

***SIMULATED
VETERINARY
URINALYSIS
INVESTIGATION***

KIT# 4A

CONTENTS

- 15 LAB-AIDS® Chemplates® w/spatula
- 5 density tubes, each containing 2 plastic balls
- 5 pH color charts
- 3 drop-controlled bottles Simulated Urine I
- 3 drop-controlled bottles Simulated Urine II
- 3 drop-controlled bottles Simulated Urine III
- 3 drop-controlled bottles Simulated Urine IV
- 3 drop-controlled bottles Simulated Urine V
- 3 drop-controlled bottles Chloride Test Solution
- 3 drop-controlled bottles Benedict's Solution
- 3 drop controlled bottles Phosphate Test Solution 1
- 3 drop controlled bottles Phosphate Test Solution 2
- 1 vial universal indicator paper
- 30 Student Worksheets and Guides
 - 1 Teacher's Guide
 - 1 Safety Data Sheet (SDS) packet

Note: A hot water bath, small test tubes, and a test tube holder are needed to perform the glucose test. These materials are not included in the kit and must be provided by the teacher.

Analyses and Conclusions

1. After you have been able to examine the urine specimens what health concerns (if any) would you look further into for each dog? Give evidence for your recommendations.

Dog 1: very low specific gravity indicates the need for follow-up tests for kidney problems.

Dog 2: low specific gravity, high pH and positive phosphate results indicate the need for follow-up tests for kidney problems.

Dog 3: very low specific gravity and positive glucose indicates the need for follow-up tests for kidney problems and diabetes.

Dog 4: low pH and positive chloride results indicate the need for follow-up tests

Dog 5: low specific gravity, high pH and positive phosphate and chlorides indicate the need for follow-up tests for kidney problems.

2. Why is it important to develop a case history of the physical symptoms of each of these patients? Why can't we rely on the urinalysis alone?

A urine sample is an initial tool for health evaluation. The results from the urinalysis can guide the veterinarian if further testing should be done. Just like any test, a urinalysis alone does not give enough information without further testing. There can be many factors that appear similar and the more information the veterinarian has the more accurate his diagnosis. Many health issues may exhibit similar symptoms so more testing is important for diagnosing patients. It is also important to know if a condition is chronic or acute and if the patient has a history of analogous symptoms.

3. If there is a result that is different from the norm (color, pH, etc) should the veterinarian make an immediate diagnosis? Explain why or why not.

Abnormal tests should always be tested again. There is always a chance for bacterial growth or outside contamination. Diet, hydration, and medications can all be issues that could affect the results. Urinalysis should also be tested ideally as soon as they are collected or within 30 minutes. If not they can be refrigerated and brought back to room temperature before testing. The timing of the test could affect the outcome if not handled properly.

TABLE 2. TEST RESULTS

Sample	pH	Phosphates	Chlorides	Glucose
Dog 1	5-6	—	—	—
Dog 2	9	+	—	—
Dog 3	5-6	—	—	+
Dog 4	5	—	+	—
Dog 5	7-8	+	+	—

pH refers to how acidic or alkaline the urine is. Urine may be acidic in cases of diabetes, dehydration, or an extremely high protein diet. Highly alkaline urine is present when there is a urinary tract infection. The typical pH for dog urine ranges from 5.5-7.0.

The body needs phosphorus to build and repair bones and teeth, help nerves function, and make muscles contract. The kidneys help control the amount of phosphate (phosphorus ion) in the body and kidney problems are a common cause of high or low levels of phosphate in the urine.

Chloride, an important electrolyte in the blood., helps keep the amount of fluid inside and outside of your cells in balance, helps maintain the pH of body fluids, blood volume, and blood pressure. A higher than normal urine chloride level is commonly caused by too much salt intake or adrenal or kidney problems. Decreased urine chloride levels can often be caused by too little salt intake or loss of fluids from diarrhea

There should be no glucose in the urine. When there is, it often means the sugar level in blood entering the kidney is so high it exceeds the kidney's ability to pass it back into the blood. The spillover ends up in the urine. The condition is associated with diabetes but is also common in pancreatitis, and hypothyroidism. or vomiting.

BACKGROUND

Urine is a complex aqueous solution of organic and inorganic substances most of which are the waste products of metabolism. The composition of an animal's urine is an important reflection of its general health as well as being a specific measure of kidney function. The kidneys function as filters removing wastes from the bloodstream. Some of the waste is eliminated in the form of urine. The kidneys also recycle to the blood numerous chemicals that should not be eliminated. In essence, the kidneys are the major organs of homeostasis in the animal. Analysis of urine informs physicians if the kidneys are functioning properly and if proper levels of chemicals are being removed or maintained in the body. Urinalysis or the test for chemical content in urine is a part of every complete examination, because urine is easily obtained and can yield much information about overall health and in particular the health of the kidneys.

A routine urinalysis usually consists of tests for specific gravity (concentration of solids), protein (albumin), and sugar (glucose). Microscopic examination for bacteria, parasites, chemical crystals, and casts (solid matter made up of bacteria, blood cells, pus, protein, etc.) and examination for acid or alkaline reaction (pH), color, odor and transparency are also involved. Many veterinarians feel that the test for protein in the urine is the best single indicator of kidney disease.

While there are many tests that may be performed on urine, this lab activity will include only a few that are commonly used in a routine urinalysis. Many of these tests are done in a vet's office in minutes with the aid of dipsticks. These are small strips of paper or plastic that have been coated in bands that have reactive chemicals that change color in the presence of certain other chemicals in urine. In this lab activity you will be using simulated urine and chemical reagents to conduct a "urinalysis." The reagents will react with the chemicals in the sample in an observable way.

The specific gravity of urine is a measure of the proportion of dissolved material to total volume. It indicates the ability of the kidney to concentrate and dilute fluid. pH refers to how acidic or alkaline urine is. Urine may be acidic in cases of diabetes, dehydration, or an extremely high protein diet. Highly alkaline urine is present when there is a urinary tract infection. The typical pH for dog urine ranges from 5.5-7.0.

The body needs phosphorus to build and repair bones and teeth, help nerves function, and make muscles contract. The kidneys help control the amount of phosphate (phosphorus ion) in the body and kidney problems are a common cause of high or low levels of phosphate in the urine.

Chloride, an important electrolyte in the blood., helps keep the amount of fluid inside and outside of your cells in balance, helps maintain the pH of body fluids, blood volume, and blood pressure. A higher than normal urine chloride level is commonly caused by too much salt intake or adrenal or kidney problems. Decreased urine chloride levels can often be caused by too little salt intake or loss of fluids from diarrhea or vomiting.

There should be no glucose in the urine. When there is, it often means the sugar level in blood entering the kidney is so high it exceeds the kidney's ability to pass it back into the blood. The spillover ends up in the urine. The condition is associated with diabetes but is also common in pancreatitis, and hypothyroidism.

Urine is a dilute aqueous solution containing about 60 grams of solids in a twenty-four hour sample. One half of the amount is urea, the chief waste product and the remainder is distributed among creatinine, sodium chloride and an assortment of other organic and inorganic constituents. Incidentally, urine's characteristic color is due to urochrome a pigment derived from bile.

Characteristics of Normal Canine Urine (24 hour sample)

Volume: 15-50 mL/kg body weight

Color: Pale yellow to yellow brown

Transparency: Clear

Odor: mildly aromatic, garlicky

Specific gravity: 1.001-1.065

pH: 5.5-7.0

Protein: negative*

Glucose: negative*

Ketones: negative*

*detected using test strips

A. TEACHER PREPARATION

- For a class with 15 groups, each group will collect only some of the needed data and groups will share their data with the class so that each student can record a complete set of data. The suggested method is to assign one of the five dogs to each group, which will mean that each dog will be assigned to three different groups. Using this method, each dog is independently tested three times. This provides an opportunity to discuss any discrepant data and produces greater confidence in the results. If you have a smaller class and/or enough time, each group can run the tests on more than one dog.
- Each of the fifteen (15) teams of 2 students should be given the following materials:
 - 1 bottle of simulated urine
 - 1 Chemplate®
 - 2 pairs of safety eyewear (and any other protective gear you want students to wear)
 - 2 Student Worksheets and Guides
- Five stations should be set up in the lab with the materials for each analysis. There is no particular order for these tests.

Specific Gravity

5 Density Tubes containing one of each type of plastic ball

NOTE: The density tubes in this kit can not be used to determine the specific gravity or density of urine or other liquids.

Phosphates Station

3 bottles of Phosphate Test Solution 1

3 bottles of Phosphate Test Solution 2

Chlorides Station

3 bottles of Chloride Test Solution

Glucose Station

3 bottles of Benedict's Solution

5 small test tubes and test tube holders

at least one hot water bath.

pH Station

1 vial of universal indicator paper

5 pH color charts

- Students should always wear safety goggles whenever they are working with chemicals in a laboratory situation. Your school policies and procedures for safety should of course be followed at all times.

B. DOING THE ACTIVITY

Have students read all of the instructions thoroughly before allowing them to proceed with the activities.

The specific gravity of urine from healthy dogs is usually between 1.016 - 1.060 g/mL. When the value is less than 1.000 g/mL, it is an indication of poor kidney function.

Table 1. Results of Specific Gravity Tests on Simulated Urine Samples

SAMPLE	OBSERVATIONS	SPECIFIC GRAVITY	KIDNEY FUNCTION
Dog 1	Both beads sink	less than 1.000 g/mL	Very poor
Dog 2	One sinks, one floats	1.000 to 1.015 g/mL	Possible Problems
Dog 3	Both beads sink	less than 1.000 g/mL	Very poor
Dog 4	Both beads float	greater than 1.015 g/mL	Healthy
Dog 5	One sinks, one floats	1.000 to 1.015 g/mL	Possible Problems

Key:

Observations	Specific Gravity
Both beads sink	less than 1.000 g/mL
One bead sinks, one bead floats	1.000 to 1.015 g/mL
Both beads float	greater than 1.015 g/mL