Instructions
This exam consists of 50 questions. You may write on the exam itself, but be sure to answer all your questions on a “Scantron” sheet with a #2 pencil. For each question there is one response that is the best response. You must select the one best response to receive credit for each question.

Read all responses for a question before selecting your answer! I recommend that you first write your answers on the exam itself, then fill in the answers on the answer sheet. If you fill in a response on the answer sheet and wish to change your response, then be sure to completely erase the errant response.

Be sure to write your name on this exam booklet and on the answer sheet. Turn in both the exam booklet and answer sheet as you leave the testing center. If you believe that a question is written incorrectly, then attach a note to the front of this exam.
1. Mike has a tumor on one of his kidneys, and this kidney is producing abnormally high levels of kidney hormones. Otherwise, his kidneys are functioning normally. Which one of the following statements is most likely true as a result of the high levels of kidney hormones?
   a. Mike’s erythrocyte count is high.
   b. Mike’s erythrocyte count is low.
   c. Mike’s leukocyte count is high.
   d. Mike’s leukocyte count is low.

2. Which structure is found in the medulla of a kidney?
   a. renal pyramid
   b. fibrous capsule
   c. minor calyx
   d. major calyx
   e. renal pelvis

3. The __________ is found between the renal fascia and the fibrous capsule.
   a. renal papilla
   b. cortex
   c. perirenal fat capsule
   d. renal column
   e. renal sinus

4. The glomerular capsule and the glomerulus together make up the
   a. loop of Henle.
   b. renal corpuscle.
   c. nephron.
   d. collecting tubule system.
   e. renal capsule.

5. Consider a drop of blood flowing from the interlobar artery to the renal vein. Which one of the following lists places the blood vessels in the proper order? *(Note that the correct answer does not necessarily have all the structures, they just need to appear in the proper order.)*
   a. arcuate vein, cortical radiate artery, afferent arteriole, interlobar vein
   b. arcuate artery, glomerulus, arcuate vein, interlobar vein
   c. cortical radiate artery, efferent arteriole, afferent arteriole, interlobular vein
   d. arcuate artery, peritubular capillaries, glomerulus, interlobar vein
   e. segmental artery, afferent arteriole, peritubular capillary, interlobar vein.
6. As tubular fluid is formed, processed, and becomes urine, it flows through various structures. Which answer shows the structures in the proper order? *(Note that the correct answer does not necessarily have all the structures, they just need to appear in the proper order.)*

a. collecting duct, DCT, loop of Henle, PCT, major calyx
b. loop of Henle, PCT, DCT, collecting duct, ureter
c. PCT, DCT, collecting duct, loop of Henle, minor calyx
d. PCT, loop of Henle, DCT, collecting duct, urethra
e. None of the responses above is correct.

7. What is the first section of a renal tubule?

a. proximal convoluted tubule
b. distal convoluted tubule
c. loop of Henle
d. glomerulus
e. glomerular capsule

8. Which one of the following items is freely filtered into the nephron from the glomerulus?

a. albumin
b. erythrocyte
c. glucose
d. hemoglobin

9. Jim has been stranded in the desert without water for seven days. He is dehydrated, and his blood pressure has fallen to abnormally low levels. Which one of the following statements is most likely true?

a. The myogenic mechanism in Jim’s kidneys is constricting afferent arterioles to reduce GFR.
b. Jim’s sympathetic system is acting to cause dilation of afferent arterioles to increase GFR.
c. Aldosterone is acting on the glomerular capsules to make more dilute urine.
d. Angiotensin II is acting to constrict efferent arterioles and increase GFR.
e. Levels of aldosterone are low to stimulate release of water by the collecting ducts.

10. In the proximal convoluted tubule

a. sodium and potassium are actively secreted into the filtrate.
b. about 85% of glucose and amino acids are reabsorbed from the filtrate.
c. water is passively reabsorbed from the filtrate by osmosis.
d. solutes in the filtrate that are not reabsorbed diffuse into the filtrate.
e. H⁺ or HCO₃⁻ is secreted into the tubular fluid to regulate pH.
11. Secretion of HCO$_3^-$ into the filtrate
   a. increases the pH of the blood.
   b. decreases the pH of the blood.
   c. has no effect on the pH of the blood.

12. Caffeine and alcohol are both inhibitors of ADH. What effect will drinking caffeine or alcohol have on the collecting ducts?
   a. increased permeability to sodium
   b. decreased permeability to sodium
   c. increased permeability to water
   d. decreased permeability to water

13. As blood flows from an efferent arteriole to a cortical radiate vein, the amount of water in the blood
   a. increases.
   b. decreases.
   c. stays approximately the same.

14. Which chemical is used to adjust the amount of **obligatory** water reabsorption?
   a. renin
   b. aldosterone
   c. ADH
   d. All of these chemicals can adjust the amount of obligatory water reabsorption.
   e. None of these chemicals can adjust the amount of obligatory water reabsorption.

15. Which of the following chemicals may the body use to adjust the amount of facultative water reabsorption?
   a. renin
   b. aldosterone
   c. ADH
   d. All of these chemicals can adjust the amount of facultative water reabsorption.
   e. None of these chemicals can adjust the amount of facultative water reabsorption.
Answer questions 16 and 17 by selecting from the following responses:

a. creatinine
b. urea
c. uric acid
d. All of the responses above are correct.
e. None of the responses above is correct.

16. Which chemical is a waste product of RNA metabolism?

17. Which chemical is a waste product of protein metabolism?

18. When cells of the macula densa detect a low rate of flow in the distal convoluted tubule
a. they inhibit the release of ADH.
b. they promote dilation of the afferent arterioles.
c. they promote constriction of both afferent and efferent arterioles.
d. they inhibit reabsorption of sodium by the ascending limb of the loop of Henle.
e. None of the responses above is correct.

19. The layer of smooth muscle that causes emptying of the urinary bladder is the
a. muscularis mucosae.
b. external urethral sphincter.
c. plicae muscle.
d. detrusor muscle.
e. urogenital diaphragm.

20. The rugae of the urinary bladder
a. allow the bladder to expand.
b. cause contraction of the bladder.
c. allow increased absorption of materials by the bladder.
d. All of the responses above are correct.
e. None of the responses above is correct.

21. The distance between the internal urethral orifice and the external urethral orifice
a. is about the same in men and women.
b. is greater in a man than in a woman.
c. is greater in a woman than in a man.
22. The hypothalamus contains osmoreceptors, which monitor the concentration of solutes in the extracellular fluid of the hypothalamus. What is the most likely result when these osmoreceptors detect increasing concentrations of solutes?
   a. increased secretion of ADH
   b. decreased permeability of the collecting ducts to water
   c. increased secretion of sodium by the collecting ducts
   d. Responses “a” and “b” are both correct.
   e. Responses “b” and “c” are both correct.

23. If a person is suffering from chronic respiratory or metabolic acidosis, then there is likely to be
   a. increased secretion of renin by the kidneys.
   b. increased secretion of potassium by the distal convoluted tubules.
   c. increased secretion of H⁺.
   d. increased secretion of HCO₃⁻.
   e. increased secretion of water by the loops of Henle.

24. How many openings (total) are normally found in the urinary bladder?
   a. one
   b. two
   c. three
   d. four
   e. five

25. In a man, which structure may transport both urine and semen (but hopefully not at the same time!).
   a. ureter
   b. urethra
   c. ejaculatory duct
   d. ductus deferens
   e. urinary bladder

26. Which structure is a gonad?
   a. ovary
   b. scrotum
   c. prostate gland
   d. uterus
   e. More than one of the responses above is correct.
27. What structures enclose the ductus deferens, testicular arteries and veins, and nerves as they pass through the inguinal canal.
   a. seminal vesicles
   b. spermatic cords
   c. rete testes
   d. seminiferous tubules
   e. None of the responses above is correct.

28. Interstitial cells produce
   a. androgens.
   b. FSH.
   c. gonadotropin releasing hormone.
   d. testosterone.
   e. More than one of the answers above is correct.

29. In a man who has NOT been circumcised,
   a. the distal portion of the corpus spongiosum has been removed.
   b. the foreskin covers the corpus cavernosum.
   c. the prepuce covers the glans.

30. A midsagittal cut through the abdominopelvic cavity and the penis will show all of the following structures EXCEPT FOR the
   a. prostatic urethra
   b. vas deferens
   c. external urethral orifice
   d. penile urethra

31. Contraction of the ___________ draws the testes closer to the body wall.
   a. urogenital diaphragm
   b. spermatic cord
   c. superficial fascia
   d. cremaster muscle
   e. inguinal canal
32. Seminal plasmin is produced for the semen by the
   a. bulbourethral gland.
   b. epididymis.
   c. prostate gland.
   d. seminal vesicles.
   e. seminiferous tubules.

33. Semen contains __________ , which stimulates contractions in the uterus.
   a. fibrinogen
   b. fructose
   c. human chorionic gonadotropin
   d. prostaglandin
   e. seminal plasmin

34. Erection of the penis requires all of the following EXCEPT FOR
   a. contractions of smooth muscle in the vas deferens.
   b. nitric oxide.
   c. the parasympathetic nervous system.
   d. the corpus spongiosum.
   e. the corpora cavernosa.

35. The primary target of gonadotropin releasing hormone (GnRH) in males is the
   a. anterior pituitary.
   b. hypothalamus.
   c. Leydig cells.
   d. spermatogonia.
   e. seminiferous tubules.

36. Each ovary is attached to the uterus by
   a. fimbriae.
   b. a suspensory ligament.
   c. an ovarian ligament.
   d. an ovarian artery.
   e. a ligamentum ductosum.
37. The ovaries of a five-year-old girl contain
   a. primary oocytes.
   b. secondary oocytes.
   c. ova (the plural of “ovum”).
   d. fundus.
   e. More than one of the responses above is correct.

38. The ovaries of a five-year-old girl contain
   a. primordial follicles.
   b. primary follicles.
   c. secondary follicles.
   d. corpus luteum.
   e. More than one of the responses above is correct.

39. If the internal os of the uterus were blocked, then a sperm could NOT get to the
   a. cervical canal.
   b. external os.
   c. fornix.
   d. lumen of the uterus.
   e. More than one of the responses above is correct.

40. When a woman takes certain antibiotics, it is often the case that
   a. the pH of the vagina increases.
   b. the pH of the vagina decreases.
   c. Antibiotics should have no effect on the pH of the uterus.

41. Which one of the following structures is NOT part of the vulva?
   a. mons pubis
   b. labia majora
   c. labia minora
   d. fornix
   e. vestibule
42. Which one of the following structures of a mammary gland contains all of the others?
   a. alveolus
   b. lobe
   c. lobule
   d. lactiferous duct

43. During ovulation a(n) ___________ is released from the ovary.
   a. oogonium
   b. primary oocyte
   c. secondary oocyte
   d. ovum

44. Wilma is a 37-year-old woman. She had a tumor on her pituitary gland, which was treated by surgical removal of the entire pituitary gland. In the absence of further treatment by the artificial administration of hormones, which of the following statements will be true about Wilma?
   a. She will have normal menstrual cycles.
   b. Her levels of FSH will be similar to those of a typical 37-year-old woman.
   c. Her levels of estrogens will rise normally with a peak at about day 14.
   d. She will not ovulate.
   e. Her levels of progesterone will rise earlier in the ovarian cycle than normal.

45. During the menstrual phase of the uterine cycle
   a. the basal layer of the endometrium degenerates and is shed.
   b. the functional layer of the endometrium degenerates and is shed.
   c. the level of progesterone in the body rises to its peak.
   d. the level of FSH decreases.
   e. the functional layer produces large amounts of glycogen.

46. If an egg is not fertilized shortly after ovulation, then over the next two weeks
   a. the level of progesterone rises dramatically.
   b. the level of estrogen rises dramatically.
   c. the level of LH rises dramatically.
   d. All of the responses above are correct.
   e. None of the responses above is correct.
47. __________________ is \textbf{NOT} a secondary sexual characteristic caused by estrogen and/or progesterone.
   a. Growth of the endometrium
   b. Growth of hair in the axillary and pubic regions
   c. Increased calcium absorption
   d. Growth of breasts
   e. Deposition of fat in the hips

48. The first day of menses is considered day ____ of the menstrual cycle.
   a. 1
   b. 7
   c. 14
   d. 21

49. During sexual intercourse, the parasympathetic nervous system
   a. causes dilation of blood vessels leading to the clitoris.
   b. inhibits secretion of mucus by the vestibular glands.
   c. causes orgasm.
   d. All of the responses above are correct.
   e. None of the responses above is correct.

50. Betty is a 27-year-old woman of generally normal health. She is intensely devoted to long-distance running. She has not had a menstrual period in eight months. Which condition best describes Betty?
   a. menopause
   b. dysmenorrhea
   c. amenorrhea
   d. pre-pubescent
   e. nymphomaniac