

BIOA02, Module 2, Sample Exam Questions 2018

Lecture 1

1. The August Krogh Principle states:

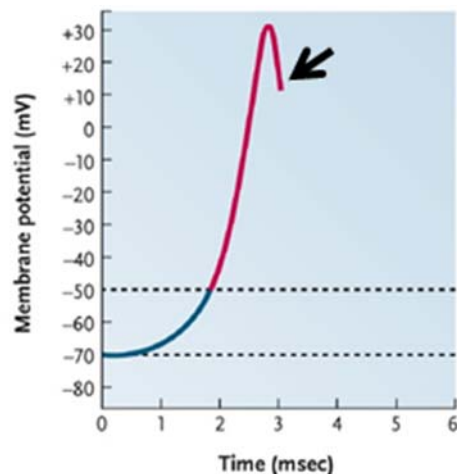
- a) Comparative physiology strives to understand the evolutionary relationship between animals.
- b) For every question in comparative physiology there is an ideal environment in which to study it.
- c) For every question in biology there is an ideal model system.
- d) Every question in biology has medical relevance.
- e) All physiological mechanisms have some adaptive significance.

Lecture 2

2. Which of the following most accurately describes the components of the efferent nervous system?

- a) It consists of the sympathetic nervous system and the parasympathetic nervous system.
- b) It consists of the somatic nervous system and the sympathetic nervous system.
- c) It consists of the somatic nervous system and the parasympathetic nervous system.
- d) It consists of the somatic nervous system and the autonomic nervous system.
- e) It consists of the brain and the spinal cord.

3. The diagram below represents a stage of an action potential travelling down an axon. At the point indicated by the arrow, what is the open or closed status of the sodium channel's activation and inactivation gates?



- a) Activation gate is closed; Inactivation gate is closed
- b) Activation gate is open; Inactivation gate is closed
- c) Activation gate is open; Inactivation gate is open

4. During which phase of an action potential does sodium move into a neuron?

- a) Depolarisation
- b) Repolarisation
- c) Hyperpolarisation
- d) A and B
- e) A and C

5. Which of the following is (or are) responsible for the absolute refractory period in a neuron?

- a) During the depolarisation phase of an AP, the opening of Na^+ channels has already been set in motion and cannot be affected by a second stimulus.
- b) During the depolarisation phase of an AP, the opening of K^+ channels has already been set in motion and cannot be affected by a second stimulus.
- c) During the repolarisation phase of an AP, the inactivation gate is closed and cannot be opened by a second stimulus.
- d) A and C
- e) B and C

Lecture 3

6. Adrenaline and noradrenaline (epinephrine and norepinephrine) are examples of what type of hormone?

- a) Amines
- b) Peptides
- c) Steroids
- d) Fatty Acids

7. Which of the following is not a function of calcitonin?

- a) It stimulates calcium deposition into the bones.
- b) It reduces calcium uptake in the kidneys.
- c) It decreases calcium uptake in the intestines.
- d) All of the above are functions of calcitonin.

8. Which two glands release hormones that are involved in blood glucose regulation?

- a) The adrenal gland and the pancreas.
- b) The pancreas and the posterior pituitary.
- c) The adrenal gland and the posterior pituitary.
- d) The thyroid and parathyroid glands.
- e) The posterior pituitary and the pineal gland.

Lecture 4

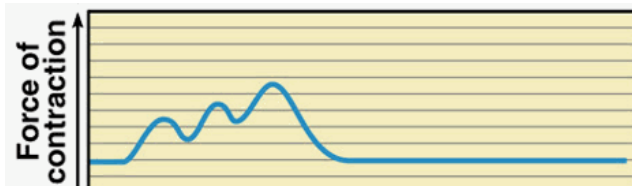
9. The regulatory protein troponin binds which of the following?

- a) Actin, tropomyosin and Ca^{2+} .
- b) Myosin, tropomyosin and Ca^{2+} .
- c) Actin, acetylcholine and Ca^{2+} .
- d) Myosin, acetylcholine and Ca^{2+} .
- e) The thick filaments, tropomyosin and Ca^{2+} .

10. Which of the following is required to prevent muscle from remaining in a state of rigor?

- a) The hydrolysis of ATP into ADP and an inorganic phosphate (Pi).
- b) The release of Pi from an ATPase site.
- c) The release of ADP from an ATPase site.
- d) The binding of ATP to the ATPase site on myosin.
- e) The binding of ATP to the ATPase site on actin.

11. The pattern of muscle contraction shown illustrates which of the following?



- a) A single muscle twitch.
- b) An isoinergetic twitch triplet.
- c) Twitch summation.
- d) Tetanus.

Lecture 5

12. In the mammalian fetal heart, which of the following allows deoxygenated blood from the pulmonary artery to move into the aorta?

- a) The Foramen of Panizza.
- b) The Foramen Ovale.
- c) The Ductus Arteriosus.
- d) The Foramen Arteriosus.

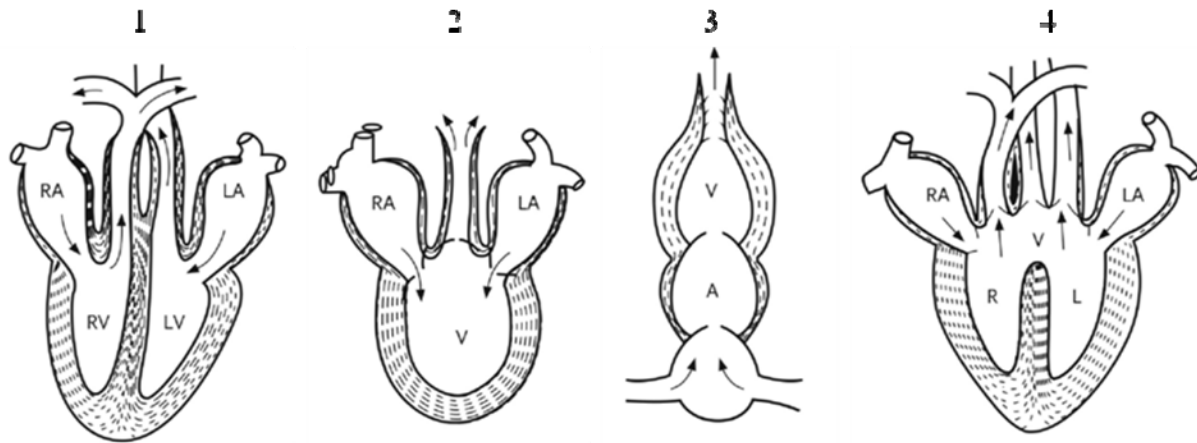
13. In lungfish, which blood vessel carries deoxygenated blood to the lungs?

- a) The ventral aorta.
- b) The dorsal aorta.
- c) The systemic aorta.
- d) The pulmonary artery.
- e) The pulmonary vein.

14. In a crocodilian reptile during “normal breathing” (i.e., the animal is not underwater) which of the following does not occur?

- a) Blood flows to the lungs via the pulmonary artery.
- b) The valve between the right ventricle and the left aorta is open.
- c) The valve between the left ventricle and right aorta is open.
- d) Blood flows from the right aorta into the left aorta.

15. Match the following hearts to the animals.



- a) 1 = cat; 2 = toad; 3 = salmon; 4 = lizard
- b) 1 = lizard; 2 = toad; 3 = salmon; 4 = cat
- c) 1 = human; 2 = lizard; 3 = trout; 4 = cat
- d) 1 = human; 2 = lizard; 3 = trout; 4 = crocodile
- e) 1 = crocodile; 2 = toad; 3 = trout; 4 = lizard

Lecture 6

16. What is the site of gas exchange (i.e., oxygen uptake and carbon dioxide excretion) on the gills of a water-breathing fish?

- a) The gill arches.
- b) The gill filaments.
- c) The secondary lamellae.
- d) The secondary filaments.
- e) The operculum.

17. During bird inspiration (“first or second” inspiration), which of the following is occurring?

- a) Air flows from the trachea into the posterior air sacs and from the posterior air sacs into the lungs.
- b) Air flows from the posterior air sacs into the lungs and from the anterior air sacs into the trachea.
- c) Air flows from the lungs into the anterior air sacs and from the anterior air sacs into the trachea.
- d) Air flows from the trachea into the posterior air sacs and from the lungs into the anterior air sacs.

18. During inspiration in humans, which of the following does not occur?

- a) The diaphragm contracts.
- b) The diaphragm moves upward.
- c) The chest wall expands.
- d) The lungs expand.
- e) Air flows through the trachea and ultimately into the alveoli.

Lecture 7

19. Which combination of the following respiratory control systems or centres is involved in terminating inspiration?

- a) Carotid body oxygen chemoreceptors and the dorsal respiratory group.
- b) Central (brain) CO₂ chemoreceptors and the pontine respiratory group.
- c) Lung (pulmonary) stretch receptors and the pontine respiratory group.
- d) Lung stretch receptors and the dorsal respiratory group.
- e) Lung stretch receptors and the ventral respiratory group.

20. Which of the following is not involved in the sensing of CO₂ levels by central (brain) chemoreceptors?

- a) Diffusion of CO₂ from the blood into the cerebral spinal fluid (CSF).
- b) Diffusion of H⁺ ions from the blood into the CSF.
- c) Hydration of CO₂ within the CSF to form an H⁺ ion and a bicarbonate ion.
- d) Stimulation of the chemoreceptor cells by H⁺ ions.

21. Which of the following combination of factors (temperature and pH) would cause an oxygen equilibrium curve to shift to the left?

- a) Low temperature and high pH.
- b) Low temperature and low pH.
- c) High temperature and high pH.
- d) High temperature and low pH.

22. Which of the following reactions within the red blood cell proceed from the left to right as the blood flows through the metabolically active tissues?

- 1) $\text{H}_2\text{O} + \text{CO}_2 \rightarrow \text{H}^+ + \text{HCO}_3^-$
- 2) $\text{H}^+ + \text{HCO}_3^- \rightarrow \text{H}_2\text{O} + \text{CO}_2$
- 3) $\text{Hb}\cdot\text{O}_2 + \text{H}^+ \rightarrow \text{O}_2 + \text{H}^+\cdot\text{Hb}$
- 4) $\text{O}_2 + \text{H}^+\cdot\text{Hb} \rightarrow \text{Hb}\cdot\text{O}_2 + \text{H}^+$

- a) 1 and 3
- b) 1 and 4
- c) 2 and 3
- d) 2 and 4

Lecture 8

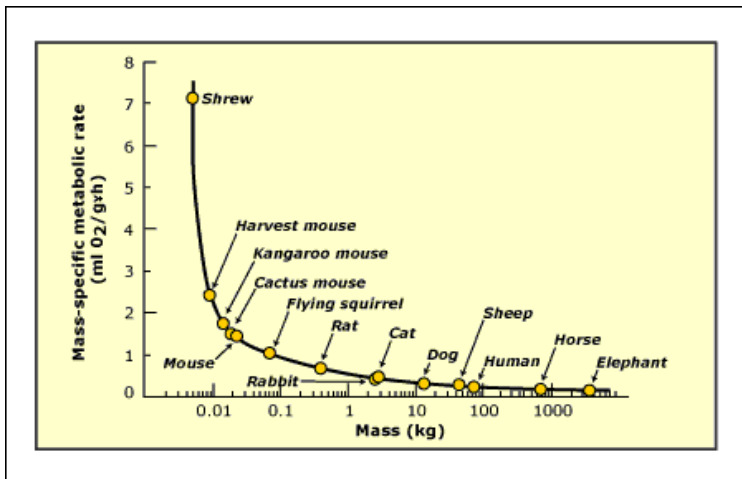
23. Which of the following is not an indirect measurement of metabolic rate?

- a) A measurement of oxygen consumption.
- b) A measure of carbon dioxide production.
- c) A “material balance” measurement that measures calories ingested and energy lost in the feces.
- d) A measurement of heat production.
- e) All of the above are indirect measurements of metabolic rate.

24. Which of the following conditions do not need to be met when measuring basal metabolic rate (BMR) in an endotherm?

- a) Ambient temperature must be between the lower and upper critical temperatures.
- b) The animal must be in its thermoneutral zone.
- c) The animal must be fasting.
- d) The animal must be at rest.
- e) All of the above conditions need to be met when measuring BMR in an endotherm.

25. Based on the following graph, which animal would have the highest metabolic rate if metabolic rate were expressed as ml O₂ consumed per hour?



- a) Shrew
- b) Cactus mouse
- c) Rat
- d) Dog
- e) Sheep

Lecture 9

26. Which of the following animals is a homeothermic endotherm?

- a) A crab.
- b) A benthic fish.
- c) A hummingbird.
- d) A human.

27. A probe is implanted into the hypothalamus of a squirrel in order to heat or cool the hypothalamus. What happens if the hypothalamus is cooled?

- a) Metabolic heat production increases and the animal's body temperature increases.
- b) Metabolic heat production increases and the animal's body temperature decreases.
- c) Metabolic heat production decreases and the animal's body temperature decreases.
- d) Metabolic heat production decreases and the animal's body temperature increases.
- e) Metabolic heat production does not change but the animal's body temperature increases.

28. In endotherms which of the following processes could be used as both a defense against the heat and a defense against the cold?

- a) Shivering thermogenesis.
- b) Huddling.
- c) Hibernation.
- d) Changes in cutaneous blood flow.
- e) Brain cooling.

Lecture 10

29. Which of the following does not occur in a freshwater fish?

- a) They gain water by osmosis.
- b) They lose ions by diffusion.
- c) They drink water.
- d) They recover lost ions via transport mechanisms on the gills.
- e) They excrete excess water in the urine.

30. Which of the following most accurately reflects the osmoregulatory capabilities of the shrimp, green crab and mussel?



- a) Shrimp = full osmoregulator; crab = osmoconformer; mussel = partial osmoregulator.
- b) Shrimp = osmoconformer; crab = partial osmoconformer; mussel = full osmoregulator.
- c) Shrimp = osmoconformer; crab = full osmoregulator; mussel = partial osmoregulator.
- d) Shrimp = full osmoregulator; crab = partial osmoregulator; mussel = osmoconformer.
- e) Shrimp = full osmoregulator; crab = partial osmoregulator; mussel = partial osmoregulator.

31. Which of the following animals does not use the Na^+ - K^+ - Cl^- co-transporter for ion regulatory / osmoregulatory purposes?

- a) Freshwater teleost (gills)
- b) Seawater teleost (gills)
- c) Seawater elasmobranch (rectal gland)
- d) Marine birds (salt gland)

Lecture 11

32. Which of the following combinations of substances are found in saliva?

- a) Bicarbonate; salivary amylase; mucous; salivary lipase.
- b) Bicarbonate; salivary amylase; mucous; lysozyme.
- c) Bicarbonate; salivary amylase; pepsin; lysozyme.
- d) Carbonic acid; salivary amylase; mucous; lysozyme

33. Which of the following cell types are found in the gastric pits and what is the primary substance that they release?

- a) Chief cells - pepsinogen; parietal cells - HCl; mucous cells – mucous.
- b) Chief cells – HCl; parietal cells – pepsinogen; mucous cells – mucous.
- c) Chief cells – pepsin; parietal cells – HCl; mucous cells – mucous.
- d) Chief cells – pepsinogen; parietal cells – HCl; duct cells – bicarbonate.
- e) Chief cells – pepsin; parietal cells – pepsinogen; duct cells – mucous.

Tree of Life Questions

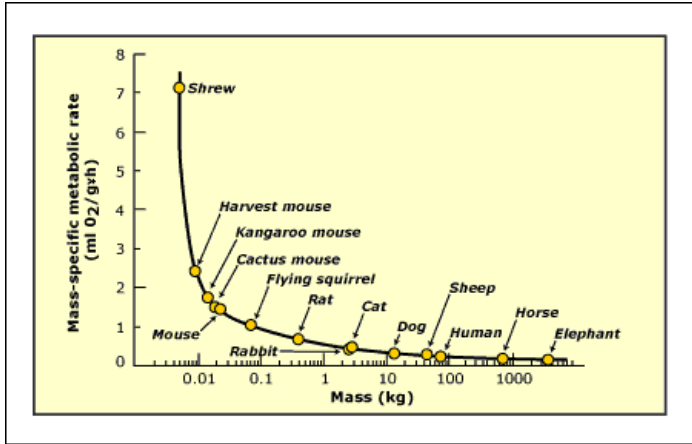
34. In which of the following aquatic animals would you expect to find the red muscle located under the skin as opposed to within the core of the animal? Note that this topic wasn't actually covered in the lectures this year.

- a) A great white shark.
- b) A swordfish.
- c) A goldfish.
- d) A skipjack tuna.

35. Which of the following is the only vertebrate with blood that is isosmotic to seawater?

- a) The lamprey.
- b) The hagfish.
- c) The dogfish shark.
- d) The great white shark.
- e) The killer whale.

36. Consider a plot of land that is 1 km^2 in area. Based on the following graph, which species would you expect to have the largest average biomass of the entire population within that 1 km^2 area? Note that this concept wasn't actually covered in the lectures this year.



- a) Shrew
- b) Harvest mouse
- c) Cactus mouse
- d) Flying squirrel
- e) Human

37. Which of the following animals do not have a pulmonary artery?

- a) A lungfish.
- b) A turtle.
- c) A crocodile.
- d) A human.
- e) All of the above have a pulmonary artery.