

## Excretory System Problem Set

Biology 12

Name: \_\_\_\_\_

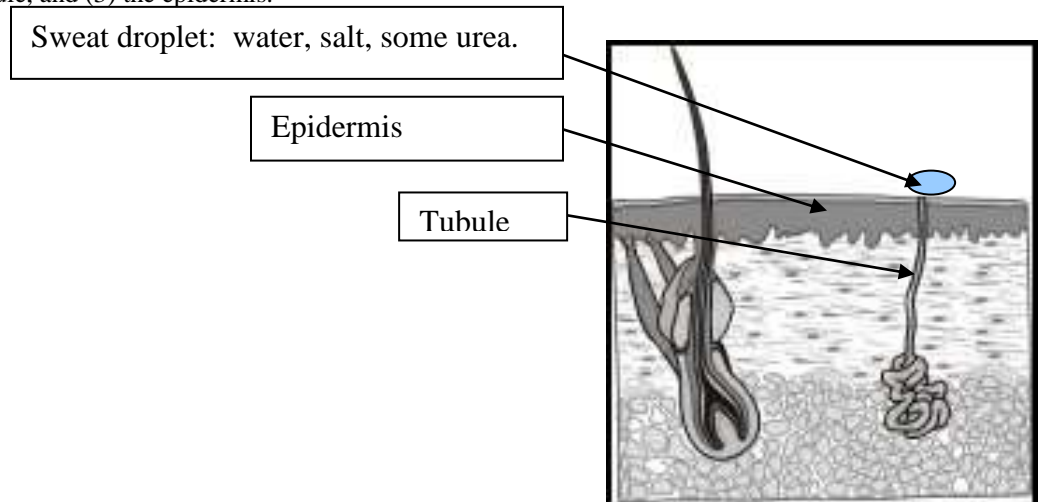
Johnston

Date: \_\_\_\_\_

1. What is the difference between excretion and secretion?
  - EXCRETION IS REMOVAL OF METABOLIC WASTES (WASTES FROM CELLS)
  - SECRETION IS WHEN A CELL PUTS OUT ONE OF ITS PRODUCTS (NOT A WASTE) FOR EXAMPLE: SWEAT IS A SECRETION TO CAUSE BODY COOLING, OIL IS A SECRETION TO HELP PROTECT SKIN / HAIR. (THERE IS SOME WASTE EXCRETED WITH SECRETED SWEAT, HOWEVER).
2. What is the difference between defecation and excretion?
  - DEFECATION IS THE REMOVAL OF DIGESTIVE WASTES
3. List 4 organs that excrete substances and the substances they excrete. Also state which organ system each is a part of.

ORGAN	SUBSTANCE	SYSTEM
SWEAT GLAND	UREA	SKIN
LIVER	BILE PIGMENTS	DIGESTIVE
LUNGS	CO <sub>2</sub> AND WATER	RESPIRATORY
KIDNEYS	UREA, CREATININE, URIC ACID, SALTS, SODIUM, POTASSIUM, MAGNESIUM, CALCIUM, CHLORIDES, SULFATES, PHOSPHATES, BICARBONATE.	URNARY

4. What ions do our bodies excrete?
  - HYDROGEN, SODIUM, POTASSIUM, MAGNESIUM, CALCIUM, CHLORIDES, SULFATES, PHOSPHATES, BICARBONATE.
5. The above ions are vital to life. Why do our bodies excrete them?
  - POTASSIUM IS SOMETIMES EXCRETED TO HELP MAINTAIN BLOOD VOLUME / BLOOD PRESSURE.
  - HYDROGEN IONS AND AMMONIA ARE EXCRETED TO MAINTAIN BLOOD Ph
  - OTHER IONS ARE EXCRETED BECAUSE THEY ARE IN EXCESS
6. Why do we excrete water when our bodies need it so much? It would appear to be a waste of energy to drink so much water only to pass it out of our bodies again.
  - MOSTLY BECAUSE OUR BODIES ARE NOT ABLE TO EXCRETE OUR NITROGENOUS WASTE (UREA) AS URIC ACID PASTE. IF WE PRODUCE URIC ACID IN OUR BODIES IT PRECIPITATES OUT OF THE PLASMA AND COLLECTS AS CRYSTALS IN OUR JOINTS CAUSING PAINFUL GOUT. THE WATER DILUTES OUR WASTES LEAVING OUR KIDNEYS.
7. Make a detailed diagram of a sweat gland excreting a droplet of sweat. Label the following 3 things: (1) What the sweat droplet contains, (2) the tubule, and (3) the epidermis.



8. Urine is yellow because ...
  - ...SOME OF THE MOLECULES WE EXCRETE ARE YELLOWISH. NO REAL PURPOSE TO IT BEING YELLOW.
9. How come the colour of urine can vary from day to day?
  - IT VARIES WITH THE AMOUNT OF WATER WE ARE EXCRETING...THE COLOUR GETS DILUTED IF THERE IS MORE WATER.
10. How does urine get from your kidneys to the outside world?
  - 1<sup>ST</sup> = KIDNEY → BLADDER THROUGH URETER, THEN BLADDER → OUTSIDE THROUGH URETHRA
11. Why do animals have a bladder?
  - TO STORE URINE UNTIL IT IS CONVENIENT TO GET RID OF IT. IT'S NOT A GOOD IDEA TO 'DRIP' URINE AT ALL TIMES WHICH IS WHAT WOULD HAPPEN IF NO BLADDER.
12. What is the difference between a ureter and a urethra? (Make up a mnemonic [memory trick] to remember which is where).
  - URETER JOINS KIDNEY TO BLADDER, URETHRA JOINS BLADDER TO OUTSIDE
13. Why do males and females have different urethras? What is this difference?
  - MALE URETHRA IS LONGER. FEMALE BLADDER SITS LOWER TO ACCOMMODATE UTERUS, SO URETHRA IS SHORTER, MALE URETHRA LONGER BECAUSE IT EXTENDS OUTSIDE THE BODY.
14. How do you know when your bladder needs emptying?
  - STRETCH RECEPTORS IN THE WALL OF THE BLADDER SEND SIGNALS ALONG NERVES TO YOUR BRAIN THAT TRIGGER THAT 'FEELING' THAT YOU NEED TO URINATE.
15. Sketch or trace a kidney in cross section. Label all parts and include some kidney stones (in the correct place). Also detail the chemical composition of the kidney stones.
  - YOU HAVE SEVERAL DIAGRAMS TO TRACE AND LABEL. KIDNEY STONES OCCUR IN THE PELVIS. COMPOSITION OF KIDNEY STONES: URIC ACID, CALCIUM CARBONATE OR CALCIUM OXALATE, MAGNESIUM AMMONIUM PHOSPHATE HEXAHYDRATE AND SOMETIME CALCIUM PHOSPHATE. (Superb! photos at: <http://www.herringlab.com/photos/>)
16. Summarize the differences between Bowman's capsule and the glomerulus.
  - BOWMAN'S CAPSULE IS LIKE A FUNNEL SURROUNDING THE GLOMERULUS AND IS NOT A CAPILLARY OR PART OF THE CIRCULATORY SYSTEM. BC IS MADE OF DIFFERENT TYPE OF TISSUE. NEVER CARRIES BLOOD, JUST FILTRATE THAT LEFT THE BLOOD.
  - GLOMERULUS IS A CAPILLARY NET AND THUS PART OF CIRC SYST CARRYING BLOOD. GLOMERULUS IS INSIDE OF BOWMAN'S CAPSULE.
17. Summarize the differences between glomerular capillaries and capillaries found throughout the rest of your body.
  - GLOMERULAR CAPS FORM A NET OR BULB OR ROUND KNOT INSIDE OF BOWMAN'S CAPSULE. OTHER CAPILLARIES ARE LINEAR IN NATURE.
  - GLOMERULAR CAPS HAVE HIGHER BLOOD PRESSURE THAN REGULAR BODY CAPS.
  - JOB OF BODY CAPILLARIES IS TO RELEASE OXYGEN AND NUTRIENTS TO TISSUES and GATHER CO<sub>2</sub> AND WASTES FROM TISSUES.
  - GLOMERULAR CAPS JOB IS TO KEEP IN LARGE MOLECULES AND BLOOD COMPONENTS WHILE RELEASING SMALL MOLECULES AND WASTES INTO "FUNNEL" THAT IS BOWMAN'S CAPSULE.
18. List, in order, the parts of the nephron.
  - BOWMAN'S CAPSULE – PROXIMAL CONVOLUTED TUBULE – DESCENDING LIMB OF LOOP OF HENLE – ASCENDING LIMB OF LOOP OF HENLE – DISTAL CONVOLUTED TUBULE – COLLECTING DUCT.
19. Compare and contrast what happens to glomerular filtrate in the proximal convoluted tubule versus the distal convoluted tubule.

PROXIMAL		DISTAL	
<ul style="list-style-type: none"> <li>• SELECTIVE REABSORPTION OF WATER, GLUCOSE, AMINO ACIDS, AND SALTS <b>BACK INTO BLOOD.</b></li> </ul>	<ul style="list-style-type: none"> <li>• IN SAME PART OF KIDNEY – THE CORTEX.</li> <li>• REABSORPTION OF WATER (ENTIRE NEPHRON DOES THIS).</li> </ul>	<ul style="list-style-type: none"> <li>• ACTIVE TRANSPORT OF URIC ACID, CREATININE, HYDROGEN IONS, AMMONIA, PENICILLIN <b>OUT OF BLOOD.</b></li> </ul>	

20. Compare and contrast what happens in the descending versus the ascending portions of the loop of Henle.

DESCENDING		ASCENDING
<ul style="list-style-type: none"> <li>• WATER DIFFUSES OUT</li> <li>• SODIUM DIFFUSES IN</li> </ul>	<ul style="list-style-type: none"> <li>• IN SAME PART OF KIDNEY – THE MEDULLA (PYRAMID)</li> </ul>	<ul style="list-style-type: none"> <li>• IMPERMEABLE TO WATER</li> <li>• ACTIVE TRANSPORT OF SODIUM OUT.</li> </ul>

21. Which parts of the nephron are in the cortex of your kidney? Which parts are in the medulla?

- CORTEX: GLOMERULUS, BOWMAN’S CAPSULE, PROXIMAL CONV TUBULE, DISTAL CONV TUBULE, SOME OF PERITUBULAR CAP NETWORK.
- MEDULLA: LOOP OF HENLE, COLLECTING DUCT, SOME OF PERITUBULAR CAP NETWORK.

22. Which cells of your nephron require the most energy? How are these energy needs met?

- CELLS WHICH ARE ACTIVELY TRANSPORTING ... NEEDS MET BY THE MANY MITOCHONDRIA IN THESE CELLS.

23. Explain countercurrent exchange as it happens in excretion. (Where does it occur? What is happening?)

- OCCURS IN THE LOOP OF HENLE. THE ‘CURRENT’ OF FLUID INSIDE THE LOOP FLOWS PAST ITSELF IN OPPOSITE DIRECTIONS. THE PURPOSE OF THIS IS TO DRAW THE MOST WATER POSSIBLE OUT OF THE LOOP.
- WATER GOING DOWN THE LOOP IS DRAWN OUT BY OSMOSIS DUE TO THE HIGH CONCENTRATION OF SODIUM IN THE TISSUES OF THE PYRAMID. THE ASCENDING LOOP IS NOT PERMEABLE TO WATER AND IS ACTIVELY TRANSPORTING SODIUM OUT IN ORDER TO INCREASE SODIUM CONCENTRATION IN THE TISSUES (AND CAUSE THE WATER TO LEAVE THE DESCENDING LIMB).

24. If the people participating in the 30-hour-famine stop drinking water (and all other fluids) as well as not eating ... (a) What could happen to their blood volume and why? (b) How will their bodies compensate for this?

- BLOOD VOLUME WILL GO DOWN AS THEIR KIDNEYS CONTINUE TO FILTER THEIR BLOOD AND SOME WATER IS TO THIS. THEY KEEP URINATING.
- COMPENSATE BY:
  1. LOW BLOOD VOLUME DETECTED BY POSTERIOR PITUITARY AND IT SECRETES **ANTIDIURETIC HORMONE**. **ADH** INCREASES PERMEABILITY OF COLLECTING DUCT THUS MORE WATER LEAVES THE DUCT AND RE-ENTERS THE PERITUBULAR CAPILLARY NETWORK. MORE WATER IN THE BLOODSTREAM = HIGHER BLOOD VOLUME.
  2. JUXTAGLOMERULAR APPARATUS IN AFFERENT ARTERIOLE DETECTS LOW BLOOD PRESSURE (BP DROPS IF BLOOD VOLUME DROPS) AND SECRETES RENIN. RENIN CAUSES ANGIOTENSINOGEN INTO ANGIOTENSIN I. ANGIOTENSIN I, WHEN IT GETS TO LUNGS, CHANGES INTO ANGIOTENSIN II. ANGIOTENSIN II, CAUSES VASOCONSTRICTION ALL OVER THE BODY AND WHEN IT GETS TO KIDNEYS, CAUSES THE ADRENAL CORTEX TO REALEAS **ALDOSTERONE**. ALDOSTERONE CAUSES REABSORPTION OF SODIUM IONS INTO THE BLOOD AT THE DISTAL CONV TUBULE AND THE EXCRETION OF POTASSIUM IONS. THIS INCREASE OF SODIUM IONS IN BLOOD CAUSES MORE WATER TO OSMOSE BACK INTO THE BLOOD. MORE WATER IN THE BLOODSTREAM = HIGHER BLOOD VOLUME.

25. The blood volume problem experienced in question 24 could also lead to a blood pressure problem. (a) What could happen to their blood pressure? Why? (b) How would your excretory system react to this?

- BLOOD PRESSURE DROPS AS BLOOD VOLUME DROPS.
- EXCRETORY SYSTEM REACTS IN SAME WAY AS IT DOES TO LOW BLOOD VOLUME. (ALDOSTERONE AND ADH).

