THE UNIVERSITY OF WESTERN ONTARIO
Physiology 2130 650-Introduction to Human Physiology
Distance Studies
Final Exam - Summer 2015
Date: July 2015
Format: 2 hours Multiple Choice Exam; Version 1

DIRECTIONS FOR COMPLETING THE ANSWER SHEET

Using a **PEN** for your signature, and a **PENCIL** for all other information.

Print your name, the course name (Human Physiology) and the course number (2130).

Under the heading **STUDENT NUMBER**, **record all 9 digits of your student number**. FILL IN THE OVAL UNDER THE NUMBERS COMPLETELY!

The **SECTION** number is **213.** The digits and ovals must be filled in underneath the section number.

The **CODE,** enter **001.**

To answer the multiple choice questions, use an HB pencil to completely fill the ovals on the answer sheet. Use a white nylon eraser to entirely remove any mistakes.
Calculators are permitted.

QUESTION BOOKLET

Please make sure that this booklet contains **60 questions** (17 page sides, including front page).

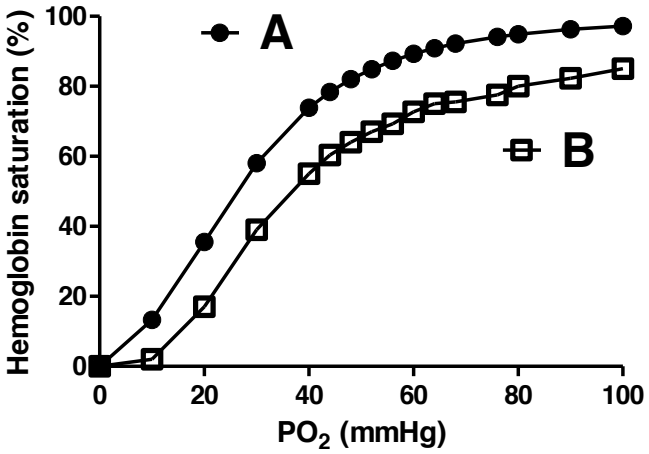
Hand in this booklet (with your name signed below), along with the scantron sheet, when you have completed the exam.

NAME: _____ SIGNATURE: _____
(PLEASE PRINT)

DIRECTIONS: Each of the questions or incomplete statements below is followed by four suggested answers or completions. Select the ONE that is BEST in each case and blacken the appropriate space on the Scantron sheet.

Questions	ans	owner
1. Which of the following statement about the alveolar-capillary barrier (respiratory membrane) is **FALSE**? A. There is a very large alveolar surface area B. The pressure gradients drive gas diffusion C. The total cross-sectional area of the pulmonary capillaries is very large D. The velocity of the blood in the pulmonary capillaries is very fast	D	
2. An unknown disease has affected a patient leaving him with intact alveolar walls; however his alveoli completely lack alveolar epithelial type II cells. What do you expect to observe in this patient? A. No significant changes as the alveolar walls are still intact B. Lungs will be difficult to inflate (let air in) due to low lung compliance C. Increased arterial oxygenation due to improved gas exchange D. Lungs will be difficult to deflate (let air out) due to high lung compliance	B	
3. Which of the following statements about gas exchange and transport at the tissue is **TRUE**? A. Upon entering the tissue capillaries (arterial end), blood PO_2 is 46mmHg and oxygen diffuses from the blood to the tissue B. At the tissue capillaries, bicarbonate ions enter the red blood cell (chloride shift) and it is converted to CO_2 by the carbonic anhydrase C. As blood leaves the tissue capillaries (venous end), blood PO_2 is 40mmHg and some carbamino hemoglobin has been generated D. As blood leaves the tissue capillaries (venous end), blood PCO_2 is 46mmHg and hemoglobin is about 97% saturated	C	
4. Given the following parameters for a subject, calculate the subject's alveolar ventilation (V_A): Tidal volume = 600 ml Vital capacity = 6000 ml Respiratory rate = 12 breaths/min Body weight = 170lb A. 7200 ml/min B. 5160 ml/min C. 7030 ml/min D. 2640 ml/min	B	

DIRECTIONS: **Each of the questions or incomplete statements below is followed by four suggested answers or completions. Select the <u>ONE</u> that is <u>BEST</u> in each case and blacken the appropriate space on the Scantron sheet.**

Questions	ans	owner
5. Eureka! You have just synthesized hemoglobin in the lab, although somehow you realize that the heme group is missing the iron (Fe) atom. How will this affect your synthetic hemoglobin? A. The globin molecules will not be able to interact with the heme groups B. More carbon dioxide will bind to the heme group (increased affinity) C. Oxygen will not be able to dissociate from the synthetic hemoglobin D. The synthetic hemoglobin cannot transport oxygen	D	
6. In the figure below, curve A and curve B represent oxygen-hemoglobin dissociation curves. Curve A was obtained at a body temperature of 37C, and blood pH of 7.4. Which of the following statement about curve B is **FALSE**?  A. The hemoglobin in curve A has an overall greater affinity for oxygen than the hemoglobin in curve B B. An increased pH caused the right shift in curve B compared to curve A C. For the same PO_2, more oxygen is unloaded from hemoglobin in the case of curve B, compared to curve A D. An increase in body temperature caused the right shift in curve B compared to curve A	B	

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Questions	ans	owner
7. Given the following values for a subject: Tidal Volume = 500 mL Total Lung Capacity = 6200 mL Residual Volume = 1500 mL Inspiratory Reserve Volume = 2700 mL Which of the following represents the subject's Inspiratory Capacity? A. 5700 mL B. 4700 mL C. 4200 mL D. 3200 mL	D	
8. A patient is hyperventilating while having a panic attack. Which of the following will most likely occur? A. Vasodilation and decreased H^+ concentration B. Decreased PCO_2 and increased H^+ concentration C. Vasoconstriction and respiratory alkalosis D. More oxygen is unloaded from the hemoglobin molecule at the tissues	C	
9. Which of the following statements is **CORRECT**? A. Central chemoreceptors are sensitive to pH changes in the interstitial space of the medulla B. The inspiratory and expiratory centers are directly sensitive to changes in PO_2 and PCO_2 C. Peripheral chemoreceptors are located in the aortic arch and in the brainstem D. Ventilation is spontaneous (involuntary), and there is no voluntary control of ventilation	A	

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Questions	ans	owner
10. Starting from the vessels going TO the nephron, and ending with the vessels coming OUT of the nephron, which of the following is the **CORRECT** order of renal blood flow? i) Peritubular capillaries ii) Renal artery iii) Afferent arteriole iv) Efferent arteriole v) Glomerulus vi) Renal vein A. vi, iii, v, iv, i, ii B. ii, iii, v, iv, i, vi C. ii, iv, v, iii, i, vi D. i, ii, iii, v, iv, vi	B	
11. You are analyzing the glomerular filtrate collected from experimental animals and, among other substances, large proteins can be found in this glomerular filtrate. What does this finding suggest about glomerular filtration? A. The colloid osmotic pressure in the glomerular capsule is zero B. The process of filtration has occurred as usual in a healthy nephron C. The glomerular capillaries and the filtration slits of the podocytes are damaged D. Large proteins are usually filtered and then reabsorbed at the proximal tubule	C	
12. Given the following data: Body weight = 190 lb Glomerular filtration rate (GFR) = 150 L/day Na^+ plasma concentration = 6 g/L Amount of water excreted = 1.2 L Amount of Na^+ reabsorbed = 565 g/day Calculate the amount of Na^+ excreted in the urine (in g/day). A. 279 g/day B. 307 g/day C. 335 g/day D. 363 g/day	C	

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Questions	ans	owner
13. A patient presents with glucose in his urine, and this symptom leads you to a quick diagnosis. Which of the following statements is **FALSE** about this patient's condition? A. Their blood glucose concentration and glucose filtered load are higher than normal B. They would become dehydrated due to a decrease in water reabsorption and increased urine volume C. The Na^+/glucose co-transporters along the nephron are saturated D. The Na^+/K^+ pumps on the luminal side of the membrane are not working properly	D	
14. Which of the following concerning the concentration (osmolality) of the filtrate throughout the renal tubule is **CORRECT**? A. At the collecting duct, the final concentration of the filtrate is affected by antidiuretic hormone (ADH) B. At the end of the descending limb of the loop of Henle (deep into the medulla) the filtrate has a concentration around 100 mOsm/kg water C. At the proximal tubule, the osmolality of the filtrate is affected by the hormone aldosterone D. The concentration of the filtrate at the end of the ascending limb of the loop of Henle is about 1200 mOsm/kg	A	
15. Which of the following statements about tubular Na^+/K^+ pumps in the nephron is **CORRECT**? A. They are found on the luminal side (close to the lumen of nephron) of the tubule cells B. They generate the concentration gradient necessary to power the Na^+/H^+ exchanger C. They are only found in the proximal convoluted tubule D. They are a form of secondary active transport	B	
16. The Na^+/H^+ exchanger: A. It is located on the basolateral side of the tubule cells membrane B. It makes the urine pH more alkaline C. It is moves Na^+ ions OUT of the cell, and H^+ ions IN D. Its activity can be increased by angiotensin II	D	

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Questions	ans	owner
17. You noticed that your friend has barely drunk any water all day, and now he is eating a bag of very salty chips! What do you think it is happening in his body? A. More aquaporin channels will be inserted in the luminal membrane of the late distal convoluted tubule and collecting duct B. The activity of the Na^+/H^+ exchanger will be increased at the proximal tubule and ascending loop of Henle C. More K^+ channels will be inserted in the luminal membrane of the late distal convoluted tubule and collecting duct D. The osmoreceptors in the hypothalamus will swell	A	
18. Which of the following statements about aldosterone is **FALSE**? A. Its receptor is found in the cytoplasm of the tubule cells B. It increases the activity of the Na^+/K^+ pump at the late distal convoluted tubule and collecting duct C. It is released in response to high K^+ levels, Angiotensin II, or adrenocorticotropic hormone D. It induces synthesis and insertion of new K^+ channels into the basolateral side of the tubule cell membrane	D	
19. Damage to the Na^+/H^+ exchanger and to the H^+-ATP pump of the kidney will most likely affect: A. The filtration of H^+ ions from volatile acids B. The reabsorption of H^+ ions from the filtrate C. The secretion of H^+ ions from non-volatile acids D. The excretion of Na^+ ions into the filtrate	C	
20. The solution you prepared in the lab turns out to have the wrong pH! Your solution has a pH= 5.5, but it should have a neutral pH. Which of the following would you use to adjust the pH? A. Sulfuric acid B. Hydrochloric acid C. Lactic acid D. Bicarbonate ion	D	

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Questions	ans	owner
21. A patient has been affected by severe and prolonged vomiting. You decide to check the pH of his body fluids (i.e. blood), what do you expect to find? A. Metabolic alkalosis B. Respiratory acidosis C. Respiratory alkalosis D. Metabolic acidosis	A	
22. Which of the following statements about bicarbonate ions reabsorption is **TRUE**? A. Bicarbonate ions enter the tubule cells through the chloride shift B. Bicarbonate ions reabsorption requires the help of carbonic anhydrase C. At the proximal tubule, for each bicarbonate ion reabsorbed two H+ ions will be secreted D. At the collecting duct, the bicarbonate ions are reabsorbed from the filtrate	B	
23. You have discovered an unknown hormone, and notice that this hormone circulates in the blood only bound to a protein carrier. Based on this information, which of the following statements about this hormone is **TRUE**? A. This hormone may have large concentrations in the blood B. The receptor for this hormone may activate a tyrosine kinase C. The receptor for this hormone may be cytoplasmic or nuclear D. This hormone may be a protein hormone	C	
24. In a general sense, hormones: A. Always need a receptor to exert their effects on a target cell B. Only act on target cells that are in very close proximity to where the hormone is released C. Are always bound to a protein carrier in the blood D. Are very fast acting and generate short term effects	A	
25. What is **THE SAME** between the anterior and posterior pituitary? A. They are both made of neural tissue B. They are both controlled by hypothalamic hormones C. They are both made of endocrine tissue D. They both release hormones into the circulation	D	

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Questions	ans	owner
26. Which of the following statements about the posterior pituitary is **TRUE**? A. It is made of axons and axon terminals of neurons whose cell bodies are in the thalamus B. Neurohormones from the posterior pituitary are secreted into the hypothalamic-hypophyseal portal system C. The posterior pituitary stores and secretes two neurohormones D. One of the neurohormones from the posterior pituitary can regulate sodium balance	C	
27. Without the hypothalamic-hypophyseal portal system: A. ADH or oxytocin would not be found in the systemic circulation B. Increased concentrations of corticotropin releasing hormone or GHRH would be found in the systemic circulation C. No cortisol, estrogen, or thyroid hormones would be found in the systemic circulation D. Increased concentrations of insulin or glucagon would be found in the systemic circulation	C	
28. Which of the following statements about the production of thyroid hormones T3 and T4 is **TRUE**? A. When thyrotropin releasing hormone binds to its receptor on the epithelial cells, T3 and T4 are secreted in the blood B. T3 and T4 can move freely inside the colloid, but cannot move freely in blood C. Thyroglobulin and iodine are both absorbed from the diet D. Iodine and tyrosine are combined together while on the backbone of a thyroglobulin glycoprotein	D	
29. A patient has the following symptoms: fast heart rate, sensitivity to warm temperatures, and an agitated, hyperactive behavior. Based on these symptoms, your patient has: A. Hypothyroidism B. Cushing's syndrome C. Hyperthyroidism D. Cretinism	C	

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Questions	ans	owner
30. Choose the **CORRECT** match concerning the structure and function of the adrenal gland: A. Zona glomerulosa – aldosterone secretion B. Adrenal medulla – cortisol secretion C. Zona fasciculata – androgens secretion D. Zona reticularis – epinephrine secretion	A	
31. Which of the following statements about cortisol is **FALSE**? A. Increased levels of cortisol lead to decreased ACTH and CRH levels B. Cortisol decreases gluconeogenesis in the liver C. Emotional stress can increase cortisol levels D. Once bound to cortisol, the cytosolic receptor moves to the nucleus	B	
32. If a disease were to eliminate all of the alpha cells of the pancreas, what would most likely happen? A. There would be no exocrine secretions B. The pancreas would not secrete any somatostatin C. During starvation, blood glucose would be severely low D. Following a meal, glycogen synthesis and lipogenesis would not occur	C	
33. What is DIFFERENT between type I and type II diabetes? A. The patient has glucose in their urine only in type II diabetes B. The patient experiences dehydration only in type I diabetes C. The patient has damaged blood vessels only in type II diabetes D. The patient experiences metabolic acidosis only in type I diabetes	D	
34. Which of the following statements about the fetal development of the reproductive system (reproductive tract and external genitalia) is **CORRECT**? A. At around 7 weeks, testicular cells in the male fetus release the Wolffian Inhibiting Hormone, and the Wolffian duct regresses B. The development of the reproductive system in the female fetus is not under hormonal control C. The development of the reproductive tracts and external genitalia in the male fetus does not require testosterone D. In the female fetus, the Mullerian duct regresses while the Wolffian duct differentiates into the Fallopian tube	B	

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Questions	ans	owner
35. Choose the **CORRECT** match between the structures of the male reproductive system and their description: A. Epididymis – site of spermatogenesis (sperm production) B. Vas (ductus) deferens – duct carrying the sperm from the seminal vesicles to the urethra C. Prostate – gland for sperm maturation and storage D. Seminal vesicles – vesicles contributing fluid to the semen and nourishment for the sperm	D	
36. Which of the following statements about Sertoli cells is **CORRECT**? A. They secrete inhibin, which negatively feeds back on the hypothalamus B. They are found in the interstitial space of the seminiferous tubules C. They form the blood-testis barrier D. They respond to LH and make testosterone	C	
37. If a doctor surgically blocks the fallopian tubes: A. Fertilization will not occur B. Ovulation will not occur C. Ejaculation will not occur D. Menses will not occur	A	
38. During the secretory phase of the menstrual cycle: A. Estrogen levels are at their maximum peak B. The follicular phase of the ovarian cycle occurs C. The lining of the uterus keeps developing in preparation for a possible pregnancy (implantation of the fertilized egg) D. Increased levels of progesterone are secreted by the granulosa and theca sells	C	

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Questions	ans	owner
39. Which of the following statements about the development of the follicle is **FALSE**? A. Before puberty, the primary follicle is made of a single layer of granulosa cells, a primary oocyte, and an antrum filled with fluid B. At puberty, the growing follicle develops an inner (close to the antrum) layer of theca cells, which secrete only androstenedione from cholesterol C. The corpus luteum is formed by the remnants (leftovers) of granulosa and theca cells left in the ovary D. At puberty, the granulosa cells of the maturing follicles secrete estrogen, and estrogen stimulates growth (replication) of the granulosa cells	B	
40. A woman in her late twenties seems to have some fertility problems. Following some analyses, her estrogen levels from day 7 to day 14 of her menstrual cycle appeared to be constantly low, and no ovulation occurred. What is most likely happening in this patient? A. The theca cells are not responding to FSH and do not produce enough androstenedione B. This phase of the menstrual cycle usually has high progesterone levels, and low estrogen levels C. The granulosa cells are not responding to LH and do not produce enough estradiol from androstenedione D. The low estrogen levels do not exert any positive feedback on the hypothalamus and anterior pituitary to stimulate the LH surge	D	
41. Which of the following is NOT a digestive enzyme? A. Amylase B. Colipase C. Maltase D. Trypsin	B	
42. Which of the following statements about carbohydrate digestion and absorption is **CORRECT**? A. The enzyme salivary amylase breaks down carbohydrates in the mouth first, and then in the stomach B. Intestinal glucose absorption requires a Na+/glucose ATPase on the luminal side of the cell membrane C. Enzymes in the brush border of the intestinal epithelial cells digest disaccharides to monosaccharides D. Glucose diffuses out of the intestinal epithelial cell via secondary active transport	C	

DIRECTIONS: Each of the questions or incomplete statements below is followed by four suggested answers or completions. Select the <u>ONE</u> that is <u>BEST</u> in each case and blacken the appropriate space on the Scantron sheet.

Questions	ans	owner
43. While at a summer festival, you stumble upon your favorite food truck! While you are looking at the delicious food choices, the smell is amazing. What is happening in your digestive system? A. The sympathetic nervous system is activated in anticipation of a meal B. Short loop reflexes involving the enteric nervous system are causing secretion of HCl C. There is an increased secretion of the hormone gastrin from the parietal cells D. The activity of the parasympathetic nervous system is increasing gastric motility	D	
44. Which of the following components of the small intestine is **NOT** correctly matched with its description? A. Brush border – the group of epithelial cells delimiting the border each villus B. Villus - a finger like protrusion of the intestinal folds C. Lacteals – lymphatic vessels found inside the villi D. Microvilli – small projections on the luminal surface of the epithelial cells	A	
45. Which one of the following statements about the roles of hydrochloric acid (HCl) in the digestive system is **FALSE**? A. HCl converts pepsinogen into the active enzyme pepsin B. HCl triggers the release of the hormone cholecystokinin C. HCl inactivates the salivary amylase D. HCl kills any bacteria ingested with food	B	
46. A person ate a meal rich in proteins and lipids. After the chime reaches the duodenum, which of the following will **NOT** occur? A. Insulin will be secreted from the beta cells of the pancreas B. Bicarbonate will be secreted into the duodenum of the small intestine to buffer the acidic chime C. The gallbladder will contract and emulsification will take place D. Gastric muscle contraction will increase and the chime will be let out of the pyloric sphincter more often	D	

DIRECTIONS: Each of the questions or incomplete statements below is followed by four suggested answers or completions. Select the ONE that is BEST in each case and blacken the appropriate space on the Scantron sheet.

Questions	ans	owner
47. Which one of the following statements about the basal electrical rhythms (BER) is **TRUE**? A. They always reach threshold, so that action potentials are fired and muscle contraction occurs B. They are only generated in response to a mechanical, hormonal, or nervous stimulus C. They travel from one smooth muscle cell to the other through gap junctions D. They have a faster frequency in the stomach and slower frequency in the duodenum	C	
48. What could be the consequences from the lack of colipase? A. The pancreatic lipase would not have access to the lipid droplets that are surrounded by bile salts B. No noticeable consequences, as the pancreatic lipase could digest lipids instead of the colipase C. There would be insufficient emulsification of the lipids D. There would be no activation of the pancreatic lipase	A	
49. Which of the following is **NOT** a segment of the small intestine? A. Duodenum B. Cecum C. Ileum D. Jejunum	B	
50. Your friend is exercising very hard, and the workout is really strenuous. In terms of metabolic reactions, what will happen in his muscles at first (before compensatory adjustments in blood flow and hemoglobin saturation)? A. Excess pyruvate from glycolysis will be converted and stored as acetyl-CoA B. Lots of ATP will be generated from pyruvate entering the citric acid cycle C. More than 2 ATP molecules will be generated from glycolysis to provide more energy D. Excess pyruvate from glycolysis will be converted into lactic acid	D	

DIRECTIONS: Each of the questions or incomplete statements below is followed by four suggested answers or completions. Select the ONE that is BEST in each case and blacken the appropriate space on the Scantron sheet.

Questions	ans	owner
51. You just had a nice meal. Which one of the following statements about the metabolism of nutrients after a meal is **FALSE**? A. Excess glucose will be converted into triglycerides in the muscle B. Blood levels of insulin will increase C. Amino acids will be converted into proteins used by the cells of the body D. There will be increased storage of glucose as glycogen in liver and muscle	A	
52. Which of the following statements about glucagon is **FALSE**? A. Glucagon increases the formation of new glucose molecules B. Glucagon increases lipolysis C. Glucagon increases the formation of new protein molecules D. Glucagon increases glycogenolysis	C	
53. Which of the following statements about glycolysis and the citric acid cycle is **FALSE**? A. Lactic acid can be converted to pyruvate and enter the citric acid cycle B. Triglycerides can be converted to Acetyl CoA and enter the citric acid cycle C. Amino acids can be converted to Acetyl CoA and enter the citric acid cycle D. Amino acids can be converted to pyruvate and enter glycolysis	B	
54. Your body needs to raise blood glucose levels, and needs to make new glucose molecules starting from amino acids. Which cells can do this? A. Any cell in the body, if needed B. Only muscle cells C. Only liver cells D. Only cells of the adipose tissue	C	

Answer Choice	A	B	C	D	E
Correct statement(s)	1,2,3	1,3	2,4	Only 4	All correct

Directions: **For each of the incomplete statements/questions below, <u>ONE</u> or <u>MORE</u> of the completions/answers given is/are correct.**

Answer:
(A) if only <u>1,2 and 3</u> are correct
(B) if only <u>1 and 3</u> are correct
(C) if only <u>2 and 4</u> are correct
(D) if only <u>4</u> is correct
(E) if <u>ALL</u> are correct

Questions	ans	owner
55. At rest, during quiet exhalation: 1) The alveolar pressure becomes lower than atmospheric pressure 2) The expiratory center of the medulla sends action potentials to the muscles 3) The abdominal and the internal intercostals muscles contract 4) The diaphragm and the external intercostals muscles relax	D	
56. Due to an unknown genetic condition, the juxtaglomerular cells of your patient DO NOT produce any of the enzyme called **renin**. Which of the following may be altered/ affected as a consequence of the lack of renin? 1) Vasoconstriction (to increase total peripheral resistance), in response to low blood pressure 2) Reabsorption of Na^+ ions at the proximal tubule and ascending loop of Henle, in response to low plasma Na^+ levels 3) Release of aldosterone, in response to low plasma Na^+ levels 4) The sense of thirst, when blood pressure is low	E	
57. For some strange reason, a patient has decided to eliminate all of the iodine from his diet. After a period of time without iodine in his diet, this patient is not feeling too well. What do you expect to observe in this patient? 1) High TRH levels 2) Reduced basal metabolic rate 3) High TSH levels 4) Reduced size of the thyroid gland	A	

Answer Choice	A	B	C	D	E
Correct statement(s)	1,2,3	1,3	2,4	Only 4	All correct

Questions	ans	owner
58. What is the SAME between spermatogenesis and oogenesis? 1) At puberty, both spermatogonia and oogonia divide by mitosis to replenish their own pool 2) In both spermatogenesis and oogenesis, mature sperm cells and eggs have only 23 chromosomes 3) In both spermatogenesis and oogenesis, the maturation of one primary spermatocyte or one primary oocyte leads to the generation of four spermatids or four oocytes, respectively 4) Both spermatogenesis and oogenesis rely on the anterior pituitary hormones, LH and FSH	C	
59. Which one(s) of the following statements about fat digestion and adsorption is/are **CORRECT**? 1) Lipids are emulsified in the stomach through churning and mixing, and bile keeps small droplets emulsified in the small intestine 2) Cholesterol molecules directly diffuse through the membrane of the intestinal epithelial cell 3) The pancreatic lipase breaks down lipids into monoglycerides and fatty acids 4) Chylomicrons generated in the smooth endoplasmic reticulum are secreted out of the intestinal cell and immediately released into the bloodstream	B	
60. A drug inhibits the Na^+/K^+ ATPase expressed on the basolateral side of the intestinal epithelial cell membrane. Which one(s) of the following would be affected? 1) Absorption of vitamins A, D, E, K 2) Absorption of vitamins B (B group) and C 3) Absorption of disaccharides 4) Absorption of amino acids	C	