

## CIRCULATORY SYSTEM BASICS

1. The circulatory system includes components of \_\_\_\_\_ and \_\_\_\_\_ systems.
2. What are the functions of the circulatory system?
3. What is the most basic function of the lymphatic system?
4. What is circulation that supplies all organs except the lungs?
5. Oxygenated blood from the lungs travel in the \_\_\_\_\_ into the \_\_\_\_\_.
6. Ventricles receive blood from \_\_\_\_\_. Atria from \_\_\_\_\_.
7. Resistance in the \_\_\_\_\_ is greater than the \_\_\_\_\_.
8. Give the order of conduction in the heart.
9. Myocardial cells are \_\_\_\_\_, \_\_\_\_\_, and interconnected by \_\_\_\_\_.
10. What is the muscle that forms the entire chamber called?
11. Why are the four chambers of the heart separated by nonconductive tissue?
12. What are the processes involved in electrical activation of the heart?
13. What cell has continuous spontaneous depolarization?
14. What is the order of AP transmission in the heart?

## CARDIAC ACTION POTENTIALS

15. What cells conduct a fast response AP?
16. What cells conduct a slow response AP?
17. Changes in membrane potential in cardiac cells is determined by \_\_\_\_\_, \_\_\_\_\_,
18. What ions are in high concentration outside of the cell?
19. The electrostatic contribution gives us \_\_\_\_\_.
20. The plateau signifies what?
21.  $G_x$  stands for what?
22. The depolarization period between \_\_\_\_\_ mV & \_\_\_\_\_ mV in the SA node is known as the \_\_\_\_\_.
23. What are the three factors of SA node pacemaker potential/automaticity?
24. cAMP hyperpolarizes this crucial  $I_f$  channel for the pacemaker potential to occur. What is it?
25. SA node diastolic depol. occurs faster when exposed to \_\_\_\_\_ & \_\_\_\_\_ resulting in more \_\_\_\_\_.
26. Spontaneous phase 4 depolarization in non-SA node myocardial cells is called \_\_\_\_\_.
27. Myocardial cells are depolarized from their resting potential of \_\_\_\_\_ mV by the \_\_\_\_\_.
28. What conditions may result in an ectopic pacemaker?
29. What produces the upstroke in Myocardial APs?
30. At what voltage does the long plateau occur and for how long in Myocardial APs?
31. The AV node has a \_\_\_\_\_ conduction rate, while the Purkinje fibers have a \_\_\_\_\_ rate.
32. When does ventricular contraction occur in comparison to atrial contraction?
33. The heart is stimulated by the \_\_\_\_\_ center, while it is inhibited by the \_\_\_\_\_ center.



34. Depolarization of myocardial cells results in what chain of events?
35. The P wave is caused by \_\_\_\_\_.
36. The QRS complex is caused by \_\_\_\_\_.
37. The T wave is caused by \_\_\_\_\_.

### FAST RESPONSE CARDIAC POTENTIAL

38. Fast response cells have a \_\_\_\_\_ duration. Gives the times for each type.
39. Atrial, ventricle, and Purkinje cells have \_\_\_\_\_.
40. Describe Phase 0.
41. Phase 1 is a brief period of \_\_\_\_\_ by closure of \_\_\_\_\_ and opening of \_\_\_\_\_.
42. What drives the  $K^+$  out of the cell in phase 1?
43. What does Tetrodotoxin block and when?
44. Phase 2 sees an increase in \_\_\_\_\_ producing a(n) \_\_\_\_\_ via \_\_\_\_\_ channels.
45. Genesis of the plateau occurs when? What causes it?
46. A high resting Potassium conductance occurs during what phase?
47. What does the L stand for with calcium channels?
48. During Phase 2, the calcium influx may induce what?
49.  $Ca^{2+}$  conductance (\_\_\_) may be enhanced by the stimulation of Sympathetic neurons via \_\_\_\_\_.
50. Upon the  $\beta$ -adrenergic receptor activation, what chain of events may occur?
51. What may diminish  $G_{Ca}$ ?
52. What are some possible pharmaceutical calcium channel blockers?
53. What occurs during phase 3 of a fast response cardiac cycle?
54. What occurs during phase 4 of a fast response cardiac cycle?
55. When is sodium conductance the highest? Calcium?
56. What are the regulators of ionic concentration restoration?
57. What does the  $Na^+ K^+$  ATPase do and when?
58. What does the  $Na^+ / Ca^{2+}$  exchanger protein do and when?
59. What is the  $Na^+ K^+$  ATPase pharmaceutical blocker?

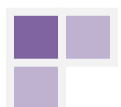
### SLOW RESPONSE CARDIAC POTENTIAL

60. What phases are non-existent in SRCP?
61. What causes the upstroke during phase 0?
62. What occurs during phase 3 of a slow response cardiac cycle?
63. What occurs during phase 4 of a slow response cardiac cycle?
64. What keeps the pacemaker channels open for diastolic depolarization?
65. What turns on the  $I_f$ ? Why is this important?



## CARDIAC CYCLE

66. Systole refers to the \_\_\_\_\_ and systolic pressure is the \_\_\_\_\_.
67. What heart chambers contract in tandem?
68. When do the ventricles contract?
69. Describe ventricular filling.
70. What occurs during ventricular systole?
71. What phase of ventricular systole opens the semi-lunar valves? When does it occur?
72. What is isovolumetric contraction?
73. During \_\_\_\_\_, all valves close and the ventricles undergo \_\_\_\_\_.
74. What occurs during atrial systole?
75. What is the Dicrotic notch?
76. When does the heart sounds occur?
77. What causes the semilunar valves to close?
78. \_\_\_\_\_ is the volume of blood in the ventricles at the end of diastole (\_\_\_\_ ml).
79. What is stroke volume?
80. What is the end-systolic volume?
81. What is cardiac output?
82. Cardiac output is the product of \_\_\_\_\_ and \_\_\_\_\_.
83. \_\_\_\_\_ is the difference between resting and maximal Cardiac Output.
84. What are the factors that affect stroke volume?
85. The Fick principle uses what law?
86. What is the equation of the Fick Principle?
87. What is the preload?
88. What is contractility?
89. What is afterload?
90. What is the ejection fraction?
91. What states that strength of ventricular contraction varies directly with EDV?
92. What is the intrinsic property of the myocardium?
93. Increased contractility can be caused by \_\_\_\_\_ stimulation.
94. What clinical actions would reduce stroke volume?
95. What is velocity of blood flow?
96. Blood flow is measured in \_\_\_\_\_ and is equivalent to \_\_\_\_\_.
97. What is blood pressure?
98. How is BP measured?
99. What drives blood around the vascular system?
100. What is peripheral resistance?



101. What are the three primary sources of resistance? It is described by what equation?
102. Which of the resistance factors readily changes?
103. The steepest change in BP can occur in the \_\_\_\_\_.
104. Arterial BP reflects two factors of arteries close to the heart. What are they?
105. BP in elastic arteries near the heart is \_\_\_\_\_.
106. What is systolic blood pressure? Diastolic?
107. What is pulse pressure?
108. What is mean arterial pressure?
109. What is the capillary blood pressure range?
110. Why is low blood pressure favorable?
111. The venous blood pressure is \_\_\_\_\_.
112. Since venous blood pressure is steady, how does a lesion differ from an artery cut?
113. What are the main factors determining blood pressure?
114. The 1<sup>st</sup> sound, a.k.a. \_\_\_\_\_, is produced by the closing of the \_\_\_\_\_.
115. The 2<sup>nd</sup> sound, a.k.a. \_\_\_\_\_, is produced by the closing of the \_\_\_\_\_.
116. What are heart murmurs?
117. What are two common causes of heart murmurs?
118. What is mitral stenosis?
119. If blood accumulates in the left ventricle, what may occur?
120. Damaged papillary muscles may lead to \_\_\_\_\_ valves, meaning they \_\_\_\_\_.
121. What are septal defects and what is their usual source?

## REGULATION OF HEART RATE

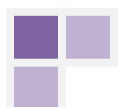
122. Mechanisms that affect cardiac rate are called \_\_\_\_\_.
123. Sympathetic nerves will release \_\_\_ & \_\_\_ opening \_\_\_\_\_, and thus depolarizing SA node.
124. Parasympathetic nerves release \_\_\_ opening \_\_\_\_\_, and thus \_\_\_\_\_ depolarization.
125. The HCN channels ( $I_f$ ) are stimulated by \_\_\_\_\_, and allow \_\_\_ to enter the cell.
126. What coordinates the activity of autonomic innervations?
127. A shortened pacemaker potential yields a(n) \_\_\_\_\_ heart rate.
128. What direction does the  $K^+$  go when Ach stimulates the cell?
129. Sympathetic fibers on atrial and ventricle muscles can result in \_\_\_\_\_.
130. Sympathetic fibers on the AV node may result in what? Parasympathetic?
131. \_\_\_\_\_ is phosphorylated and then activates the \_\_\_\_\_ to restore a resting muscle state.
132. Where are the stretch receptors, a.k.a. \_\_\_\_\_, located?
133. As the walls stretch, baroreceptors conduct \_\_\_ to the \_\_\_ & \_\_\_ of the medulla oblongata.
134. What is the baroreceptor reflex most sensitive too?



135. What is the Atrial (Bainbridge) reflex?
136. What does the atrial reflex stimulate?
137. In an attempt to reduce BP, \_\_\_\_\_ may occur to reduce BP and blood flow.
138. The baroreceptor reflex attempts to \_\_\_\_\_ the HR.
139. Increases in blood volume inhibits \_\_\_\_\_ and promotes secretion of \_\_\_\_\_.
140. What hormones may increase heart rate?
141. What must be maintained for normal heart function?
142. What are the neural controls of peripheral resistance?
143. What is utilized in the neural control
144. Vasomotor activity can be modified by what?
145. What are chemoreceptors sensitive too?
146. What is the vasomotor center?
147. What is the cardiovascular center?
148. If BP is increased, what will attempt to lower it and how?
149. If BP decreases to much, what will attempt to raise it and how?
150. Where are the prominent chemoreceptors located?
151. What are the higher brain centers that can modify BP via the medulla?
152. What chemicals decrease BP?
153. What chemicals increase BP?
154. BP can be regulated by what long term mechanism?
155. Give the order of production on the Renin-angiotensin mechanism.

## DIGESTIVE SYSTEM BASICS

156. \_\_\_\_\_ is the assimilation, storage, and synthesis of food molecules.
157. \_\_\_\_\_ is the mechanical and chemical breakdown of food materials.
158. What is the order of hydrolysis breakdown for carbohydrates?
159. What is the order of hydrolysis breakdown for fats?
160. What are the accessory organs of the digestive system?
161. What is the organization of the GI tract?
162. Salivary glands get their primary neural control from what system?
163. What are the components of the alimentary tract?
164. Digestion in the stomach is started by what two things?
165. Where is the submucosal plexus found? The Myentric plexus?
166. What are the mediators of the serous acinar cells?
167. Describe the cholinergic control mechanism during salivation.
168. Describe the adrenergic control mechanism during salvation.



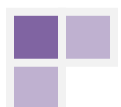
169.  $\text{PIP}_2 \rightarrow$  \_\_\_\_ & \_\_\_\_ . What does the primary product do?
170. What are the means of GI tract motility?
171. Where does it occur and what is segmentation?
172. Endocrine glands discharge their products where?
173. What are the exocrine GI tract secretions?
174. What does  $\text{HCO}_3^-$  do?
175. The endocrine secretions tend to be \_\_\_\_\_.

#### GASTROINTESTINAL TRACT FUNCTIONS

176. The regulation of gastrointestinal tract functions is controlled by \_\_\_\_\_.
177. Hormones are produced by \_\_\_\_\_ and released into the \_\_\_\_\_.
178. Neurocrines are produced by \_\_\_\_\_ and act \_\_\_\_\_ on the target cell.
179. Paracrines are produced by \_\_\_\_\_ and act \_\_\_\_\_ on the target cell.
180. What does the GI tract secrete?
181. Where are endocrine cells located?
182. What do paracrine substances regulate?
183. What is the long reflex?
184. What is the short reflex?
185. What are the plexuses of the short reflex?
186. Sympathetic innervations of the GI tract reduces \_\_\_\_\_ and \_\_\_\_\_.
187. Parasympathetic postganglionic neurons are \_\_\_\_\_ and \_\_\_\_\_.
188. What does the Vagus nerve innervate?
189. What does the Pelvic nerve innervate?
190. What has the ability of directing all GI tract functions if needed?
191. Myenteric neurons control \_\_\_\_\_ and are located between the \_\_\_\_\_ and \_\_\_\_\_.
192. The excitatory neurons of the myenteric plexus are stimulated by \_\_\_\_\_ and \_\_\_\_\_.
193. The inhibitory neurons of the myenteric plexus are stimulated by \_\_\_\_\_ and \_\_\_\_\_.
194. Submucosal neurons control \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_ functions of the GI tract.
195. The resting membrane potential of GI tract cells oscillates in slow waves do the the \_\_\_\_\_.
196. Gastrointestinal smooth muscle cells have a \_\_\_\_\_ compared to other \_\_\_\_\_.
197. What causes the rising phase of GI smooth muscle Action potential?

#### STOMACH & PANCREAS

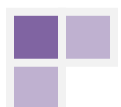
198. What cells of the stomach are impermeable to HCL?
199. The alkaline mucus that protects the stomach contains \_\_\_\_\_ and is secreted by \_\_\_\_\_.
200. \_\_\_\_\_ inhibit gastric secretions.



201. To protect the stomach, epithelial cells have \_\_\_\_\_ and a \_\_\_\_\_.
202. In addition to a mucus secretion, what secretion protects the stomach lining?
203. Mucin is a \_\_\_\_\_.
204. Why are carbohydrates no longer digested in the stomach?
205. What are the physiological agonists of gastric acid HCL secretion?
206. The HCL agonists, which are collectively known as \_\_\_\_\_, bind to \_\_\_\_\_.
207. What is the function of the stomach?
208. What do goblet cells secrete?
209. What do parietal cells secrete?
210. What do chief cells secrete?
211. What do enterochromaffin-like cells secrete?
212. What do g-cells secrete? D-cells?
213. What does HCL do in the stomach?
214. When the  $H^+$  and  $Cl^-$  are produced, what is the by produce placed into the blood capillary?
215. What allows the  $Cl^-$  to enter the lumen in exchange for the Carbonate?
216. The  $H^+$  is secreted in response to what hormone and neurotransmitter?
217. When Histamin binds to parietal cells \_\_\_\_\_ results in H release.
218. When gastrin and Ach bind to parietal cells \_\_\_\_\_ results in H release.
219. What is the endocrine function of the pancreas?
220. What is the exocrine secretions of the pancreas?
221. What are the four pancreatic juices?
222. How do Ach, CCK/Gastrin, & Substance P lead to increased enzyme secretion?
223. How does secretin/vip lead to increased enzyme secretion?

## INTESTINES

224. Primary absorption of food occurs in the \_\_\_\_\_ and is facilitated by its \_\_\_\_\_.
225. What enzyme, which (*is/is not*) secreted into the lumen, is attached to microvilli?
226. The microvilli attached enzymes are exposed to \_\_\_\_\_.
227. Sugar digestion via sucrase digest sucrose to \_\_\_\_\_.
228. Sugar digestion via lactase digest lactose to \_\_\_\_\_.
229. Sugar digestion via maltase digest maltose to \_\_\_\_\_.
230. What are the peptidase enzymes?
231. What do aminopeptidases produce?
232. What do enterokinase do? Deficiency of enterokinase results in what?
233. What are needed for absorption of calcium and are regulated by Vitamin D?
234. What does alkaline phosphatase do? What may it be regulated by?



235. Although it has no digestive function, the large intestine absorbs \_\_\_\_, \_\_\_\_, \_\_\_\_, \_\_\_\_, and \_\_\_\_.
236. Although the LI surface lacks \_\_\_\_\_, it does have a \_\_\_\_\_ which produce \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_.
237. The intestine bacteria produce fatty acids from the fermentation of what substance?
238. Although the SI absorbs more water overall, the LI absorbs \_\_\_\_\_.
239. Water absorption in the LI begins with the \_\_\_\_\_ set up by \_\_\_\_\_.
240. What stimulates water and salt reabsorption?
241. What occurs via active transport of NaCl?
242. The defecation reflex begins with the relaxation of what?

## KIDNEY, LIVER, GALL BLADDER

243. Digested food is first delivered to the \_\_\_\_\_ via the \_\_\_\_\_.
244. What is the recirculation of compounds released thru bile back into the liver from the SI?
245. What are the functions of the liver?
246. Bile pigment, aka \_\_\_\_\_, is produced in the \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_.
247. When bilirubin combines with \_\_\_\_\_, it forms \_\_\_\_\_, which is the actual bile secretion.
248. What is urobilinogen?
249. Bile acids emulsify \_\_\_\_\_, increase surface area for \_\_\_\_\_, and form \_\_\_\_\_.
250. Bile acids are produced from what substance?
251. What is the purpose of micelles?
252. When are gall stones formed?
253. Bilirubin is bound to \_\_\_\_\_ in plasma.

## DIGESTION AND ABSORPTION

254. Pancreatic amylase converts starch to \_\_\_\_\_, which are hydrolyzed by \_\_\_\_\_.
255. What do the endopeptidases do in the SI and give 3 examples.
256. What do the exopeptidases do in the SI and give 3 examples.
257. What is the result of protein digestion in the SI?
258. Pancreatic lipase hydrolyzes \_\_\_\_\_ into \_\_\_\_\_ and \_\_\_\_\_.
259. Phospholipase A breaks down \_\_\_\_\_ into \_\_\_\_\_ & \_\_\_\_\_.
260. When fatty acids and monoglycerides dissolve into micelles they become known as \_\_\_\_\_.
261. Once FA's, monoglycerides, & lysolecithin enter the epithelial cells what occurs to them?
262. What are VLDL's made by, where, and for what purpose?
263. LDL's transport \_\_\_\_\_. HDL's transport \_\_\_\_\_.
264.  $Ca^{+}$  is absorbed in the \_\_\_\_\_ & \_\_\_\_\_ stimulates its absorption by activating the \_\_\_\_\_.
265. What binds Calcium to the inner surface of the brush border membrane?
266. \_\_\_\_\_ stores Iron. \_\_\_\_\_ passes iron to transferrin receptors. Transferrin \_\_\_\_\_.

