** KMTC/QP-08/TIS**

**VOI CAMPUS**

**DEPARTMENT OF CLINICAL MEDICINE AND SURGERY**

DIPLOMA IN CLINICAL MEDICINE AND SURGERY

CAT EXAMINATION FOR MARCH 2020 CLASS

**PAPER:** **PHYSIOLOGY I**

**DATE: Thursday, 18th February 2021**

**TIME ALLOWED: 1 Hour**

**INSTRUCTIONS:**

Read these instructions carefully before attempting the paper

1. Write your examination number in full at the top right hand corner of the answer book
2. The paper consists of one single best choice/ answer (10 Marks), MCQ (20 Marks), Short answer questions (20 Marks), & Essay (10 Marks).
3. Answer **ALL** questions; avoiding grammatical mistakes
4. **Cheating** in the examination will lead to disqualification from the entire examination
5. **MOBILE PHONES** are not allowed in the examination room
6. Answer **ALL** the questions in the answer booklet provided
7. No candidate will be allowed to leave the examination room until the stipulated time is over

**SECTION ONE: ONE SINGLE BEST CHOICE / ANSWER(10 MARKS)**

Select only one single best answer. Answer all questions.

**1. Since muscle cells make and utilize an abundance of ATP (energy) for muscle activity, each muscle cell most likely has numerous \_\_\_\_\_\_\_\_\_\_.**

a. peroxisomes

b. lysosomes

**c. mitochondria**

d. Golgi

**2. The Functional Residual Capacity is:**

a. The maximum volume of gas that can be ex haled after maximal

inspiratory effort.

b. The volume of gas that can be ex haled after a tidal inspiration.

c. The volume of gas that can be ex haled after a tidal expiration.

**d. The volume of gas in the lung after normal expiration.**

**3. With regard to Surfactant, which of the following statements is FALSE?**

a. Improves alveolar stability.

b. Assists in keeping the alveolar dry.

c. Is produced by the Type II alveolar cells.

**d. Counteracts the adverse effects predicted by Poiseuille's law.**

4.  **Transcription and translation take place in the \_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_, respectively.**

**a. nucleus; cytoplasm**

b. nucleolus; nucleus

c. nucleolus; cytoplasm

d. cytoplasm; nucleus

5. **What produces the force which drives normal exhalation, and is the process active or passive?**

a. Diaphragm, active

b. Intercostal muscles, active

**c. Elastic force, passive**

d. Reflec arcs, passive

6. **What is the pressure of gas within the alveoli at the peak of inspiration, just before expiration, relative to that of atmospheric air?**

a. Less than atmospheric air

b. Greater than atmospheric air

c. Cannot be predicted without more information

**d. The same as atmospheric air**

7. **Which of the following lists includes only structures that compose the anatomic dead-space?**

a. Respiratory bronchioles, alveoli, trachea, nasal cavity

b. Pharynx, bronchi, alveolar ducts, larynx

c. Capillaries, respiratory bronchioles, trachea, bronchi

**d. Pharynx, nasal cavity, trachea, bronchi**

8. **Lung compliance:**

a. Has the units of pressure per volume (cm H20/L)

**b. Is greater at functional residual capacity than at total lung capacity**

c. Is greater at functional residual capacity than at total lung capacity

d. Is greater in small mammals than in large mammals, even when adjusted for differences in lung size

9. **Pulmonary surfactant:**

a. Can be deficient in premature newborns

b. Is produced in type II alveolar cells

c. Decreases surface tension of the fluid lining the alveoli

**d. All of the above**

10. **Urine that has glucose in it usually an indicator of \_\_\_\_\_\_\_\_\_**

**a) Diabetes**

b) Bacterial infection

c) Kidney stones

d) Muscle atropy

**SECTION TWO: MULTIPLE CHOICE QUESTIONS (20 MARKS)**

Indicate **T** for **TRUE** or **F** for **False** in the choices for the following questions. Any correct answer will earn you 1 mark and any wrong answer will earn -1 mark. Any choice that won't be marked either true or false will earn you a zero (0) mark. Attempt all questions but avoid guessing.

1. How does RNA differ from DNA?

(A). RNA contains deoxyribose, and DNA contains ribose. F

(B). RNA contains uracil, and DNA contains thymine. T

(C). RNA is double stranded, and DNA is single stranded. F

(D). All of the above. F

(E). None of the above. F

2D. Immune system cells use damaging proteases and reactive oxygen species to destroy foreign invaders. The immune system cells are not harmed because the microbes are sequestered in vesicles. How did the invaders get to the vesicles?

(A). Osmosis F

(B). Phagocytosis T

(C). Exocytosis F

(D). Pinocytosis F

(E). None of the above F

3. Which of the following mechanisms is not important in sodium homeostasis?

(A). ANP F

(B). Aldosterone F

(C). Baroreceptors F

(D). Epinephrine T

(E). All of the above F

4. With regard to Surfactant, which of the following statements are FALSE?

(A). Improves alveolar stability. F

(B). Assists in keeping the alveolar dry. F

(C). Assists in keeping the alveolar moist. T

(D). Is produced by the Type II alveolar cells. F

(E). Counteracts the adverse effects predicted by Poiseuille's law. T

5. Carbon Dioxide transported from the body cells back to the lungs as

(A). bicarbonate (HCO3) - 70% T

(B). carbaminohemoglobin - 23% T

(C). dissolved in the plasma - 7% T

(D). Carbonic Acid -3 % F

(E). Carbon Monoxide - 0.9% F

**SECTION THREE: SHORT ANSWER QUESTIONS (20 MARKS)**

Answer all questions in this section.

1. List 4 importance of studying physiology. (4 marks) **Physiology is important because it is the foundation upon which we build our knowledge of what "life" is, how to treat disease, and how to cope with stresses imposed upon our bodies by different environments. Physiological studies of normal biological function provide the basis for understanding the abnormal function seen in animal and human disease (pathophysiology) and for developing new methods for treating those diseases (translational research).**
2. Name 4 types of membrane proteins. (4 marks) **Structural Proteins, Channel Proteins, Carrier proteins, Enzymes, Receptor proteins, gnaling proteins / Recognition proteins**
3. What are the advantages of having surfactant and the low surface tension? (4 marks)

* **It increases the compliance of the lung**
* **It reduces the work of expanding the lung with each breath**
* **It stabilizes the alveoli (thus the smaller alveoli do not collapse at the end-expiration)**
* **It keeps the alveoli dry (as the surface tension tends to collapse alveoli, it also tends to suck fluid into the alveolar space from capillaries).**

4. Name the four bases of DNA. (4 marks) *adenine* and *guanine, thymine and cytosine*

5. Name 4 types of RNA. (4marks) mRNA, rRNA, tRNA, Precursor messenger RNA, Small nuclear RNA (snRNA), MicroRNA (miRNA)

**SECTION FOUR: ESSAY (10 MARKS)**

Discuss respiratory system adaptations to exercise. (10 marks)

|  |  |
| --- | --- |
| **Ventilation / Breathing rate** | * Breathing rates increase with higher intensity training (this is more an adaptation from anaerobic fitness and muscular endurance training or higher intensity aerobic fitness training).  This enables more air to move in and out of the lungs enhancing gas exchange. |
| **Lung Capacity/ Volume** | * Lungs increase their ability to expand enabling a greater quantity of air to move in and out (this is a similar adaptation to the increase in stroke volume in the cardiovascular system). |
| **Respiratory Muscles** | * The strength and endurance of the diaphragm and intercostal muscles improves.  This results in an improved ability to breathe in more air, for longer with less fatigue. * Aerobic training tends to improve the endurance of respiratory muscles * Anaerobic training tends to increase the size and strength of respiratory muscles |
| **Capillarisation in the lungs** | * More capillaries are formed in the lungs over time allowing more blood to flow in and out of the lungs.  This improves the uptake of oxygen as there is a greater surface area for blood to bind with haemoglobin. |
| **Alveoli** | * The numbers of alveoli in the lungs increase to enable more gas exchange to occur. |
| **Gas Exchange** | * The exchange of oxygen and carbon dioxide improves as the gradient between each becomes larger.  This occurs because the more oxygen used in the tissues and the more carbon dioxide produced creates a larger difference/gradient between the blood and tissues. * Aerobic fitness training tends to improve the efficiency of the body’s tissues at absorbing O2 and removing CO2, while anaerobic fitness and muscular endurance training tends to improve the capacity for this gas exchange. |