Part I. Multiple Choice. 2 Points each (26 points total).

1. Which ONE of the following is FALSE regarding the pressures that contribute to the glomerular filtration rate (GFR)?
   A. Glomerular capillary blood pressure favors filtration
   B. Plasma protein osmotic pressure opposes filtration
   C. Hydrostatic pressure in Bowman’s capsule favors filtration
   D. Net pressure (add them all up) favors filtration

2. If blood pressure drops slightly, and the GFR is therefore slightly reduced, autoregulation of GFR takes place by tubuloglomerular feedback. Which ONE of the following best describes this process?
   A. JGA senses the increase in tubule fluid, releases renin, which causes GFR to increase back up to normal
   B. JGA senses the decrease in tubule fluid and releases a vasoconstrictor, which causes GFR to increase back up to normal
   C. JGA senses the decrease in tubule fluid and releases a vasodilator, which causes GFR to increase back up to normal
   D. JGA senses the decrease in tubule fluid and releases renin, which causes GFR to increase back up to normal

3. What properties of the loop of Henle allow countercurrent multiplication to occur and result in the osmotic gradient in the interstitial fluid of the kidney medulla? Circle TWO (2) of the following.
   A. Descending loop is permeable to water, and does not pump Na+
   B. Ascending loop is not permeable to water, but pumps Na+
   C. Descending loop is not permeable to water, but pumps Na+
   D. Ascending loop is permeable to water, and pumps Na+

4. If a cell is in a solution that is hypertonic, that cell will
   A. Swell
   B. Shrink
   C. Stay the same size
   D. Divide
Which ONE of the following is FALSE regarding the function of cholecystokinin (CCK)?

A It inhibits gastric emptying  
B It stimulates secretion of pancreatic enzymes  
C It stimulates secretion of gastric juices  
D It stimulates bile release

Which ONE of the following best describes the digestive function of trypsin?

A Proteins ➔ peptides  
B Disaccharides ➔ monosaccharides  
C Peptides ➔ amino acids  
D Starch ➔ disaccharides

Which ONE of the following best describes the digestive function of pancreatic amylase?

A Proteins ➔ peptides  
B Starch/Glycogen ➔ disaccharides  
C Peptides ➔ amino acids  
D Starch ➔ disaccharides

Which ONE of the following is FALSE regarding the effect of insulin on liver metabolism?

A promotes glycogen synthesis  
B promotes protein synthesis  
C promotes synthesis of glucose from amino acids (gluconeogenesis)  
D promotes conversion of excess amino acids and glucose into fatty acids

Which ONE of the following is FALSE regarding the effect of insulin on other tissues?

A in adipose tissue, promotes the breakdown of triglycerides into fatty acids  
B in muscle, promotes uptake of glucose and amino acids  
C in all tissues, promotes glucose uptake  
D in muscle, promotes the synthesis of glycogen from glucose

Which ONE of the following is NOT required for spermatogenesis?

A Sertoli cells  
B Prostate fluid  
C testosterone  
D a temperature slightly lower than body temperature
11. Which ONE of the following is FALSE regarding male tropic hormones?

A. Increase in GnRH at puberty stimulates the release of LH and FSH
B. FSH acts on Leydig cells to regulate testosterone secretion
C. Testosterone regulates LH secretion by negative feedback
D. Sertoli cells secrete inhibin which regulates FSH secretion by negative feedback

12. Which ONE of the following is FALSE regarding fertilization and the initial stages of development?

A. The acrosome reaction allows the sperm to digest the corona radiata and the zona pellucida
B. The cortical reaction involves depolarization of the ovum and Ca++ entry
C. The morula uses glycogen as an energy source
D. The trophoblast becomes the embryo; the blastocyst becomes the placenta

13. Which ONE of the following is FALSE regarding placental hormones?

A. The synthesis of progesterone is delayed because the fetal adrenal cortex provides the precursor, DHEA
B. Human chorionic gonadotropin (hCG) prolongs the life of the corpus luteum
C. Estriol stimulates growth of the uterus
D. Human chorionic somatomammotropin (hCS) inhibits the effects of insulin on the mother

Part II. Short Answer. 3 Points each (63 points total).

14. The “Three Basic Renal Processes” are: ______________ _
_________________
(I usually add a fourth: “Concentration”).

15. The steroid hormone aldosterone works by binding to _______________ (nuclear or cell surface) receptors in kidney tubule cells and causing more _______________ (water channels or Na+/K+ ATPase pumps) to be added to the cell membrane. This promotes _______________ of Na+.

16. To eliminate toxins and other nasties using the kidneys, the liver must first convert them into _______________ so that they can be secreted by kidney tubule cells into the urine.

17. Anti-diuretic hormone (ADH), also known as _______________ is released by the hypothalamus and causes the collecting tubule to become _______________ (more or less) permeable to water. The effects of ADH can be inhibited by the commonly ingested drug, _______________
18. In the diagram (below, left), show where intracellular fluid (ICF), extracellular fluid (ECF), plasma, and interstitial fluid are located. Which one of these is regulated by the kidneys?

19. This diagram (above, right) shows cells lining the proximal tubule of the kidney, regulating acid/base balance. What is the name of the enzyme labeled X in diagram? Where did the HC03- in the tubules come from?

20. If the plasma is too acidic, the tubules will increase secretion of (Y in diagram), and increase reabsorption of (Z in diagram).

21. Name the three mechanisms for maintaining acid/base balance, in the order in which they are used.

22. Suppose a person holds their breath for a while. What effect will this have on blood chemistry? Will plasma become more acidic or more basic?

23. Lactase is a brush-border enzyme that digests lactose into the monosaccharides glucose and galactose. Name one other brush-border enzyme and its function.

24. Why are pancreatic proteolytic enzymes secreted in an inactive form?

25. What is the function of segmentation in the small intestine?

26. What would happen to a lactose-intolerant person after drinking a glass of milk? Describe one symptom and why it would occur.

27. The fasting state is characterized by low levels of the pancreatic hormone and high levels of the pancreatic hormone.
28. During a prolonged fast, the liver converts fatty acids to ____________ which the brain can use in addition to its usual fuel, ____________

29. What hormone prevents hypoglycemia (low blood glucose) during assimilation of a very high protein meal? ____________

30. The “animal energy equation”: INPUT = OUTPUT What is the sole source of energy input? ________________ Heat is the major energy output. Name 2 others.

31. Name one component of semen (besides sperm) ________________ Where did this component originate (which male accessory organ?) ________________ What is the function of this component? ________________

32. In a nonpregnant female, progesterone is synthesized by the ________________; in a pregnant female, it is also synthesized by the ________________

33. In the diagram below, which steroid hormone is dominant during the follicular phase (dotted line)? ________________ Which steroid hormone is dominant during the luteal phase (solid line)? ________________

34. Which tropic hormone triggers ovulation? ________________ There is a fairly high level of estradiol during the luteal phase. Why isn’t there another LH surge?

![Diagram of hormone levels](image)
Part III. Describe/Illustrate. 7 Points each (21 points total).

35. Choose one of the following. Please circle your choice.

A  Describe (and use an illustration) Na+ dependent secondary active transport as a mechanism for reabsorbing glucose from the kidney tubules.
B  Describe (and use an illustration) either the primary positive regulation system that promotes Na+ retention OR the negative regulation system that reduces Na+ retention.

36. Choose one of the following. Please circle your choice.

A  Describe the effects of insulin deficiency (type I diabetes) on carbohydrate metabolism and how this could lead to death.
B  Describe (and draw) a feedback mechanism for regulating gastric emptying. Indicate whether you are describing a mechanism that will increase or decrease the rate of emptying. Include the hormones involved.

37. Choose one of the following. Please circle your choice.

A  Describe the positive feedback cycle involved in the first stage of labor (cervical dilation), include the major hormone involved.
B  Describe the physiology of erection as a spinal reflex. Include the "neurotransmitter" that is involved.