1) Which of the following is an Enteric Nervous system (ENS) plexus?

  A. Myasthenic
  B. Lamina propria
* C. Myenteric
  D. Membranous
  E. Subdermal

2) The control of the GI system is:

  A. Entirely regulated by the ANS
* B. Predominantly self-regulated
  C. Completely disconnected from higher centers
  D. Entirely regulated by the CNS

3) Select the ENS excitatory neurotransmitters from the following list. (Multiple answers)

  A. somatostatin
* B. motilin
  C. vasoactive intestinal polypeptide
* D. tachykinins
  E. nitric oxide

4) Select the species that has an esophagus composed entirely of skeletal muscle. (Multiple answers)

  A. Horses
* B. Dogs
  C. Pigs
* D. Goats
  E. Cats
* F. Cattle
  G. Crocodiles

5) Movement of the stomach and the intestines is largely coordinated and propagated by all of the following, except :

  A. Intrinsic rhythmic depolarizations from pacemaker cells
  B. Local circuits
  C. Gap junctions between smooth muscle cells
* D. Cranial nerve V & VII

6) Which of the following concerning slow waves of the GI tract is incorrect?

  A. They move from oral to aboral segments
  B. They can be produced in the stomach, duodenum and the colon
* C. They cause contraction of smooth muscle
  D. They are produced in the ICC (Interstitial cells of Cajal)

7) Anti-peristalsis (retrograde) movement of ingesta:

  A. Is defined as a mass movement that occurs at regular intervals to clear the contents of a whole gut segment
* B. Occurs in the colon to increase time for water absorption
  C. Occurs in the small intestine to increase time for digestion of food
  D. Never occurs in the GI, since movement is from oral segments to aboral segments
  E. Is initiated by pacemakers in the stomach of ruminants so they can chew their cud

8) How does water move across the intestinal wall (multiple answers)?

  A. Exocytosis
  B. Co-transport (usually anti-port)
  C. Through primary active transport
* D. Transcellular pathway
* E. Paracellular pathway
  F. Co-transport (usually symport)

9) What factors do NOT drive water to move from the intestinal lumen into enterocytes?

  A. The higher oncotic pressure of the nearby capillaries
* B. When large molecules in the lumen are broken up (digested)
  C. Passive diffusion
* D. Active transport
  E. When nutrients are absorbed by enterocytes

10) Antiports are a type of primary active transport.

* A. False
  B. True

11) Which of the following statements about nutrient absorption is true?

* A. Nutrients must be broken down into simple molecules for absorption to occur.
  B. Absorption primarily depends on passive diffusion.
  C. Nutrients such as glucose are primarily absorbed through the paracellular pathway because it is easier for large molecules to travel in the spaces between cells.
  D. Absorption primarily depends on secondary active transport.

12) Which of the following statements concerning blood flow to the GI is false?

  A. If blood flow to the small intestine is decreased drastically, villi blunting (sloughing) can occur.
  B. If blood flow to the stomach is decreased, stomach ulcers may occur.
  C. Prostaglandins can both increase and decrease local blood flow.
* D. The tips of intestinal villi are usually very well perfused because approximately 75% of blood flow to the GI is to the mucosa.

13) Which of the following is NOT a function of saliva?

  A. Lubrication
* B. Digestive enzymes for protein digestion
  C. Grooming
  D. Antibacterial properties

14) Which of the following is a FALSE statement regarding saliva secretion?

  A. Atropine decreases saliva secretion
  B. Saliva secretion is inhibited by sympathetic stimulation
* C. CNS stimulation has no effect on saliva secretion
  D. Acetylcholine increases salivation

15) Swallowing involves a voluntary phase and an involuntary phase. Which cranial nerve (yeah, back to neuro) is not involved with the involuntary phase?

  A. X
  B. V
* C. VI
  D. VII

16) The esophagus is surrounded by muscles which create peristaltic waves. Which of the following statements is FALSE regarding these muscles?

  A. The esophagus in cats has skeletal muscle only in the proximal portion
  B. The distal esophagus in horses is smooth muscle
* C. The esophagus in dogs is skeletal muscle all the way down and controlled by the ENS
  D. The esophagus in dogs is skeletal muscle all the way down and controlled by the CNS

17) Which of the following is NOT a function of the simple stomach?

  A. Store food
  B. Creation of a acidic environment
  C. Digestion of protein
  D. Control release of chyme to the small intestine
* E. Water absorption
  F. Mechanical breakdown of food

18) Chyme is released from the stomach into the small intestine. Which of the following is NOT an effect of chyme entering the duodenum?

  A. ENS interneurons are stimulated which inhibit emptying of the stomach
  B. Afferent nerves are stimulated which decrease vagal input and increase sympathetic input
  C. Enteroendocrine cells in the duodenum secrete cholecystokinin and somatostatin
* D. The secretion of gut hormones is stimulated which increases stomach motility

19) Vomiting and regurgitation are different actions. Which of the following is not a difference between the two?

* A. Vomiting involves contraction of the stomach while regurgitation does not.
  B. Vomiting involves partially digested food, regurgitation had undigested food.
  C. Regurgitation is passive while vomiting is an active process
  D. Vomited food is acidic while regurgitated food is often neutral.

20) Which of the following is NOT true of HCl production?

  A. It involves a H+/K+/ATPase pump
* B. Occurs in chief cells
  C. Cl- is actively secreted
  D. Occurs in parietal cells

21) Which of the following statements is false regarding the control of HCl secretion?

  A. HCl release is stimulated by CNS stimulation
* B. Histamine H2 receptors inhibit HCl release
  C. Gastrin stimulates HCl release
  D. Chyme in the duodenum inhibits HCl release

22) The liver secretes bile, which is used for (multiple answers)

  A. Digestion of protein
  B. Aiding proliferation of mucus secreting cells in the duodenum
* C. Waste elimination from the liver
  D. Elimination of urea
* E. Lipid digestion

23) Hepatocytes are cells that line the sinusoids of the liver

  A. True
* B. False

24) The 4 main classes of secretions from the pancreas include…

* A. Amylases, lipases, zymogens, and nucleases/ribonucleases
  B. Zymogens, bile salts, peroxidases, and lipases
  C. Amylases, lipases, mucus, bile acids
  D. Amylases, zymogens, mucus, bile acids

25) Pancreatic cells have receptors for…

* A. Gastrin, acetylcholine, cholecystokinin, and secretin
  B. Epinephrine, Norepinephrine and Acetylcholine
  C. Acetylcholine, amylase, thyroid hormone, Gastrin
  D. Cholecystokinin, epinephrine, and secretin

26) Secretion of bicarbonate and mucus from duodenal glands is stimulated by…

  A. Physical or chemical stimulation of mucosa
  B. Vagal stimulation
  C. GI hormones (especially secretin)
* D. All of the above

27) The following are hormones or enzymes created by cells in the duodenum

  A. Amylases, lipases, zymogens, and nucleases/ribonucleases
  B. Cholecystokinin, epinephrine, and secretin
  C. Acetylcholine, amylase, thyroid hormone, Gastrin
  D. Epinephrine, Norepinephrine and Acetylcholine
* E. Secretin, Cholecystokinin, Enterokinase

28) Intrinsic (hormonal and ENS) mechanisms are the major control mechanisms of exocrine pancreas secretion

  A. False
* B. True

29) Carbohydrates are mainly of plant cell origin and include the following types…

  A. Starch, granulated sugars, pectins
  B. Starch, cellulose, lignin
  C. Fiber, Starch, Amylase
* D. Fiber, starch, sugars

30) Simple Sugars (monosaccharides) are absorbed intact by (multiple answers)

  A. Active transport
* B. SGLT1 and GLUT5
* C. Sodium co-transport and facilitated diffusion
  D. Facilitated diffusion only
  E. Simple diffusion through paracellular spaces

31) Glucose/Sodium transport in the crypts of villi is very efficient and results in absorption of 2 sodium for every glucose or galactose molecule

* A. False
  B. True

32) Digestion of proteins begins in the stomach where gastric enzymes are most active in a low pH

  A. False
* B. True

33) Proteins are normally absorbed into an adult's enterocytes in the following forms

  A. Amino acids, tri-peptides, whole proteins
* B. Amino Acids, tri-peptides, di-peptides
  C. Tri-peptides, di-peptides, protein granulations
  D. Proteins can only be taken up in their original form or else they are useless to the animal

34) Some of the factors that influence emulsification of fats in the body are (multiple answers)

* A. Detergent action of bile acids and phospholipids
* B. Physical mixing action
  C. Action by lipases
  D. Hormonal action
* E. Temperature

35) Combined action of lipase AND co-lipase bound to bile acid and phopsholipid-coated lipid droplets digests triglycerides. However, at high enough temperatures lipase can work on its own because less bile acids are needed to emulsify fats

* A. False
  B. True

36) Absorption of lipids occurs by…

  A. Simple diffusion
  B. Transporter FATP
  C. Sodium co-transporter
* D. A and B only
  E. All of the above

37) What is the structure (classification) of the pancreas?

  A. Compound Alveolar.
  B. Simple tubular.
  C. Simple acinar.
* D. Compound tubuloacinar.
  E. Compound acinar.

38) The tubuloacinar secretory unit is continuous with a short intercalated duct. This duct begins with flattened cells (only the nucleus of which can be seen) that extend into the lumen of the acinus. These cells are known as?

  A. Bipolar-pseudoparenchymal-exocholic-metaacinar cells.
  B. Tubuloacinar cells
  C. Pre-ductile cells.
  D. Centroadenomeric cells.
* E. Centroacinar cells.

39) The intralobular ducts of the pancreas are striated?

  A. True.
* B. False.

40) The function of the thick/dense connective tissue separating the tubuloacini of the pancreas is:

  A. Prevent spread of zymogen to adjacent acini.
  B. Cushion lobes of pancreas against shock.
  C. Insulate the tubuloacini.
  D. All of the above.
* E. None of the above.

41) Which of the following is NOT an exocrine product of the pancreas?

  A. Bicarbonate.
  B. Trypsin.
  C. Amylase.
  D. Lipase.
* E. Glucagon.

42) Which cells can be found in the cardiac region of the stomach?

  A. Mucous secreting cells.
  B. Parietal (oxyntic).
  C. Endocrine (Argentaffin).
* D. Both A and C
  E. Both B and C

43) How is it possible to distinguish between the fundic and pyloric regions of the stomach?

  A. The pyloric region secretes HCl and zymogens but the fundic region does not.
  B. The fundic region secretes HCl and zymogens but the pyloric region does not.
  C. The pyloric region is closest to the esophagus while the fundus region is between the pyloric and cardiac region.
* D. The fundic region has shallow gastric pits and extensive simple branched tubular gastric glands while the pyloric region has very deep gastric pits and shallow simple branched tubular glands.
  E. The fundic region does not contain mucous neck cells while the pyloric region does contain mucous neck cells.

44) Which of the following promote secretion of Gastric Acid in the stomach (note, all three must be correct for the answer to be correct)?

* A. Acetylcholine, Gastrin, Histamine.
  B. Gastrin, low pH, Motilin.
  C. Histamine, Gastrin, Secretin.
  D. Secretin, Gastric inhibitory peptide, low pH.
  E. Insulin, Secretin and Somatostatin

45) All of the following are epithelial cells of the mucosa of the small intestine, EXCEPT :

  A. Paneth cells
  B. Enterocytes
  C. Enterochromaffin cells
  D. Undifferentiated stem cells
* E. Mucous neck cells

46) Which of the following statements are true?

  A. Villi are longest in the duodenum and become shorter distally and disappear in the large intestine.
  B. Paneth cells may be found in the small intestine where they release anti-bacterial substance called lysozyme.
  C. Peyer’s patches are located in the colon and nowhere else.
  D. Both 1 and 3.
* E. Both 1 and 2.

47) What are the role of protozoa in the microflora ecosystem of the rumen?

  A. Volatile fatty acid absorption
  B. Volatile fatty acid production
  C. Digestion of protein
  D. Digestion of plant cell walls
* E. Slow down fermentation of starches and proteins

48) Between a high fiber diet and a high starch diet, what is the difference in production of VFA?

  A. Butyrate production is much higher in a high fiber diet
  B. Acetate is the greatest proportion of VFA produced in high-starch but not high-fibre
  C. There is no difference as bacteria do not distinguish between the two diets
* D. The ratio of Acetate to Propionate is lower in a high starch diet

49) Which of the following is not a factor that facilitates the transport of VFA from lumen to bloodstream?

* A. Gap Junctions
  B. Tight junctions
  C. Intercellular bridges
  D. Intercellular (basolateral) spaces
  E. All of the above facilitate transport of VFA from lumen to bloodstream

50) Which of these is the primary reason that sodium is not diffused back into the rumen at high concentrations within the epithelial cells?

  A. It is transported out too quickly, so turnover is high
  B. HCO_3 couples to the Na, preventing its diffusion back out to the lumen
* C. Tight junctions prevent backflow into the rumen
  D. The Na /K ATPase pump maintains the balance of any lost Na+ ions
  E. The neutral pH of the rumen prevents ion flow back into the lumen

51) Which of the following conditions is most desirable in a ruminant for the efficient production of VFA’s?

  A. high numbers of fungi
* B. rapid multiplication of bacteria
  C. high carbohydrate to protein feed
  D. rapid turnover of VFA
  E. high protein to carbohydrate feed

52) Why is eructation important?

  A. It prevents the clogging of the reticulum with particles that are too large
  B. It prevents distension of the caudoventral blind sac
* C. It allows gases to escape via the cardia and prevent bloat
  D. It inhibits primary ruminal contractions to increase transit time
  E. It promotes the presentation of foodstuff for remastication and refermentation

53) Which of these is not a simultaneous action during regurgitation (as part of rumination)?

  A. Contraction of reticulum prior to primary contraction
  B. Relaxation of cardia
  C. Closure of glottis
  D. Inspiratory movement
* E. All of the above are simultaneous actions of rumination

54) Which of the following statements regarding control of reticuloruminal motility is correct?

  A. Large rumen mats decrease motility
* B. The central nervous system is solely responsible for reticuloruminal motility
  C. Greater osmolarity leads to increased motility
  D. Moderate stretch decreases motility
  E. Marked stretch increases motility

55) What is the relationship between fiber and absorption of nutrients in equids?

  A. No relationship
  B. Logarithmic
  C. Direct
* D. Inverse
  E. Sinusoidal

56) Which of the following GI organs could be classified as ‘consistently’ secreting digestive products (enzymes or acid) in a horse? (single answer)

  A. Stomach
  B. Pancreas
  C. Gall bladder
  D. Esophagus
* E. A and B

57) How is the fermentation in a horse like the fermentation in a foregut ruminant?

* A. In both systems, VFA’s are taken up with the aid of hydronium (H+)
  B. Gap junctions allow for the speedy transport of VFA’s in both the colon and rumen epithelium
  C. H+ and Na+ are cotransported into the lumen in the colon and rumen respectively
  D. Proteins manufactured by microbial flora are used by the horse and cow, respectively.
  E. Both the rumen and the colon can take up a proportionally large amount of water

58) Which of the following is not a pacemaker in the large intestine of the horse?

  A. All of the above are pacemakers in the LI of the horse.
  B. Pelvic flexure
  C. Right ventral colon
  D. Cecum
* E. Left dorsal colon

59) Which of the following statements is FALSE?

* A. An up-regulation of ferritin would promote iron toxicity
  B. Herbivores do not need vitamin B12 (cobalamin) in their diet as they are able to synthesize their own
  C. Phosphorus is usually abundant in the diet and readily absorbed
  D. Although calcium is a vital mineral, it is not terribly well absorbed
  E. Excess iron can be highly toxic, particularly in the ferric form

60) You are presented with a patient who has been losing weight and is quite lethargic. After performing some biochemical tests, you find that the animal has low amylase, lipase, and TLI with respect to the reference intervals. You suspect exocrine pancreatic insufficiency (EPI) as a differential diagnosis. All of the following may be found in a patient with EPI except:

  A. Vitamin A deficiency
* B. Hyperglycemia due to a lack of insulin
  C. Excess fat in the feces (stetorrhea)
  D. Diarrhea

61) An effective method to treat copper toxicosis in animals is to give the animal a large amount of zinc.

* A. True
  B. False

62) All of the following are absorbed by a Na+/substrate symport except:

  A. vitamin C
  B. glucose
* C. lipids
  D. galactose
  E. amino acids

63) Which of the following statements regarding diarrhea is TRUE?

  A. Since intestinal villi are moderately hypoxic, ingesting antioxidants can often alleviate symptoms of diarrhea
* B. Some toxins loosen tight junctions allowing nutrients and electrolytes to leak back into the lumen
  C. Activation of the RAAS system by the body only worsens the symptoms of diarrhea
  D. An increase in frequency of defecation is not considered diarrhea
  E. Secretory diarrhea results in excess water in the lumen due to the loss of membrane-bound enzymes

64) The rectosphincteric reflex:

  A. stimulates anitperistalsis to increase transit time
  B. is a sympathetic reflex that promotes defecation
* C. stimulates the relaxation of the internal rectal sphincter
  D. is not a true reflex, as defecation is a voluntary act
  E. is synonamous with the vomiting reflex

65) A diet that is lacking lipid-soluble vitamins will hinder the absorption of Calcium.

* A. True
  B. False

66) Bicarbonate reabsorption in the distal GI is promoted by:

  A. bicarbonate dissolves in the water that follows potassium diffusion out of the lumen
  B. bile acids dissociate bicarbonate into its individual ions that can readily diffuse out of the lumen
* C. coupled sodium chloride transport
  D. a chloride/bicarbonate symport
  E. the chloride bicarbonate exchanger

67) The slow waves that originate from the ICC cells in the colon are identical to the slow waves that originate in the small intestine.

  A. True
* B. False

68) All of the following occur to a great extent in the colon except:

  A. Cl-/HCO3- exchanger
* B. Na+ co-transport
  C. Na+/Cl- coupled transport
  D. HCO3- absorption
  E. K+ absorption

69) A large segment of large intestine was removed. Which of the following would NOT be true in this case?

  A. you may find less urobilinogen in the urine
  B. the section of colon removed may test positive for vitamin K
  C. your body would not be able to reabsorb potassium as well
* D. during the surgery, branches of the celiac, cranial mesenteric, and caudal mesenteric artery may have to be ligated
  E. the segment you removed would show ample goblet cells but a lack of villi under the microscope

70) Liver damage would result in all of the following except:

  A. impair the absorption of vitamin E
  B. elevated unconjugated bilirubin in the blood
  C. elevated ALT and SDH levels in a large animal
* D. excess sterocobilinogen in the feces
  E. impaired lipid digestion

71) All of the following would impair vitamin A absorption except:

  A. pancreatic insufficiency
* B. a mutation that prevents enterokinase expression
  C. extrahepatic cholestasis
  D. a lack of co-lipase, but a compensatory overproduction of lipase
  E. a stenotic sphincter of Oddi

72) Which of the following does not lead to a significant change in luminal pH of the GI tract?

A. taking an H2 antagonist such as Tagamet
B. the proton / potassium pump in parietal/oxyntic cells
C. taking AlkaSeltzer (sodium bicarbonate) after a meal
D. the chloride / bicarbonate exchanger in enterocytes
* E. activity of the sodium / chloride transporter in enterocytes