Review Questions for Clinical Examination of Urine Part 1 topic

Review questions will not be collected and are not worth any points. Doing them will, however, help you prepare for the midterms and quizzes in this course. Furthermore, some of these review questions will appear on the final exam (although the numbers within the questions may be changed).

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1) The main nitrogen containing waste that is removed from the blood by the kidneys is…

A) bilirubin.
B) urea.
C) albumin.
D) ammonia.

2) The blood vessel delivering blood directly to the entire kidney organ is the

A) renal artery.
B) peritubular artery.
C) renal vein
D) afferent arteriole.

3) The region of the kidney that contains most of the nephrons is called the

A) medulla
B) cortex
C) renal artery
D) urethra

4) Which of the following are too large to filter through the renal corpuscle and thus are **not** normally found in the filtrate? (More than one correct answer)

A) blood cells
B) glucose
C) amino acids
D) sodium ions
E) proteins

5) Filtration is driven by

A) Osmosis
B) Diffusion
C) Blood pressure

6) Blood in the glomerulus that does not filter into the nephron exits the glomerulus via a blood vessel called the efferent arteriole. The efferent arteriole then becomes a capillary bed that surrounds the nephron. What is the name of this capillary bed?

A) The peritubular capillary bed.
B) The renal capillary bed.
C) The collecting duct
D) The nephron capillary bed.

7) Monosaccharides (such as glucose) will enter the glomerular filtrate because of

A) their size.
B) their use as an energy source by the nephron
C) their attraction to receptor proteins in the collecting duct
D) All of the above

8) The return of filtered molecules from the nephron tubules back into the blood is called

A) filtration.
B) reabsorption.
C) secretion.
D) excretion.

9) How much of the filtrate is reabsorbed back into the blood?

A) None
B) Very little
C) Most
D) All

10) If a substance is neither filtered, reabsorbed, nor secreted, where would you expect to find it? In…

A) The filtrate
B) The blood that exits the kidney
C) The urine
D) All of the above.

11) If a substance is filtered and also secreted but not reabsorbed, where would you **not** expect to find it?

A) The filtrate
B) The blood that exits the kidney
C) The urine
D) All of the above.

12) Which of the following is filtered but not reabsorbed?
A) K+
B) sodium
C) urea
D) glucose

13) How much of the filtrate becomes the urine?
A) None
B) Very little
C) Most
D) All

14) When the concentration of antidiuretic hormone increases in the blood…
A) The urine becomes more dilute and has increased volume
B) The urine becomes more dilute and has decreased volume
C) The urine becomes more concentrated and has increased volume
D) The urine becomes more concentrated and has decreased volume

15) Which statement about antidiuretic hormone (ADH) is false?
A) ADH is released from the pituitary gland
B) The target cells of ADH are the nephron cells
C) More ADH is released when the body is dehydrated
D) More ADH is released when there is an increase in the blood's water content

16) When ADH _____, _____ water moves _____ of the filtrate.
A) increases; more, out
B) increases; less, out
C) decreases, more, into
D) decreases, more, out

17) Aldosterone
A) is the major hormone secreted by the kidney.
B) promotes the filtration of Na+ into the nephron
C) promotes the reabsorption of Na+ from the nephron
D) is secreted by the pituitary gland

18) If aldosterone levels _____, then (because of osmosis) blood volume will _____, and blood pressure will _____.

A) increase; increase, increase
B) increase; decrease, increase
C) decrease; increase, decrease
D) decrease, decrease, increase

19) Which response would NOT be observed in a person with low blood pressure?

A) increased renin secretion.
B) increased aldosterone secretion.
C) increased ADH secretion
D) increased urinary Na+.

20) Which protein is secreted by the kidney into the blood in response to low blood pressure?

A) Angiotensin II
B) Albumin
C) Aldosterone
D) ADH
E) Renin
F) Sodium

21) Which plasma protein becomes activated by the substance described in the question above?

A) Angiotensin II
B) Albumin
C) Aldosterone
D) ADH
E) Renin
F) Sodium

22) Which substance directly causes vasoconstriction?

A) Angiotensin II
B) Albumin
C) Aldosterone
D) ADH
E) Renin
F) Sodium

23) The normal blood pH is

A) 6 - 8
B) 7.4
C) Exactly 7.0 (neutral) because of acid/base balancing
D) 4.6 – 8.0

24) The normal urine pH range is

A) 0 - 14
B) 7.4
C) Exactly 7.0 (neutral) because of acid/base balancing
D) 4.6 – 8.0

25) The normal urine specific gravity range is

A) 7.0
B) 1.01 – 1.025
C) 4/5 (80%)
D) 4.6 – 8.0

26) If a person drank a very large amount of water, their urine's specific gravity would

A) increase
B) decrease
C) stay the same (as long as the water was pH 7.0)
D) stay the same (regardless of the water pH)

27) Urine is formed in the two _____ (a pair of organs). From each of these organs, a tube called the _____ propels the urine downward to the _____ where it is stored until its release is convenient, at which time it flows out of the body through the _____.

28) The urethra exits the body in the _____ or males and near the _____ of females.

29) In the blank space in each phrase, write the most correct and specific anatomical direction term (such as Superior, Inferior, Anterior, Posterior, Medial, Lateral, Superficial, or Deep).

a) The kidneys are _____ to the bladder
b) The bladder is _____ to the ureters
c) The kidney is _____ to the adrenal gland
d) The cortex of the kidney is _____ to the renal artery.
e) The urethra is _____ to the bladder.

30) Define the following terms as they were defined in class:

a) “Clean the blood”

b) “Balance the blood”

c) Nephron

d) Glomerulus

e) Filtration

f) Filtrate

g) Reabsorption

h) Secretion

i) Specific gravity

j) Equivalent (of ions)

31) Name three examples of each of the following:

a) Cell types in the blood: _____

b) Monomers in the plasma: _____

c) Ions in the plasma: _____

d) Proteins in the plasma: _____

32) The kidneys’ major role is to _____ the blood (which means to remove waste products) and to _____ the blood (which means to adjust the blood’s nutrient and water concentrations to their correct levels).

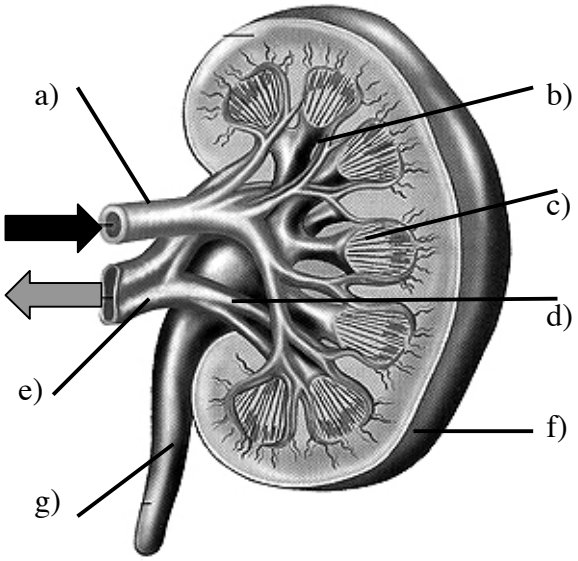
33) The most abundant waste molecule that the kidneys clean from the blood is _____. This nitrogen-containing waste product is made by the liver from ammonia that it detoxifies.

34) The kidney forms _____ out of the wastes, excess solutes, and excess water that it has removed from the blood.

35) Blood reaches the kidney via the _____ (a blood vessel). In the kidney, this artery branches into smaller arteries that pass through the medulla (middle) region of the kidney. The artery branches eventually reach the outer region of the kidney, called the _____ of the kidney, which is the region when the blood is cleaned and balanced by microscopic tubules called _____.

36) Each kidney contains roughly this many nephrons? _____.

37) Study the kidney diagram and answer the questions by writing letters in the blanks below the figure.



a) Which kidney region is where the nephrons are located? _____

b) Which kidney region is the renal artery? _____

c) Which kidney region is the ureter? _____

d) Which kidney region is the renal cortex? _____

38) The blood that has entered the kidney eventually flows through small blood vessels called afferent arterioles. Each afferent arteriole delivers its blood into a ball-shaped capillary bed called a(n) _____.

39) Not all the blood that enters the glomerulus filters into the nephron. The blood in the glomerulus that does not filter into the nephron exits the glomerulus and then enters a blood vessel that surrounds the nephron. This blood vessel that surrounds the nephron is called the _____.

40) The process of _____ in the kidney means when the small molecules of the blood (such as water and small solutes) are separated from the larger blood components (such as blood cells and proteins) by passing through small openings in the wall of the renal corpuscle (the glomerulus and glomerular capsule of the nephron).

41) _____ is the force that powers filtration into the nephrons.

42) The liquid that enters the nephron from the blood in the glomerulus is called the _____.

43) What substances in the blood are found in the filtrate?

44) What components of the blood are not found in the filtrate?

45) Explain what determines which molecules from the blood enter the nephron and which do not.

46) The blood contains many organic molecules, such as proteins and glucose. Explain how proteins are excluded from the filtrate but glucose is not.

47) The filtration of the blood as it passes from the glomerulus into the nephron does/doesn't (circle one word) clean the blood. Justify the answer you circled.

48) The filtration of the blood as it passes from the glomerulus into the nephron does/doesn't (circle one word) balance the blood. Justify the answer you circled.

49) The process of _____ in the kidney means when water, glucose, amino acids, ions, and other nutrient molecules are transported from the filtrate in the nephron back into the blood.

50) The blood vessel that receives the reabsorbed nutrients and water from the nephron is the _____ (a blood vessel).

51) The amounts of water and nutrients that are reabsorbed from the nephron into the peritubular capillary bed are/aren't (circle one word) the balanced amounts of water and nutrients.

52) Urea and other wastes are/aren't (circle one word) reabsorbed from the nephron into the peritubular capillary bed. .

53) To summarize the previous review questions, the process of small molecules entering the nephron from the blood by passing through the renal corpuscle (the "filter") is called _____. The process of molecules from the filtrate being returned from the nephron to the blood is called _____.

54) Which is the first blood vessel in the kidney to contain cleaned and balanced blood? _____. Justify the answer you wrote in the blank.

55)What happens to any substances in the filtrate that are not reabsorbed as they pass through the nephron?

56) If you were injected with very large amounts of penicillin, vitamin C, or any other molecule that the kidney rapidly removes from the blood, would you expect your urine volume to increase, decrease, or stay the same? Justify your answer. Hint: In your notes from the carbohydrates laboratory, review the effect of diabetes mellitus on urine volume and why diabetes affects the urine volume.

57) Insufficient water concentration in the plasma is called _____. Common causes are _____, _____, and _____.

58) Over-hydration (too much water in the blood) is generally caused by _____.

59) Sensors in the brain monitor the blood's water concentration. In response to changes in water concentration, these brain regions regulate the release of _____ hormone from the _____ gland. This hormone promotes the reabsorption of ____ from the filtrate.

60) ADH is released when the brain senses an increase/decrease (circle one) in the water concentration of the blood. (Note: These same conditions also result in the sensation of thirst).

61) Antidiuretic hormone (ADH) causes _____ (what action?) by the _____ organ.

62) When ADH levels are high, more water in the filtrate is reabsorbed, resulting in urine that is low/high (circle one) volume and low/high (circle one) in solute concentration.

63) When ADH levels are low, less water in the filtrate is reabsorbed, resulting in urine that is low/high (circle one) volume and low/high (circle one) concentration.

64) Osmoreceptors in the hypothalamus of the brain are stimulated by an increase / decrease (circle one word) in the plasma osmolarity.

65) When they detect an increase/decrease (circle one word) in blood osmolarity, the osmoreceptors stimulate the secretion of _____ from the _____ gland.

66) The hormone named in the question above stimulates the kidneys to _____.

67) Describe how ADH secretion and action in the kidneys help to maintain homeostasis of blood volume and solute concentration:_____

68) Antidiuretic hormone increases/decreases (circle one word) the secretion/filtration/reabsorption (circle one word) of H_2O .

69) If a person had normal blood osmolarity, and the person was given a large injection of ADH, the osmolarity of their blood would soon increase/decrease (circle one word) and the osmolarity of the urine would soon increase/decrease (circle one word). The concentration of water in the blood would soon increase/decrease (circle one word) and the concentration of water in the urine would soon increase/decrease (circle one word).

70) If a person had larger than normal concentration water in their blood, the pituitary gland would increase/decrease (circle one word) the amount of ADH that it releases.

71) If a person had larger than normal blood osmolarity, the pituitary gland would increase/decrease (circle one word) the amount of ADH that it releases.

72) When the body needs to conserve water, the kidneys excrete hypertonic urine. However, the fluid that the urine is made from, the plasma, is an isotonic solution. First . define what the terms isotonic and hypertonic mean, then describe how the kidneys change the isotonic fluids they receive from the blood into hypertonic urine.

73) The receptors for thirst are located in a part of the brain called the hypothalamus. These receptors, called osmoreceptors, are stimulated by an increase blood osmolality. Imagine a man who is initially properly hydrated. He lands on a desert island with no water to drink Trace the course of events leading to his sensation of thirst. Can he satisfy his thirst by drinking seawater? Explain

74) Imagine a very dehydrated desert prospector and a champagne-drinking partygoer, each of whom gives a urine sample. Fill in the table below comparing how the two urine samples would differ. (*Hint:* Alcohol inhibits ADH secretion.)

On each row of the table, compare the urine samples to each other use relative terms (such as *Higher* or *Lower*).

Urine measurement:	Prospector	Partygoer:
Urine volume	_____	_____
Specific gravity	_____	_____
Solute concentration	_____	_____

After you complete this table, write a paragraph justifying the answers that you gave.

75) Diuretics are drugs that block the action of ADH. Diuretic drugs, therefore, cause an increase/decrease (circle one) in the water reabsorbed from the filtrate. Based on the answer you circled, you would expect the blood pressure of a person taking diuretics to increase/decrease (circle one). Justify the answer you circled in the last sentence.

76) The hormone _____ controls sodium and potassium levels in the blood.

77) Aldosterone is released by the _____ gland, which is located on top of the _____ (a pair of organs).

78) Aldosterone is secreted in response to low blood levels of _____ ion and in response to high blood levels of _____ion.

79) Aldosterone increases/decreases (circle one word) the secretion/filtration/reabsorption (circle one word) of Na^+.

80) Aldosterone increases/decreases (circle one word) the secretion/filtration/reabsorption (circle one word) of K^+.

81) At a molecular level, the hormone aldosterone controls sodium and potassium levels by changing the amount of a certain transport protein that is found in the nephron walls. What is the name of the transport protein that aldosterone changes the levels of?

_____

82) If a person had normal levels of Na^+ and K^+, and the person was given a large injection of aldosterone, the concentration of Na^+ in the blood would soon increase/decrease (circle one word) and the concentration of Na^+ in the urine would soon increase/decrease (circle one word). The concentration of K^+ in the blood would soon increase/decrease (circle one word) and the concentration of K^+ in the urine would soon increase/decrease (circle one word).

83) If a person had larger than normal concentration of K^+ in their blood, the adrenal gland would increase/decrease (circle one word) the amount of aldosterone that it releases.

84) If a person had larger than normal concentration of Na^+ in their blood, the adrenal gland would increase/decrease (circle one word) the amount of aldosterone that it releases.

85) If a person had smaller than normal concentration of K^+ in their blood, the adrenal gland would increase/decrease (circle one word) the amount of aldosterone that it releases.

86) If a person had smaller than normal concentration of Na^+ in their blood, the adrenal gland would increase/decrease (circle one word) the amount of aldosterone that it releases.

87) Many diuretic drugs used clinically inhibit Na^+ reabsorption from the nephron by inhibiting the sodium-potassium pump. Predict the effect of these drugs on potassium levels in the plasma. Justify your answer.

88) Most molecules enter the nephron through the glomerulus and glomerular capsule (this process is called "filtration") and exit the nephron by being transported back into the blood (this process is called "reabsorption"). But there is a third type of transport process that takes place in the neprhon: Some molecules enter the nephron by moving from the peritubular capillaries into the nephron. This process is called _____.

89) K^+ secretion into the nephron is caused by the same hormone (Aldosterone) that causes Na^+ to be reabsorbed out of the nephron. Therefore, if the body increases aldosterone because blood K^+ is high, the blood's Na^+ concentration will _____.

90) Body functions are more easily damaged by changes in potassium ion concentration than it is by changes in sodium ion concentration. If a person had high potassium and high sodium in their blood, which hormone would you predict would be used to adjust the imbalance, and would the level of this hormone increase or decrease? Explain the answer you circled, and include a discussion of in what way the hormone will correct the imbalance and in what way the hormone will worsen the imbalance.

91) When blood pressure is low, the kidney secretes a protein called _____ into the blood, which indirectly causes an increase in blood pressure because it leads to the activation of the plasma protein _____ which in turn raises blood pressure by causing vasoconstriction.

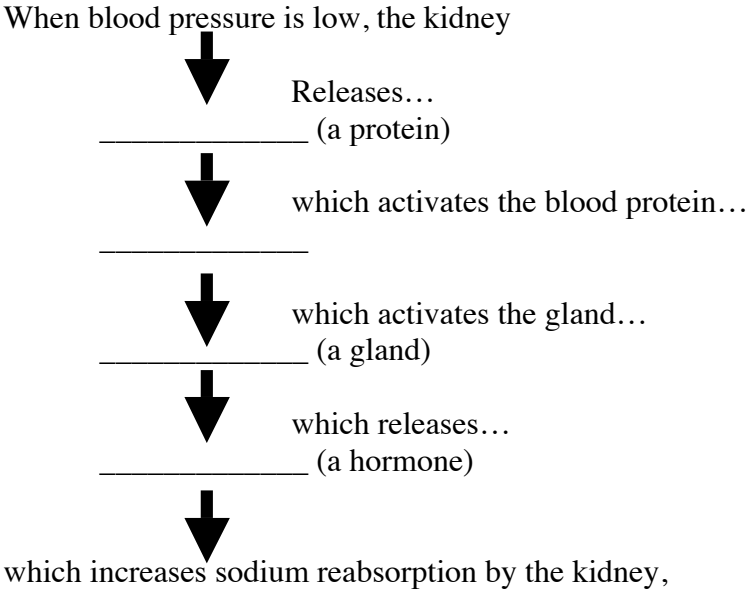
92) The concentration of sodium and potassium are the major triggers of aldosterone release. But aldosterone is also secreted in response to increased/decreased (circle one) blood pressure.

93) When aldosterone is released in response to low blood pressure, it is because the protein _____ has activated the adrenal gland to release aldosterone.

94) Aldosterone increases blood pressure in this way: Aldosterone increases the blood concentration of ____, which raises the osmolarity of the blood. The high osmolarity blood attracts _____ from the tissues of the body, which increases blood volume and blood pressure.

95) Since aldosterone secretion is controlled by angiotensin II, which is in turn controlled by renin, aldosterone release is indirectly controlled by the _____ (organs), the organs which produce the renin.

96) When blood pressure is low, a series of events that lead to an increase in the kidney's reabsorption of sodium occur. These events are outlined below. Fill in the missing terms in the blanks. Some blanks require more than one word answers. Hints appear next to some blanks.

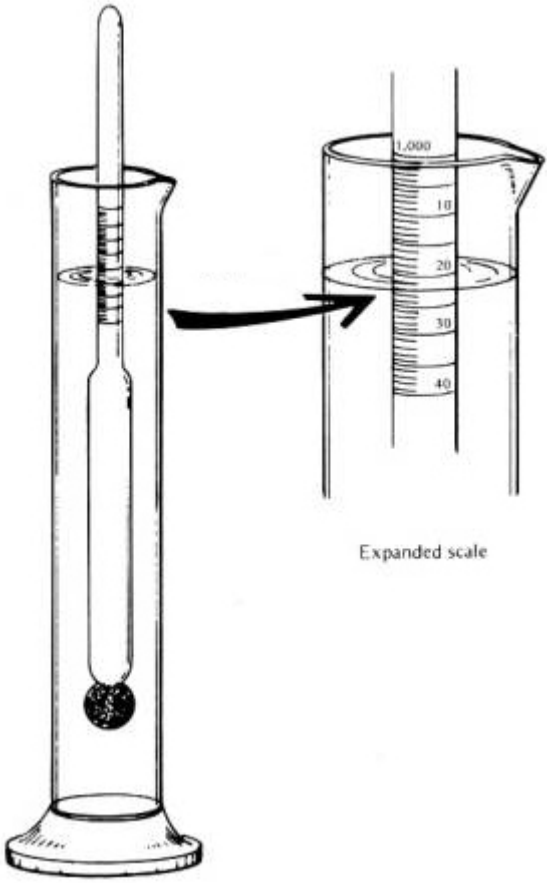


97) Angiotensin II raises blood pressure in two ways. One way be my causing the adrenal gland to secrete more aldosterone, which raises the blood pressure by increasing sodium reabsorption. The other way that angiotensin II raises blood pressure is by causing _____ throughout the body.

98) The kidney responds to low blood pressure by a) Increasing the amount of water reabsorbed from the filtrate, and b) Increasing the amount of sodium reabsorbed from the filtrate. Describe briefly (2 –3 sentences) how reabsorbing more sodium from the filtrate leads to an increase in blood pressure.

99) The measurement that is 1.000 for pure water and that is above 1.000 when solutes are present in the water is called: _____

100) The specific gravity of a patient's urine was measured using the same method that you used in laboratory. Based on the urinometer reading shown on the right, the patient's urine specific gravity is: _____



101) If it required 7 drops of silver nitrate in procedure step 4d to turn the urine sample color permanently from yellow to amber, what is the chloride ion concentration, expressed in mg/100 ml: _____ mg/100 ml.

102) In the previous problem, what is the chloride ion concentration, expressed in mEq/L: _____ mEq/L . The atomic weight of chlorine atoms is 35 g/mole. Show all unit conversion factors. Hint:

103) Sodium ions (Na^+) are normally present in the plasma at a concentration of 0.14 moles per liter. What is the normal sodium ion concentration in mEq/L? _____. The atomic weight of Na is 23 g/mole. Show all unit conversion factors. Hint: You may or may not need the atomic weight.

104) Potassium ions (K^+) are normally present in the plasma at a concentration of 18 mg per 100 mL. What is the normal potassium ion concentration in mEq/L? _____. The atomic weight of K is 39 g/mole.

105) Calcium ions are normally present in the plasma at a concentration of about 0.1 g/L. Calculate the mEq/L of Ca^{2+} in the plasma: _____ The atomic weight of calcium is 40 g/mole.

106) A solution has a sulfate ion (SO_4^{2-}) concentration of 100 mg/L. Calculate the mEq/L of sulfate ion in the solution: _____ The atomic weight of sulfur is 32 g/mole and the atomic weight of oxygen is 16 g/mole.

107) Describe the purposes of the kidneys in a single sentence.

108) You hire a landscaper to trim your rose bushes and pull some weeds. The rose trimmings and the weeds both end up in the garbage can.

a) Which activity (weed pulling or rose trimming) is cleaning your yard? Justify your answer.

b) Which activity (weed pulling or rose trimming) is balancing your yard? Justify your answer.

c) As your yard is to the blood, the trash can is to the _____ and the landscaper is to the _____. Justify your answers.

109) In the context of the urinary system, explain what "clean and balance the blood" means. Your answer should include the names of specific molecules in the blood as examples.

Answers for Review Questions for Renal Solute Regulation Review topic:

1) B

2) A

3) B

4) A and E

5) C

6) A

7) A

8) B

9) C

10) B

11) B

12) C

13) B

14) D

15) D

16) A

17) C

18) A

19) D

20) E

21) A

22) A

23) B

24) D

25) B

26) B

27) Kidneys
Ureter
Urinary bladder
Urethra

28) Penis
Vagina

29) a) Superior (or lateral)

b) Inferior (or medial)

c) Inferior

d) Lateral

e) Inferior

30) a) “Clean the blood” = To remove unwanted waste molecules from the blood.

b) “Balance the blood” = To adjust the blood’s water and nutrient levels to their correct concentrations by removing any excess amounts of these molecules.

c) Nephron = The tubular structures in the kidney that clean and balance the blood.

d) Glomerulus = A ball shaped capillary bed where substances from the blood filter into the nephron.

e) Filtration = The selective passage of molecules through a porous membrane based on the size of the molecule.

f) Filtrate = The substances that have passed through a porous membrane. (In the urinary system, the term filtrate means the substances in the blood which filter into the nephron. These include water, nutrients, and wastes but do not include blood cells or plasma proteins).

g) Reabsorption = The transport of substances from the filtrate in the nephron into the blood in the peritubular capillary bed.

h) Secretion = The transport of substances in the blood of the peritubular capillary bed into the filtrate in the nephron.

i) Specific gravity = The density of a solution compared to the density of pure water.

j) Equivalent (of ions) = One mole of ionic charge.

31) a) RBCs, WBCs, platelets

b) Amino acids, glucose, nucleotides, fatty acids

c) Na^+, K^+, Cl^-, Mg^{2+}, Ca^{2+}, HCO_3^-, H^+, etc. [Name any three]

d) Albumin, antibodies, clotting factors

32) Clean
Balance

33) Urea

34) Urine

35) Renal artery
Cortex
Nephrons

36) Roughly one million nephrons per kidney

37) a) F (the renal cortex)

b) A (the renal artery)

c) G (the uereter)

d) F (the renal cortex)

38) Glomerulus

39) Peritubular capillary bed

40) Filtration

41) Blood pressure

42) Filtrate

43) Water
Nutrients (such as monomers, ions, and vitamins)
Wastes (such as urea)

44) Blood cells
Plasma proteins

45) The size of the molecules determines whether they can filter into the nephron or not. The pores (holes) in the wall of the glomerulus and the nephron are small enough to allow small molecules such as water, monomers, ions, and wastes to enter the nephron, but larger blood substances (such as blood cells and plasma proteins) are too large to pass through the pores and therefore these do not enter the nephron.

46) Plasma proteins are too large to pass through the pores in the wall of the glomerulus and the nephron, and are therefore the proteins are too large to enter the nephron. Glucose is a much smaller molecule than protein. Glucose is small enough to pass through the pores and therefore glucose does enter the nephron.

47) Filtration doesn't clean the blood. Cleaning the blood means to remove the wastes from the useful parts of the blood (such as water and nutrients). The filtration step does not remove the wastes from the water and nutrients of the blood. The wastes, the water, and the nutrients all are filtered together into the nephron.

48) Filtration doesn't balance the blood. Balancing the blood means to adjust the water and nutrient levels to their proper concentrations by removing any excess water and nutrients. The filtration step does not remove excess water and nutrients from the blood. All amounts of water and nutrients, whether they are in the proper concentration range or not, are filtered into the nephron.

49) Reabsorption

50) Peritubular capillary bed

51) Are

52) Aren't

53) Filtration
Reabsorption

54) The peritubular capillary bed.
It is the blood vessel that receives the proper amounts of water and nutrients from the filtrate in the nephron. Therefore the blood in the peritubular capillary bed is balanced. The blood in the peritubular capillary bed does not receive any of the wastes from the filtrate in the nephron, therefore the blood in the peritubular capillary bed is cleaned blood.

55) Substances in the filtrate that are not reabsorbed back into the blood pass all the way through the nephron and eventually become the urine.

56) The urine volume would increase. This is due to osmosis. When the kidney removes large amounts of a solute from the blood (such as penicillin, vitamin C, or the large amounts of blood glucose when a person has diabetes mellitus) the solute appears at a high concentration in the urine. The principle of osmosis says that a large solute concentration will attract water. Water will therefore move from the surrounding tissues into the urine, which increases the volume of the urine.

57) Dehydration
    Not drinking enough fluids
    Excessive sweating
    Excessive diarrhea

58) Drinking excessive water

59) Antidiuretic hormone (ADH)
    Pituitary gland
    Water

60) Decrease

61) Water reabsorption
    Kidney

62) Low
    High

63) High
    Low

64) Increase

65) Increase
    ADH
    Pituitary gland

66) Reabsorb more water

67) If the blood is low in water concentration, the blood will have low volume and high osmolarity (high solute concentration). Increased ADH secretion from the pituitary gland adds more water to the blood by reabsorbing more water from the filtrate back into the blood. Adding water to the blood will increase the blood's volume and decrease its osmolarity (solute concentration).

If the blood is high in water concentration, the blood will have high volume and low osmolarity (low solute concentration). Decreased ADH secretion from the pituitary gland decreases the amount of water returned to the blood by reabsorption, and therefore there is an increase in the amount of water that is transferred from the blood to the urine. Removing water to the blood will decrease the blood's volume and increase its osmolarity (solute concentration).

68) Increases
Reabsorption

69) Decrease
Increase
Increase
Decrease

70) Decrease

71) Increase

72) Isotonic = The same solute concentration as a cell
Hypertonic = Greater solute concentration than a cell

The kidney removes water from the filtrate to convert it from an isotonic solution to a hypertonic solution. At the beginning of the nephron, the filtrate is isotonic because the filtrate comes directly from the plasma, which is isotonic. As the filtrate moves through the nephron, water is removed from the filtrate by reabsorption. Removing water from any solution increases the solution's solute concentration, and this converts it from an isotonic solution into a hypertonic solution.

73) The man's plasma is initially an isotonic solution since he is properly hydrated. As he sweats and defecates on the desert island, his body loses water. Removal of water from any solution increases the osmolarity (the solute concentration) of the solution, so the man's plasma begins to increase in solute concentration. Eventually it becomes hypertonic. The osmoreceptors in his brain detect that the plasma has too high a solute concentration. The brain then generates feelings of thirst in the man.

The man cannot satisfy his thirst by drinking sea water. Sea water is hypertonic, and adding one hypertonic solution (the sea water) to another hypertonic solution (his plasma) cannot make the plasma an isotonic solution. He must drink fresh (non-salty) water to restore his plasma to an isotonic state.

74)

Urine measurement:	Prospector	Partygoer:
Urine volume	Lower volume	Higher volume
Specific gravity	Higher SG	Lower SG
Solute concentration	Higher conc.	Lower conc.

Justifications: When a person is dehydrated (such as the prospector), the kidney conserves water by reabsorbing more water from the filtrate in the nephrons. Removing the water from the urine lowers the urine's volume, increases the urine's solute concentration, and increases its density (specific gravity).

When a person's secretion of ADH hormone is inhibited (such as the partygoer), the kidney reabsorbs less water from the filtrate in the nephrons. This means that more water will appear in the urine. Adding more water to the urine raises the urine's volume, decreases the urine's solute concentration, and decreases its density (specific gravity).

75) Decrease
Decrease.

One factor that determines the blood pressure is the blood's volume. Higher blood volumes lead to higher blood pressure and lower blood volumes lead to lower blood pressure. Blocking ADH causes less water to be reabsorbed into the blood, which lowers the blood's volume, which lowers the blood pressure.

76) Aldosterone

77) Adrenal gland
Kidneys

78) Low sodium ion (Na^+)
High potassium ion (K^+)

79) Increases
Reaborption

80) Increases
Secretion

81) The sodium-potassium pump

82) Increase
Decrease
Decrease
Increase

83) Increase

84) Decrease

85) Decrease

86) Increase

87) This class of diuretic drugs would tend to increase potassium levels in the blood. This is because the drugs inhibit the sodium-potassium pump, which is used to secrete excess potassium out of the blood and into the urine.

88) Secretion

89) Increase

90) Aldosterone would be used to correct the ion inbalances.

The aldosterone levels would increase because increased aldosterone levels will remove the excess potassium from the blood by secreting the excess potassium into the nephrons. In this way the potassium ion balance will be restored. The sodium ion imbalance, however, will be worsened. This is because aldosterone increases sodium ion reabsorption from the filtrate in the nephron into the blood. Therefore, the high levels of sodium in the blood will become even higher. Since potassium imbalance is more harmful to the body than sodium imbalance, the body is willing to worsen the sodium imbalance to correct the potassium imbalance.

91) Renin
Angiotensin II

92) Decreased

93) Angiotensin II

94) Na^+
Water

95) Kidneys

96) Renin
Angiotensin II
Adrenal gland
Aldosterone

97) Vasoconstriction

98) The increased sodium reabsorption by the kidney will raise blood pressure in the following way: Increased sodium reabsorption increases the solute concentration of the blood. This makes the blood hypertonic compared to the tissue fluids. This causes water to move by osmosis from the tissue fluid into the blood. The water increases blood volume, which raises the blood pressure.

99) Specific gravity

100) 1.020 (or 1.022. The figure is slightly unclear where the waterline touches the urinometer)

101) 427 mg Cl^-/100 ml urine.

102) Answer = 122 mEq/L

427 mg Cl^-/100 ml x (1g/1000 mg) x (1000 ml/1L)

x (1 mole Cl/35 g Cl) x (1 mole ionic charge/1 mole Cl^-)

x (1 Eq/1 mole ionic charge) x (1000 mEq/1 Eq)

= 122 mEq/L

103) Answer = 140 mEq/L

0.14 moles Na^+/L x (1 mole ionic charge/1 mole Na^+)

x (1 Eq/1 mole ionic charge) x (1000 mEq/1 Eq)

= 140 mEq/L

104) Answer = 4.6 mEq/L

18 mg K^+/100 ml x (1g/1000 mg) x (1000 ml/1L)

x (1 mole Cl/39 g K) x (1 mole ionic charge/1 mole K^+)

x (1 Eq/1 mole ionic charge) x (1000 mEq/1 Eq)

= 4.6 mEq/L

105) Answer = 5 mEq/L

0.1 g Ca^{2+} /L x (1 mole Ca/40 g Ca)

x (2 moles ionic charge/1 mole Ca^{2+}) x (1 Eq/1 mole ionic charge)

x (1000 mEq/1 Eq) = 5 mEq/L

106) Answer = 2.1 mEq/L

100 mg SO_4^{2-}/L x (1 g/1000 mg)

x (1 mole SO_4^{2-}/96 grams SO_4^{2-})*

x (2 moles ionic charge/1 mole SO_4^{2-})

x (1 Eq/1 mole ionic charge) x (1000 mEq/1 Eq)

= 2.1 mEq/L

* The molecular weight of SO_4^{2-} is calculated as follows: The SO_4^{2-} molecule contains one sulfur atom. An atom of sulfur has an atomic weight of 32. The SO_4^{2-} molecule also contains four oxygen atoms. Each oxygen atom has an atomic weight of 16, so the four oxygen atoms together have a combined weight of 64 (4 x 16). Adding together the atomic weights of the one sulfur atom and the four oxygen atoms gives a molecular weight of 96 (32 + 64) for the entire molecule.

107) The kidneys clean and balance the blood.

108) a) Weed pulling is cleaning your yard. Cleaning means to remove unneeded and unwanted substances. You do not want any weeds in your yard so removing the weeds is cleaning.

b) Trimming the roses is balancing your yard. Balancing means to adjust the amount of a wanted substance to its proper level. You want roses in your yard so trimming them to their proper level is balancing.

c) As your yard is to the blood, the trash can is to the urine and the landscaper is to the kidney.

The yard is like the blood because the yard and the blood both contain needed substances and unneeded substances.

The trash can is like the urine because both the trash can and the urine receive the unneeded substances and also receive the excess amounts of the needed substances.

The landscaper is like the kidney because both the landscaper and the kidney remove the unneeded substances and also remove excess amounts of the needed substances.

109) Clean the blood means to remove unneeded substances (wastes) from the blood. Examples of wastes that are removed from the blood include urea, uric acid, and urochrome.

Balance the blood means to restore needed substances in the blood to their proper levels. Examples of needed substance sin the blood include sodium ions, calcium ions, potassium ions, and water.