Urinalysis and Body Fluids

The following items have been identified generally as appropriate for both entry level medical laboratory scientists and medical laboratory technicians. Items that are appropriate for medical laboratory scientists only are marked with an “MLS ONLY.”

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Urinalysis: Pre-Analytical Examination

1. After receiving a 24-hour urine for quantitative total protein analysis, the technician must first:
   a. subculture the urine for bacteria
   b. add the appropriate preservative
   c. screen for albumin using a dipstick
   d. measure the total volume

2. False results in urobilinogen testing may occur if the urine specimen is:
   a. exposed to light
   b. adjusted to a neutral pH
   c. cooled to room temperature
   d. collected in a nonsterile container

3. A clean-catch urine is submitted to the laboratory for routine urinalysis and culture. The routine urinalysis is done first, and 3 hours later, the specimen is sent to the microbiology department for culture. The specimen should:
   a. be centrifuged, and the supernatant cultured
   b. be rejected due to the time delay
   c. not be cultured if no bacteria are seen
   d. be processed for culture only if the nitrate is positive

4. Which of the following urine results is most apt to be changed by prolonged exposure to light?
   a. pH
   b. protein
   c. ketones
   d. bilirubin

5. Urine samples should be examined within 1 hour of voiding because:
   a. RBCs, leukocytes and casts agglutinate on standing for several hours at room temperature
   b. urobilinogen increases and bilirubin decreases after prolonged exposure to light
   c. bacterial contamination will cause alkalization of the urine
   d. ketones will increase due to bacterial and cellular metabolism
The following results were obtained on a urine specimen at 8:00 AM:

- pH: 5.5
- protein: 2+
- glucose: 3+
- ketones: 3+
- blood: negative
- bilirubin: positive
- nitrite: positive

If this urine specimen was stored uncapped at 5°C without preservation and retested at 2 PM, which of the following test results would be changed due to these storage conditions?

- a glucose
- b ketones
- c protein
- d nitrite

A urine specimen comes to the laboratory 7 hours after it is obtained. It is acceptable for culture only if the specimen has been stored:

- a at room temperature
- b at 4°-7°C
- c frozen
- d with a preservative additive

Which of the following would be affected by allowing a urine specimen to remain at room temperature for 3 hours before analysis?

- a occult blood
- b specific gravity
- c pH
- d protein

A 24-hour urine from a man who had no evidence of kidney impairment was sent to the laboratory for hormone determination. The volume was 600 mL, but there was some question as to the completeness of the 24-hour collection. The next step would be to:

- a perform the hormone determination, since 600 mL is a normal 24-hour urine volume
- b check the creatinine level; if it is <1 g, do the procedure
- c report the hormone determination in mg/dL in case the specimen was incomplete
- d check the creatinine level; if it is >1 g, do the procedure

Failure to observe RBC casts in a urine specimen can by caused by:

- a staining the specimen
- b centrifuging an unmixed specimen
- c mixing the sediment after decantation
- d examining the sediment first under low power

eGFR calculated by the MDRD formula takes into account the age, BUN, race, albumin and what else for its calculations?

- a urea
- b ammonia
- c creatinine
- d cystatin C

The creatinine clearance is reported in:

- a mg/dL
- b mg/24 hours
- c mL/min
- d mL/24 hours
Microalbumin can be measured by a random urine collection. An increased microalbumin is predictive of:

- a diabetes mellitus
- b nephropathy
- c hypertension
- d nephrotic syndrome

**Urinalysis: Physical Examination**

14 A patient with uncontrolled diabetes mellitus will most likely have:

- a pale urine with a high specific gravity
- b concentrated urine with a high specific gravity
- c pale urine with a low specific gravity
- d dark urine with a high specific gravity

15 While performing an analysis of a baby’s urine, the technologist notices the specimen to have a “mousy” odor. Of the following substances that may be excreted in urine, the one that most characteristically produces this odor is:

- a phenylpyruvic acid
- b acetone
- c coliform bacilli
- d porphyrin

16 An ammonia-like odor is characteristically associated with urine from patients who:

- a are diabetic
- b have hepatitis
- c have an infection with *Proteus* sp
- d have a yeast infection

17 Urine that develops a port wine color after standing may contain:

- a melanin
- b porphyrins
- c bilirubin
- d urobilinogen

18 Acid urine that contains hemoglobin will darken on standing due to the formation of:

- a myoglobin
- b sulfhemoglobin
- c methemoglobin
- d red blood cells

19 Urine from a 50-year-old man was noted to turn dark red on standing. This change is caused by:

- a glucose
- b porphyrins
- c urochrome
- d creatinine

20 The clarity of a urine sample should be determined:

- a using glass tubes only; never plastic
- b following thorough mixing of the specimen
- c after addition of sulfosalicylic acid
- d after the specimen cools to room temperature
21 Milky urine from a 24-year-old woman would most likely contain:
   a. spermatozoa  
   b. many white blood cells  
   c. red blood cells  
   d. bilirubin

22 A brown-black urine would most likely contain:
   a. bile pigment  
   b. porphyrins  
   c. melanin  
   d. blood cells

23 The yellow color of urine is primarily due to:
   a. urochrome pigment  
   b. methemoglobin  
   c. bilirubin  
   d. homogenistic acid

24 Red urine may be due to:
   a. bilirubin  
   b. excess urobilin  
   c. myoglobin  
   d. homogenistic acid

25 A urine specimen collected on an apparently healthy 25-year-old man shortly after he finished eating lunch was cloudy but showed normal results on a multiple reagent strip analysis. The most likely cause of the turbidity is:
   a. fat  
   b. white blood cells  
   c. urates  
   d. phosphates

26 In which of the following metabolic diseases will urine turn dark brown to black upon standing?
   a. phenylketonuria  
   b. alkaptonuria  
   c. maple syrup disease  
   d. aminoaciduria

27 Urine osmolality is related to:
   a. pH  
   b. filtration  
   c. specific gravity  
   d. volume

28 Urine specific gravity is an index of the ability of the kidney to:
   a. filter the plasma  
   b. concentrate the urine  
   c. alter the hydrogen ion concentration  
   d. reabsorb sodium ions

29 Osmolality is a measure of:
   a. dissolved particles, including ions  
   b. undissociated molecules only  
   c. total salt concentration  
   d. molecule size
30. A patient urine sample has an increased protein and a high specific gravity. Which of the following would be a more accurate measure of urine concentration?
   a. osmolality
   b. ketones
   c. refractive index
   d. pH

31. To prepare a solution appropriate for quality control of the refractometer, a technician should use:
   a. urea with a specific gravity of 1.040
   b. water with a specific gravity of 1.005
   c. sodium chloride with a specific gravity of 1.022
   d. calcium chloride with an osmolality of 460

32. A urine's specific gravity is directly proportional to its:
   a. turbidity
   b. dissolved solids
   c. salt content
   d. sugar content

33. Isothmeneuria is associated with a specific gravity which is usually:
   a. variable between 1.001 and 1.008
   b. variable between 1.015 and 1.022
   c. fixed around 1.010
   d. fixed around 1.020

34. The fluid leaving the glomerulus normally has a specific gravity of:
   a. 1.001
   b. 1.010
   c. 1.020
   d. 1.030

35. An antidiuretic hormone deficiency is associated with a:
   a. specific gravity around 1.031
   b. low specific gravity
   c. high specific gravity
   d. variable specific gravity

36. Use of a refractometer over a urinometer is preferred due to the fact that the refractometer uses:
   a. large volume of urine and compensates for temperature
   b. small volume of urine and compensates for glucose
   c. small volume of urine and compensates for temperature
   d. small volume of urine and compensates for protein

37. Calibration of refractometers is done by measuring the specific gravity of distilled water and:
   a. protein
   b. glucose
   c. sodium chloride
   d. urea

38. The method of choice for performing a specific gravity measurement of urine following administration of x-ray contrast dyes is:
   a. reagent strip
   b. refractometer
   c. urinometer
   d. densitometer
Which of the following urinary parameters are measured during the course of concentration and dilution tests to assess renal tubular function?

- a urea, nitrogen and creatinine
- b osmolality and specific gravity
- c sodium and chloride
- d sodium and osmolality

Refractive index is a comparison of:

- a light velocity in solutions to light velocity in solids
- b light velocity in air to light velocity in solutions
- c light scattering by air to light scattering by solutions
- d light scattering by particles in solution

Which of the following can give a false-negative urine protein reading?

- a contamination with vaginal discharge
- b heavy mucus
- c presence of blood
- d very dilute urine

The pH of a urine specimen measures the:

- a free sodium ions
- b free hydrogen ions
- c total acid excretion
- d volatile acids

Upon standing at room temperature, a urine pH typically:

- a decreases
- b increases
- c remains the same
- d changes depending on bacterial concentration

Urine reagent strips should be stored in a(n):

- a refrigerator (4°C-7°C)
- b incubator (37°C)
- c cool dry area
- d open jar exposed to air

The principle of the reagent strip test for urine protein depends on:

- a an enzyme reaction
- b protein error of indicators
- c copper reduction
- d the toluidine reaction

The protein section of the urine reagent strip is most sensitive to:

- a albumin
- b mucoprotein
- c Bence Jones protein
- d globulin
Routine screening of urine samples for glycosuria is performed primarily to detect:

- a. glucose
- b. galactose
- c. bilirubin
- d. ketones

48. Which of the following reagents is used to react with ketones in the urine?

- a. sodium nitroprusside
- b. acetoacetic acid
- c. acetone
- d. beta-hydroxybutyric acid

49. A test area of a urine reagent strip is impregnated with only sodium nitroprusside. This section will react with:

- a. acetoacetic (diacetic) acid
- b. leukocyte esterase
- c. beta-hydroxybutyric acid
- d. ferric chloride

50. A reagent strip area impregnated with stabilized, diazotized 2,4-dichloroaniline will yield a positive reaction with:

- a. bilirubin
- b. hemoglobin
- c. ketones
- d. urobilinogen

51. Which of the following factors will not interfere with the reagent strip test for leukocytes?

- a. ascorbic acid
- b. formaldehyde
- c. nitrite
- d. urinary protein level of 500 mg/dL

52. Excess urine on the reagent test strip can turn a normal pH result into a falsely acidic pH when which of the following reagents runs into the pH pad?

- a. tetrabromphenol blue
- b. citrate buffer
- c. glucose oxidase
- d. alkaline copper sulfate

53. When employing the urine reagent strip method, a false-positive protein result may occur in the presence of:

- a. large amounts of glucose
- b. x-ray contrast medium
- c. Bence Jones protein
- d. highly alkaline urine

54. A 17-year-old girl decided to go on a starvation diet. After 1 week of starving herself, what substance would most likely be found in her urine?

- a. protein
- b. ketones
- c. glucose
- d. blood
A 2-year-old child had a positive urine ketone. This would most likely be caused by:

- vomiting
- anemia
- hypoglycemia
- biliary tract obstruction

A patient’s urinalysis revealed a positive bilirubin and a decreased urobilinogen level. These results are associated with:

- hemolytic disease
- biliary obstruction
- hepatic disease
- urinary tract infection

A urine specimen with an elevated urobilinogen and a negative bilirubin may indicate:

- obstruction of the biliary tract
- viral hepatitis
- hemolytic jaundice
- cirrhosis

Microscopic analysis of a urine specimen yields a moderate amount of red blood cells in spite of a negative result for occult blood using a reagent strip. The technologist should determine if this patient has taken:

- vitamin C
- a diuretic
- high blood pressure medicine
- antibiotics

The purpose for routinely screening diabetes mellitus patients for microalbuminuria is to monitor the development of:

- urinary tract infection
- renal disease
- yeast infections
- diabetes insipidus

The principle of the reagent strip test for microalbuminuria is:

- a diazo reaction
- the protein error of indicators
- a dye-binding reaction
- the release of hydrogen ions to an indicator

The reason that an albumin:creatinine ratio can be run on a random specimen is:

- creatinine corrects for over or under body hydration
- a first morning specimen may be too concentrated
- albumin corrects for over or under body hydration
- the reaction is sensitive to any level of albumin

To prepare the reagent used in confirmatory protein testing, a technician would:

- dissolve 3 g sulfosalicylic acid in 100 mL of water
- dissolve 5 g trichloroacetic acid in 100 mL of water
- combine 3 mL of hydrochloric acid and 97 mL of water
- combine 5 mL of glacial acetic acid and 95 mL of water

A positive result for bilirubin on a reagent strip should be followed up by:

- notifying the physician
- requesting a new specimen
- performing an icotest
- performing a urobilinogen
64 Ammonium sulfate was added to red urine. The urine had a positive reaction for blood, but no RBCs were seen on microscopic examination. After centrifugation the supernatant fluid is red. The abnormal color is caused by:

- a pyridium
- b hemoglobin
- c porphyrins
- d myoglobin

65 A urine tested with Clinitest® exhibits a passthrough reaction and is diluted by adding 2 drops of urine to 10 drops water. This is a dilution of:

- a 1:4
- b 1:5
- c 1:6
- d 1:8

66 When performing a routine urinalysis, the technologist notes a 2+ protein result. He should:

- a request another specimen
- b confirm with the acid precipitation test
- c test for Bence Jones protein
- d report the result obtained without further testing

67 The confirmatory test for a positive protein result by the reagent strip method uses:

- a Ehrlich reagent
- b a diazo reaction
- c sulfosalicylic acid
- d a copper reduction tablet

68 A urine specimen is analyzed for glucose by a glucose oxidase reagent strip and a copper reduction test. If both results are positive, which of the following interpretations is correct?

- a galactose is present
- b glucose is present
- c lactose is not present
- d sucrose is not present

69 A woman in her ninth month of pregnancy has a urine sugar which is negative with the urine reagent strip, but gives a positive reaction with the copper reduction method. The sugar most likely responsible for these results is:

- a maltose
- b galactose
- c glucose
- d lactose

70 An urinalysis performed on a 2-week-old infant with diarrhea shows a negative reaction with the glucose oxidase reagent strip. A copper reduction tablet test should be performed to check the urine sample for the presence of:

- a glucose
- b galactose
- c bilirubin
- d ketones

71 When using the sulfosalicylic acid test, false-positive protein results may occur in the presence of:

- a ketones
- b alkali
- c glucose
- d radiographic contrast media
Which of the following is the primary reagent in the copper reduction tablet?

- a. sodium carbonate
- b. copper sulfate
- c. glucose oxidase
- d. polymerized diazonium salt

**Urinalysis: Microscopic Examination**

73. In most compound light microscopes, the ocular lens has a magnification of:

- a. 10x
- b. 40x
- c. 50x
- d. 100x

74. The best way to lower the light intensity of the microscope is to:

- a. lower the condenser
- b. adjust the aperture diaphragm
- c. lower the rheostat
- d. raise the condenser

75. The advantage to using phase microscopy in urinalysis is to:

- a. provide higher magnification
- b. enhance constituents with a low refractive index
- c. allow constituents to stain more clearly
- d. provide a larger field of view

76. The presence of leukocytes in urine is known as:

- a. chyluria
- b. hematuria
- c. leukocytosis
- d. pyuria

77. Oval fat bodies are:

- a. squamous epithelial cells that contain lipids
- b. renal tubular epithelial cells that contain lipids
- c. free-floating fat droplets
- d. white blood cells with phagocytized lipids

78. A microscopic examination of urine sediment reveals ghost cells. These red blood cells seen in urine with a:

- a. >2% glucose concentrations
- b. specific gravity <1.007
- c. large amounts of ketone bodies
- d. neutral pH

79. Glitter cells are a microscopic finding of:

- a. red blood cells in hypertonic urine
- b. red blood cells in hypotonic urine
- c. white blood cells in hypertonic urine
- d. white blood cells in hypotonic urine
80 What cell is most commonly associated with vaginal contamination?
   a white
   b transitional
   c squamous
   d glitter

81 A reagent strip test for blood has been reported positive. Microscopic examination fails to yield red blood cells. This patient’s condition can be called:
   a hematuria
   b hemoglobinuria
   c oliguria
   d hemosiderinuria

82 Ghost red blood cells are seen in urine that is:
   a acidic and dilute
   b alkaline and dilute
   c acidic and concentrated
   d alkaline and concentrated

83 The possibility of detecting glitter cells is associated with urine that is:
   a acidic
   b dilute
   c alkaline
   d concentrated

84 An eosinophil count may be requested on urine from a patient with suspected:
   a acute glomerulonephritis
   b cystitis
   c renal lithiasis
   d acute interstitial nephritis

85 Clue cells are a form of:
   a squamous epithelial cell
   b urothelial cell
   c white blood cell
   d renal tubular epithelial cell

86 Which of the following cells is most likely to be seen in the urine sediment following a catheterization procedure?
   a squamous epithelial cell
   b urothelial cell
   c white blood cell
   d renal tubular epithelial cell
A patient admitted following an accident involving massive crush injuries has the following urinalysis results:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Result</th>
<th>Microscopic findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td>Red brown</td>
<td>Renal tubular epithelial: 5-10</td>
</tr>
<tr>
<td>Clarity</td>
<td>Clear</td>
<td>Renal tubular cell casts: 1-2</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>1.011</td>
<td></td>
</tr>
<tr>
<td>pH</td>
<td>6.0</td>
<td></td>
</tr>
<tr>
<td>Protein</td>
<td>1+</td>
<td></td>
</tr>
<tr>
<td>Blood</td>
<td>Large</td>
<td></td>
</tr>
<tr>
<td>Glucose</td>
<td>Negative</td>
<td></td>
</tr>
<tr>
<td>Ketones</td>
<td>Negative</td>
<td></td>
</tr>
<tr>
<td>Nitrite</td>
<td>Negative</td>
<td></td>
</tr>
<tr>
<td>Leukocytes</td>
<td>Negative</td>
<td></td>
</tr>
<tr>
<td>Bilirubin</td>
<td>Negative</td>
<td></td>
</tr>
<tr>
<td>Urobilinogen</td>
<td>Negative</td>
<td></td>
</tr>
</tbody>
</table>

The discrepancy between the large amount of blood and the absence of RBCs on microscopy is caused by:

- a failure to mix the specimen before centrifuging
- b mistaking RBCs for RTE cells
- c contaminating oxidizing detergents in the container
- d the presence of myoglobin in the urine specimen

What is the most likely diagnosis given this microscopic finding?

- a glomerulonephritis
- b pyelonephritis
- c nephrotic syndrome
- d cystitis

Identify the formed element in this photomicrograph:

- a RBC
- b WBC
- c epithelial cell
- d yeast
All casts typically contain:

- albumin
- globulin
- immunoglobulins G and M
- Tamm-Horsfall glycoprotein

Hyaline casts are usually found:

- in the center of the coverslip
- under subdued light
- under very bright light
- in the supernatant

Which of the following casts is most likely to be found in healthy people?

- hyaline
- red blood cell
- waxy
- white blood cell

Which of the following casts is most indicative of end stage renal disease?

- hemoglobin
- granular
- cellular
- waxy

A technologist performed a STAT microscopic urinalysis and reported the following:

WBC: 10-13
RBC: 2-6
hyaline casts: 5-7
bacteria: 1+

The centrifuge tube was not discarded and the urine sediment was reevaluated microscopically 5 hours after the above results were reported. A second technologist reported the same results, except 2+ bacteria and no hyaline casts were found. The most probable explanation for the second technologist's findings is:

- sediment was not agitated before preparing the microscope slide
- casts dissolved due to decrease in urine pH
- casts dissolved due to increase in urine pH
- casts were never present in this specimen

Which of the following aids in differentiating a spherical transitional cell from a round renal tubular cell?

- spherical transitional cell is larger
- eccentrically-placed nucleus in the renal tubular cell
- eccentrically-placed nucleus in the spherical transitional cell
- round renal tubular cell is larger

The urine microscopic constituents that best differentiate between cystitis and pyelonephritis are:

- WBCs
- bacteria
- RBCs
- WBC casts

Epithelial cell casts are most indicative of:

- glomerulonephritis
- nephrotic syndrome
- tubular necrosis
- pyelonephritis
98 Granular casts found in the urine of a football player admitted to the hospital with a broken leg occurring during the game can be the result of:
   a  excessive bruising
   b  strenuous exercise
   c  excess power drink ingestion
   d  bone fracture

99 Which of the following casts most frequently appears to have a brittle consistency?
   a  hyaline
   b  granular
   c  waxy
   d  fatty

100 To distinguish between a clump of WBCs and a WBC cast, it is important to observe:
   a  the presence of free-floating WBCs
   b  a positive leukocyte reaction
   c  a positive nitrite reaction
   d  the presence of a cast matrix

101 Spherical urothelial cells may be confused with:
   a  oval fat bodies
   b  renal tubular epithelial cells
   c  glitter cells
   d  lymphocytes

102 Prior to reporting a red blood cell cast, it is important to observe:
   a  free-floating RBCs
   b  hyaline casts
   c  granular casts
   d  increased white blood cells

103 In a specimen with a large amount of bilirubin, which of the following sediment constituents would be most noticeably bile-stained?
   a  squamous epithelial cells
   b  white blood cell casts
   c  cystine crystals
   d  renal tubular epithelial cell casts

104 What is the most likely diagnosis given this microscopic finding?
   a  glomerulonephritis
   b  pyelonephritis
   c  nephrotic syndrome
   d  cystitis
105 A white precipitate in a urine specimen with a pH of 7.5 would most probably be caused by:
   a amorphous urates
   b WBCs
   c amorphous phosphates
   d bacteria

106 Which of the following is an abnormal crystal described as a hexagonal plate?
   a cystine
   b tyrosine
   c leucine
   d cholesterol

107 The primary component of most urinary calculi is:
   a calcium
   b uric acid
   c leucine
   d cystine

108 After warming, a cloudy urine clears. This is due to the presence of:
   a urates
   b phosphates
   c WBCs
   d bacteria

109 Tiny, colorless, dumbbell-shaped crystals were found in an alkaline urine sediment. They most likely are:
   a calcium oxalate
   b calcium carbonate
   c calcium phosphate
   d amorphous phosphate

110 Which of the following crystals may be found in acidic urine?
   a calcium carbonate
   b calcium oxalate
   c calcium phosphate
   d triple phosphate

111 Using polarized light microscopy, which of the following urinary elements are birefringent?
   a cholesterol
   b triglycerides
   c fatty acids
   d neutral fats

112 Which of the following crystals appear as fine, silky needles?
   a cholesterol
   b leucine
   c hemosiderin
   d tyrosine

113 Which of the following crystals is seen in an amber urine with a positive bilirubin?
   a ammonium biurate
   b cystine
   c tyrosine
   d uric acid
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Questions

114 Following ingestion of ethylene glycol (antifreeze) numerous crystals are found in the urine. The shape of these crystals is:

- **a** flat with notched corners
- **b** oval/dumbbell
- **c** coffin-lid
- **d** rosettes/rhomboid

115 Cholesterol crystals will most likely be observed in urine that contains:

- **a** 3+ glucose
- **b** 4+ protein
- **c** WBC casts
- **d** triple phosphate crystals

116 The finding of a large amount of uric acid crystals in a urine specimen from a 6-month-old boy:

- **a** may actually be diaper fibers
- **b** could indicate Lesch-Nyhan syndrome
- **c** should not be reported
- **d** may indicate improper feeding

117 The following crystal is found in:

![Crystal Image]

- **a** acid pH and is nonpathologic
- **b** alkaline pH and is nonpathologic
- **c** acid pH and is pathologic
- **d** alkaline pH and is pathologic

118 Identify this crystal:

![Crystal Image]

- **a** uric acid
- **b** calcium phosphate
- **c** calcium carbonate
- **d** triple phosphate acid
Alkaline urine showed this microscopic finding.

The technologist should:

a. dilute with saline  
b. request a new sample  
c. culture for bacteria  
d. dissolve with acetic acid

Polarized light can often be used to differentiate between:

a. fibers and mucus clumps  
b. hyaline and waxy casts  
c. squamous and transitional epithelial cells  
d. red blood cells and white blood cells

Which of the following contaminants has a dimpled center and will polarize?

a. starch  
b. oil droplets  
c. air bubbles  
d. pollen grains

The presence of this element in urine indicates the presence of:

a. a UTI  
b. powder  
c. carbohydrate deficiency  
d. high urine amylase
123 Identify the formed element in this photomicrograph:

- a cloth fiber
- b hyaline cast
- c granular cast
- d waxy cast

124 A technologist is having trouble differentiating between red blood cells, oil droplets and yeast cells on a urine microscopy. Acetic acid should be added to the sediment to:

- a lyse the yeast cells
- b lyse the red blood cells
- c dissolve the oil droplets
- d crenate the red blood cells

125 A urine specimen is tested and has the following results:

<table>
<thead>
<tr>
<th>Reagent strip</th>
<th>Microscopic findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>glucose: 3+</td>
<td>&gt;100 WBCs/hpf</td>
</tr>
<tr>
<td>protein: 1+</td>
<td>many yeast cells</td>
</tr>
</tbody>
</table>

This is indicative of:

- a diabetes mellitus
- b contamination
- c pyelonephritis
- d diabetes insipidus

126 When identifying urinary crystals, which reagent strip result is most important?

- a protein
- b pH
- c specific gravity
- d nitrite

127 Bacteria are considered significant in the urine sediment when the:

- a nitrite is positive
- b protein is positive
- c specimen is cloudy
- d leukocytes is positive

128 Which of the following exhibits rapid motility in urine sediment?

- a spermatozoa
- b *Trichomonas vaginalis*
- c *Gardnerella vaginalis*
- d *Enterobius vermicularis*
129 Which of the following positive chemical reactions is most closely associated with the presence of yeast in the urine sediment?

a. nitrite  
b. protein  
c. glucose  
d. blood

130 What of the following is consistent with this urine microscopic finding?

a. ketone  
b. glucose  
c. specific gravity  
d. nitrate

131 A 21-year-old woman had glucose in her urine with a normal blood sugar. These findings are most consistent with:

a. renal glycosuria  
b. diabetes insipidus  
c. diabetes mellitus  
d. alkaline tide

**Urinalysis: Complete Examination**

132 A 59-year-old man is evaluated for back pain. Urine studies (urinalysis by multiple reagent strip) include:

**Urinalysis**
- specific gravity: 1.017
- pH: 6.5
- protein: negative
- glucose: negative
- blood: negative

**Microscopic findings**
- rare epithelial cells

**Urine protein electrophoresis**
- monoclonal spike in gamma globulin region

Which of the following statements best explains these results?

a. urine protein is falsely negative due to the specific gravity  
b. urine protein is falsely negative because the method is not sensitive for Bence Jones protein  
c. microscopic examination is falsely negative due to the specific gravity  
d. electrophoresis is incorrect and should be repeated
133 The results of a urinalysis on a first morning specimen are:

- specific gravity: 1.024
- pH: 8.5
- protein: negative
- glucose: negative

**Microscopic findings**
- uric acid crystals

The next step is to repeat the:
- a microscopic examination
- b protein and glucose
- c specific gravity
- d pH and microscopic examination

134 The following urinalysis results were obtained from an 18-year-old woman in labor:

- pH: 6.5
- protein: 30 mg/dL
- glucose: 250 mg/dL
- ketones: negative
- bilirubin: small (color slightly abnormal)
- blood: negative
- nitrite: negative
- urobilinogen: 0.1 EU/dL
- specific gravity: 1.025
- copper reduction test: 1.0 g/dL

Which of the following is the most likely explanation for the patient’s positive copper reduction test?

- a only glucose is present
- b only lactose is present
- c glucose and possibly other reducing substances/sugars are present
- d results are false positive due to the presence of protein

135 The following urine results were obtained on a 25-year-old female:

- pH: 7.0
- color: yellow
- appearance: cloudy
- protein: 1+
- glucose: negative
- blood: small
- specific gravity: 1.015

**Microscopic findings**
- bacteria: many
- WBC casts: 0-3/lpf
- WBC/hpf: 30-40

These results are most compatible with:

- a glomerulonephritis
- b renal calculus
- c cystitis
- d pyelonephritis
A urinalysis performed on a 27-year-old woman yields the following results:

- **Microscopic findings**
  - WBC/hpf: 10-15
  - RBC/hpf: 30-55
  - casts/lpf: hyaline, 5-7; RBC, 2-5; granular, 2-3
  - uric acid crystals: moderate

These findings are most consistent with:

a. yeast infection
b. pyelonephritis
c. bacterial cystitis
d. glomerulonephritis

A 62-year-old patient with hyperlipoproteinemia has a large amount of protein in his urine. Microscopic analysis yields moderate to many fatty, waxy, granular and cellular casts. Many oval fat bodies are also noted. This is most consistent with:

a. nephrotic syndrome
b. viral infection
c. acute pyelonephritis
d. acute glomerulonephritis

A patient has 2 separate urinalysis reports, which contain the following data:

<table>
<thead>
<tr>
<th>Test</th>
<th>Report A</th>
<th>Report B</th>
</tr>
</thead>
<tbody>
<tr>
<td>specific gravity</td>
<td>1.004</td>
<td>1.017</td>
</tr>
<tr>
<td>pH</td>
<td>5.5</td>
<td>7.0</td>
</tr>
<tr>
<td>protein</td>
<td>negative</td>
<td>1+</td>
</tr>
<tr>
<td>glucose</td>
<td>negative</td>
<td>negative</td>
</tr>
<tr>
<td>blood</td>
<td>negative</td>
<td>small</td>
</tr>
<tr>
<td>microscopy</td>
<td>rare epithelial cells</td>
<td>1-2 granular cast/lpf</td>
</tr>
</tbody>
</table>

Which of the following statements best explains these results?

a. protein, glucose and microscopy of A are false negatives because of the specific gravity
b. protein and glucose are false positives in B due to the specific gravity
c. microscopic of A is false negative because of the pH
d. microscopic of B is false positive because of the pH

A 4-year-old girl develops edema following a recent immunization. Laboratory studies reveal:

- **serum albumin**: 1.8 g/dL (18 g/L)
- serum cholesterol: 450 mg/dL (11.66 mmol/L)
- serum urea nitrogen: 20 mg/dL (7.14 mmol/L)
- urinalysis: protein 4+; hyaline, granular and fatty casts

These findings are most compatible with:

a. acute poststreptococcal glomerulonephritis
b. minimal change disease
c. acute pyelonephritis
d. diabetes mellitus
140 A specimen with a negative nitrate reaction and a positive leukocytes reaction that has WBCs, WBC casts, and no bacteria in the sediment will be seen in cases of:

- cystitis
- pyelonephritis
- acute interstitial nephritis
- acute glomerulonephritis

141 Urinalysis results on a female patient who brings a urine specimen to the physician’s office for her annual physical are:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td>yellow</td>
</tr>
<tr>
<td>Clarity</td>
<td>cloudy</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>1.020</td>
</tr>
<tr>
<td>pH</td>
<td>7.0</td>
</tr>
<tr>
<td>Protein</td>
<td>trace</td>
</tr>
<tr>
<td>Glucose</td>
<td>negative</td>
</tr>
<tr>
<td>Ketones</td>
<td>negative</td>
</tr>
<tr>
<td>Blood</td>
<td>negative</td>
</tr>
<tr>
<td>Bilirubin</td>
<td>negative</td>
</tr>
<tr>
<td>Urobilinogen</td>
<td>0.2 mg/dL</td>
</tr>
<tr>
<td>Nitrite</td>
<td>positive</td>
</tr>
<tr>
<td>Leukocytes</td>
<td>negative</td>
</tr>
</tbody>
</table>

What action should be taken?

- place the patient on a broad spectrum antibiotic for 7 days
- ask the patient to collect another specimen at the office
- tell the patient she will be called when the culture and sensitivity reports are back
- have the patient return in a week with a new specimen

142 A patient with lupus erythematosus has the following urinalysis results:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Result</th>
<th>Microscopic findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td>red</td>
<td>WBC/hpf: 5-10</td>
</tr>
<tr>
<td>Clarity</td>
<td>cloudy</td>
<td>RBC/hpf: 40-50</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>1.011</td>
<td>casts/lpf: hyaline, 2-4; RBC, 3-5</td>
</tr>
<tr>
<td>pH</td>
<td>6.3</td>
<td></td>
</tr>
<tr>
<td>Protein</td>
<td>3+</td>
<td></td>
</tr>
<tr>
<td>Glucose</td>
<td>negative</td>
<td></td>
</tr>
<tr>
<td>Ketones</td>
<td>negative</td>
<td></td>
</tr>
<tr>
<td>Blood</td>
<td>large</td>
<td></td>
</tr>
<tr>
<td>Bilirubin</td>
<td>negative</td>
<td></td>
</tr>
<tr>
<td>Urobilinogen</td>
<td>1.0 mg/dL</td>
<td></td>
</tr>
<tr>
<td>Nitrite</td>
<td>negative</td>
<td></td>
</tr>
<tr>
<td>Leukocytes</td>
<td>trace</td>
<td></td>
</tr>
</tbody>
</table>

These results would be associated with:

- chronic glomerulonephritis
- chronic pyelonephritis
- acute interstitial nephritis
- acute tubular necrosis

143 The sediment of a urine specimen with a reagent strip glucose of 250 mg/dL (13.8 mmol/L) and a pH of 5.5 is ideal for the presence of:

- cystine crystals
- *Trichomonas vaginalis*
- *Candida albicans*
- thorny apple crystals
A patient with severe back pain has the following urinalysis results:

<table>
<thead>
<tr>
<th>Microscopic findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>RBC/hpf: 10-20</td>
</tr>
<tr>
<td>squamous epithelial cells: moderate</td>
</tr>
<tr>
<td>calcium oxalate crystals: moderate</td>
</tr>
</tbody>
</table>

| color: dark yellow |
| clarity: hazy     |
| specific gravity: 1.030 |
| pH: 6.0            |
| protein: trace     |
| glucose: negative  |
| ketones: negative  |
| blood: small       |
| bilirubin: negative |
| urobilinogen: 0.4 mg/dL |
| nitrite: negative  |
| leukocytes: negative |

In addition to the presence of blood, what other reagent strip result relates to the patient's symptoms?

- a specific gravity
- b pH
- c protein
- d urobilinogen

**Urine Physiology**

145 The normal renal threshold for glucose in the adult is approximately:

- a 50 mg/dL (2.8 mmol/L)
- b 100 mg/dL (5.5 mmol/L)
- c 160 mg/dL (8.8 mmol/L)
- d 300 mg/dL (16.5 mmol/L)

146 The volume of urine excreted in a 24-hour period by an adult patient was 500 mL. This condition would be termed:

- a anuria
- b oliguria
- c polyuria
- d dysuria

147 A patient has glucosuria, hyperglycemia and polyuria. These findings are most consistent with:

- a renal glucosuria
- b diabetes mellitus
- c emotional stress
- d eating a heavy meal

148 The normal glomerular filtration rate is:

- a 1 mL/min
- b 120 mL/min
- c 660 mL/min
- d 1,200 mL/min

149 Normal urine primarily consists of:

- a water, protein and sodium
- b water, urea and protein
- c water, urea and sodium chloride
- d water, urea and bilirubin
150 An abdominal fluid is submitted from surgery. The physician wants to determine if this fluid could be urine. The technologist should:
   a) perform a culture
   b) smell the fluid
   c) test for urea and creatinine
   d) test for protein, glucose and pH

151 Antidiuretic hormone regulates the reabsorption of:
   a) water
   b) glucose
   c) potassium
   d) calcium

152 Which of the following components are present in serum but not present in the glomerular filtrate?
   a) glucose
   b) amino acids
   c) urea
   d) large molecular weight proteins

153 Polyuria is usually correlated with:
   a) acute glomerulonephritis
   b) diabetes mellitus
   c) hepatitis
   d) tubular damage

154 Cessation of urine flow is defined as:
   a) azotemia
   b) dysuria
   c) diuresis
   d) anuria

155 The reason for performing a Clinitest® on a newborn’s urine is to check for:
   a) fructose
   b) galactose
   c) glucose
   d) lactose

156 Ketones in urine are due to:
   a) complete utilization of fatty acids
   b) incomplete fat metabolism
   c) high carbohydrate diets
   d) renal tubular dysfunction

157 Reagent strip tests for ketones measure primarily:
   a) acetone
   b) acetoacetic acid
   c) cholesterol
   d) beta-hydroxybutyric acid

158 Bilirubinuria may be associated with:
   a) strenuous exercise
   b) increased destruction of platelets
   c) viral hepatitis
   d) hemolytic anemia
159 Myoglobinuria is **most** likely to be noted in urine specimens from patients with which of the following disorders?

- a hemolytic anemia
- b lower urinary tract infection
- c myocardial infarction
- d paroxysmal nocturnal hemoglobinuria

160 A patient with renal tubular acidosis would most likely excrete a urine with a:

- a low pH
- b high pH
- c neutral pH
- d variable pH

161 Glycosuria may be due to:

- a hypoglycemia
- b increased renal threshold
- c renal tubular dysfunction
- d increased glomerular filtration rate

162 The area of the nephron that is impermeable to water is the:

- a proximal convoluted tubule
- b descending loop of Henle
- c ascending loop of Henle
- d distal convoluted tubule

163 The urinary tract structures responsible for renal concentration are the:

- a renal pelvis
- b cortical nephrons
- c renal papillae
- d juxtamedullary nephrons

164 The most accurate test to determine renal concentration is:

- a osmolarity
- b glomerular filtration rate
- c specific gravity
- d tubular reabsorption rate

165 Failure of the nephron to produce ammonia will result in urine with a:

- a low specific gravity
- b positive nitrite
- c high pH
- d positive protein

**Other Body Fluids**

166 To avoid falsely elevated spinal fluid cell counts:

- a use an aliquot from the first tube collected
- b use only those specimens showing no turbidity
- c centrifuge all specimens before counting
- d select an aliquot from the last tube collected
A turbid cerebrospinal fluid is most commonly caused by increased:

- white blood cells
- protein
- glucose
- bacterial organisms

The normal concentration of proteins in cerebrospinal fluid, relative to serum protein, is:

- <1%
- 5%-10%
- 25%-30%
- 50%-60%

To prepare the reagent used for mucin clot determination of synovial fluid, water is mixed with:

- hydrochloric acid
- sodium hydroxide
- trichloroacetic acid
- glacial acetic acid

In addition to the sperm count in a fertility study, analysis of seminal fluid should also include:

- time of liquefaction, estimation of motility, morphology
- motility, morphology, test for alkaline phosphatase
- time of liquefaction, test for acid phosphatase, qualitative test for hemoglobin
- time of liquefaction, qualitative test for hemoglobin and motility

The following lab values were obtained on a body fluid sample:

- protein: 3 g/dL (30 g/L)
- albumin: 2.1 g/dL (21 g/L)
- hyaluronate: 0.4 g/dL (4 g/L)
- glucose: 80 mg/dL (4.4 mmol/L)
- lactate: 10 mg/dL (1.1 mmol/L)

The sample is:

- pleural fluid
- synovial fluid
- urine
- cerebrospinal fluid

A physician attempts to aspirate a knee joint and obtains 0.1 mL of slightly bloody fluid. Addition of acetic acid results in turbidity and a clot. This indicates that:

- the fluid is synovial fluid
- plasma was obtained
- red blood cells caused a false-positive reaction
- the specimen is not adequate

Synovial fluid is analyzed with a polarizing microscope. Strongly birefringent needles are seen. This most likely indicates:

- monosodium urate crystals
- calcium pyrophosphate crystals
- corticosteroid crystals
- talc crystals

A sperm count is diluted 1:20 and 50 sperm are counted in 2 large squares of the Neubauer counting chamber. The sperm count in mLs is:

- 5,000
- 50,000
- 500,000
- 5,000,000
The principal mucin in synovial fluid is:

- a hyaluronate
- b albumin
- c orosomucoid
- d pepsin

The synovial fluid easily forms small drops from the aspirating syringe. This viscosity is:

- a normal
- b increased
- c associated with inflammation
- d associated with hypothyroidism

Pleural transudates differ from pleural exudates in that transudates have:

- a protein values of >4 g/dL
- b specific gravity values of >1.020
- c LD values of >200 IU
- d relatively low cell counts

Pleural fluid from a patient with congestive heart failure would be expected to:

- a contain bacteria
- b have a high protein content
- c be purulent
- d appear clear and pale yellow

Monosodium urate (MSU) and calcium pyrophosphate dehydrate (CPPD) crystals can be distinguished by using a red compensator in a polarizing microscope. When the crystal is aligned with the slow vibration of the compensator, which is true?

- a MSU are blue
- b MSU are yellow
- c CPPD are blue
- d corticosteroids are yellow

False-positive results can occur for fecal occult blood due to the ingestion of

- a ascorbic acid
- b horseradish
- c acetaminophen
- d blueberries

The chromogen for the fecal occult blood test is:

- a gum guaiac
- b NADH
- c o-toluidine
- d p-aminocinnamaldehyde

A build up of fluid in a body cavity is called:

- a an effusion
- b a transudate
- c an exudate
- d metastasis

A fluid sample was collected by thoracentesis. A serum sample was collected immediately afterward. The LD fluid to serum ratio was 0.9. There were 5,000 WBC/μL, with 75% PMNs. Which of the following describes this fluid?

- a pleural effusion exudate
- b pericardial effusion exudate
- c pleural effusion transudate
- d pericardial effusion transudate
7: Urinalysis and Body Fluids | Other Body Fluids

184 Ascites is collected by:
   a thoracentesis
   b lumbar puncture
   c amniocentesis
   d paracentesis

185 Amniotic fluid is tested for the concentration of lamellar bodies. This test determines:
   a fetal lung maturity (FLM)
   b hemolytic disease of the newborn (HDN)
   c alpha-fetoprotein (AFP)
   d trisomy 21

186 Amniocentesis should be performed to:
   a screen for Down syndrome
   b to confirm a high maternal serum alpha-fetoprotein (MSAFP)
   c to test bilirubin levels for an Rh positive mother
   d test folic acid levels in fetal blood

187 A sweat chloride > 60 mEq/L (60 mmol/L) is indicative of:
   a multiple sclerosis
   b muscular dystrophy
   c respiratory distress syndrome
   d cystic fibrosis

188 The most common genetic defect associated with cystic fibrosis is called:
   a delta-F508
   b trisomy 21
   c Philadelphia chromosome
   d fragile X

189 The presence of oligoclonal bands in the CSF but not in the serum is associated with:
   a spina bifida
   b hydrocephalus
   c Reye syndrome
   d multiple sclerosis

190 Normal CSF has a relative abundance of which of the following proteins when compared to serum?
   a transferrin
   b prealbumin
   c albumin
   d fibrinogen

191 A CSF was collected from a 5-year-old with a fever, and 3 tubes were transported to the lab. Tube 1 had 50,000 RBC/mL and 48 WBC/mL. Tube 3 had 10 RBC/mL and 0 WBC/mL. What is the most likely explanation for the discrepancy?
   a tube 3 was QNS
   b bacterial meningitis
   c subarachnoid hemorrhage
   d traumatic tap

192 An increased IgG index indicates:
   a antibody response to bacteria
   b synthesis of IgG in the CNS
   c brain tumor
   d breach of the blood brain barrier
The appearance of normal CSF is:

a. pale yellow and clear
b. colorless and clear
c. opalescent
d. xanthochromic

A CSF was hazy and the WBC was too high to perform undiluted. The technologist took 50 mL of sample and added 500 mL of saline. The cell count on the diluted sample was 200 WBC per mL. This should be multiplied by:

a. 10
b. 11
c. 1/10
d. 1/11

The finding of hemosiderin laden macrophage in a CSF sample indicates:

a. bacterial infection
b. viral infection
c. previous hemorrhage
d. traumatic tap

Which CSF results are most consistent with bacterial meningitis?

<table>
<thead>
<tr>
<th>CSF sample</th>
<th>Glucose</th>
<th>Protein</th>
<th>Lactate</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>20 mg/dL (1.1 mmol/L)</td>
<td>50 mg/dL (500 mg/L)</td>
<td>increased</td>
</tr>
<tr>
<td>B</td>
<td>75 mg/dL (4.1 mmol/L)</td>
<td>20 mg/dL (200 mg/L)</td>
<td>increased</td>
</tr>
<tr>
<td>C</td>
<td>20 mg/dL (1.1 mmol/L)</td>
<td>45 mg/dL (450 mg/L)</td>
<td>decreased</td>
</tr>
<tr>
<td>D</td>
<td>75 mg/dL (4.1 mmol/L)</td>
<td>120 mg/dL (1,200 mg/L)</td>
<td>decreased</td>
</tr>
</tbody>
</table>

Which of the following is the best indicator of Reye syndrome for CSF (hepatic encephalopathy)?

a. glutamine
b. ammonia
c. ALT
d. bilirubin

The tau isoform of transferrin is a carbohydrate deficient protein found only in:

a. CSF
b. sweat
c. amniotic fluid
d. semen

Which marker can be used to identify a body fluid as semen?

a. PSA
b. alkaline phosphatase
c. fructose
d. hyaluronic acid

Which stain is used to measure sperm viability?

a. eosin nigrosin
b. Wright
c. toluidine blue
d. Papanicolaou
201 The dimensions of a hemacytometer are:

- a 3 x 3 x 0.1 mm
- b 1 x 1 x 10 mm
- c 3 x 10 x 1 mm
- d 1 x 1 x 0.3 mm

202 Rapid forward progression of sperm is rated as:

- a 1.0
- b 2.0
- c 3.0
- d 4.0

203 Laboratory characteristics of malabsorption syndrome due to pancreatic insufficiently include:

- a increased fecal fat
- b fecal leukocytes
- c positive Clinistest®
- d fecal occult blood

204 Pilocarpine iontophoresis refers to the specific process of:

- a inducing sweat
- b separating proteins in CSF
- c measuring ions in sweat
- d measuring pilocarpine in CSF

205 During sweat collection, a consideration that can result in a falsely high result is:

- a high ambient temperature
- b evaporation
- c preparation of area with type 1 water
- d high sweat rate

206 Methods used as screening tests for cystic fibrosis include:

- a coulometric Cl measurement
- b Cl selective electrodes
- c sweat conductivity
- d pilocarpine iontophoresis

207 Which pair does not match with respect to amniotic fluid?

- a colorless—normal
- b dark red-brown—fetal death
- c dark green—hemolytic disease of the newborn
- d blood-streaked—traumatic tap

208 Amniotic fluid is evaluated using a Liley graph and change in absorbance at 450 nm. What is being evaluated, and why?

- a bilirubin, which increases in HDN
- b AFP, which increases in spina bifida
- c HCG, which increases in Down syndrome
- d lamellar bodies, which increase with fetal lung maturity

209 Which assay for fetal lung maturity using amniotic fluid gives a ratio of surfactant to albumin?

- a Amniostat
- b L/S
- c lamellar bodies
- d fluorescence polarization assay
210 Triglycerides (chyle) can be identified in body fluids by their ability to:
   a polarize light
   b stain with Sudan III
   c sediment upon standing
   d glitter

211 Peritoneal lavage is used to:
   a detect intra-abdominal bleeding in blunt injury
   b dialyze patients with end stage renal disease (ESRD)
   c replace ascites with saline
   d perform therapeutic thoracentesis

212 Tumor markers that can be measured on body fluids include all except:
   a CEA
   b CA 125
   c ANA
   d CYFRA 21-1

213 Which semen result is abnormal?
   a sample pours in droplets after 60 minutes
   b >50% are motile within 1 hour of collection
   c pH 7.5
   d motility of 1.0

214 Increased CSF lactate is found in:
   a bacterial meningitis
   b Reye encephalopathy
   c spina bifida
   d multiple sclerosis

215 Decreased CSF protein can be found in:
   a meningitis
   b hemorrhage
   c multiple sclerosis
   d CSF leakage

216 What calculation is used to determine if there is a breach in the blood-brain barrier?
   a IgG index
   b CSF-serum albumin index
   c fluid-serum LD ratio
   d albumin gradient
<table>
<thead>
<tr>
<th></th>
<th>Answer Key - Urinalysis and Body Fluids</th>
<th>Answer Key - Urinalysis and Body Fluids</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>d</td>
<td>b</td>
</tr>
<tr>
<td>2</td>
<td>a</td>
<td>c</td>
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<td>3</td>
<td>b</td>
<td>a</td>
</tr>
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<td>4</td>
<td>d</td>
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<td>c</td>
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<td>7</td>
<td>b</td>
<td>c</td>
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<td>b</td>
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<td>24</td>
<td>c</td>
<td>b</td>
</tr>
<tr>
<td>25</td>
<td>d</td>
<td>b</td>
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| 117 | 175 | 176 | 177 | 178 | 179 | 180 | 181 | 182 | 183 | 184 | 185 | 186 | 187 | 188 | 189 | 190 | 191 | 192 | 193 | 194 | 195 | 196 | 197 | 198 | 199 | 200 | 201 | 202 | 203 | 204 | 205 | 206 | 207 | 208 | 209 | 210 | 211 | 212 | 213 | 214 | 215 | 216 | 412 | The Board of Certification Study Guide |
8. c Consider whether a substance can increase or decrease outside the body. No more blood can be produced. Although the RBC may rupture, they will still make a positive result on a biochemical strip. The amount of solutes won't change, so specific gravity won't change. pH is affected by metabolism of the urine components by bacteria, and room temperature is warm enough for this to occur. Protein will not increase or decrease.
[Strasinger 2008, p33]

9. d The reader should know the approximate volume of a daily void, which is approximately 1,500 mL, but can range from 600–2,000 mL. In order to determine if 600 is the actual volume, or some sample was missed, evaluate the creatinine. Creatinine is excreted at approximately 1.2 mg/24 hour. Now evaluate the choices. a could be correct, but it is not sufficient, since 600 mL is unusually low. b is incorrect, because the creatinine is too low. c is incorrect, because it does not answer the medical question, and it bills the patient. This leaves d, which is the correct answer.
[McBride 1999]

10. b Larger sediment constituents sink to the bottom of the specimen container. Without prior mixing, the sediment in the container may not be poured into the centrifuge tube.
[Strasinger 2008, p83]

11. c Several methods have been described to estimate glomerular filtration. The creatinine clearance test uses plasma creatinine vs urine creatinine. However, it is unwieldy and time consuming for the patient. The new estimated formula, called the modification of diet in renal disease (MDRD) uses ethnicity, serum creatinine, BUN and serum albumin.
[Strasinger 2008, p21]

12. c The creatinine clearance is a filtration rate, and is reported in minutes. The sample is a 24-hour urine, which is entered into the calculation as the volume in milliliters, and the factor of 1,440 minutes per 24 hours is applied.
[Strasinger 2008, p20]
13  **b**  Patients with hypertension and diabetes mellitus are at risk for kidney disease. Detection of small amounts of albumin in the urine predict eventual kidney disease. The advantage of this sensitive detection is that patients with microalbuminuria can be treated with anti-hypertensive medications and followed up more intensely to delay nephropathy.  
[Strasinger 2008, p58]

21  **b**  The 2 items listed that produce a white color are white blood cells and semen. It is more likely that a woman would have a UTI with many WBC than enough post coital sperm contamination to make the urine white.  
[Strasinger 2008, p45]

22  **c**  Match the color to the pigment. Bile is green/brown. Porphyrin is red. Melanin is black. Blood cells are red or white.  
[Strasinger 2008, p44]

23  **a**  The only normal pigment/substance listed here is urochrome.  
[Strasinger 2008, p42]

24  **c**  Match the color to the pigment. Bilirubin is amber. Myoglobin is red, like hemoglobin. Homogentisic acid will produce a dark urine on standing.  
[Strasinger 2008, pp42-43]

25  **d**  Since the patient is healthy, assume the turbidity is caused by something nonpathologic. After meals, urine is more alkaline; this is referred to as the alkaline tide. Due to this pH, amorphous phosphates may be found.  
[McBride 1999, p63]

26  **b**  In alkaptonuria, the acid urine will turn black on standing.  
[Strasinger 2008, p44]

27  **c**  Both osmolality and specific gravity measure solutes in a solution.  
[Strasinger 2008, p22]

28  **b**  Specific gravity gives the concentration for the sample relative to water. It does not give specific information about $H^+$ or $Na^+$ ions.  
[Strasinger 2008, p46]

29  **a**  Osmolality measures the number of particles in a solution. Salts will dissociate into ions, and each ion contributes to the osmolality.  
[Strasinger 2008, p22]

30  **a**  Only 2 of the answers, osmolality and refractive index, measure urine concentration. Refractive index is disproportionately affected by protein, so the correct answer is osmolality.  
[McBride 1999, p58]
31  c  An easy to make control for urinalysis is 6.5% NaCl. This has a specific gravity of 1.022, so c is correct. b is false, since the specific gravity of water is 1.000. d refers to osmolality, which is not measured by refractometry. [Strasinger 2008, p48]

32  b  Dissolved solids, including salt, sugar, urea, etc, contribute to specific gravity. Turbidity is caused by cells and crystals, which do not dissolve, and do not contribute to specific gravity. [McBride 1999, p57]

33  c  Isosthenuric urine has a specific gravity of 1.010. A specific gravity less than that is termed hypothenuric, and one greater than that is hyperthenuric. [Strasinger 2008, p48]

34  b  Fluid leaving the glomerulus is isosthenuric. [Strasinger 2008, p48]

35  b  Diuretics cause people to lose water as urine. Antidiuretic hormone has the opposite effect, that of retaining water. A deficiency of ADH results in a loss of water in the urine. The amount of solutes (salts and sugars) is not altered, but they are diluted, resulting in a low specific gravity. [Strasinger 2008, p149]

36  c  Although few labs (if any) use a urinometer, all of them should have a refractometer. These use 1 drop of sample, and compensate for temperature. A pitfall is that they are disproportionately affected by glucose and protein. [Strasinger 2008, p47]

37  c  Distilled water is used to calibrate the refractometer. Since protein and glucose cause refractometer error, these should not be used as calibrators. Urea is susceptible to urease from bacterial contamination. NaCl is cheap and reliable. [Strasinger 2008, p48]

38  a  The reagent strip is not affected by contrast dye. The refractometer reads the darker solution as density. A densitometer is a chemistry instrument, not a urinalysis instrument. A urinometer is not generally used in the modern lab. [Strasinger 2008, p49]

39  b  Osmolality and specific gravity are both measures of the concentration of urine. [Strasinger 2008, p22]

40  b  Light bends when it hits the surface of the liquid, because the liquid slows down its velocity. This is called refraction. The degree that the light bends is the refractive index. [Strasinger 2008, p47]

41  d  a, b, and c may give false-positive results. A false-negative can result from a dilute urine, so d is correct. [Strasinger 2008, p149]

42  b  Both b and c refer to pH; however, a urine pH is a number, not a concentration per unit of urine, so c is incorrect. [Strasinger 2008, p56]

43  b  The change in pH is due to breakdown of urea to ammonia by urease producing bacteria, and loss of CO2. [Strasinger 2008, p33]

44  c  Reagent strips must be handled carefully to prevent them from picking up excess moisture. Heating or refrigeration is not appropriate. They work optimally at room temperature. They should be stored in a dark, tightly capped bottle, not exposed to light. [Strasinger 2008, p55]

45  b  Two pH indicators are incorporated in the strip. Protein accepts H+ ions from the pad, resulting in a pH and, therefore, color change. [Strasinger 2008, p58]

46  a  Albumin is the most abundant plasma protein and it is relatively small. In nephropathy, albumin will be the most abundant protein in the urine. This test is done to look for nephropathy (ie, kidney disease). [Strasinger 2008, p58]

47  a  The 2 sugars in these distractor answers are glucose and galactose. Galactosuria is relatively rare genetic condition. The glucose biochemical strip is specific for glucose and will not detect galactose. Glucose is found in diabetes mellitus as well as other diseases. [Strasinger 2008, p61]

48  a  The only reagent listed is in a. The other answers are forms of ketones. [Strasinger 2008, p665]
<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
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<tbody>
<tr>
<td>49</td>
<td>a You should recognize that sodium nitroprusside is the reagent for ketones. It reacts with ace-to-acetic acid, not beta-hydroxybutyric acid. [Strasinger 2008, p65]</td>
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<tr>
<td>50</td>
<td>a The student should memorize the chemical reactions for each of the dipstick biochemicals. Diazeo reagent is used for bilirubin. [Strasinger 2008, p68]</td>
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<td>51</td>
<td>c Nitrite is produced by bacteria, and WBCs are found when there is a bacterial infection. If nitrite interfered with the WBC reaction, then the dipstick would be worthless when testing patients with UTIs. [Strasinger 2008, p74]</td>
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<tr>
<td>52</td>
<td>b The protein pad of the biochemical strip is held at an acidic pH by citrate buffer. If the strip is not blotted, the acid buffer can &quot;run over&quot; to the pH pad and cause a falsely acidic pH. Tetramethylphenol blue is a pH indicator, not an acid. Glucose oxidase is the reagent on the glucose strip. Copper sulfate is the reagent of the reducing substances (Benedict) test. [Strasinger 2008, p56]</td>
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<tr>
<td>53</td>
<td>d The protein pad must be held at a pH of 3 in order to see the effect that protein has on the double indicators. In alkaline urine, the pH of 3 may be neutralized, and the indicators change color. [Strasinger 2008, p11]</td>
</tr>
<tr>
<td>54</td>
<td>b Ketones are byproducts of fat metabolism. During low carbohydrate or starvation diets, ketones can be found in the urine. [Strasinger 2008, p64]</td>
</tr>
<tr>
<td>55</td>
<td>a Vomiting leads to dehydration and utilization of fat for energy. Fat metabolism produces ketones. [Strasinger 2008, p64]</td>
</tr>
<tr>
<td>56</td>
<td>b Biliary obstruction inhibits the normal flow of conjugated bilirubin into the intestine, and it backs up into the blood. From there, it will be filtered into the urine. Urobilinogen is a product of bacterial reduction of bilirubin in the intestine. Some urobilinogen is reabsorbed into the bloodstream and will be filtered into the urine. In biliary obstruction, less bilirubin reaches the intestine, and less is converted into urobilinogen. [Strasinger 2008, pp68-70]</td>
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<tr>
<td>57</td>
<td>c Each answer is a different live/biliary condition. In hemolytic jaundice, the total bilirubin goes up, but the direct/conjugated bilirubin does not. [Strasinger 2008, p70]</td>
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<td>58</td>
<td>a Ascorbic acid inhibits reactions that use peroxidase. [Strasinger 2008, p67]</td>
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<tr>
<td>59</td>
<td>b Microalbuminuria refers to the urinary excretion of amounts of albumin that cannot be detected by routine reagent strips. Persons with diabetes mellitus are at risk for end-stage renal disease if the damage occurring to the glomerulus is not detected in its early stages. [Strasinger 2008, p60]</td>
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<tr>
<td>60</td>
<td>c The reagent strip test for microalbuminuria uses a dye binding technique. As opposed to the conventional protein error of indicators principle used in routine reagent strips, the dye is highly sensitive and specific for albumin. [Strasinger 2008, p61]</td>
</tr>
<tr>
<td>61</td>
<td>a Including a reagent strip reaction for creatinine, along with the reaction of microalbuminuria, the amount of creatinine that is excreted at a constant rate can correct for the hydration or dehydration in a patient’s urine. [Strasinger 2008, p61]</td>
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<tr>
<td>62</td>
<td>a 3% SSA is used to confirm positive protein tests. 3% implies 3 g in 100 mL. [Campbell 1997, p136]</td>
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<tr>
<td>63</td>
<td>c The bilirubin dipstick pad can show a false positive from a colored urine. All positives should be confirmed with an ictotest. [Strasinger 2008, p68]</td>
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<tr>
<td>64</td>
<td>d Both hemoglobin and myoglobin will produce a red urine without RBC. Hemoglobin will be precipitated by ammonium sulfate, but myoglobin will not. Myoglobin will remain in the supernate after centrifugation. [Strasinger 2008, p67]</td>
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<tr>
<td>65</td>
<td>c When 2 drops of urine are added to 10 drops of water, it is a 2/12 proportion. 12 is the total volume. This is the same as a 1:6 dilution. [Strasinger 2008, p63]</td>
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</table>
66  b  It is not uncommon to find a urine specimen with positive protein. It is necessary to confirm positive protein if the urine pH is elevated, but this is not one of the choices. The choice of b will allow all results to be correct, but the choice of d would cause some of the results to be wrong. [Strasinger 2008, p59]

67  c  Sulfsalicylic acid will precipitate protein. Ehrlich reagent is for urobilinogen. Diazo is for bilirubin, and copper reduction is for reducing substances. [Strasinger 2008, p59]

68  b  A positive glucose oxidase is specific for glucose. Glucose will also cause copper reduction (a positive Clinitest®). [Strasinger 2008, p64]

69  d  The 2 keys here are that the dipstick glucose is negative, so the answer is not glucose; and that the woman is pregnant, and about to deliver. This implies that she may be making milk. Lactose is the most likely answer. [Strasinger 2008, p64]

70  b  Children with failure to thrive may have galactosuria. In this case, only a and b are reducing substances. Since the reagent strip for glucose is negative, this leaves galactose. [Strasinger 2008, p64]

71  d  Radiographic dye will precipitate in SSA. [Strasinger 2008, p60]

72  b  The Clinitest® is a copper reduction test, utilizing copper sulfate as the reactant. In the presence of a reducing substance, such as a sugar, and heat and alkali, the copper is reduced, producing a change in color from blue to orange/red. [Strasinger 2008, p63]

Urinalysis: Microscopic Examination

73  a  The ocular lens has a magnification of 10x. This multiplied by the magnification of the objectives 10x (low power), 40x (high power), etc. equals the total magnification. [Strasinger 2008, p68]

74  c  Adjusting the condenser of the diaphragm of the microscope also affects image resolution. Adjusting the main light source only changes the light intensity. [Strasinger 2008, p89]

75  b  The diffracted light in phase microscopy enhances slight variations in the refractive indices of constituents with low refractive indices. Staining is not required to enhance low refractive index constituents when using phase microscopy. [Strasinger 2008, p90]

76  d  The prefix py- means pus (leukocytes). The suffix -uria means pertaining to urine. [Masters 2003, p149]

77  b  Renal tubular epithelial cells lining the tubules absorb the urinary filtrate. In disorders producing fat in the filtrate, the fat is absorbed into the cells. When the cells slough from the tubules, they appear as oval fat bodies. [Strasinger 2008, p99]

78  b  Osmosis occurs through the red blood cell membrane. In dilute urine, the cells absorb water and swell, lyse, and release hemoglobin. [Strasinger 2008, p92]

79  d  White blood cells absorb water when they are in hypotonic (low specific gravity) urine, and swell. Granules in the WBCs then exhibit Brownian movement, producing the glittering effect in the cells. [Strasinger 2008, p94]

80  c  Squamous epithelial cells line the female vagina and urethra, but only the distal part of the male urethra. In females, they may also indicate perianal contamination. [Brunzel 2004, p195]

81  b  The reagent strip test for blood is positive for hemoglobin from lysed red blood cells, filtered hemoglobin from intravascular hemolysis, and myoglobin. With no RBCs present, the terminology is hemoglobinuria, indicating the presence of filtered hemoglobin. [Strasinger 2008, p65]

82  b  RBCs absorb water when in dilute urine, and are also less preserved in alkaline urine. Therefore, as the cells swell in the alkaline urine, the cell membrane allows hemoglobin to leak from the cell, resulting in the empty cell membrane and the pale appearance. [Strasinger 2008, p92]

83  b  In a hypotonic urine, WBCs will absorb water and swell. This results in the granules in the granulocytic WBCs to exhibit Brownian movement. [Strasinger 2008, p94]
A d Acute interstitial nephritis is caused by an allergic reaction resulting in inflammation of the renal tubules. The reaction is frequently caused by a medication. As a result of the allergic reaction, eosinophils are increased. An eosinophil count can aid in confirming the diagnosis. [Strasinger 2008, p151]

a Clue cells represent the attachment of the bacterium Gardnerella vaginalis to squamous epithelial cells. Gardnerella causes vaginal infections, and the cells lining the vagina are the squamous epithelial cells. [Strasinger 2008, p97]

b Urothelial/transitional epithelial cells line the bladder, renal pelvis and ureters. These can be dislodged from the walls of the bladder during a catheterization procedure. [Strasinger 2008, p97]

d Myoglobin is a product of muscle destruction as occurs with crush injuries. The reagent strip reaction for blood is positive with the presence of RBCs, hemoglobin, and myoglobin. Both hemoglobin and myoglobin are toxic to the renal tubules, resulting in decreased urine flow, favoring cast formation and the sloughing of the damaged cells. Notice also that the specimen is clear. [Strasinger 2008, p68]

da Some key findings for each condition are: a glomerulonephritis—red blood cell casts, b pyelonephritis—white blood cell casts, c nephrotic syndrome—lipids and fatty casts, and d cystitis (urinary tract infection)—white blood cells, bacteria, possible RBCs. This image has no casts, just WBCs, bacteria, and RBCs. [Strasinger 2008, p95]

b Hyaline casts have a low refractive index, and may not be visible under bright light. Urine microscopic analysis is first performed under reduced light, and the edges of the coverslip examined for the casts. Casts are larger than other sediment constituents and are pushed to the edges of the coverslip. [Strasinger 2008, pp102-103]

a Hyaline casts may be excreted by healthy people following strenuous exercise or normal condition that produces decreased urine flow. Red cell, white cell, and waxy casts indicate a pathogenic condition within the nephron. [Strasinger 2008, p103]

d Broad casts indicate extreme stasis of urine flow through the nephron. Stasis allows casts to form in the larger collecting ducts. Damage to the walls of the distal convoluted tubules also causes broader casts to form. [Strasinger 2008, p109]

c Multiplication of bacteria present in the specimen caused an increase in the urine pH during the 5-hour delay, resulting in the casts dissolving. [Strasinger 2008, p102]

b Centrally-placed nuclei are characteristic of spherical transitional cells. [Strasinger 2008, p98]

d Pyelonephritis is an inflammation/infection of the renal tubules. Therefore, white blood cell casts would indicate the location of the source of the inflammation/infection. Cystitis is an infection of the bladder. [Strasinger 2008, p105]

c Damage to the renal tubules causes sloughing of the cells lining the tubules, making these cells the most prominent in the cast formation. Although casts are seen in each of the other listed disorders, each has its own most prominent cast feature i.e., red blood cells, fat, and white blood cells. [Strasinger 2008, p149]

b Formation of a cast matrix is not uncommon following strenuous exercise, due primarily to dehydration resulting in decrease urine flow. Increased metabolism by the renal tubular cells results in excess excretion of lysozymes that become attached to the cast matrix, resulting in the appearance of granular casts. [Strasinger 2008, p108]
99 c Waxy casts are seen with extreme stasis of urine flow, indicating they have remained in the tubules for an extended time. These aging casts are more refractile, and often contain notches and jagged edges as the result of granular disintegration.
[Strasinger 2008, p109]

100 d White blood cells are often attached to the cast matrix as well as being imbedded in the matrix. White blood cells frequently occur in clumps and could in fact resemble a cast, but no cast matrix is observed. WBC casts indicate a more serious tubular infection, whereas WBC clumps can be seen in cystitis.
[Strasinger 2008, p106]

101 b Spherical urothelial cells appear similar to round tubular epithelial cells. The eccentric placement of the nucleus in renal tubular cells differentiates them from spherical urothelial cells, which have a centrally-placed nucleus.
[Strasinger 2008, p97]

102 a Before reporting a red blood cell cast, it is essential to observe free-floating RBCs in the sediment. A coarsely granular cast may sometimes resemble a red blood cell cast. Without the presence of free red blood cells, a red blood cell cast could not have formed in the tubules.
[Strasinger 2008, p105]

103 d The renal tubular cells lining the tubules absorb the urinary filtrate, and therefore will appear bile-stained.
[Strasinger 2008, p107]

104 a RBC casts, protein and RBCs together are indicative of glomerulonephritis. RBC casts form when there is bleeding in the glomerulus and tubules.
[Strasinger 2008, p29]

105 c Amorphous phosphates are found in alkaline urine. Under conditions such as refrigeration, they produce a white precipitate. Urates produce a pink precipitate, and WBCs and bacteria do not precipitate.
[Strasinger 2008, p115]

106 a Cystine crystals appear as hexagonal plates, frequently in clumps. Tyrosine crystals are needle-shaped, leucine crystals are round, and cholesterol crystals are flat with notched corners.
[Strasinger 2008, p116]

107 a Approximately 75% of renal calculi are composed of calcium compounds (oxalate, phosphate and others). Magnesium ammonium phosphate makes up about 15% of the calculi.
[Brunzel 2004, p261]

108 a Amorphous urates will dissolve when the specimen is briefly warmed. Amorphous phosphates are dissolved by the addition of acid, which will also destroy other sediment constituents.
[Strasinger 2008, p113]

109 b Calcium carbonate crystals are small dumbbell-shaped or round crystals often seen in clumps. With careful examination, dumbbell-shaped forms can be distinguished.
[Strasinger 2008, p116]

110 b Calcium oxalate crystals are found in acidic and neutral urine, but not in alkaline urine.
[Strasinger 2008, p113]

111 a Cholesterol is the only one of these lipids capable of polarizing light. The other lipids will stain with Sudan III.
[Strasinger 2008, p85]

112 d Tyrosine crystals are fine needles often seen in clumps. Leucine crystals are spherical with concentric striations. Cholesterol crystals are flat plates with notched corners. Hemosiderin granules are dark, and often clumped.
[Strasinger 2008, p117]

113 c Urinary crystals associated with liver disorders include bilirubin, tyrosine, and leucine.
[Strasinger 2008, p118]

114 b Calcium oxide monohydrate crystals are most frequently seen following ingestion of ethylene glycol/antifreeze. Unlike the more commonly seen envelope-shaped dihydrate crystals, they are oval or dumbbell shaped.
[Strasinger 2008, p113]

115 b Increased lipids in the urine is a characteristic of the nephrotic syndrome. Massive amounts of protein also are associated with the nephrotic syndrome. The crystals form most readily in urine that has been refrigerated.
[Strasinger 2008, p116]
Lesch–Nyhan syndrome is an inherited disorder of purine metabolism. The first indication of this disorder may be the presence of uric acid indicating the incomplete metabolism of dietary purines.
[Strasinger 2008, p170]

Triple phosphates crystals, nicknamed “coffin lids” are nonpathologic. They are found in alkaline urines, usually urines with bacterial overgrowth.
[Strasinger 2008, p113]

Uric acid has many shapes, is found in acid urine, and is nonpathologic. The reader should become familiar with the different shapes.
[Strasinger 2008, p44]

The crystals are amorphous phosphates. These can be dissolved in dilute acetic acid, in order to view other formed elements that are obscured.
[Strasinger 2008, p113]

Contaminants frequently contain substances capable of polarizing light. None of the other listed constituents are capable of polarizing light.
[Strasinger 2008, p120]

Starch granules are very refractile and produce a Maltese cross under polarized light. Oil, air bubbles and pollen grains do not polarize.
[Strasinger 2008, p120]

These are starch crystals, a contaminant from powder.
[Strasinger 2008, p120]

Cloth fiber is a contaminant. It should not be confused with a cast. Fiber can have a rough and stringy appearance. Vegetable fibers have intricate repeating detail.
[Strasinger 2008, pp120-121]

Acetic acid lyses red blood cells, but not oil droplets and yeast. Acetic acid will also lyse other formed elements and should be added to an aliquot of the sediment.
[Strasinger 2008, p93]

Yeast cells are commonly seen in urine specimens from persons with diabetes mellitus, because the high glucose content provides an excellent growth media for yeast.
[Strasinger 2008, p100]

Urine crystal formation is associated with the optimal pH needed for their formation (acid, alkaline or neutral).
[Strasinger 2008, p110]

Based on the time between collection and analysis of a urine specimen and the method of preservation, bacteria can be a heavy contaminant of urine. A positive LE test indicating the presence of WBCs confirms the actual presence of an infection.
[Strasinger 2008, p100]

The flagellate Trichomonas vaginalis moves rapidly through the sediment. If not moving, it may resemble a WBC, and careful examination of phase microscopy is needed to visualize the flagellum. Urine is toxic to spermatozoa.
[Strasinger 2008, p100]

Yeast cells are commonly seen in urine specimens from persons with diabetes mellitus, because the high glucose content provides an excellent growth media for yeast.
[Strasinger 2008, p100]

Many bacteria produce nitrites from nitrate. If the biochemical strip is positive for nitrite, you should find bacteria in the sediment.
[Strasinger 2008, p72]

Glucose in the urine of a person with a normal blood glucose is indicative of renal tubule damage or the inherited disorder, renal glycosuria, in which transport receptors are absent in the proximal convoluted tubules.
[Strasinger 2008, p149]

Reagent strip tests for protein are primarily sensitive to albumin. The monoclonal spike in the gamma region indicates the presence of Bence Jones protein that is an immunoglobulin rather than albumin.
[Strasinger 2008, p59]

Uric acid crystals are seen in acid urine. The reagent strip pH may have been recorded wrong. Uric acid crystals have many shapes, and an artifact may have been mistaken for the uric acid crystals.
[Strasinger 2008, p112]
134 c The reagent strip glucose test using glucose oxidase is specific for glucose; therefore, glucose must be present in the sample. The copper reduction test is positive with many sugars, including glucose. The copper reduction test has a lower sensitivity than the reagent strip; therefore, the higher reading on the copper reduction test indicates the presence of an additional sugar. In the case of a nursing mother, the most likely additional sugar is lactose.
[Strasburger 2008, p64]

135 d Pyelonephritis is an infection involving the renal tubules. Therefore, the presence of WBC casts and bacteria aids in the diagnosis. Cystitis is an infection of the bladder and does not affect the tubules. RBC casts are the prominent finding with glomerulonephritis.
[Strasburger 2008, p150]

136 d The presence of RBC casts is consistent with glomerulonephritis. WBCs, RBCs and protein are present as a result of the glomerular damage.
[Strasburger 2008, p147]

137 a Damage to the electrical charges of the glomerular membrane, allowing the passage of high molecular-weight proteins and lipids occurs in nephrotic syndrome. This results in markedly increased urine protein levels, and the appearance of fatty casts and oval fat bodies that are characteristic of nephrotic syndrome.
[Strasburger 2008, p144]

138 a A specimen with a specific gravity of 1.004 is very dilute. This will result in the concentration of urine constituents being too low, below the ability to be detected by chemical and microscopic examination.
[Strasburger 2008, p34]

139 b Minimal change disease is seen primarily in children, often following allergic reactions or immunizations. Classic laboratory results include markedly elevated urine protein, fatty casts, elevated serum lipids, decreased serum albumin, and normal BUN.
[Strasburger 2008, p146]

140 c Acute Interstitial nephritis is caused by an allergic reaction, resulting in inflammation, not infection, of the renal tubules. Bacteria are not present in an inflammation.
[Strasburger 2008, p151]

141 b The presence of heavy bacteria with a negative leukocyte esterase and normal WBC numbers indicates the specimen has been collected >2 hours before being tested. Testing a fresh specimen will determine if bacterial multiplication has occurred in the first specimen.
[Strasburger 2008, p33]

142 a A major cause of glomerular disorders is the deposition of immune complexes on the glomerular membrane, producing damage to the membrane. The presence of RBC casts is indicative of glomerulonephritis. WBC casts would be present in chronic pyelonephritis and acute interstitial nephritis, and renal tubular epithelial cells are present in tubular necrosis.
[Strasburger 2008, p144]

143 c The ideal conditions for the growth of Candida albicans are an acid pH and the presence of glucose. Candida is a frequent cause of urinary tract infections in diabetic patients.
[Strasburger 2008, p101]

144 a The high specific gravity indicates the patient is in a dehydrated state that favors the formation of the renal calculi, producing the back pain and presence of red blood cells resulting from irritation to the urinary tract caused by the calculi.
[Strasburger 2008, p153]

Urine Physiology

145 c The renal threshold is the plasma level at which a substance, such as glucose, is no longer reabsorbed by the proximal convoluted tubules. The plasma level for glucose ranges from 160-180mg/dL.
[Strasburger 2008, p62]

146 b The prefix oligo- means scanty. Knowing that the normal daily urine volume is around 1200mL, 300mL is scanty. The prefix an- means not, poly- means many, and dys- means pain.
[Masters 2003, p147]

147 b The combination of these results is consistent with diabetes mellitus. The polyuria occurs due to the need to excrete the excess dissolved glucose in the urinary filtrate. Hyperglycemia is not present with renal glucosuria. Both stress and a heavy meal can cause transient glucosuria.
[Strasburger 2008, p62]
Although the normal glomerular filtration rate is 120mL/min, tubular reabsorption returns normally all but 1 mL to the plasma. [Strasinger 2008, p.20]

Normal plasma constituents that can be filtered by the glomerulus are water, urea and sodium chloride. Protein molecules are too large to normally pass the glomerulus. Bilirubin is not a normal constituent of plasma. [Strasinger 2008, p.13]

Urine is the only body fluid containing large amounts of the waste products urea and creatinine. These 2 constituents are used to determine if an unknown fluid is urine. [Strasinger 2008, p.31]

Based on the body's state of hydration, antidiuretic hormone regulates the permeability of the walls of the collecting ducts to water. When the body is dehydrated, ADH is released by the pituitary gland, reducing the permeability of the walls to water. [Brunzel 2004, p.51]

The intact structure of the glomerular membrane does not permit passage of high-molecular-weight substances, such as protein molecules. [Strasinger 2008, p.13]

The increased plasma glucose seen in diabetes mellitus results in excess glucose in the glomerular filtrate. Increased amounts of water are required for excretion of the excess glucose in the filtrate. As a result, increased fluid intake is characteristic of persons with diabetes mellitus. [Strasinger 2008, p.31]

The prefix an- means not, or without. The prefix azo- stands for nitrogenous, dys- means pain, and di- means double. [Masters 2003, p.146]

Galactosuria is an inborn error of metabolism, resulting in the failure to inherit the one of the enzymes needed to metabolize dietary galactose to glucose. Byproducts of this metabolic failure are toxic, and can result in severe mental retardation. Early detection and dietary changes can prevent the toxicity. [Strasinger 2008, p.170]

Ketones are intermediate components of fat metabolism. When access to carbohydrates normally broken down to supply energy is limited, fats are broken down for energy, and the intermediate ketone products (acetone, acetoacetic acid and beta-hydroxybutyric acid) can be detected in the urine. [Strasinger 2008, p.64]

The nitroprusside/ferricyanide reagent strip reaction reacts with acetoacetic acid. Glycine must be present for the reaction to include acetone, beta-hydroxybutyric acid is present in the largest amount, but does not react with nitroferricyanide. [Strasinger 2008, p.65]

Bilirubin is a product of hemoglobin degradation. It occurs in both unconjugated and conjugated forms. Only conjugated bilirubin can pass through the glomerulus, because unconjugated bilirubin is bound to albumin. Conjugation of bilirubin takes place in the liver, and liver damage interferes with the continued degradation to urobilinogen. [Strasinger 2008, p.68]

Myoglobin is a product of muscle destruction. Myocardial infarctions damage the heart muscle. [Brunzel 2004, p.134]

Renal tubular acidosis is the inability to produce an acid urine even when in acidosis. The hydrogen ions needed to produce an acid urine are easily reabsorbed. To remove them, tubular secretion of the ions, combined with ammonium ions produced in the proximal and distal convoluted tubules, is needed. [Brunzel 2004, p.256]

The majority of the filtered glucose is reabsorbed by active transport in the proximal convoluted tubules (PCT). Damage to the PCTs results in glycosuria and a normal plasma glucose. [Strasinger 2008, p.62]

To maintain the high concentration of solutes in the renal medulla that result in the ability to concentrate urine, water cannot be removed from the filtrate as it passes through to ascending loop of Henle. [Strasinger 2008, p.17]
7: Urinalysis and Body Fluids | Other Body Fluids

163  
\[
\text{a.} \quad \text{Osmolarity measures the number of particles in a solution, whereas specific gravity is influenced not only by the number of particles but also their density. Renal concentration is concerned with smaller molecules, such as sodium and chloride. Each of these molecules will contribute the same to an osmolarity reading as a large molecule of glucose.}
\]

[Strasinger 2008, p22]

164  
\[
\text{b.} \quad \text{Urine and CSF are ruled out because of the high protein value. Urine and CSF have proteins in the mg/dL range. Hyaluronate is a component of synovial fluid, not pleural fluid. The best answer is synovial fluid.}
\]

[Strasinger 2008, p201]

165  
\[
\text{c.} \quad \text{The production of ammonia is essential for the removal of hydrogen ions from the glomerular filtrate. Lack of ammonia results in a lack of hydrogen ions in the filtrate and a high pH.}
\]

[Strasinger 2008, p20]

166  
\[
\text{d.} \quad \text{The lumbar tap may be traumatic, which will produce blood. Blood cells in the CSF will not be due to a central nervous system defect in that case. Do the cell count on the last tube; it is the least likely to be contaminated by a bloody tap.}
\]

[Strasinger 2008, p179]

167  
\[
\text{a.} \quad \text{Protein and glucose are dissolved substances and don’t contribute to turbidity. Bacteria and WBCs are solids that make the CSF turbid. When bacteria are present, so are WBCs. The large WBCs contribute more to turbidity than the smaller bacteria.}
\]

[Strasinger 2008, p180]

168  
\[
\text{a.} \quad \text{Consider that a normal serum protein is approximately 7 g/dL, and a normal CSF protein is 15 mg/dL. The units are different by 1,000. This indicates that the CSF protein is <1% of serum protein.}
\]

[Strasinger 2008]
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177  

**d** Transudates are thin, watery effusions with low LD, low protein, and low cell counts. Exudates are inflammatory or infectious effusions with high LD, protein, and WBC.  
[Strasinger 2008, p223] 

178  

**d** Congestive heart failure is a buildup of fluid because of poor heart pumping. The fluid is watery, not infected.  
[Strasinger 2008, p223] 

179  

**b** Uric acid produces a yellow color when the crystal is aligned with the compensator, but the color is blue when the crystal is perpendicular to the compensator. CPPD, calcium pyrophosphate has the opposite color results. This difference is due to the molecular stacking within the crystals.  
[Strasinger 2008, p216-217] 

180  

**b** False positives for fecal occult blood occur when patient diet includes food that produces peroxidase. Horseradish, broccoli, radishes, melons, and other foods can cause a false positive. Patients that take aspirin may have some occult bleeding that is not associated with colorectal cancer, but acetaminophen is not a cause of bleeding. Ascorbic acid at high doses can interfere with the test and cause a false-negative.  
[Strasinger 2008, p251] 

181  

**a** The principle of occult blood testing is based on the oxidation of guaiac. This occurs in the presence of hydrogen peroxide (the reagent) and the enzyme peroxidase. Hemoglobin has a pseudoperoxidase activity that drives the reaction, making oxidized guaiac, which is blue in color.  
[Strasinger 2008, p250] 

182  

**a** A small amount of fluid fills the cavity between the cavity wall (the parietal membrane) and the organ (visceral membrane). An increase in the fluid can be due to infection, inflammation, cancer, and defects in hydrostatic and colloidal pressure. An accumulation of fluid is called an effusion.  
[Strasinger 2008, p222] 

183  

**a** The thorax is the chest. Fluid from the chest, surrounding the lungs, is called pleural fluid. An increase in this fluid is a pleural effusion. When the fluid/serum LD ratio is over 0.6, and/or the WBC is over 1,000/µL, the fluid is an exudate.  
[Strasinger 2008, pp223, 284] 

184  

**d** Accumulation of fluid in the peritoneal cavity is called ascites, and it is collected by paracentesis.  
[Strasinger 2008, pp229, 282] 

185  

**a** Amniotic fluid can be collected to test for birth defects such as trisomy 21 (Down syndrome), spina bifida (increased AFP and acetylcholinesterase), hemolytic disease of the newborn (bilirubin), and fetal lung maturity (FLM). FLM can be determined by increased lamellar body production in the amniotic fluid. Lamellar bodies are phospholipids produced by the maturing pneumocytes. They are approximately the size of small platelets, and can be counted by instruments that are used to count platelets.  
[Strasinger 2008, p241] 

186  

**b** Amniocentesis is an invasive procedure, and should not be used as a screen. In women with a high MSAFP, amniocentesis is used to collect fluid to detect levels of AFP and acetylcholinesterase. High levels are predictive of neural tube disorders, such as spina bifida and anencephaly. Neural tube disorders are linked to a low folic acid level in the mother in early pregnancy. c is a distractor in that, while Rh- women may have an Rh+ fetus with hemolytic disease, Rh+ women do not have that complication.  
[Strasinger 2008, p237] 

187  

**d** Cystic fibrosis is caused by a defective ion channel, which causes an accumulation of chloride in the sweat.  
[Burtis 2001, p437] 

188  

**a** All of the answers are mutations. Delta-F508 is the deletion of phenylalanine at position 508 of the CFTR protein. Trisomy 21 is a third copy of chromosome 21, associated with Down syndrome. The Philadelphia chromosome is a gene translocation associated with acute myelocytic leukemia. Fragile X is a form of mental retardation caused by an increased number of nucleotide repeats.  
[Buckingham 2007, p319] 

189  

**d** The synthesis of IgG in the central nervous system is associated with some neurologic disorders, most predominantly multiple sclerosis. The other conditions are also CNS disorders, but do not cause an increased gamma protein.  
[Strasinger 2008, p191]
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190 b  If one compares CSF electrophoresis to serum electrophoresis, there is an obvious band seen in CSF that is absent in serum. This band runs ahead of albumin, and is prealbumin.  
[Strasinger 2008, p190]

191 d  A traumatic tap is a collection of a body fluid that has blood contamination. The first tube will have most of the contamination, so that subsequent tubes will show fewer blood cells. Cell counts should routinely be performed on the last tube, to minimize the amount of cellular contamination due to the tap.  
[Strasinger 2008, pp179-180]

192 b  The IgG index is used to determine if increased IgG in CSF is due to increased production in the CNS or contamination from a breach to the blood-brain barrier. The calculation includes the CSF IgG/serum IgG ratio, and is normalized by dividing that by the CSF albumin/serum albumin.  
[Strasinger 2008, p191]

193 b  CSF looks like water. If it is yellow or pink it is called xanthochromic. This indicates a previous bleed into the CNS. Opalescence is a haziness, usually due to the presence of lipids.  
[Strasinger 2008, p18]

194 b  To calculate the dilution, take the amount of sample and divide it by the total of the new solution. So the dilution is 50 μL divided by 500 + 50 μL. This is a 1/11 dilution. To correct the final answer, multiply by the inverse of the dilution, or 11.  
[Strasinger 2008, p181]

195 c  Hemosiderin is an indication that RBCs have been processed and degraded. The presence of hemosiderin, then, indicates bleeding, which limits the answers to c and d. The degradation of RBCs to hemosiderin takes time, so that a traumatic tap would not show hemosiderin, but a previous hemorrhage would.  
[Strasinger 2008, p184]

196 a  Normal CSF glucose is approximately 60% of plasma glucose. Glucose is decreased in bacterial meningitis, and lactate is produced. Normal protein in CSF is 15-45 mg/dL. Protein is slightly elevated in bacterial meningitis.  
[Strasinger 2008, p193]

197 a  In hepatic encephalopathy, ammonia levels in the plasma build up, and ammonia can be found in the spinal fluid. Ammonia is volatile, and not easily measured. Glutamine is a byproduct of ammonia, and is stable, making it a better choice.  
[Strasinger 2008, p192]

198 a  Tau transferrin is found only in CSF.  
[Strasinger 2008, p190]

199 a  Consider each answer, and determine if it is are unique to a particular site:

a  PSA is used to screen for prostate cancer, because it is high in secretions from the prostate; therefore, semen is high in PSA. PSA can be used forensically to identify a fluid as semen.

b  Alkaline phosphatase is found predominantly in bone and liver. On the other hand, acid phosphatase, not a choice, is high in prostate secretions, and semen.

c  Fructose is the major carbohydrate found in semen, but it is not unique to semen.

d  Hyaluronic acid is associated with synovial fluid.  
[Burtis 2001, pp344-345]

200 a  All of these stains can be used to view sperm; however, the eosin-nigran stain is differential between live and dead sperm. Living cells will stain bluish white, dead cells stain red.  
[Strasinger 2008, p205]

201 a  The total volume of the 9 large cells is 0.9 μL. Counting 10 of the large cells is the equivalent of 1 μL.  
[Rodak 2007, p161]

202 d  The WHO rating for sperm motility is:

0 = no movement
1.0 = no forward movement
2.0 = slow forward/lateral movement,
3.0 = faster speed, some lateral movement
4.0 = rapid, straight line movement.  
[Strasinger 2008, p203]
Pancreatic insufficiency can lead to increased fecal fat and to the finding of undigested muscle in the stool. Fecal leukocytes are associated with pathogenic bacteria, and a positive **Climitez** is due to the presence of sugars, usually from an osmotic diarrhea, as in lactose intolerance. Fecal occult blood is associated with colorectal cancer, and is positive in other gastrointestinal bleeding. It is not associated with pancreatic insufficiency.

- \( \text{(Strasinger 2008, pp248-249)} \)

Sweat chloride is measured to diagnose cystic fibrosis. Sweating is induced by stimulating local sweat glands by driving pilocarpine into the skin, using a process called pilocarpine iontophoresis.

- \( \text{(Burris 2001, p437)} \)

Evaporation of the sample will concentrate the ions. This can happen in a patient with a low sweat rate, or with a prolonged collection time.

- \( \text{(Burris 2001, p437)} \)

Sweat conductivity testing is relatively easy to perform, and used as a screening method. A positive should be confirmed with a chloride measurement by coulometry or by ion-selective electrodes. Pilocarpine iontophoresis is used to stimulate sweat production, not to measure it.

- \( \text{(Burris 2001, p437)} \)

Dark green amniotic fluid indicates the presence of meconium. This is the infant's first bowel movement, and indicates fetal distress.

- \( \text{(Strasinger 2008, p238)} \)

A fetus with hemolytic disease will have increased bilirubin in the amniotic fluid. Bilirubin absorbs light at 450 nm. The change in absorbance between the expected and observed value is plotted on a Liley graph, and used to assess the fetus. This is also called a Delta-OD 450.

- \( \text{(Strasinger 2008, p239-240)} \)

The amount of surfactant (phospholipids) in amniotic fluid increases during gestation, and is an indicator of fetal lung maturity. The value is compared to albumin, as albumin concentration remains constant during gestation. Fluorescent dye binds to surfactants and to albumin in this assay; when it is bound to the surfactant, it has a low polarization. As surfactant increases during lung maturation, the fluorescence polarization of the sample decreases.

- \( \text{(Strasinger 2008, p241)} \)

Neutral fats, such as triglycerides, stain orange with Sudan III. They do not polarize light. Fats are lighter than body fluids, so they do not sediment. They do not glitter.

- \( \text{(Strasinger 2008, p224)} \)

A patient with blunt trauma, such as a car accident, may have internal bleeding. Peritoneal lavage introduces a fixed volume of saline into the peritoneal cavity, and withdraws an aliquot. RBC are counted. Counts greater than 100,000/µL indicate blunt trauma.

- \( \text{(Strasinger 2008, p229)} \)

The only acronym listed here that is not a tumor marker is ANA. This stands for anti-nuclear antibody.

- \( \text{(Strasinger 2008, p228)} \)

Semen should liquefy and pour in droplets after 30-60 minutes. The normal pH is 7.2-8.0. Within an hour after collection, more than 50% should be motile, and their motility grade should be 2.0 or greater.

- \( \text{(Strasinger 2008, p201)} \)

Lactate is increased in the CSF in conditions that cause hypoxia. The highest lactate values (>35 mg/dL) are found in patients with bacterial meningitis. Viral, tubercular and fungal meningitis have lactate levels above normal, but not as high as bacterial meningitis.

- \( \text{(Strasinger 2008, p183)} \)

Meningitis, hemorrhage, and neurologic diseases, such as MS, will increase CSF protein. Decreased protein can be found due to CSF leakage, recent puncture, and rapid CSF production.

- \( \text{(Strasinger 2008, p190)} \)

The CSF/serum albumin ratio with a value of < 9 indicates an intact blood-brain barrier. The other distractors have different purposes: a) the IgG index compares IgG in CSF and serum to determine if IgG is being synthesized in the CNS; c) the fluid/serum LD ratio is used to determine if a body fluid is a transudate or an exudate; d) the albumin gradient is used to determine if an effusion is of hepatic origin.

- \( \text{(Strasinger 2008, p191)} \)