Cheat Sheet

Chapter 44 Questions

1. **What is osmoregulation?**
2. **What is ammonia?**
3. **What is excretion?**
4. **What is osmolarity?**
5. **What is the osmolarity of human blood and seawater?**
6. **What is an osmoconformer?**
7. **What is an osmoregulator?**
8. **What are the differences between stenohaline and euryhaline animals?**
9. **What ion do Atlantic lobsters regulate?**
10. **How do sharks survive high concentrations of urea in their bodies?**
11. **How do sharks achieve a higher osmolarity than their environment?**
12. **How do salmons survive in fresh water and seawater?**
13. **What is dessication?**
14. **What is anhydrobiosis?**
15. **What is trehalose?**
16. **What makes camels better fit for the desert than humans?**
17. **What are transport epithelia?**
18. **Why can marine birds survive drinking only seawater while humans can't?**
19. **Why is ammonia (NH_3) toxic?**
20. **Describe the three forms of nitrogenous waste.**
21. **What is guano?**
22. **What is gout?**
23. **What is filtration?**
24. **What is reabsorption?**
25. **What are photonephridia?**
26. **What are metanephridia?**
27. **What are Malpighian tubules?**
28. **What are kidneys?**
29. **Describe the path of urine produced by kidneys.**
30. **Describe the structure of the kidney.**
31. **Describe the different kinds of nephrons.**
32. **Describe the pathway of filtrate in a nephron.**
33. **Describe filtrate processing in the proximal tubule.**
34. **Describe the descending loop of Henle.**
35. **Describe the ascending loop of Henle.**
36. **Describe filtrate processing in distal tubule.**
37. **Describe filtrate processing in collecting duct.**
38. **What excretory adaptation do Australian hopping mice have for desert life?**
39. **What are countercurrent multiplier systems?**
40. **How come the vasa recta does not interfere with the osmolarity gradient?**

41. How does the moisture of an animal's environment determine nephron structure?
42. Describe the unique excretory system of vampire bats.
43. What is the difference between bird, mammal, and reptile kidneys?
44. How do amphibians produce concentrated urine?
45. What is special about the nephrons of marine fishes?
46. What are chloride cells?
47. What is antidiuretic hormone (ADH or vasopressin)?
48. What is diuresis?
49. What is the normal range for blood osmolarity?
50. Describe the ADH regulatory system.
51. How does alcohol disturb homeostasis?
52. What is diabetes insipidus?
53. Describe the renin-angiotensin-aldosterone system (RAAS).
54. How is hypertension treated?
55. What is atrial natriuretic peptide?

Chapter 44 Answers

1. Animals control solute concentrations and balance water gain/loss
2. Toxic metabolite created by dismantling of nitrogenous molecules
3. Ridding body of nitrogenous metabolites and other metabolic waste products
4. Number of osmoles of solute per liter of solution
5. 300 mOsm/L and 1000 mOsm/L
6. Animal that is isoosmotic with its surroundings, all are marine animals
7. Animal that controls internal osmolarity independent of external environment
8. Most animals, cannot tolerate substantial changes in external osmolarity

   Can survive large fluctuations in external osmolarity (e.g. barnacles, mussles, bass)
9. Mg^{2+} lower concentration inside than outside
10. Organic molecule trimethylamine oxide (TMAO) produced by shark tissues, protects proteins from denaturing effect of urea
11. TMAO adds to solute concentration
12. When in freshwater osmoregulate like other freshwater fish, when in ocean produced more cortisol (steroid hormone) that increases number/size of salt-secreting cells
13. Extreme dehydration
14. Dormant state where animals lose almost all body water and survive (e.g. tardigrades)
15. disaccharide that seems to protect cells by replacing water that is normally associated with membrane proteins and lipids
16. Camels can survive 7^{o} C increase in body temp, can lose 25% of body water. Human can lose 12.5%
17. One or more layers of epithelial cells specialized for moving particular solutes in controlled amounts in specific directions, typically arranged in tubular networks
18. Have salt glands that secrete fluid much saltier than the ocean. Humans excrete more water that they gain to get rid of salt so they lose water
19. Its ion (ammonium (NH_4^+)) can interfere with oxidative phosphorylation
20. Ammonia - Need access to lots of water, ammonia tolerated at low concentrations, can pass through membranes
    Urea - Product of energy consuming metabolic cycle that combines ammonia with carbon dioxide of liver, low toxicity
    Uric Acid - Excreted by insects, land snails, and many reptiles, relatively nontoxic, does not dissolve in water, requires very little water loss, more energetically expensive than urea
21. Bird droppings, mixture of white uric acid and brown feces
22. Painful joint inflammation caused by deposits of uric acid crystals
23. Body fluid brought in contact with selectively permeable membrane of transport epithelium, hydrostatic pressure drives water/small solutes across membrane creating filtrate
24. Recovers useful molecules and water from filtrate and returns them to body fluid

25. Excretory systems of flatworms (Platyhelminthes). Network of dead-end tubules that branch in body, have flame bulbs at ends (each has tubule cell, cap cell, and tuft of cilia projecting into tubule. Cilia draws water through flame bulb to form filtrate. Found in rotifers, some annelids, mollusc larvae, and lancelets. In freshwater used for osmoregulation, in isoosmotic used for excretion
26. Excretory systems of most annelids, collect fluid directly from coelom, pair found in each segment, immersed in coelomic fluid and capillary network. Ciliated funnel draws fluid into collecting tubule (includes storage bladder that opens to outside on adjacent segment, serves excretory and osmoregulatory function)
27. Organ of terrestrial arthropods, function in excretion and osmoregulation. Extend from dead-end tips immersed in hemolymph to openings into digestive tract. No filtration, transport epithelium secretes solutes.
28. Pair of organs in humans, 10 cm in length, produces urine, typically nonsegmented, but in hagfish are segmentally arranged
29. Exits through ureter, ureters drain into urinary bladder, urine expelled through urethra. Sphincters regulate urination
30. Outer renal cortex, inner renal medulla, both supplied with blood by renal artery, drained by renal vein. Urine collected in inner renal pelvis and exits through ureter
31. Functional units of kidney, 85% cortical (short distance into medulla), remainder are juxtamedullary nephrons (deep into medulla), produce urine hyperosmotic to body fluids
32. Ball of capillaries called glomerulus surrounded by Bowman’s capsule. Blood pressure forces fluid into capsule. Filtrate passes through proximal tubule, loop of Henle (hairpin turn with descending + ascending limb), distal tubule, and collecting duct (receives processed filtrates from multiple nephrons and transports to renal pelvis). Blood supplied by afferent arteriole from renal artery, drained by efferent arteriole (branches called peritubular capillaries that surround proximal/distal tubules. Others extend downward and form vasa recta that serve loop Henle)
33. NaCl enters transport epithelium from filtrate and transferred to interstitial fluid, water follows by osmosis (diffuses into peritubular capillaries along with essential substances). H^+ and ammonia secreted into lumen by transport epithelium, reabsorbs buffer bicarbonate. Toxins secreted into tubule
34. Aquaporin proteins allow water to move out of tubule but not other small substances. Highest osmolarity (1,200 mOsm/L) at elbow. Interstitial fluid hyperosmotic all along length
35. Transport epithelium lacks aquaporins. Thin segment comes first, allows NaCl to diffuse into interstitial fluid to maintain osmolarity of medulla. In thick segment, epithelium actively transports NaCl.
36. Regulates K^+ and NaCl concentration of body fluids, controlled secretion and reabsorption of H^+ and HCO_3^- respectively
37. Hormonal control of permeability and transport determines extent to which urine becomes concentrated. In inner medulla, becomes permeable to urea to maintain high osmolarity of interstitial fluid in medulla
38. Can produce urine with osmolarity 9,300 mOsm/L (300 mOsm/L blood)

39. Countercurrent systems that expend energy to create concentration gradients
40. It carries blood in opposite directions to osmolarity gradient
41. Dry environment = longer loops
42. While feeding, excrete loads of dilute urine to allow them to be light enough to fly. While roosting must produce highly concentrated urine due to nitrogenous wastes produced by eating blood
43. Birds - juxtamedullary nephrons that extend less than mammals
    Reptiles - only cortical nephrons
44. Reabsorb water across epithelium of urinary bladder on land, in fresh water excrete dilute urine
45. Lack distal tubules, fewer and smaller nephrons, smaller glomeruli (or missing), very little urine excreted, main function is to get rid of divalent ions (2+ or 2-) by secreting in proximal tubule.
46. Specialized in gills of marine bony fish, establish ion gradients that enable secretion of salt into sea water, maintain proper level of monovalent ions
47. Hormone of the kidney, released from posterior pituitary bind, bind to surface receptors of collecting duct cells (causes insertion of aquaporins in membrane lining)
48. High level of urine production
49. 285-295 mOsm/L
50. Osmoreceptor cells in hypothalamus trigger increased release of ADH from posterior pituitary when osmolarity rises above normal range. As osmolarity falls, activity of osmoreceptor cells decreased.
51. Inhibits ADH release, leading to excessive urinary water loss and dehydration
52. ADH receptor gene mutation causes copious amounts of dilute urine to be excreted
53. Regulates kidney function, responds to drop in blood volume and pressure by increasing water/NA^+ reabsorption. Involves juxtaglomerular apparatus (tissue with cells of and around afferent arteriole) releasing renin (enzyme) in response to drop in blood pressure. Causes cleavage of angiotensinogen to form angiotensin II (triggers vasoconstriction to increase blood pressure and stimulates adrenal glands to release aldosterone that causes distal tubules/collecting duct to reabsorb NA^+ and water to increase blood volume)
54. Chronic high blood pressure, treated with drugs that block angiotensin II production, specific inhibitors of angiotensin converting enzyme (ACE) that catalyzes part of angiotensin II production
55. Opposes RAAS. Walls of atria of heart release it in response to increase in blood volume/pressure, inhibits release of renin from JGA, inhibits NaCl reabsorption by collecting ducts, reduces aldosterone release from adrenal glands