CHAPTER 12 REVIEW

(Pages 396–397)

Part 1

1. B
2. C
3. D
4. 4, 1, 3, 2

Part 2

5. See Figure 2, Section 12.1, page 379 of Student Book. The kidneys filter waste from the blood and regulate water and pH balance. The renal artery carries blood to the kidneys. The renal vein carries filtered blood away from the kidneys. The ureter transports urine from the kidney to the bladder. The bladder stores urine. The urethra carries urine from the bladder out of the body.
6.
   - C: afferent arteriole; A: efferent arteriole
   - It would increase filtration.
   - The glomerulus is not permeable to larger molecules, such as proteins, or to cells.
   - B: glomerulus or D: proximal tubule; glucose is reabsorbed in the proximal tubule.
   - D: proximal tubule; G: distal tubule
   - G: distal tubule
   - All areas of the nephron contain urea, but it would be most concentrated in G.
   - D: proximal tubule. This area is involved in active transport, which requires ATP. ATP is provided by cellular respiration, which partially occurs in the mitochondria.
7. (b), (c), (e), (f), (a), (d)
8. Proteins are not filtered. Proteins are found in the plasma but not in the glomerular filtrate.
9. Urea is secreted. The concentration of urea is greatest in the urine. It is secreted in the upper segment of the distal tubule.
10. Glucose is reabsorbed from the proximal tubule. No glucose remains in the nephron after the proximal tubule. No glucose is found in the urine.
11. The kidney helps maintain a constant blood pH by removing excess acids or bases. An acid-base balance is maintained by the bicarbonate–carbon dioxide buffer system, which absorbs excess H^+ ions (acids) or ions that act like bases. The kidney restores the bicarbonate ion buffer, which acts to eliminate H^+ ions from the body, decreasing acidity. The H^+ ions combine with ammonia or phosphate ions and are excreted from the nephron.
12. Blood would move into the glomerulus but not move out as quickly. This should increase blood pressure in the glomerulus, which would increase filtration. As filtration increases, urine production should increase.
13. The proximal tubule is involved in active transport, which is an energy-consuming activity. The mitochondria provide ATP.
14. Blood containing the drug would be filtered in the glomerulus. Fluid with the drug dissolved in it would be forced into the cavity of Bowman's capsule. From there, the fluid containing the drug would move down the descending arm of the loop of Henle. The drug would become more concentrated as water is moved out of the tubule of the nephron. The drug would pass through the loop of Henle and the distal tubule and into the collecting duct. The drug in the urine would then pass through the ureter and would be stored in the bladder until it was excreted through the urethra.
15. Urine production would increase. Amino acids and glucose are actively transported from the nephron in the area of the proximal tubule. The reduced active transport capabilities, due to the inhibition of ATP formation, would mean a higher solute concentration (increased osmotic pressure) in the nephron. Because of the higher osmotic pressure in the nephron, less water is reabsorbed, increasing urine production.

16. The reduced blood flow to the kidney would be detected by the juxtaglomerular apparatus. Renin would be released, converting angiotensinogen to angiotensin. The angiotensin causes constriction of local arterioles (this increases blood pressure) and initiates the release of aldosterone from the adrenal cortex. Aldosterone, by increasing Na^+ transport from the nephrons, increases water reabsorption, which helps elevate blood pressure.
17. Because the salt concentration in the nephron exceeds what can be actively transported, a higher solute concentration remains in the nephron, creating high osmotic pressure. Water moves into the nephron from the ECF, and this water is lost from the body, along with the excess salt.
18. Decreased blood pressure will reduce filtration, thereby decreasing the amount of urine produced.
19.

		Advantages	Disadvantages
(a)	hemodialysis	long and successful history of use	red blood cell damage; time consuming; restrictive (little movement possible)
(b)	peritoneal dialysis	less restrictive; no red blood cell damage	possible peritoneal infections; large amounts of fluids pumped into body cavity
(c)	living donors	donor is usually from within immediate family, so chance of rejection is minimized; normal functioning kidney (no dialysis)	risk to living donor is quite high; transplants must be done quickly
	cadaver donors	donor is dead; therefore, no risk to donor; normal functioning kidney (no dialysis)	risk of damage to kidney that is not removed quickly enough; high risk of rejection

20. The concentration of urea in the blood will decrease.
21. Wastes will move by diffusion. The dialysis solution must contain fewer wastes than the blood so that wastes can move via this method.
22. Students should suggest changes that would lead to less water excretion and will include adjusting passive and active transport of water during reabsorption by increasing the reabsorption of Na^+ in the proximal tubule and making the descending loop of Henle more permeable to water.

UNIT 20 D PERFORMANCE TASK: DETERMINING FITNESS LEVEL

Students may wish to use VO_2 max from Chapter 7, Investigation 9.1: Determining Lung Capacity, or Investigation 9.2: The Effects of Exercise on Lung Volume as a model for the experimental design.

Analysis

(a) Students' answers will vary. A possible equation could be the following:
VO_2 max = tidal volume × number of breaths/min × 6 % (approximate amount of O_2 used from each breath)/body mass (kg)
VO_2 max = volume of oxygen consumed per kilogram of body weight per minute of activity

(b)

	Men				
	20s	30s	40s	50s	60s
low VO_2 max	39 26	35 22	31 18	27 14	23 10
medium VO_2 max	51 40	47 35	43 32	39 28	35 24
high VO_2 max	60 52	56 48	52 44	40 40	44 36

