** of the calibration solution (distilled water) on the optical prism, close the cup and press it slightly for the solution to spread perfectly over the surface of the optical prism (without air bubbles and dry spots). Look into the eyepiece, the top of the visor should be blue, the bottom white, and the boundary should go through a calibration value of **1.3300** (left scale of the RI) If not, turn the calibration screw until the desired condition is reached.

3. Measurement.
Open the transparent cup, clean the optical prism with the **included cloth**, then put **1 to 2 drops** of the test liquid (urine) on it, close the cup and slightly press it so that the liquid can spread perfectly over the surface of the optical prism (without air bubbles and dry spots) The measured value will be represented by the intersection of the blue-white boundary on the **right measuring scale** (specific gravity).

4. Cleaning after measurement
Clean the prism and the transparent cup with a damp cloth and carefully place the device in to the case.
To wet the cloth, use **Desident CaviCide** spray.

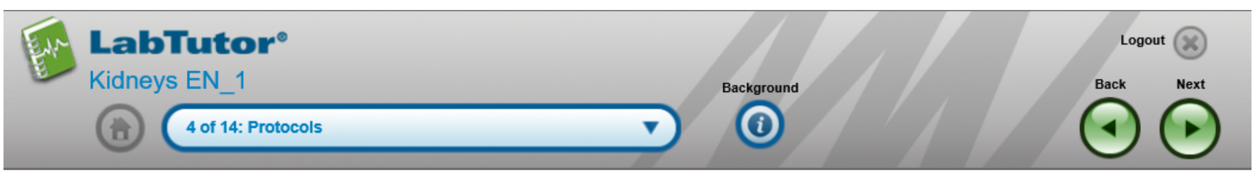
General procedures during the experiments for all volunteers

1. At the commencement of the experiment, note the time, collect your urine and measure its volume. Keep a small sample for measurement of specific gravity.
2. Immediately after the collection of the first sample, drink the required solution (except control). Once you have drunk this solution, do not drink anything else during the laboratory.
3. Continue to collect urine approximately every 20 minutes, noting the time at which the bladder is emptied to the nearest minute.
4. It will be found most convenient for each subject to be his or her own timekeeper; there is no necessity for the subjects to keep in step with each other. The essential thing is that the intervals between urination are accurately recorded.

Cautions

⚠ Do not volunteer to be a subject in this laboratory class if you are suffering from kidney or circulatory problems, have any other medical problem or are on any medications.

⚠ Urine is a potentially infectious body fluid. Therefore, students are directly responsible for all measurements of the volume and specific gravity of their own urine, and are required to clean up any spilt urine themselves.



Experimental protocols:

There are four different protocols.

Protocol 1: Control - no fluid intake during experiment.

1. Drink nothing during this laboratory and collect specimens of urine each 20 minutes or so.
2. Measure the volume and specific gravity of your urine and then dispose of the sample down the toilet.
3. Enter the volume and specific gravity of the sample into your own table.

Protocol 2: To illustrate a normal water diuresis.

1. Drink 800 mL of Solution 2, then collect specimens of urine each 20 minutes or so.
2. Measure the volume and specific gravity of your urine and then dispose of the sample down the toilet.
3. Enter the volume and specific gravity of the sample into your own table.

Protocol 3: To illustrate effects of drinking the equivalent of an isosmotic sodium chloride solution.

1. Drink 800 mL of Solution 3, then collect specimens of urine each 20 minutes or so.
2. Measure the volume and specific gravity of your urine and then dispose of the sample down the toilet.
3. Enter the volume and specific gravity of the sample into your own table.

Protocol 4: To illustrate effects of drinking a hyperosmotic glucose solution.

1. Drink 800 mL of Solution 4, then collect specimens of urine each 20 minutes or so.
2. Measure the volume and specific gravity of your urine and then dispose of the sample down the toilet.
3. Enter the volume and specific gravity of the sample into your own table.

Sample 1: 0 min

After collecting the first sample complete the fields in the table below, for each different protocol (Sample 1: 0 min). You must record the time in minutes that you last urinated before you came to the laboratory .

Protocol 1: Control

Sample No.	Time (min)	Volume (mL)	Flow (mL/min)	Specific Gravity
Prior to lab				
Sample 1 (0 min)	0			

Protocol 2: Hyposmotic Solution

Sample No.	Time (min)	Volume (mL)	Flow (mL/min)	Specific Gravity
Prior to lab				
Sample 1 (0 min)	0			

Protocol 3: Isosmotic Sodium Chloride Solution

Sample No.	Time (min)	Volume (mL)	Flow (mL/min)	Specific Gravity
Prior to lab				
Sample 1 (0 min)	0			

Protocol 4: Hyperosmotic Glucose Solution

Sample No.	Time (min)	Volume (mL)	Flow (mL/min)	Specific Gravity
Prior to lab				
Sample 1 (0 min)	0			

Protocol 1: Control - HeptaPhan Test

Sample No.	pH	Proteins	Glucose	Ketones	Urobilinogen	Bilirubin	Blood
Sample 1 (0 min)							

Protocol 2: Hyposmotic Solution - HeptaPhan Test

Sample No.	pH	Proteins	Glucose	Ketones	Urobilinogen	Bilirubin	Blood
Sample 1 (0 min)							

Protocol 3: Isosmotic Sodium Chloride Solution - HeptaPhan Test

Sample No.	pH	Proteins	Glucose	Ketones	Urobilinogen	Bilirubin	Blood
Sample 1 (0 min)							

Protocol 4: Hyperosmotic Glucose Solution - HeptaPhan Test

Sample No.	pH	Proteins	Glucose	Ketones	Urobilinogen	Bilirubin	Blood
Sample 1 (0 min)							

Study Question

While waiting to collect the next sample, answer the following question.

1. What changes in urine output do you expect to see in each of the protocols during this laboratory?

Answer
Protocol 1 - Control

Answer
Protocol 2 - Hyposmotic Solution

Answer
Protocol 3 - Isosmotic Sodium Chloride Solution

Answer
Protocol 4 - Hyperosmotic Glucose Solution

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Kidneys EN_1

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Sample 2: 20 min

After collecting the 20 minute sample complete the fields in the tables below, for each different protocol.

Protocol 1: Control

Sample No.	Time (min)	Volume (mL)	Flow (mL/min)	Specific Gravity
Prior to lab				
Sample 1 (0 min)	0			
Sample 2 (20 min)				

Protocol 2: Hyposmotic Solution

Sample No.	Time (min)	Volume (mL)	Flow (mL/min)	Specific Gravity
Prior to lab				
Sample 1 (0 min)	0			
Sample 2 (20 min)				

Protocol 3: Isosmotic Sodium Chloride Solution

Sample No.	Time (min)	Volume (mL)	Flow (mL/min)	Specific Gravity
Prior to lab				
Sample 1 (0 min)	0			
Sample 2 (20 min)				

Protocol 4: Hyperosmotic Glucose Solution

Sample No.	Time (min)	Volume (mL)	Flow (mL/min)	Specific Gravity
Prior to lab				
Sample 1 (0 min)	0			
Sample 2 (20 min)				

Protocol 1: Control - HeptaPhan Test

Sample No.	pH	Proteins	Glucose	Ketones	Urobilinogen	Bilirubin	Blood
Sample 1 (0 min)							
Sample 2 (20 min)							

Protocol 2: Hyposmotic Solution - HeptaPhan Test

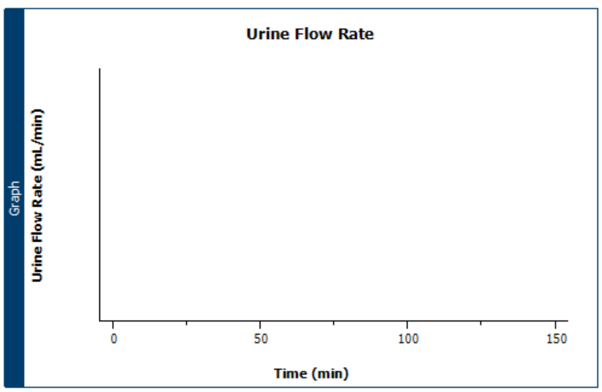
Sample No.	pH	Proteins	Glucose	Ketones	Urobilinogen	Bilirubin	Blood
Sample 1 (0 min)							
Sample 2 (20 min)							

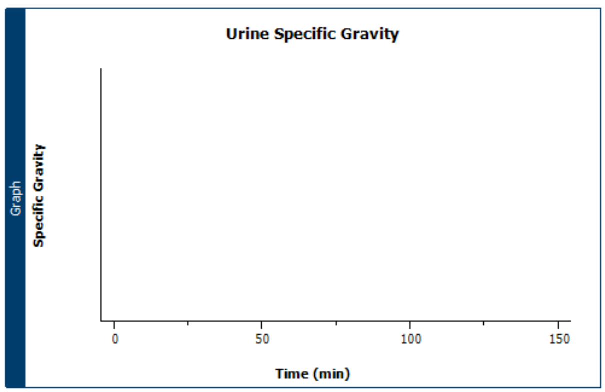
Protocol 3: Isosmotic Sodium Chloride Solution - HeptaPhan Test

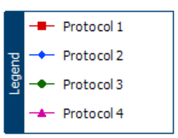
Sample No.	pH	Proteins	Glucose	Ketones	Urobilinogen	Bilirubin	Blood
Sample 1 (0 min)							
Sample 2 (20 min)							

Protocol 4: Hyperosmotic Glucose Solution - HeptaPhan Test

Sample No.	pH	Proteins	Glucose	Ketones	Urobilinogen	Bilirubin	Blood
Sample 1 (0 min)							
Sample 2 (20 min)							







Study Questions

While waiting to collect the next sample, answer the following questions.

2. What is the osmolarity of the fluid in the interstitial space in the renal cortex? Is it the same throughout that space?

Answer

3. What is the osmolarity of the fluid in the interstitial space in the renal medulla? Is it the same throughout that space?

Answer

Sample 3: 40 min

After collecting the 40 minute sample complete the fields in the table below, for each different protocol.

Protocol 1: Control

Sample No.	Time (min)	Volume (mL)	Flow (mL/min)	Specific Gravity
Prior to lab				
Sample 1 (0 min)	0			
Sample 2 (20 min)				
Sample 3 (40 min)				

Protocol 2: Hyposmotic Solution

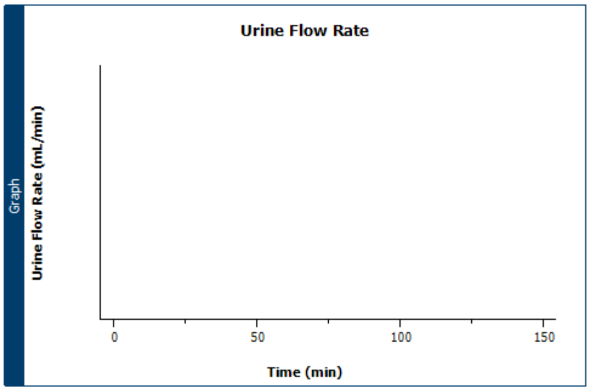
Sample No.	Time (min)	Volume (mL)	Flow (mL/min)	Specific Gravity
Prior to lab				
Sample 1 (0 min)	0			
Sample 2 (20 min)				
Sample 3 (40 min)				

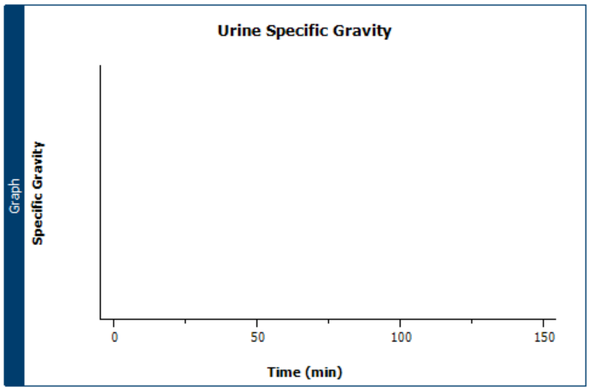
Protocol 3: Isosmotic Sodium Chloride Solution

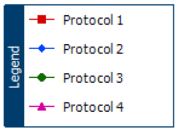
Sample No.	Time (min)	Volume (mL)	Flow (mL/min)	Specific Gravity
Prior to lab				
Sample 1 (0 min)	0			
Sample 2 (20 min)				
Sample 3 (40 min)				

Protocol 4: Hyperosmotic Glucose Solution

Sample No.	Time (min)	Volume (mL)	Flow (mL/min)	Specific Gravity
Prior to lab				
Sample 1 (0 min)	0			
Sample 2 (20 min)				
Sample 3 (40 min)				







Study Question

While waiting to collect the next sample, answer the following question.

4. What hormone is involved in regulating renal water excretion? What normally inhibits the release of this hormone?

Answer

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Kidneys EN_1
8 of 14: Sample 4: 60 min
Background
Logout
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Next

Sample 4: 60 min

After collecting the 60 minute sample complete the fields in the table below, for each different protocol.

Protocol 1: Control

Sample No.	Time (min)	Volume (mL)	Flow (mL/min)	Specific Gravity
Prior to lab				
Sample 1 (0 min)	0			
Sample 2 (20 min)				
Sample 3 (40 min)				
Sample 4 (60 min)				

Protocol 2: Hyposmotic Solution

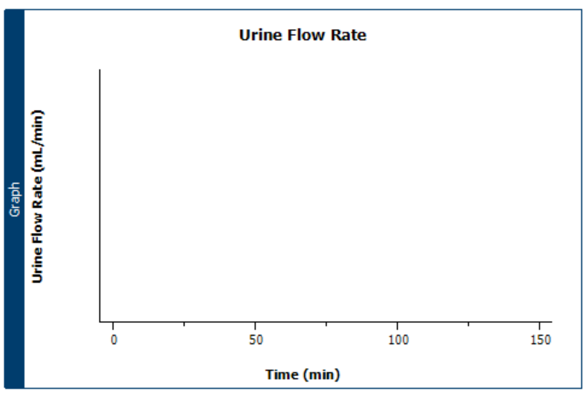
Sample No.	Time (min)	Volume (mL)	Flow (mL/min)	Specific Gravity
Prior to lab				
Sample 1 (0 min)	0			
Sample 2 (20 min)				
Sample 3 (40 min)				
Sample 4 (60 min)				

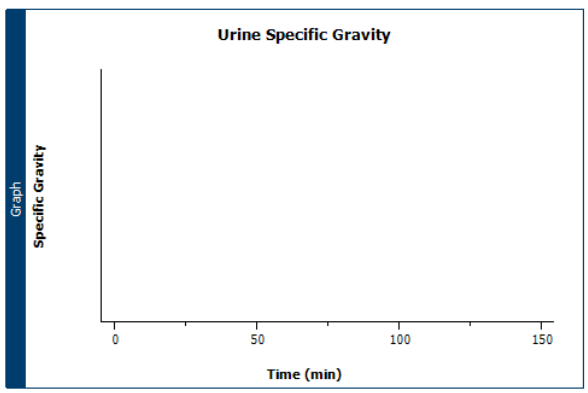
Protocol 3: Isosmotic Sodium Chloride Solution

Sample No.	Time (min)	Volume (mL)	Flow (mL/min)	Specific Gravity
Prior to lab				
Sample 1 (0 min)	0			
Sample 2 (20 min)				
Sample 3 (40 min)				
Sample 4 (60 min)				

Protocol 4: Hyperosmotic Glucose Solution

Sample No.	Time (min)	Volume (mL)	Flow (mL/min)	Specific Gravity
Prior to lab				
Sample 1 (0 min)	0			
Sample 2 (20 min)				
Sample 3 (40 min)				
Sample 4 (60 min)				





Legend
- Protocol 1
- Protocol 2
- Protocol 3
- Protocol 4

Study Question

While waiting to collect the next sample, answer the following question.

5. In question 4 you stated what normally inhibits the release of the hormone controlling water excretion. From your own experience, identify two situations where this inhibition is over-ridden. For each situation explain the physiological advantage of over-riding this inhibition.

Answer
Situation 1

Answer
Situation 2

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9 of 14: Sample 5: 80 min

Background

Logout

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Sample 5: 80 min

After collecting the 80 minute sample complete the fields in the table below, for each different protocol.

Protocol 1: Control

Sample No.	Time (min)	Volume (mL)	Flow (mL/min)	Specific Gravity
Prior to lab				
Sample 1 (0 min)	0			
Sample 2 (20 min)				
Sample 3 (40 min)				
Sample 4 (60 min)				
Sample 5 (80 min)				

Protocol 2: Hyposmotic Solution

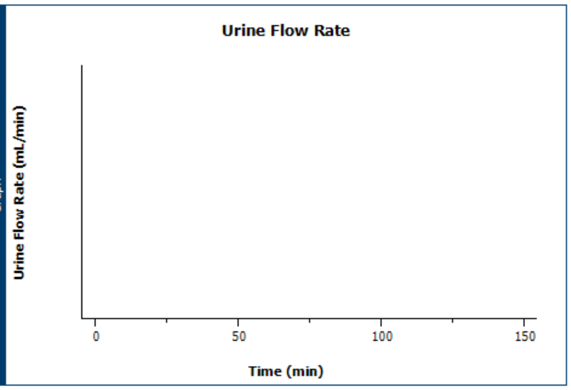
Sample No.	Time (min)	Volume (mL)	Flow (mL/min)	Specific Gravity
Prior to lab				
Sample 1 (0 min)	0			
Sample 2 (20 min)				
Sample 3 (40 min)				
Sample 4 (60 min)				
Sample 5 (80 min)				

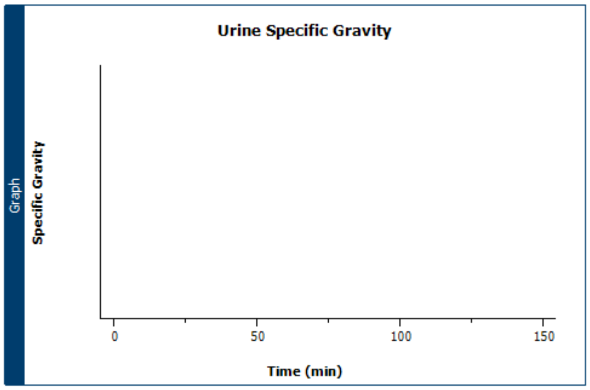
Protocol 3: Isosmotic Sodium Chloride Solution

Sample No.	Time (min)	Volume (mL)	Flow (mL/min)	Specific Gravity
Prior to lab				
Sample 1 (0 min)	0			
Sample 2 (20 min)				
Sample 3 (40 min)				
Sample 4 (60 min)				
Sample 5 (80 min)				

Protocol 4: Hyperosmotic Glucose Solution

Sample No.	Time (min)	Volume (mL)	Flow (mL/min)	Specific Gravity
Prior to lab				
Sample 1 (0 min)	0			
Sample 2 (20 min)				
Sample 3 (40 min)				
Sample 4 (60 min)				
Sample 5 (80 min)				





Legend
- Protocol 1
- Protocol 2
- Protocol 3
- Protocol 4

Study Question

While waiting to collect the next sample, answer the following question.

6. From your data collected so far, estimate the maximum volume of water that you could drink over sixty minutes while still remaining in water balance?

Answer

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Kidneys EN_1

10 of 14: Sample 6: 100 min

Background

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Sample 6: 100 min

After collecting the 100 minute sample complete the fields in the table below, for each different protocol.

Protocol 1: Control

Sample No.	Time (min)	Volume (mL)	Flow (mL/min)	Specific Gravity
Prior to lab				
Sample 1 (0 min)	0			
Sample 2 (20 min)				
Sample 3 (40 min)				
Sample 4 (60 min)				
Sample 5 (80 min)				
Sample 6 (100 min)				

Protocol 2: Hyposmotic Solution

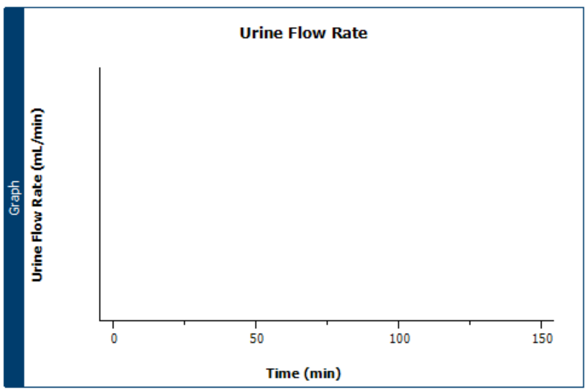
Sample No.	Time (min)	Volume (mL)	Flow (mL/min)	Specific Gravity
Prior to lab				
Sample 1 (0 min)	0			
Sample 2 (20 min)				
Sample 3 (40 min)				
Sample 4 (60 min)				
Sample 5 (80 min)				
Sample 6 (100 min)				

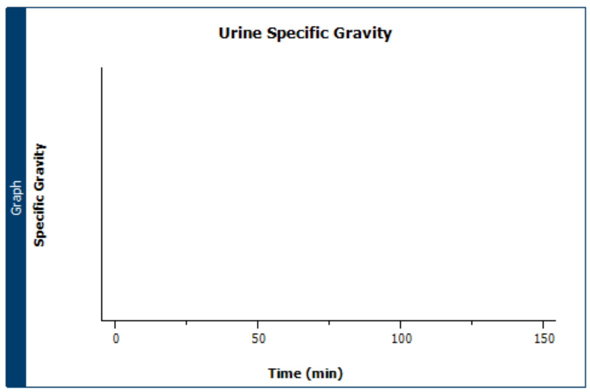
Protocol 3: Isosmotic Sodium Chloride Solution

Sample No.	Time (min)	Volume (mL)	Flow (mL/min)	Specific Gravity
Prior to lab				
Sample 1 (0 min)	0			
Sample 2 (20 min)				
Sample 3 (40 min)				
Sample 4 (60 min)				
Sample 5 (80 min)				
Sample 6 (100 min)				

Protocol 4: Hyperosmotic Glucose Solution

Sample No.	Time (min)	Volume (mL)	Flow (mL/min)	Specific Gravity
Prior to lab				
Sample 1 (0 min)	0			
Sample 2 (20 min)				
Sample 3 (40 min)				
Sample 4 (60 min)				
Sample 5 (80 min)				
Sample 6 (100 min)				





Legend

- Protocol 1
- Protocol 2
- Protocol 3
- Protocol 4

Study Question

While waiting to collect the next sample, answer the following question.

7. What would happen if your water intake over sixty minutes significantly exceeded the maximal volume you could excrete in this period? Why could this be life threatening?

Answer

Sample 7: 120 min

After collecting the 120 minute sample complete the fields in the table below, for each different protocol.

Protocol 1: Control

Sample No.	Time (min)	Volume (mL)	Flow (mL/min)	Specific Gravity
Prior to lab				
Sample 1 (0 min)	0			
Sample 2 (20 min)				
Sample 3 (40 min)				
Sample 4 (60 min)				
Sample 5 (80 min)				
Sample 6 (100 min)				
Sample 7 (120 min)				

Protocol 2: Hyposmotic Solution

Sample No.	Time (min)	Volume (mL)	Flow (mL/min)	Specific Gravity
Prior to lab				
Sample 1 (0 min)	0			
Sample 2 (20 min)				
Sample 3 (40 min)				
Sample 4 (60 min)				
Sample 5 (80 min)				
Sample 6 (100 min)				
Sample 7 (120 min)				

Protocol 3: Isosmotic Sodium Chloride Solution

Sample No.	Time (min)	Volume (mL)	Flow (mL/min)	Specific Gravity
Prior to lab				
Sample 1 (0 min)	0			
Sample 2 (20 min)				
Sample 3 (40 min)				
Sample 4 (60 min)				
Sample 5 (80 min)				
Sample 6 (100 min)				
Sample 7 (120 min)				

Protocol 4: Hyperosmotic Glucose Solution

Sample No.	Time (min)	Volume (mL)	Flow (mL/min)	Specific Gravity
Prior to lab				
Sample 1 (0 min)	0			
Sample 2 (20 min)				
Sample 3 (40 min)				
Sample 4 (60 min)				
Sample 5 (80 min)				
Sample 6 (100 min)				
Sample 7 (120 min)				

Protocol 1: Control - HeptaPhan Test

Sample No.	pH	Proteins	Glucose	Ketones	Urobilinogen	Bilirubin	Blood
Sample 1 (0 min)							
Sample 2 (20 min)							
Sample 3 (40 min)							

Protocol 2: Hyposmotic Solution - HeptaPhan Test

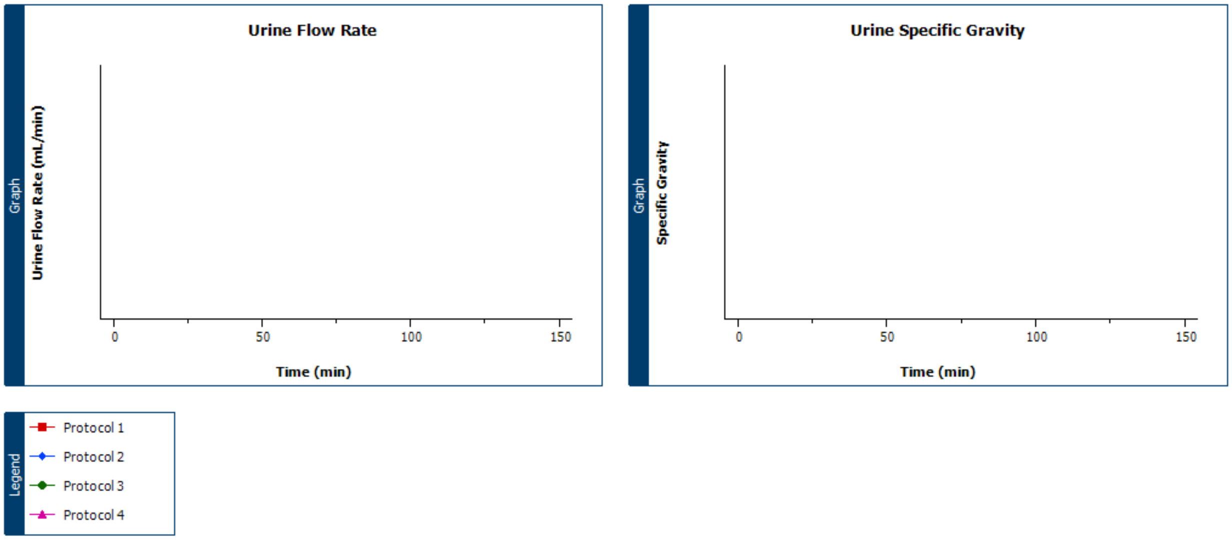
Sample No.	pH	Proteins	Glucose	Ketones	Urobilinogen	Bilirubin	Blood
Sample 1 (0 min)							
Sample 2 (20 min)							
Sample 3 (40 min)							

Protocol 3: Isosmotic Sodium Chloride Solution - HeptaPhan Test

Sample No.	pH	Proteins	Glucose	Ketones	Urobilinogen	Bilirubin	Blood
Sample 1 (0 min)							
Sample 2 (20 min)							
Sample 3 (40 min)							

Protocol 4: Hyperosmotic Glucose Solution - HeptaPhan Test

Sample No.	pH	Proteins	Glucose	Ketones	Urobilinogen	Bilirubin	Blood
Sample 1 (0 min)							
Sample 2 (20 min)							
Sample 3 (40 min)							



Study Question

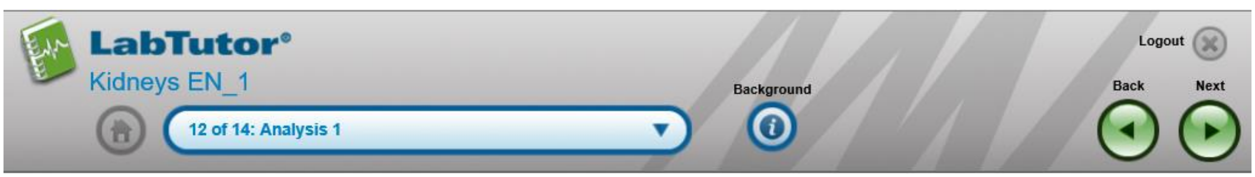
Before continuing to the analysis pages, answer the following questions.

8. Provide a physiological explanation for the results for the isosmotic sodium chloride solution and the hyposmotic solution (Protocol 3 - green vs Protocol 2 - blue)?

Answer

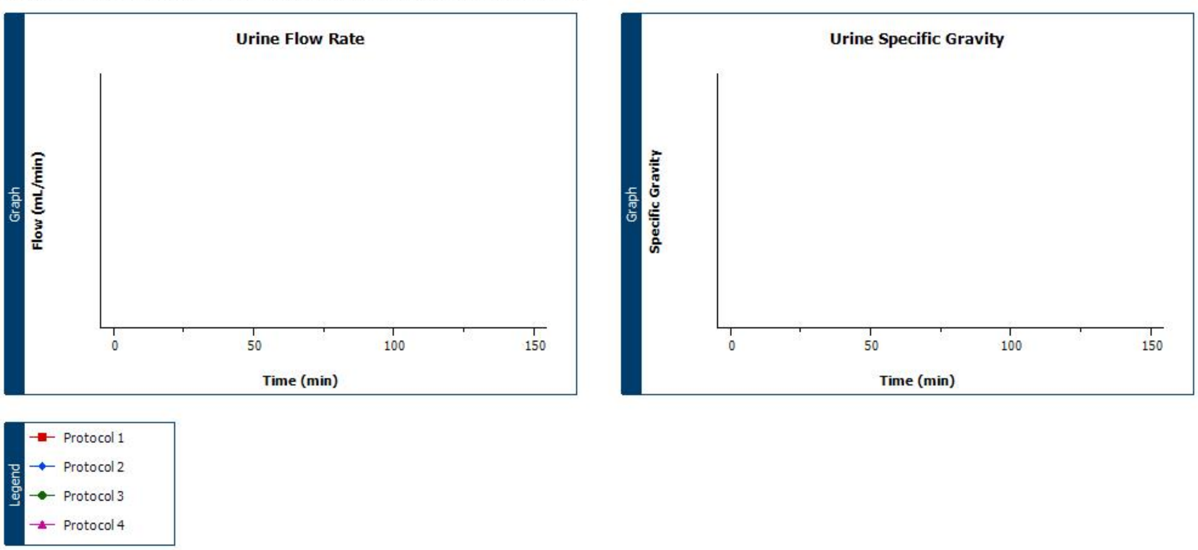
9. Provide a physiological explanation for the results for the hyperosmotic glucose solution and the hyposmotic solution (Protocol 4 - pink vs Protocol 2 - blue)?

Answer



Analysis 1: Flow and Osmolarity

Composite final results for flow and osmolarity, for all four protocols, are shown below.



Urine Flow Rate

Sample No.	Protocol 1 Flow (mL/min)	Protocol 2 Flow (mL/min)	Protocol 3 Flow (mL/min)	Protocol 4 Flow (mL/min)
Sample 1				
Sample 2				
Sample 3				
Sample 4				
Sample 5				
Sample 6				
Sample 7				

Urine Specific Gravity

Sample No.	Protocol 1 Specific Gravity	Protocol 2 Specific Gravity	Protocol 3 Specific Gravity	Protocol 4 Specific Gravity
Sample 1				
Sample 2				
Sample 3				
Sample 4				
Sample 5				
Sample 6				
Sample 7				

10. Reflect on your predictions for the trends of each protocol in the spaces below. Note that your original answers are shown but should not be changed.

Protocol 1 - Control (Prediction)

Answer

Protocol 1 - Control (Result)

Answer

Protocol 2 - Hyposmotic Solution (Prediction)

Answer

Protocol 2 - Hyposmotic Solution (Result)

Answer

Protocol 3 - Isosmotic Sodium Chloride Solution (Prediction)

Answer

Protocol 3 - Isosmotic Sodium Chloride Solution (Result)

Answer

Protocol 4 - Hyperosmotic Glucose Solution (Prediction)

Answer

Protocol 4 - Hyperosmotic Glucose Solution (Result)

Answer

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13 of 14: Analysis 2
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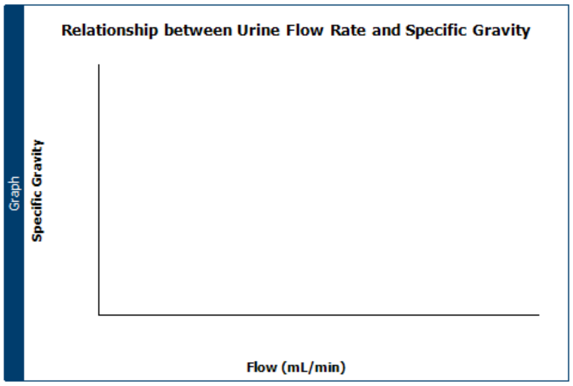
Urine Flow and Specific Gravity Relationship

The graph below shows a scatterplot of urine flow in relationship to specific gravity for your results.



Study Question

11. Explain the relationship, shown in the graph above, between the urine flow rate and specific gravity.

Answer

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14 of 14: The Report
Background | Submit | Email | Print | Logout | Back | Next

Identification

In Progress

Started
Unknown

Study Questions

Check your answers to the questions from each of the Sample pages, as shown below.

1. What changes in urine output do you expect to see in each of the protocols?

Protocol 1 - Control (Prediction)
Answer

Protocol 2 - Hyposmotic Solution (Prediction)
Answer

Protocol 3 - Isosmotic Sodium Chloride Solution (Prediction)

Protocol 4 - Hyperosmotic Glucose Solution (Prediction)

2. What is the osmolarity of the fluid in the interstitial space in the renal cortex? Is it the same throughout that space?

3. What is the osmolarity of the fluid in the interstitial space in the renal medulla? Is it the same throughout that space?

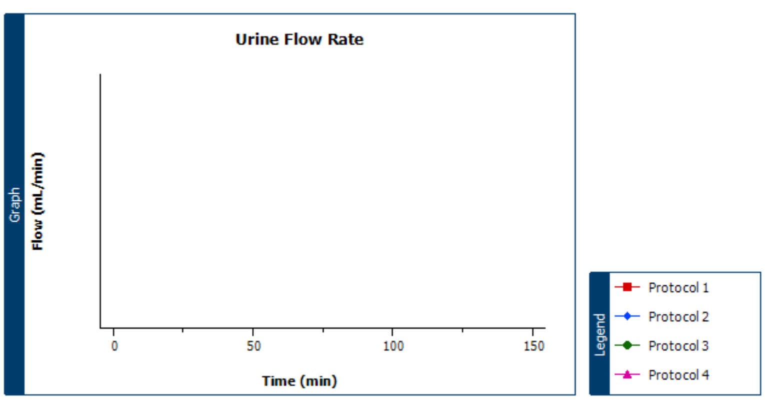
4. What hormone is involved in regulating renal water excretion? What normally inhibits the release of this hormone?

5. In question 4 you stated what normally inhibits the release of the hormone controlling water excretion. From your own experience, identify two situations where this inhibition is over-ridden. For each situation explain the physiological advantage of over-riding this inhibition.

Situation 1

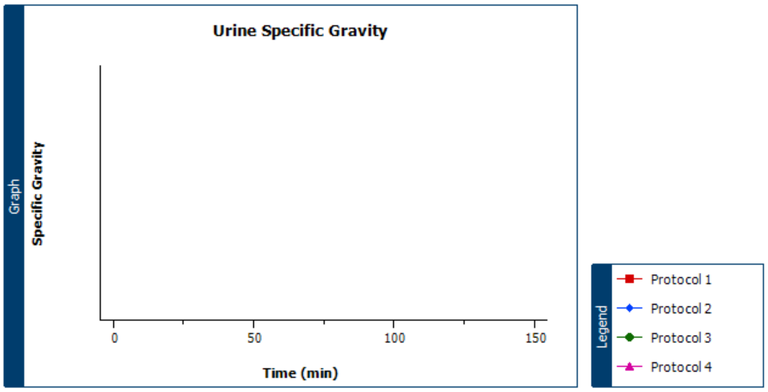
Situation 2

Results: Flow and Specific gravity



Urine Flow Rate

Sample No.	Protocol 1 Flow (mL/min)	Protocol 2 Flow (mL/min)	Protocol 3 Flow (mL/min)	Protocol 4 Flow (mL/min)
Sample 1				
Sample 2				
Sample 3				
Sample 4				
Sample 5				
Sample 6				
Sample 7				



Urine Specific Gravity

Sample No.	Protocol 1 Specific Gravity	Protocol 2 Specific Gravity	Protocol 3 Specific Gravity	Protocol 4 Specific Gravity
Sample 1				
Sample 2				
Sample 3				
Sample 4				
Sample 5				
Sample 6				
Sample 7				

6. From your data, estimate the maximum volume of water that you could drink over sixty minutes while still remaining in water balance?

Answer

7. What would happen if your water intake over sixty minutes significantly exceeded the maximal volume you could excrete in this period? Why could this be life threatening?

Answer

8. Provide a physiological explanation for the results for the isosmotic sodium chloride solution and the hyposmotic solution (Protocol 3 - green vs Protocol 2 - blue)?

Answer

9. Provide a physiological explanation for the results for the hyperosmotic glucose solution and the hyposmotic solution (Protocol 4 - pink vs Protocol 2 - blue)?

Answer

10. Reflect on your predictions for the trends of each protocol in the spaces below.

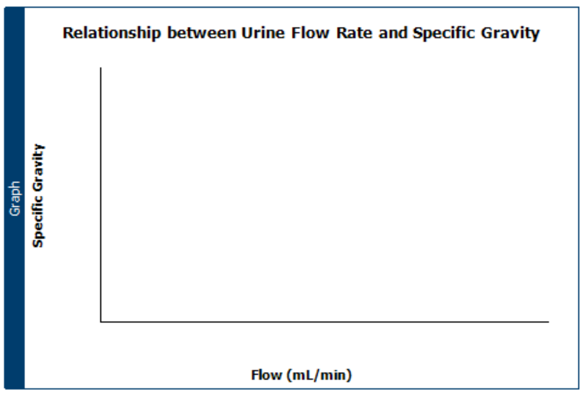
Answer — Protocol 1 - Control (Result)

Answer — Protocol 2 - Hyposmotic Solution (Result)

Answer — Protocol 3 - Isosmotic Sodium Chloride Solution (Result)

Answer — Protocol 4 - Hyperosmotic Glucose Solution (Result)

Analysis: Urine Flow and Specific Gravity Relationship



11. Explain the relationship, shown in the graph above, between the urine flow rate and specific gravity.

Answer

Results: HeptaPhan Test

Protocol 1: Control - HeptaPhan Test

Sample No.	pH	Proteins	Glucose	Ketones	Urobilinogen	Bilirubin	Blood
Sample 1 (0 min)							
Sample 2 (20 min)							
Sample 3 (40 min)							

Protocol 2: Hyposmotic Solution - HeptaPhan Test

Sample No.	pH	Proteins	Glucose	Ketones	Urobilinogen	Bilirubin	Blood
Sample 1 (0 min)							
Sample 2 (20 min)							
Sample 3 (40 min)							

Table

Protocol 3: Isosmotic Sodium Chloride Solution - HeptaPhan Test

Sample No.	pH	Proteins	Glucose	Ketones	Urobilinogen	Bilirubin	Blood
Sample 1 (0 min)							
Sample 2 (20 min)							
Sample 3 (40 min)							

Table

Protocol 4: Hyperosmotic Glucose Solution - HeptaPhan Test

Sample No.	pH	Proteins	Glucose	Ketones	Urobilinogen	Bilirubin	Blood
Sample 1 (0 min)							
Sample 2 (20 min)							
Sample 3 (40 min)							