Biology 12 Name: _____

Urinary System Per: _____ Date: _____

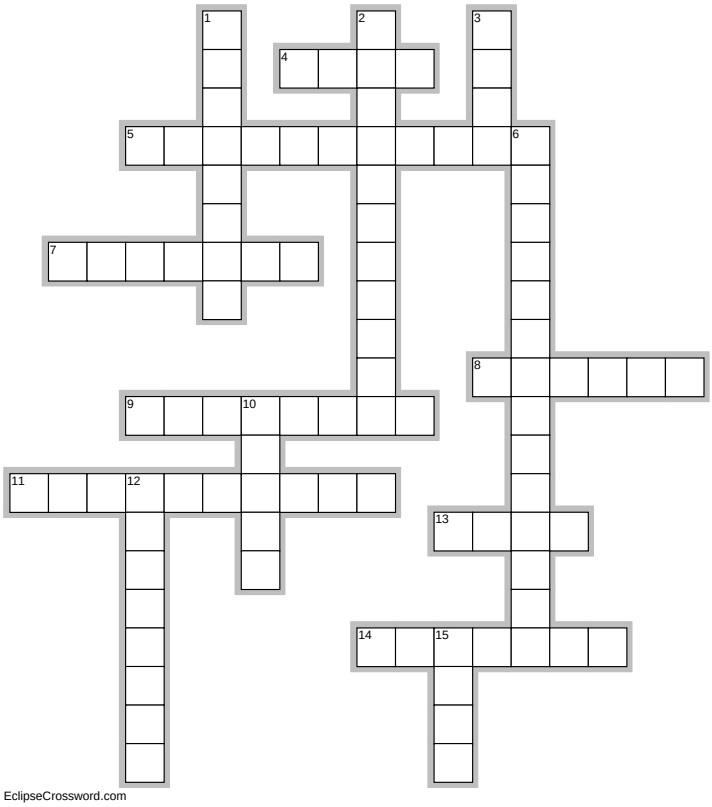
Chapter 13 – The Urinary System

Complete using BC Biology 12, page 408 - 435

13.1 The Urinary System pages 412- 413

1. As the kidneys produce urine, they carry out the following four functions
   a. _____
      - List some of the waste products: _____
   b. _____
      - How are blood volume and blood pressure related? _____
      _____
   c. _____
      - What is the average pH of urine? _____
   d. _____
      - When might the kidneys secrete **erythropoietin**? _____
      _____

2. Complete the crossword using terms from the "Functions of the Urinary Systems"



Across

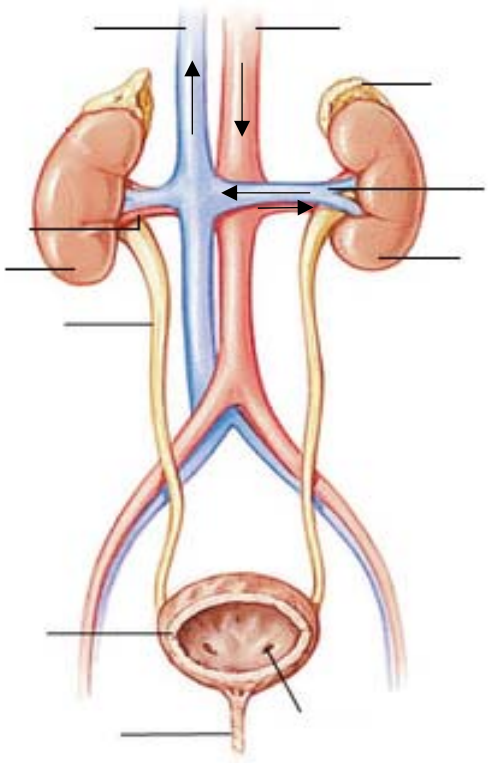
4. Blood volume is intimately associated with the balance of the body.
5. Kidneys regulate levels of other ions such as K^+, Ca^{2+} and _____.
7. Kidneys help activate vitamin D from the skin which promotes the absorption of this element from the digestive tract.
8. Aldosterone promotes the reabsorption of _____ ions by the kidneys.
9. Kidneys maintain blood pH by excreting _____ ions and reabsorbing bicarbonate ions.
11. Product of the breakdown of a high-energy phosphate reserve molecule
13. Byproduct of amino acid metabolism
14. Very toxic to cells (NH_3)

Down

1. Results from the breakdown of nucleotides.
2. Hormone released from the adrenal cortex of the adrenal glands.
3. Painful ailment caused by crystals of uric acid precipitating in the joints.
6. Hormone which stimulates red blood cell production.
10. Enzyme that leads to secretion of hormone aldosterone.
12. Some ammonia is excreted as this ion (NH_4^+)
15. Human urine is (more/less) acidic than blood due foods we eat

3. Label the diagram with the terms

   A. *adrenal glands*
   B. *aorta*
   C. *inferior vena cava*
   D. *left kidney*
   E. *renal artery*
   F. *renal vein*
   G. *right kidney*
   H. *ureter*
   I. *ureter opening*
   J. *urethra*
   K. *urinary bladder*



4. The _____ are paired, bean-shaped, reddish-brown organs located near the small of the back. They lie behind the _____ where they receive some protection from the lower rib cage. Each one is covered by a tough fibrous connective tissue layer called a _____ _____. The concave side of each kidney has a depression called the _____ where a _____ enters and a _____ and a _____ exit the kidney.

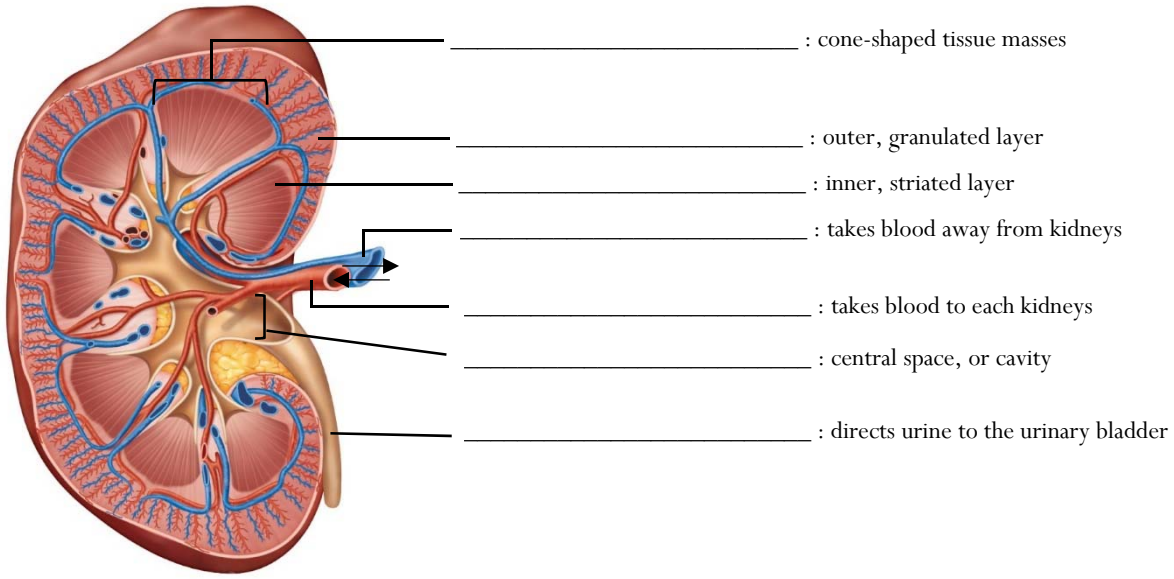
5. Summarize the structure and function of each of the following structures

   a. ureters: _____
   _____
   _____

   b. urinary bladder: _____
   _____
   _____

   c. urethra: _____
   _____
   _____

6. Identify the detailed parts of the kidney as indicated below.

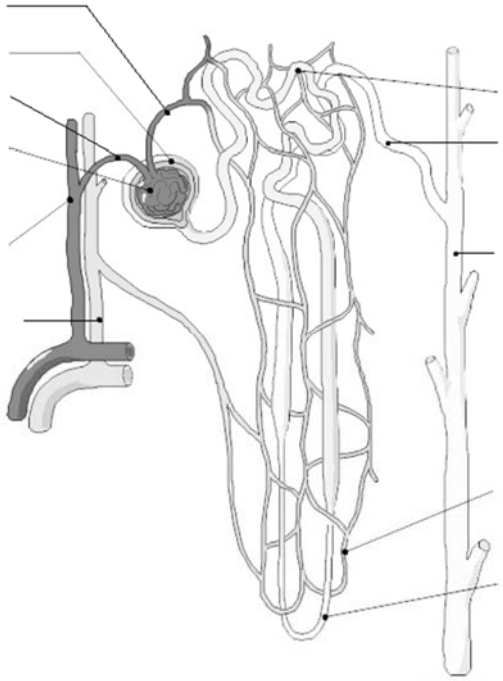


7. Each kidney is composed of over _____ individual units called _____. Each has its own blood supply, including two capillary regions. From the renal artery, an _____ arteriole leads to the _____. Blood leaving the glomerulus enters the _____ arteriole which takes blood to the _____ _____ which surrounds the rest of the nephron. From there blood goes into a venule that joins the renal vein.

8. Match the parts of a nephron to their descriptions

_____ Bowman's capsule	A. numerous mitochondria to aid in tubular excretion
_____ proximal convoluted tubule	B. cuplike structure that surrounds the glomerulus, site of filtration
_____ loop of Henle	C. mainly in the medulla; made of simple squamous epithelium
_____ distal convoluted tubule	D. has many nephrons connected to it; carries urine to renal pelvis
_____ collecting ducts	E. contains tightly packed microvilli for maximum reabsorption

9. Label the diagram with the terms
    A. *afferent arteriole*
    B. *collecting duct*
    C. *distal convoluted tubule*
    D. *efferent arteriole*
    E. *glomerulus*
    F. *Bowman's capsule*
    G. *loop of Henle*
    H. *peritubular capillary network*
    I. *proximal convoluted tubule*
    J. *renal artery*
    K. *renal vein*



10. Draw a dotted line through the above nephron to indicate the portions found in the ***renal cortex*** versus **renal medulla**. Label the regions.

11. Urine is formed through the following 3 processes. Use the table to compare them.

	Pressure Filtration	Selective Reabsorption	Tubular Excretion
Site of action or direction of flow			
Components being transferred			
Name of fluid after completing this process			

12. Trace the path of each of the following through the nephron beginning in the glomerulus. Be as specific as possible with respect to structure and process.
    a. nutrients: _____
    _____
    b. plasma proteins: _____
    _____
    c. antibiotics: _____
    _____

13.3 Regulatory Functions of the Kidneys pages 418 - 421

Osmoregulation

13. Excretion of a _____ urine (one that is more concentrated than blood) is dependent of the reabsorption of water from the _____ and the _____. It requires:

(1) *Reabsorption of Salt*

- Where are sodium ions reabsorbed?
  - _____ (67%)
  - _____ (25%)
  - _____ (~7%)
- The hormones involved in regulating blood pressure and volume (*Figure 13.7 helps*)
  - Low blood pressure triggers the _____ to secrete _____ which triggers _____ to secrete _____ causing the kidneys to excrete of K^+ and absorb Na^+. This causes an increase in _____ reabsorption therefore increasing blood _____ and subsequently blood _____ rises to normal.
  - High blood pressure triggers the heart to secrete _____ which causes kidneys to excrete more _____ and _____ in the urine. This causes blood volume to _____ and blood pressure returns to normal.

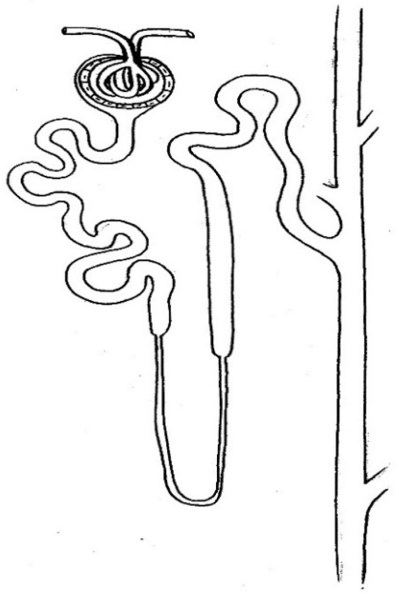
(2) *Establishment of a Solute Gradient*

- The loop of Henle is made up of a _____ limb and an _____ limb.
- The concentration of salt is _____ in the direction of the _____. Note that _____ cannot leave the _____ because that portion is impermeable to water.
- The increasing solute concentration in the renal medulla is thought to be partially due to salt but thought mainly to be due to _____ leaking from the lower portion of the _____.

(3) *Reabsorption of Water*

- Why does water leave the nephron and enter the medulla as it travels through the entire descending limb of the loop of Henle? _____
  _____
- Kidneys are able to regulate the amount of water that exits the body. When it needs to remove excess water, urine that is _____ to the general body fluids is produced (more water in the urine). If dehydrated, the _____ _____ gland releases _____ (ADH) which causes the collecting duct to become more permeable (increases the number of _____ inserted in the cells) and the kidneys are able to reclaim more water (less water in the urine).
- Why is urine more concentrated for the first urine in the morning? _____
  _____

14. Use Figure 13.8 and the basic diagram of the nephron below to illustrate how a solute gradient is established and water is reabsorbed.



15. Define **diuretics**: _____

_____

- How do each of the following act as a diuretic?
  - alcohol: _____

    _____
  - caffeine: _____

    _____
  - prescription drugs: _____

    _____
- Why is it risky to use diuretics for quick weight loss? _____

  _____

  _____

Acid-Base Balance

16. If the blood pH rises above 7.4, a person is said to have _____ and if the blood pH drops below 7.4, a person is said to have _____. The body uses several mechanisms to maintain a homeostatic pH such as:

    (1) *Acid-Base Buffer Systems*

    - Draw the formulas for the most common blood buffers

(2) *Respiratory Centre*

- Describe how pH is regulated by the respiratory center. _____

(3) *The Kidneys* – slower acting than the first two, but have a more powerful effect on pH

- For sake of simplicity we can think of the kidneys as reabsorbing _____ _____ from the tubular fluid and excreting excess _____ into the urine (when the blood is too acidic).
- Name two other means of buffering
  - _____
  - _____

13.4 Disorders of the Urinary System pages 422 - 425

17. Many major illnesses that affect other parts of the body can also cause serious kidney disease. Most tend to damage the nephrons resulting in decreased filtration and eventual kidney failure. Name some of the illnesses that can affect the kidneys.
    - _____
18. What is one of the first signs of kidney damage? _____
19. Complete the table. Your knowledge of the disorders will not be tested but rather is provided for interest.

Disorder	**Description**
Disorders of the Kidneys	
	Infection of the kidneys. Where do most infections spread from?
	Hard granules that form in the renal pelvis (composed of calcium, phosphate, uric acid, and protein).
	Urea and other waste products accumulating in the blood due to more than _____ of the nephrons being destroyed.
Disorders of the Urinary Bladder and Urethra	
	Results from bacteria gaining access to the bladder. Why is this condition more prevalent in women than men?
	Inflammation of the bladder
	Inflammation of the urethra
	Most commonly occur as a result of another condition that interferes with normal urine flow.
	Most common type of cancer of the urinary system. If the organ needs to be removed, where are the ureters re-routed?

20. Explain the process of **hemodialysis**. _____

Chapter Questions — pages 432 - 435

1. _____	7. _____	13. _____	19. _____
2. _____	8. _____	14. _____	20. _____
3. _____	9. _____	15. _____	21. _____
4. _____	10. _____	16. _____	22. _____
5. _____	11. _____	17. _____	23. _____
6. _____	12. _____	18. _____	24. _____

25. Identify the part of the nephron as described.

a. _____	i. _____
b. _____	j. _____
c. _____	k. _____
d. _____	l. _____
e. _____	m. _____
f. _____	n. _____
g. _____	o. _____
h. _____	

26. Explain the connection between the urinary system and the following systems

a. nervous system _____

b. digestive system _____

c. endocrine system _____

d. lymphatic system _____

e. circulatory system _____

f. respiratory system _____

g. reproductive system _____

27. Which of the statements describes the function of the kidneys? (yes or no)

a. _____ d. _____ g. _____ j. _____

b. _____ e. _____ h. _____

c. _____ f. _____ i. _____

29. Compare and contrast aldosterone and ADH

	Aldosterone	**ADH**
Type of molecule		
Origin		
Where it works		
Regulation		

30. Path of blood of red blood cell:

renal artery → _____ → _____ → _____

→ _____ → renal vein

32. _____

_____

39. _____

_____

40. _____

_____

45. _____

_____

51. _____

_____

52. _____

_____

53. _____

_____

57. _____

_____

Mark the review questions using the answer key on pages 550 - 552