1. The term "renal autoregulation" refers in part to the fact that

A. the kidney does not require blood flow to sustain its active transport
B. the kidney contains baroreceptors (pressure receptors) that contribute to the regulation of cardiac output
C. renal blood flow is relatively constant over a wide range of systemic arterial pressures
D. renal blood flow is not affected by activation of the sympathetic nerves that innervate the kidney
E. a combination of both C and D above

2. The nerves that innervate the kidney are essential for regulating which of the following?

A. Na-K-ATPase active transport pump rate
B. renal autoregulation of blood flow
C. urine volume and tonicity (osmolality)
D. all of the above
E. none of the above

3. Which of the following would be expected to cause renal inulin (or creatinine) clearance to increase?

A. dilation of the afferent arteriole
B. dilation of the efferent arteriole
C. constriction of the afferent arteriole
D. constriction of the efferent arteriole
E. both A and D above

4. Kidney inflammation may result in the appearance of albumin (a plasma protein) in the urine because

A. more albumin enters the proximal tubule in the glomerular filtrate
B. reabsorption of albumin from the proximal tubule is inhibited
C. secretion of albumin into the distal tubule and collecting ducts is increased
D. increased peritubular blood flow makes more albumin available for diffusion into the tubule

E. reduced active transport of sodium ion reduces cotransport of other substances, including albumin

5. As blood passes along the glomerular capillaries from the afferent to efferent arteriole, the net filtration pressure ($\Delta P - \Delta \pi$)

A. increases
B. decreases
C. first decreases, reaches a minimum about half way along the capillary, then increases
D. first increases, reaches a maximum about half way along the capillary, then decreases
E. remains constant

6. Sodium is actively reabsorbed from the renal tubule in which of the following nephron segments?

A. proximal tubule
B. distal tubule
C. thick ascending limb of the loop of Henle
D. all of the above
E. none of the above

7. The rate of water reabsorption from the proximal tubule is determined primarily by the

A. rate of dissolved particle (solute) reabsorption from the proximal tubule
B. concentration of ADH (antidiuretic hormone) in the blood
C. osmotic pressure developed by plasma proteins in the proximal tubule
D. active transport of water molecules by the proximal tubule cells
E. passive filtration due to the high hydrostatic pressure in the proximal tubule

8. Urea has a higher concentration in the fluid that leaves the proximal tubule (and enters the loop of Henle) than in blood plasma because

A. urea is synthesized by proximal tubule cells
B. urea is secreted into the proximal tubule
C. urea is reabsorbed from the proximal tubule but at a lesser rate that water is reabsorbed
D. urea diffuses back into the proximal tubule because of the high urea concentration in the renal medulla
E. urea is actively transported into Bowman's capsule from the glomerular capillaries

9. In the proximal tubule, penicillin is

A. actively secreted into the tubule
B. actively reabsorbed from the tubule
C. passively reabsorbed from the tubule
D. metabolized by the tubule cells
E. neither secreted nor reabsorbed nor metabolized

10. At which sites would the concentration of creatinine be expected to be highest? (Note: assume the person is normally hydrated.)

A. glomerular filtrate
B. end of the proximal tubule
C. end of the loop of Henle
D. urine
E. the concentration would be the same in all of the above, since creatinine is neither secreted or reabsorbed

11. Suppose a person loses the function of half his nephrons because of renal degenerative disease. Assuming the person survives and reaches a new steady state and that body urea production remains normal, which of the following would be expected to decrease below normal?

A. plasma urea concentration
B. renal urea excretion
C. renal urea clearance
D. urine urea concentration
E. all of the above

12. The following values are measured for potassium ion in a human subject.

Plasma K+	5 meq/liter
Urine K+	50 meq/liter
Renal creatinine clearance	80 ml/min
Urine formation rate	1.5 ml/minute

This patient's potassium clearance is closest to which of the following?

A. 5 ml/minute
B. 7.5 ml/minute
C. 15 ml/minute
D. 50 ml/minute
E. 75 ml/minute

13. Assuming the subject in the preceding question is a normal adult, we can conclude that most likely potassium is

A. filtered but not secreted or reabsorbed
B. secreted but not filtered or reabsorbed
C. reabsorbed but not secreted or filtered
D. filtered and secreted
E. filtered and reabsorbed

ANSWER KEY TO RENAL MECHANISMS PRACTICE QUESTIONS

1. C. Autoregulation refers to the relatively constant rate of both RBF and GFR over a wide range of systemic arterial pressures (but it does not imply that RBF and GFR are always constant, since they can be influenced by sympathetic stimulation, hormones, etc.).

2. E. Although the sympathetic nerves that innervate the kidney influence several aspects of kidney physiology, they are not essential for normal renal function.

3. E. Both dilation of the afferent arteriole and constriction of the efferent arteriole would increase glomerular capillary hydrostatic pressure and thus increase GFR. Note that inulin (or creatinine) clearance is a measure of GFR.

4. A. Loss of the glomerular filtration barrier negative charge, characteristic of nephritis, leads to increased filtration of negatively-charged plasma proteins. If the protein filtered load exceeds the limited capacity of the renal tubules to reabsorb protein (Tm-Protein), the urine will contain plasma proteins.

5. B. Hydrostatic pressure decreases because of capillary resistance. Osmotic pressure increases because plasma protein concentration increases as fluid is lost by filtration. So net filtration pressure decreases as blood passes along the glomerular capillary, and may even reach zero (no net filtration force) by the end of the capillary.

6. D. Sodium is reabsorbed by active transport in all of the segments named, although it is not actively transported in either the descending or ascending thin limbs of the loop of Henle.

7. A. The proximal tubule is very permeable to water, so water reabsorption follows solute (dissolved particle) reabsorption.

8. C.

9. A.

10. D. Remember that creatinine is filtered but neither reabsorbed nor secreted (approximately), so creatinine concentration depends on the amount of water remaining. The volume of urine is less that the volume of fluid at any of the other sites listed.

11. C. Less urea would be cleared because less urea is be filtered. The reduced filtration would cause blood urea concentration to rise until the amount of urea excreted was equal to the amount of urea produced by protein metabolism even with the reduced plasma clearance.

12. C. Remembering that $C_K = U_K \times V / P_K$, so $C_K = 50 \times 1.5 / 5 = 15$ ml/min.

13. E. Since C_K is less than GFR (80 ml/min, as measured by creatinine clearance in question 12), potassium must be filtered and reabsorbed.