

PHYSIOLOGY FINAL EXAM QUESTIONS

EP_2-3

(2020/2021)

1. PHYSIOLOGY OF THE CARDIOVASCULAR SYSTEM

- 1.1. Control of the internal environment; negative feed back, positive feed back and feed-forward control.
- 1.2. Composition and measurement of body fluid compartments. Fluid exchange between various body fluid compartments.
- 1.3. Plasma proteins, their physiological functions.
- 1.4. Production of blood cells. Properties and functions of red blood cells. Blood groups. Transfusion.
- 1.5. Hemostatic mechanisms. Functions of thrombocytes. Blood coagulation and fibrinolysis.
- 1.6. Functional organization of the circulatory system. Hemodynamic functions of different vessels. Measurement of cardiac output.
- 1.7. Factors influencing arterial blood pressure. Measurement of pressure and flow.
- 1.8. Flow, pressure and resistance in the various segments of the circulatory system. Vascular resistances in series and parallel. Total peripheral resistance.
- 1.9. Rheology of blood; effects on blood viscosity in vivo.
- 1.10. Biomechanical properties of the vessel wall. Elasticity. Physiological significance of vessel geometry.
- 1.11. The microcirculatory unit. Blood pressure and flow in the microcirculation. Transcapillary exchange mechanisms. Starling-forces.
- 1.12. Control of lymphatic flow and interstitial fluid volume. Mechanisms of edema formation.
- 1.13. Venous circulation, physiological functions of veins. Venous pump mechanisms. Factors determining venous pressure and flow. Central venous pressure.
- 1.14. Generation of rhythmic potentials in the sinoatrial node. Impulse propagation through the conductive tissue and the myocardium. Excitability. Mechanism of reentry.
- 1.15. Electric responses of myocardial and nodal tissues. Mechanism of excitation-contraction in the myocardial tissue. Adrenergic and cholinergic control.
- 1.16. The electrocardiogram.
- 1.17. Cardiac cycle. Heart sounds.
- 1.18. Changes in pressure and volume during the cardiac cycle. PV loop.
- 1.19. Biomechanical aspects of cardiac functions; relationship between active tension and myocardial fiber length.
- 1.20. Definition of myocardial contractility. Factors affecting contractility.
- 1.21. Physiological control of cardiac output.
- 1.22. Ventricular and vascular function curves.
- 1.23. Local cardio-vascular control mechanisms. Physiology of endothelial functions.
- 1.24. Systemic cardio-vascular control – efferent pathways: neural and hormonal factors.
- 1.25. Systemic cardio-vascular control – afferent pathways: receptors in the heart, central arteries and veins.
- 1.26. Circulatory reflexes: baroreflexes and chemoreflexes. Cardiovascular centers in the CNS.
- 1.27. Coronary circulation, its physiological control.
- 1.28. Cerebral blood flow (CBF) and cerebrospinal fluid. Measurement of CBF. The blood-brain barrier. Regulation of cerebral circulation. Brain metabolism, oxygen requirements.
- 1.29. Splanchnic circulation. Skin circulation and its role in thermoregulation.
- 1.30. Pulmonary circulation: general characteristics, function. Pressure, flow, resistances. Physiological control mechanisms.
- 1.31. Circulation through skeletal muscles.
- 1.32. Cardiorespiratory adaptation during physical exercise.
- 1.33. Hemorrhagic shock.

2. RESPIRATION. FORMATION & EXCRETION OF URINE. ACID-BASE BALANCE. GASTROINTESTINAL FUNCTION

- 2.1. Functional anatomy of airways. Static and dynamic lung volumes and their measurement. Non-respiratory functions of the respiratory system.
- 2.2. Definition and measurement of respiratory dead space. Alveolar ventilation, measurement.
- 2.3. Mechanical properties of breathing. Pressure-volume relationship.
- 2.4. Surface tension in the alveoli. Distensibility of the lungs and chest wall.
- 2.5. Gas exchange in the lungs. Determinants of gas exchange. Diffusion capacity.
- 2.6. Oxygen transport in the blood. Role of hemoglobin in oxygen transport.
- 2.7. Types of hypoxia.
- 2.8. CO₂ transport in the blood.
- 2.9. Respiratory muscles and respiratory movements. Neural control of respiration. Organization and function of breathing centers.
- 2.10. Chemical control of respiration. Adaptation of the cardiovascular system to physical exercise.
- 2.11. Renal circulation, measurement and control.
- 2.12. Glomerular filtration, measurement, mechanism and its regulation.
- 2.13. Basic types of tubular transport mechanisms. F/P ratio.
- 2.14. Sodium type reabsorption, physiological control.
- 2.15. Glucose type reabsorption.
- 2.16. PAH type secretion. Secretion of organic anions and cations.
- 2.17. Excretion of water. Osmoregulation. Free water clearance.
- 2.18. Water and solute (Na⁺, Cl⁻) transport in the diluting and concentrating kidney. Osmolarity of the tubular fluid along the nephron.
- 2.19. Countercurrent multiplier and exchanger mechanisms in the kidneys. Urea transport and its role in osmoregulation.
- 2.20. Homeostatic control of the composition and volume of the extracellular fluid by the kidneys.
- 2.21. Function of the urinary bladder. Control of micturition.
- 2.22. Regulation of acid-base balance.
- 2.23. Acid-base buffer systems in the human organism.
- 2.24. Determination of the acid-base parameters.
- 2.25. Generation of acidic urine. Renal handling of bicarbonate.
- 2.26. Role of the lungs and kidneys in acid-base balance. Acid-base disturbances and their compensations.
- 2.27. The enteric nervous system. GI hormones.
- 2.28. Regulation of GI motility. Swallowing. Gastric motility and its regulation. Motility of the small intestine and the colon.
- 2.29. Regulation of GI secretion: salivary secretion. Gastric secretion and its control.
- 2.30. Function and regulation of the exocrine pancreas.
- 2.31. Liver & biliary system, physiological functions and control.
- 2.32. Digestion & absorption: carbohydrates, lipids and proteins.

3. ENDOCRINOLOGY

- 3.1. The pituitary gland: posterior lobe hormones.
- 3.2. Hormones of the adenohypophysis, regulation of their secretion.
- 3.3. Growth hormone and physiology of growth. Other hormones involved in growth.
- 3.4. Regulation of ADH secretion by the posterior lobe of hypophysis. Actions of ADH. Regulation of water intake and excretion by the hypothalamus.
- 3.5. Body iodide turnover. The thyroid gland: synthesis and release of thyroid hormones. Regulation of thyroid gland activity. Transport and metabolism of thyroid hormones.
- 3.6. Actions of thyroid hormones. Hypothyroidism. Hyperthyroidism.
- 3.7. Endocrine regulation of calcium and phosphate metabolism: calcium and phosphate pools and turnover. Bone dynamics. Synthesis and release of vitamin D, parathyroid hormone and calcitonin. Hormone actions.
- 3.8. Endocrine functions of the pancreas and the regulation of hormone secretion of the Langerhans islets.
- 3.9. Effects of insulin and glucagon. Consequences of the lack of insulin.
- 3.10. Factors determining blood glucose levels. Hypoglycemia.
- 3.11. Endocrine control of protein and fat metabolism.
- 3.12. Whole body metabolism. Energy balance. Basal metabolic rate.
- 3.13. Short-term and long-term control of food intake. Obesity and starvation.
- 3.14. The adrenal cortex: structure and biosynthesis of adrenocortical hormones. Effects of adrenocortical hormones. Regulation of hormone secretion of the adrenal cortex.
- 3.15. The adrenal cortex: physiological effects of glucocorticoids and control of their secretion.
- 3.16. The adrenal cortex: effects of mineralocorticoids and control of their secretion.
- 3.17. The gonads: the male reproductive system. Gametogenesis and ejaculation. Endocrine function of the testes. Control of testicular function. Development of male secondary sexual characteristics.
- 3.18. The gonads: the female reproductive system. Menstrual cycle. Control of ovarian function.
- 3.19. Ovarian hormones and their effects. Development of female secondary sexual characteristics.
- 3.20. Pregnancy. Hormonal changes during pregnancy. Development of the mammary gland. Lactation.

4. PHYSIOLOGY OF NERVE & MUSCLE CELLS. FUNCTIONS OF THE NERVOUS SYSTEM

- 4.1. Structure, permeability and transport function of the cell membrane.
- 4.2. Cellular signal transduction pathways.
- 4.3. Resting membrane potential and ionic equilibria.
- 4.4. Action potential.
- 4.5. Electrotonic phenomena, the electric model of the cell membrane.
- 4.6. General features of synaptic function.
- 4.7. Neuromuscular synapse and the EPP.
- 4.8. Ionic mechanisms of the EPSP and IPSP. Presynaptic inhibition.
- 4.9. Major classes of transmitter substances.
- 4.10. Contractile mechanism of skeletal muscle.
- 4.11. Excitation - contraction coupling in skeletal muscle.
- 4.12. Energy use and supply in skeletal muscle. Skeletal muscle fiber types. Oxygen debt.
- 4.13. Contractile function in smooth muscle.
- 4.14. Regulation of crossbridge cycle in smooth muscle.
- 4.15. Regulation of myoplasmic calcium concentration in smooth muscle.
- 4.16. Fundamentals of sensory functions, classification and functions of receptors. Somatosensory functions. Skin receptors. 'Coding' of sensory information. Sensory pathways.
- 4.17. Pain.
- 4.18. Electrical activity of the brain. The reticular activating system. EEG, evoked potentials.
- 4.19. Spinal and supraspinal control of the muscular tone. Proprioceptive reflexes.
- 4.20. Spinal control of posture and movements. Interoceptive and exteroceptive spinal reflexes. Spinal shock.
- 4.21. The role of the vestibular system in the control by movements and of equilibrium.
- 4.22. The role of the cerebellum in the control by movements and of equilibrium.
- 4.23. The role of basal ganglia and the cortex in the control of movements.
- 4.24. Hearing: peripheral and central mechanisms. Functions of the middle ear and the cochlea. Auditory pathways.
- 4.25. Physiology of olfaction and taste.
- 4.26. Vision: chemical basis of photoreceptor mechanisms, genesis of action potentials, image forming mechanisms. Central visual pathways and cortical processing of visual information. Color vision.
- 4.27. Functions of the inner eye muscle. Accommodation. Central regulation of the function of the external eye muscles. Reflexes associated with vision. Eye movements.
- 4.28. Functional anatomy of autonomic nervous system function.
- 4.29. General characteristics of the function of the autonomic nervous system.
- 4.30. Chemical transmission at the autonomic postganglionic terminals.
- 4.31. Receptors and transduction mechanisms in the autonomic nervous system.
- 4.32. Reflex functions of the autonomic nervous system.
- 4.33. Limbic functions and hypothalamic integration I.: control of autonomic functions.
- 4.34. Limbic functions and hypothalamic integration II.: sexual, maternal and feeding behavior. Fear and rage. Motivation. Emotion.
- 4.35. Thermoregulation and its central nervous integration.
- 4.36. Functions of the neocortex. Conditioned reflexes. Learning and memory.