

## Urinalysis and Body Fluids 03

### Unit 3

#### Chemical Examination of Urine Part 1 - Overview of Procedure & pH

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## Unit Outline

- Introduction to reagent strip testing
- pH
- Glucose & Carbohydrates
- Ketones
- Protein
- Bilirubin
- Urobilinogen
- Blood
- Leukocyte esterase
- Nitrite
- Miscellaneous

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## Chemical Exam of Urine

- Reagent strip manufactures
- Siemens Multistix 10 SG
- Roche Chemstrip



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# Chemical Exam of Urine

Illustration of Multistix 10 SG




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# Chemical Exam of Urine

- Dipping method




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# Sources of Error

Source of Error	What is going on?	How to prevent it.
Testing cold samples	Chemical reactions slowed	Test fresh / RT samples
Specimen not mixed	Blood cells have settled to bottom and not in contact	Test well mixed sample.
Over-dipping strip	Reagents get leached out	Dip completely, but briefly
Inadequate blotting / fail to keep strip level	Over-run or mixing of chemicals	Blot away excess urine and keep strip horizontal
Improper timing	Over / under development of reagent pad colors	Follow manufacturer's recommendations
Inadequate lighting	Poor lighting results in mis-interpretation of results	Work in well lighted area
Mis-using color chart	Mis-interpretation of results	Align reagent pad with proper part of color chart.

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## Chemical Exam of Urine

- Handling and Storage of Strips
  - Keep strips in original container
  - Store in cool (below 30C, but not refrigerated, not frozen)
  - Protect from moisture and volatile fumes
    - Keep bottle tightly closed
    - Keep desiccant in bottle
  - Remove strips immediately prior to use
  - Do not touch reagent pad areas
  - Use before expiration date
    - Do not use if pads are discolored

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## Quality Control

- Use commercially prepared positive and negative controls.
  - at least once per 24 hours,
  - and anytime a new bottle is opened,
  - or question of validity of results.
- Readings should agree with published results  $\pm$  one color block.
- Be aware of manufacturer's stated limitations

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## Chemical Exam of Urine - pH

- **pH definition:** Negative log of the hydrogen ion concentration
- Kidneys have major role in regulation of acid/base balance .
  - *Kidneys & Lungs are major players in body acid/base balance.*
- **\*\* The over-all goal is blood pH  $7.40 \pm .005$ .**

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## Chemical Exam of Urine - pH

- No normal values
  - urine pH is a reflection of blood pH
- Kidneys capable of 4.5-8.0
- In this hemisphere, first morning urine samples usually have an acid pH (@ 6.0)
- Dipstick range is 4.5 - 9.0.
  - Kidneys are not able to produce urine with pH of 9 (either normally or abnormally)
  - pH of 9 associated with old sample / UTI

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## Fluctuations in Urine pH

Situation	Reason / effects	Urine pH
During sleep	Metabolism continues; but respiration decreased	pH decrease (more acid)
Following meals	Stomach acids being absorbed into foods	pH increases (more alkaline)
General diet	Western diets of high meat = Acid urines Eastern diets of vegetables = Alkaline urines	
Specific foods	Example: metabolism of cranberries produces quinaldic acid	pH decrease (more acid)
Metabolic disorders	Example: diabetes mellitus. Patient produces keto-acids	pH decrease (more acid)
Drugs	In-advertent affects of medication Drugs designed to control pH, as to limit kidney stone formation	depends

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## Urine pH: Significance

Persistent Acidity	Persistent Alkalinity
Acidifying drugs	Alkaline drugs
Dehydration	Acute and Chronic renal failure
Diabetes	Diuretics
Diarrhea	Renal tubular acidosis
Fever	Urinary tract infections
Gout	
High protein diets	
Pulmonary emphysema	

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## Chemical Exam of Urine - pH

- Urine pH Measurement
- Purpose / reasons
  - Although rarely diagnostic, measurement of urine pH can be used to indicate overall body acid / base status
  - Medical management of pH
    - Crystals and renal calculi may form depending on urinary pH.
  - Identify crystals by the urine's pH.
    - *Use the pH to assist in the identification of urine crystals.*

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## Chemical Exam of Urine - pH

- Urine pH Measurement
- Methods
  - pH meter
    - *Overkill of technology, so rarely required.*
  - pH papers
    - Litmus paper
    - Nitrazine paper
  - Reagent dipsticks



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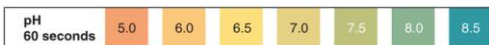
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## Chemical Exam of Urine - pH

pH color chart



- Acid indicator - methyl red
- Alkaline indicator - bromthymol blue
- Read 60 seconds after dipping
- pH ranges from 5.0 to 8.5 in half units

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## Chemical Exam of Urine - pH



### pH Over-Run Phenomenon

Buffers from the protein area of the strip (with their pH of 3.0) spill over to the pH area of the strip and make the pH of the sample appear more acidic than it really is.

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## In - Summary

- Store reagent strips in their bottle with lid closed at room temperature.
- Do not expose strips to
  - Sunlight
  - Heat
  - Cold
  - Volatile substances
  - Moisture (each bottle contains a desiccant)
- Only remove the number of strips you need for immediate testing.
- Do not use strips that have discolored pads.
- Do not use expired reagent strips.
- Test urine which is brought to room temperature.
- Run appropriate QC and only release patient results if controls perform as expected.
- Kidneys are capable of producing urine with pH 4.5 - 8.0
- Strips capable of providing results from @ 4.5 - 9.0
- pH indicators methyl red and - bromthymol blue provide results
- Be aware of 'run-over' and work to prevent it.

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## Reference Listing

- > Please credit those whose work and pictures I have used throughout these presentations.
- > Lillian Mundt & Kristy Shanahan, Graff's Textbook of Urinalysis and Body Fluids, 2<sup>nd</sup> Ed.
- > Susan Strassinger & Marjorie Di Lorenzo, Urinalysis and Body Fluids, 5<sup>th</sup> Ed.
- > Wikipedia, the free encyclopedia
  - > [www.wikipedia.org](http://www.wikipedia.org)
- > Siemens corporation, Healthcare division, Laboratory Diagnostics website
  - > <http://www.medical.siemens.com/>
- > Roche Diagnostics
  - > <http://www.roche.com>

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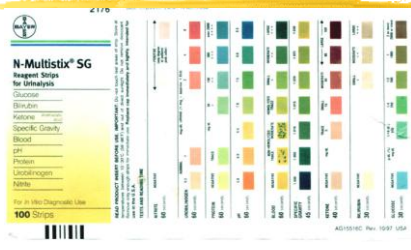
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# Chemical Exam of Urine



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