**VETERINARY/ANIMAL PHYSIOLOGY**

**Chapter 3: Respiration**

**Dr. Manisha1, Dr. Anish koul2**

1PhD Scholar, ICAR-NDRI, Karnal, Haryana

2Assistant professor, Veterinary Physiology and Biochemistry, LUVAS, Haryana

**Respiration: -**

* **External Respiration:** involves the exchange of gases between the environment outside the lungs and the lungs.
* **Internal Respiration:** The gases exchange between the blood and the body tissues.
* **Cellular Respiration:** It is a metabolic process that occurs inside cells and uses oxygen to produce energy.
* **Respiratory Structures: -**
1. **Conduction Zone**
* It mainly includes nose, pharynx, larynx, trachea, bronchi and bronchioles.
* Bring air into the to respiratory zone.
1. **Respiratory Zone**
* It includes mainly bronchioles, alveolar ducts and alveoli.
* Site of gas exchange.

**Gas transport: -**

1. **Oxygen Transportation:**

Approximately 98.5% of oxygen is conveyed through the bloodstream by binding to haemoglobin. The remaining 1.5% is transported in a dissolved state within the plasma.

1. **Carbon Dioxide Transportation:**

Around 70% of carbon dioxide (CO2) is transferred in the form of bicarbonate ions (HCO3-). Additionally, 23% of carbon dioxide binds to haemoglobin, while the remaining 7% is carried in its dissolved state within the plasma.

**Note: -**

* **Bohr Effect:** The oxygen-binding affinity of Hb decreases as the PCO2 and H+ concentration increases, enhancing oxygen release in metabolically active tissues.
* **Haldane Effect (C-D-H effect):** The oxygenation of Hb in the lungs promotes the release of CO2 from Hb, influencing the blood's capacity to transport both oxygen and carbon dioxide.
* **Hering-Breuer Reflex:** The Hering-Breuer Reflex functions as a protective mechanism, preventing lung overinflation by inhibiting inspiration through stretch receptors in bronchi and bronchioles.
* **Chloride shift (Hamburger phenomenon):** Involves the exchange of chloride ions for bicarbonate ions in red blood cells. This process facilitates the transport of carbon dioxide (CO2) from tissues into to the lungs within the bloodstream.

**Laws: -**

* **Boyle's Law:** it states that a given amount of gas's pressure is inversely proportional to its volume at constant temperature.
* **Charles's Law:** It explains how, at constant pressure, the absolute temperature and gas volume are directly proportional.
* **Henry's Law:** The solubility of a gas in a liquid is proportional to its partial pressure above the liquid.
* **Laplace's Law:** The tension, radius, and pressure in a spherical structure, such as a bubble or alveolus, stating that the pressure is directly proportional to the tension and inversely proportional to the radius.
* **Fick's Law:** The rate is directly proportional to the partial pressure difference, surface area, and diffusion coefficient, but inversely proportional to membrane thickness.

**Terminologies: -**

* **Eupnea:** Normal breathing
* **Apnea:** Cessation of breathing
* **Dyspnea:** Difficult breathing
* **Polypnea (Tachypnea/Panting):** Rapid, shallow breathing
* **Hyperpnea:** Increase depth, frequency or both
* **Hypoxia:** Inadequate oxygen supply to tissues and organs
* Hypercapnia: Elevated level of carbon dioxide (CO₂) in the bloodstream
* **Asphyxia:** Hypercapnia + hypoxia

**Oxygen-haemoglobin dissociation curve: -**

* Curve depicts the relationship between PO₂ and Hb saturation in blood
* Increase in CO2, Acidity (H+), 2,3-DPG, Exercise and Temperature cause the curve shift to right.
* **2,3-DPG:** Produced in RBC in response to low oxygen levels. Decreases Hb-oxygen affinity, enhancing oxygen release at tissues.
* **Shape:**
* For adult Hb: Sigmoidal or S shaped
* For foetal Hb: Steeper shaped

**Regulation of respiration: -**

**1. Nervous control**

|  |  |  |  |
| --- | --- | --- | --- |
| **S.N.** | **Respiratory centre** | **Location** | **Functions** |
| **1.** | **Dorsal respiratory group (DRG)** | Dorsal medulla | Control inspiration and produce a baseline breathing rhythm. |
| **2.** | **Ventral respiratory group (VRG)** | Ventral medulla | Regulate expiration (mainly forced expiration) |
| **3.** | **Pneumotaxic centre** | Upper pons | Stop inspiration, control breathing rate and inspiratory volume |
| **4.** | **Apneustic centre** | Lower pons | Responsible for deep inspiration |

**2. Chemoreceptors**

1. **Central chemoreceptors**
* located into the medulla oblongata
* It responds to elevated PCO2 levels through changes in H+ ion concentration in cerebrospinal fluid.
1. **Peripheral chemoreceptors**
* They are located at the bifurcation of the carotid arteries and the aortic arch
* Caused by elevated PCO2, elevated H+ ions, and decreased O2 in arterial blood
* The glossopharyngeal nerve transmits a signal from the carotid body to the respiratory centre.
* The Vagus nerve uses the aortic arch to send a signal to the respiratory centre.

**Lung Volumes and Capacities: -**

|  |  |  |
| --- | --- | --- |
| **Measure** | **Quantity** | **Functional Definition** |
| **Tidal Volume (TV)** | 500 ml | Air volume expelled or inhaled during a typical breath |
| **Inspiratory Reserve Volume (IRV)** | 2500 ml | Maximum amount of air that can be inhaled above and above what is typically inspired |
| **Expiratory Reserve Volume (ERV)** | 1500 ml | Maximal volume of air that can be exhaled over and above the normal expiration |
| **Residual Volume (RV)** | 1500 ml | Air volume in the lungs following a maximal exhalation |
| **Total Lung Capacity (TLC)** | 6000 ml | air volume in the lungs at its maximum after a maximal inspiration (RV + TV + ERV + RV) |
| **Functional Residual Capacity (FRC)** | 3000 ml | Volume of air present in the lung at end of normal expiration (RV + ERV) |
| **Inspiratory Capacity (IC)** | 3000 ml | Maximal volume of air that can be inhaled after normal expiration (IRV + TV) |
| **Vital Capacity (VC)** | 4500 ml | Maximal volume of air that can be forcefully inspired after a forceful expiration (IC + TV + ERV) |

**The difference between mammalian and avian respiration: -**

|  |  |  |  |
| --- | --- | --- | --- |
| **S.N.** | **Aspect** | **Mammalian respiration** | **Avian respiration** |
| **1.** | **Respiratory system** | Lungs are primary organ for respiration | Air sac and lungs collectively contributes to respiration |
|  | **Efficiency of respiratory system** | Less efficient | More efficient |
| **2.** | **Surfactant-secreting cells** | Type-II Pneumocytes | Granular/trilaminar cells |
| **3.** | **Gas exchange** | Alveoli | Parabronchi/tertiary bronchi |
| **4.** | **Voice-box** | larynx | syrinx |
| **5.** | **Diaphragm** | Primary muscle for breathing | absent |
| **6.** | **Inspiration & expiration** | Inspiration-activeExpiration-passive | Both active |

**Note: -**

* Dipalmitoylphosphatidycholine (DPPC), act as a pulmonary surfactant.
* There are nine air sacs in birds: two paired clavicular, two anterior, two posterior, two cervical, and two abdominal.
* There are two types of parabronchi in birds: Paleopulmonic (ancient) and Neopulmonic (new lung)
* Neopulmonic parabronchi have bidirectional air flow, while paleopulmonic parabronchi have unidirectional air flow.
* Paleopulmonic parabronchi founds in all birds
* In penguin and emu, neopulmonic parabronchi is absent
* In fowl and song birds, neopulmonic parabronchi is more developed than Paleopulmonic parabronchi

**Respiratory Disorders: -**

* **Asthma:** Chronic inflammation of airways, bronchoconstriction, and increased mucus production.
* **Emphysema:** Destruction of alveolar walls, dilation and rapture of alveoli is seen
* **Atelectasis:** the partial or complete collapse of a lung, failure of alveoli to open
* **Chronic Bronchitis:** Inflammation and irritation of bronchial tubes, leading to excessive mucus production.

**Multiple Choice Questions**

1. Name of the organ of phonation in mammals
2. Larynx
3. Pharynx
4. Syrinx
5. Oesophagus
6. Which one of followings organ of phonation in birds
	1. Pharynx
	2. Syrinx
	3. Oesophagus
	4. Larynx
7. Which one is the smallest subdivision of the air passages
	1. Alveoli
	2. Trachea
	3. Oesophagus
	4. Glottis
8. In which of the following species, there are two phases during inspiration and, two phases are present during expiration
	1. Dog
	2. Cattle
	3. Swine
	4. Horse
9. ………………. carries deoxygenated blood is called as
	1. Aorta
	2. Heart
	3. Pulmonary artery
	4. Pulmonary vein
10. Gas exchange between the pulmonary capillaries and the lungs is referred to as
	1. Pulmonary ventilation
	2. Gas transport
	3. Internal respiration
	4. External respiration
11. Gas exchange between blood and tissues is referred to as
	1. Pulmonary ventilation
	2. Internal respiration
	3. External respiration
	4. Cellular respiration
12. The inhalation and exhalation of air in and out of the lungs is
	1. Pulmonary ventilation
	2. Internal respiration
	3. External respiration
	4. Gas transport
13. Actula gas exchange takes place in which of the followings
	1. Trachea
	2. Small bronchioles
	3. Alveoli
	4. Alveoli ducts
14. Instrument required for required for recording of pulmonary volumes and capacities
	1. Spirometer
	2. Anemometer
	3. Spirograph
	4. Sphygmomanometer
15. Spirometer cannot measure
	1. Vital Capacity
	2. Functional Residual Volume
	3. Expiratory Reserve Volume
	4. Inspiratory Reserve Volume
16. Vital capacity of lungs is
	1. ERV+RV
	2. IRV+TV
	3. IRV+TV+ERV
	4. ERV+TV
17. The amount of gas left over after a typical tidal inspiration that can be inspired is referred to as the
	1. Residual volume
	2. Tidal volume
	3. Expiratory Reserve Volume
	4. Inspiratory Reserve Volume
18. Volume of the gas that can still be expired at the end of a normal tidal expiration is known as
	1. Residual volume
	2. Tidal volume
	3. Expiratory Reserve Volume
	4. Inspiratory Reserve Volume
19. Which of the following statements about an animal in rest is true?
	1. TLC>VC>TV>FFRC
	2. TLC>FRC>TV>VC
	3. TLC>VC>FRC>TV
	4. VC>TLC>TV>FRC
20. The amount of air in the lungs that remains after maximum expiration is referred to as
	1. Residual volume
	2. Tidal volume
	3. Expiratory Reserve Volume
	4. Inspiratory Reserve Volume
21. Inspiratory Capacity is defined as
	1. The entire volume of air that can be drawn in following a tidal collapse
	2. The total volume of exchangeable air
	3. The total amount of air inspired after a tidal inspiration
	4. Another name for Vital Capacity
22. ………………………. cycles are characterised by a deep, rapid inspiration followed by expiration of longer duration
	1. Complementary breathing
	2. Sigh
	3. Both the above
	4. Coastal breathing
23. …………………is a characterized by pronounced rib movement. When breathing becomes difficult, this kind of breathing becomes more pronounced
	1. Complementary breathing
	2. Sigh
	3. Both the above
	4. Coastal breathing
24. Complementary breathing cycles (Sigh) apparently not present in which species
	1. Cattle
	2. Goat
	3. Pig
	4. Horse
25. Collateral ventilation is a feature of
	1. Cattle
	2. Goat
	3. Pig
	4. Dog
26. Purring is seen in which species
	1. Cat
	2. Dog
	3. Cattle
	4. Horse
27. What is the main purpose of the medulla oblongata's respiratory center?
28. It stimulates the diaphragm to contract during expiration
29. It inhibits the diaphragm during inspiration
30. It controls the rate and depth of breathing
31. It regulates blood pH by releasing carbon dioxide
32. Which statement accurately describes the function of the epiglottis?
	1. When swallowing, the epiglottis stops food from getting into the trachea.
	2. The epiglottis enhances air exchange in the alveoli
	3. The epiglottis produces mucus for respiratory lubrication
	4. The epiglottis regulates vocal cord tension
33. How does the respiratory system respond to an increase in carbon dioxide levels in the blood?
34. By decreasing the respiratory rate
35. By increasing the respiratory rate
36. By constricting bronchioles
37. By decreasing the tidal volume
38. What function does the diaphragm serve in breathing?
39. It assists in vocalization
40. It regulates blood pH by excreting carbon dioxide
41. It controls the volume of air inhaled and exhaled
42. It produces surfactant for alveolar stability
43. Which statement accurately describes the role of the respiratory system in acid-base balance?
44. The respiratory system primarily excretes excess acid through urine
45. The respiratory system regulates blood pH by controlling carbon dioxide levels
46. The respiratory system has no impact on acid-base balance
47. The respiratory system directly neutralizes excess base in the blood
48. Normal, quiet respiration is called as
	1. Costal respiration
	2. Abdominal respiration
	3. Sigh
	4. None of the above
49. The effect of surface tension on pulmonary alveoli can be clarified by
	1. Boyle’s low
	2. Charle’s low
	3. Laplace’s low
	4. Henry’s low
50. The low which explains the effect of temperature on gas volume is known as
	1. Boyle’s low
	2. Charle’s low
	3. Laplace’s low
	4. Henry’s low
51. The low which explains the relationship between volume of gas and solubility is given by
	1. Boyle’s low
	2. Charle’s low
	3. Laplace’s low
	4. Henry’s low
52. Which one of the followings is the main site for gas exchange
	1. Type-I alveolar cells
	2. Type-II alveolar cells
	3. Septal cells
	4. None of the above
53. Surfactant is produced by which cells
	1. Type-I alveolar cells
	2. Type-II alveolar cells
	3. Septal cells
	4. None of the above
54. The functions for pulmonary surfactant
	1. Prevents alveolar collapse
	2. Decrease alveolar surface tension
	3. Increase lung compliance
	4. All of the above
55. In bird surfactant produced by
	1. Trilaminar cells
	2. Type-I alveolar cells
	3. Type-II alveolar cells
	4. Septal cells
56. Which of the following describes peaceful, regular breathing?
	1. Eupnea
	2. Polypnea
	3. Dyspnea
	4. Hyperpnea
57. Difficulty in breathing is known as
	1. Eupnea
	2. Polypnea
	3. Dyspnea
	4. Hyperpnea
58. Increase in the depth, frequency or both after severe exercise is termed as
	1. Eupnea
	2. Polypnea
	3. Dyspnea
	4. Hyperpnea
59. Rapid, shallow breathing, similar to breathing is termed as
	1. Eupnea
	2. Polypnea (Tachypnea)
	3. Dyspnea
	4. Hyperpnea
60. Asphyxia is described as
	1. Hypoxia + hypocapnia
	2. Hypercapnia + hypoxia
	3. Cyanosis + Hypocapnia
	4. Hypoxia + bradypnea
61. ……………….is a measurement of the distensibility of the lungs
	1. Lung compliance
	2. Emphysema
	3. Pneumothorax
	4. Pneumonia
62. Listening of the lung sound with the help of stethoscope is known as
	1. Percussion
	2. Auscultation
	3. Both the above
	4. None of the these
63. The state in which air moves into the gap between the partial and visceral pleura is known as
	1. Lung compliance
	2. Emphysema
	3. Pneumothorax
	4. Pneumonia
64. Acute hyperventilation causes
	1. Respiratory alkalosis
	2. Respiratory acidosis
	3. Respiratory distress
	4. All of the above
65. Acute hyperventilation causes
	1. Respiratory alkalosis
	2. Respiratory acidosis
	3. Respiratory distress
	4. All of the above
66. The volume of gas that is inspired but which do not take part in gas exchange in the airways and alveoli is known as
	1. Anatomical dead space
	2. Physiological dead space
	3. Respiratory dead space
	4. Alveolar dead space
67. The upper portion of airway where no diffusion of gases between blood and the airways down to the bronchioles is termed as
	1. Anatomical dead space
	2. Physiological dead space
	3. Respiratory dead space
	4. Alveolar dead space
68. An air pressure in the lungs and the passages leading to them is called as
	1. Intrapulmonic pressure
	2. Intrapleural pressure
	3. Intra-alveolar presuure
	4. Both a & c
69. The pressure in the thorax outside the lungs called as
	1. Intrapulmonic pressure
	2. Intrapleural pressure
	3. Intrathoracic pressure
	4. Both b & c
70. During inspiration…………. becomes slightly sub atmospheric
	1. Intrapulmonic pressure
	2. Intrapleural pressure
	3. Intrathoracic pressure
	4. Both a & c
71. In the blood, oxygen is transported in the form of
	1. As physically dissolved form
	2. In oxyhaemoglobin form
	3. Both the above
	4. None of the above
72. The partial pressure of O2 and CO2 (mmHg) at alveolar level is
	1. 104, 40
	2. 40, 104
	3. 45, 40
	4. 100, 50
73. The partial pressure of O2 and CO2 (mmHg) at arterial level is
	1. 45, 40
	2. 95, 40
	3. 100, 20
	4. 40, 45
74. How does the respiratory system respond to low oxygen levels in the blood?
	1. By decreasing the respiratory rate
	2. By constricting blood vessels in the lungs
	3. By releasing erythropoietin to stimulate red blood cell production
	4. By promoting the breakdown of haemoglobin
75. Which of the following sums up the purpose of the nasal conchae in the nasal cavity?
	1. The nasal conchae produce mucus for filtration
	2. The nasal conchae warm and humidify inhaled air
	3. The nasal conchae contain taste receptors
	4. The nasal conchae regulate vocal cord tension
76. During exercise, what happens to respiratory rate and tidal volume?
	1. Tidal volume and respiratory rate both decreases.
	2. Both the tidal volume and the respiratory rate rise.
	3. Tidal volume decreases while respiratory rate increases.
	4. Respiratory rate decreases, but tidal volume increases
77. Which statement is true regarding the composition of inspired air?
	1. Inspired air is always saturated with water vapor
	2. Inspired air has a constant concentration of oxygen
	3. Inspired air contains a higher percentage of carbon dioxide than expired air
	4. Inspired air contains a higher percentage of nitrogen than oxygen
78. What is the primary factor that influences the diffusion of gases across the respiratory membrane in the alveoli?
	1. Thickness of the respiratory membrane
	2. Concentration of nitrogen in the alveoli
	3. Size of the alveoli
	4. Presence of surfactant
79. Respiratory quotient is
	1. Volume of CO2 produced/Volume of O2 consumed
	2. Volume of CO2 consumed /Volume of O2 consumed
	3. Volume of CO2 consumed /Volume of O2 produced
	4. Volume of CO2 produced /Volume of O2 produced
80. Which group of the following is set up correctly in terms of the respiratory quotient (RQ) value?
	1. Carbohydrate > fat > protein
	2. Fat > protein > carbohydrate
	3. Protein > fat > carbohydrate
	4. Carbohydrate > protein > fat
81. Amount of O2 carried by 100 ml of blood is
	1. 30 ml
	2. 40ml
	3. 20ml
	4. 10ml
82. The way that O2 binds to Hb is described as
	1. Compliant
	2. Irreversible
	3. Reversible
	4. noncompliant
83. The loading and unloading of O2 ability of Hb in the form of graph known as
	1. Oxyhaemoglobin dissociation curve
	2. Carboxyhaemoglobin dissociation curve
	3. Myoglobin dissociation curve
	4. Methaemoglobin dissociation curve
84. For adult O2 transport oxyhaemoglobin dissociation curve is
	1. Sigmoid
	2. S shape
	3. Both the above
	4. None of the these
85. For foetal O2 transport oxyhaemoglobin dissociation curve is
	1. Sigmoid
	2. S shape
	3. Steeper
	4. All of the above
86. As blood moves to the lungs from the tissues, the Oxyhaemoglobin dissociation curve shifts to;
	1. Right
	2. Left
	3. Up
	4. Down
87. Foetal haemoglobin has greater affinity for O2 than adult haemoglobin because;
	1. Its concentration is very high
	2. Foetal blood gets O2 from mother
	3. It binds 2,3 DPG less avidly by gamma polypeptide chain than HbA
	4. Its polypeptide chain binds very fast with oxygen
88. 2,3 DPG present in
	1. Blood plasma
	2. RBC
	3. WBC
	4. Blood of lungs
89. The majority of carbon dioxide is transported in the blood
	1. Attached to Hb
	2. Dissolved in the plasma
	3. As bicarbonate ion in RBC
	4. As carbon monoxide in RBC
90. CO2 combines with Hb to form
	1. Carbaminohaemoglobin
	2. Carboxyhaemoglobin
	3. Myoglobin
	4. Methaemoglobin
91. Which component from the plasma enters the RBC during the bicarbonate ion diffusion process during carbon dioxide transportation, balancing the increase in hydrogen ion concentration in the RBC?
	1. Humberger shift
	2. Chloride shift
	3. Both a & b
	4. Haldane effect
92. Effect of O2 on hydrogen ion and CO2 loading and unloading from haemoglobin is termed as
	1. C-D-H effect
	2. Haldane effect
	3. Both a & b
	4. Bohr effect
93. Bohr effect explains
	1. Hb binds CO more readily than O2
	2. Hb unloads its O2 when it encounters low pH
	3. Diffusion occurs so slowly over long distance
	4. O2 is present in the atmosphere in relatively low concentrations
94. Double Bohr effect occurs in;
	1. Foetal circulation
	2. Maternal circulation
	3. In the placenta operating in both maternal and foetal circulation
	4. In the uterine wall
95. In chloride shift, chloride ion diffuses
	1. Into RBC to maintain electrical neutrality
	2. Out of RBC to maintain electrical neutrality
	3. Into RBC to maintain pH
	4. Out of RBC to maintain pH
96. Hering-Breuer reflex serves as a protective mechanism to prevent
	1. Tracheal collapse
	2. Excess oxygenation
	3. Excess lung inflation
	4. All
97. What statement about hemoglobin's function in the respiratory system is true?
98. Haemoglobin binds to oxygen and releases carbon dioxide
99. Haemoglobin binds to carbon dioxide and releases oxygen
100. Haemoglobin only transports nitrogen in the blood
101. Haemoglobin has no role in gas exchange
102. Regarding pulmonary ventilation, which statement is correct?
103. During inspiration, intrapulmonary pressure decreases
104. During expiration, intrapulmonary pressure increases
105. During both inspiration and expiration, intrapulmonary pressure remains constant
106. Intrapulmonary pressure is not affected by respiratory movement
107. What effect does sympathetic stimulation have on bronchioles?
108. Bronchioles constrict
109. Bronchioles dilate
110. Sympathetic stimulation has no impact on bronchioles
111. Bronchioles become rigid
112. How does the Bohr effect influence oxygen transport?
	1. It enhances oxygen binding to haemoglobin in low pH conditions
	2. It reduces oxygen binding to haemoglobin in low pH conditions
	3. It has no impact on oxygen transport
	4. It only affects carbon dioxide transport
113. Which statement is true regarding the Haldane effect?
	1. It describes the effect of oxygen concentration on carbon dioxide binding to haemoglobin
	2. It explains the increased affinity of haemoglobin for carbon dioxide in low oxygen conditions
	3. It has no relation to respiratory physiology
	4. It only affects oxygen dissociation from haemoglobin
114. The urge to inhale because of
	1. Rising PO2
	2. Falling PO2
	3. Rising PCO2
	4. Falling PCO2
115. Mechanism for regulation of respiration
	1. Nervous
	2. Chemical
	3. Humoral
	4. All of the above
116. The respiratory control centre is located on the
	1. Medulla oblongata
	2. Alveoli
	3. RBC
	4. Trachea
117. Group of neurons located in the dorsal part of medulla
	1. Dorsal Respiratory Group (DRG)
	2. Ventral Respiratory Group (VRG)
	3. Pneumotaxic & Apneustic centre
	4. All
118. Group of neurons located in the ventrolateral part of medulla
	1. Dorsal Respiratory Group (DRG)
	2. Ventral Respiratory Group (VRG)
	3. Pneumotaxic & Apneustic centre
	4. All
119. Neuron of the Dorsal Respiratory Group primarily
	1. Generate the basic rhythm of breathing
	2. Responsible for expiration
	3. Limit inspiration
	4. Responsible for deep inspiration
120. Group of the neurons work for inspiration centre
	1. Dorsal Respiratory Group
	2. Ventral Respiratory Group
	3. Pneumotaxic & Apneustic centre
	4. All of the above
121. Group of the neurons associated with both inspiration and expiratory activity
	1. Dorsal Respiratory Group
	2. Ventral Respiratory Group
	3. Pneumotaxic & Apneustic centre
	4. All of the above
122. Neuron of the Ventral Respiratory Group responsible for
	1. Generate the basic rhythm of breathing
	2. Primarily Responsible for expiration
	3. Limit inspiration
	4. Responsible for deep inspiration
123. Pneumotaxic centre located in
	1. Dorsal side of medulla
	2. Ventral side of medulla
	3. Pons
	4. Carotid artery
124. Pneumotaxic centre is responsible for
	1. Basic rhythm of breathing
	2. For expiration
	3. Deep inspiration
	4. Limit inspiration and therefor regulates inspiratory volume and respiration rate
125. Apneustic centre located in
	1. Ventral medulla
	2. Dorsal medulla
	3. Rostral pons
	4. Caudal pons
126. Apneustic centre responsible for
	1. Basic rhythm of breathing
	2. For expiration
	3. Deep inspiration
	4. Limit inspiration
127. During exercise when expiration become an active process which centre becomes activate
	1. Dorsal Respiratory Group (DRG)
	2. Ventral Respiratory Group (VRG)
	3. Pneumotaxic centre
	4. Apneustic centre
128. Complementary breathings are manifestation of
	1. Dorsal Respiratory Group (DRG)
	2. Ventral Respiratory Group (VRG)
	3. Pneumotaxic centre
	4. Apneustic centre
129. Factors responsible for chemical regulation of respiration
	1. PCO2
	2. PO2
	3. H+ Concentration
	4. All of the above
130. Which statement about peripheral chemoreceptors is true?
	1. Located in carotid and aortic bodies
	2. Sensitive to change in PCO2, PO2 and H+
	3. Acute increase in H+
	4. All of the above
131. Which of the following describes central chemoreceptors correctly?
	1. Located in carotid and aortic bodies
	2. Located in medulla
	3. Sensitive to change in H+ concentration of CSF
	4. Both b & c
132. Which of the following is the primary variable for the regulation of central chemoreceptors
	1. PCO2
	2. PO2
	3. arterial pH
	4. Venous pH
133. Most potent respiratory stimulus is
	1. Low plasma pH
	2. High plasma pH
	3. Low CSF pH
	4. High plasma PCO2
134. Normal respiratoryfrequency in cattle (breath/min) is
	1. 10-15
	2. 18-22
	3. 21-25
	4. 26-35
135. Normal respiratoryfrequency in horse (breath/min) is
	1. 10-15
	2. 18-22
	3. 21-25
	4. 26-35
136. Normal respiratoryfrequency in dog (breath/min) is
	1. 10-14
	2. 15-30
	3. 21-25
	4. 26-35
137. A state in which tissues does not get adequate supply of O2
	1. Hypoxia
	2. Anoxia
	3. Stagnant hypoxia
	4. Histotoxic hypoxia
138. Cessation of breathing is called as
	1. Hypoxia
	2. Anoxia
	3. Stagnant hypoxia
	4. Histotoxic hypoxia
139. When the arterial blood insufficiently saturated with oxygen because of low PO2 in the atmosphere being breathed is called as
	1. Stagnant hypoxia
	2. Histotoxic hypoxia
	3. Ambient hypoxia
	4. Anaemic hypoxia
140. When cells are unable to use O2 that isadequately supplied is known as
	1. Stagnant hypoxia
	2. Histotoxic hypoxia
	3. Ambient hypoxia
	4. Anaemic hypoxia
141. When the blood's ability to carry oxygen decreases due to a Hb deficiency, this is referred to as
	1. Stagnant hypoxia
	2. Histotoxic hypoxia
	3. Ambient hypoxia
	4. Anaemic hypoxia
142. When oxygen content of blood is normal and tissues receive love oxygen because of general and local circulation failure called as
	1. Stagnant hypoxia
	2. Histotoxic hypoxia
	3. Ambient hypoxia
	4. Anaemic hypoxia
143. What type of respiration seem in dog and cat
	1. Costal
	2. Abdominal
	3. Costo-abdominal
	4. All of the above
144. What type of respiration seem in ruminants
	1. Costal
	2. Abdominal
	3. Costo-abdominal
	4. All of the above
145. What type of respiration seem in horse
	1. Costal
	2. Abdominal
	3. Costo-abdominal
	4. All of the above
146. Which of the following is most impacted by the oxygen scarcity?
	1. Brain
	2. Kidney
	3. Liver
	4. Intestine
147. When alveoli do not open, it is referred to as
	1. Atelectasis
	2. Asphyxia
	3. Cyanosis
	4. Emphysema
148. Dilation and rapture of alveoli develops
	1. Atelectasis
	2. Asphyxia
	3. Cyanosis
	4. Emphysema
149. Entry of air into the pleural cavity is known as
	1. Atelectasis
	2. Asphyxia
	3. Cyanosis
	4. Pneumothorax
150. Acute inflammation of lungs called as
	1. Atelectasis
	2. Asphyxia
	3. Pneumonia
	4. Pneumothorax
151. Barker syndrome is connected to insufficient
	1. Surfactant
	2. Stretch receptor
	3. Neurotransmitter
	4. Plural fluid
152. Barker syndrome is common in
	1. Cattle
	2. Swine
	3. Horse
	4. Both b & c
153. Tracheal cartilages in birds have
	1. Complete rings
	2. Incomplete rings
	3. Both
	4. None of these
154. In birds gas exchange take place in
	1. Extrapulmonary primary bronchus
	2. Intrapulmonary primary bronchus
	3. Parabronchi
	4. None of the above
155. …………. air sacs present in chicken
	1. 7
	2. 9
	3. 10
	4. 8
156. In birds, inspiration and expiration are
	1. Active
	2. Passive
	3. Inspiration active
	4. Expiration active
157. Penguins and Emu have
	1. Paleopulmonic parabronchi
	2. Neopulmonic parabronchi
	3. Both
	4. None of the them
158. Pigeons, ducks and cranes have
	1. Paleopulmonic parabronchi
	2. Neopulmonic parabronchi
	3. Both the above
	4. None of the them

**Fill in the blank questions**

1. The ………...are principal structure of respiratory system.
2. During……………..., the body takes in oxygen and releases carbon dioxide.
3. Nostrils are more pliable in…………….and most rigid in……….
4. Food and air are directed through the appropriate pathways by.............
5. **…………...**is lidlike structure that closes to allow food to pass through the oesophagus.
6. …………...nerve stimulates the diaphragm to contract.
7. The contraction of the………. and…………... produces expiratory motions.
8. Inspiratory movements are produced by contraction of the ………….and……………
9. The primary muscle responsible for inspiration is the……………., which contracts to increase thoracic volume.
10. Inflammation of lungs covering causes severe chest pain known as……………
11. The most abundant gas in air is………...
12. 2,3 DPG binds to……...chain of Hb.
13. At high altitude, the number of RBC……….in circulation.
14. Hiccups is due to irritation of………nerve.
15. …………….is the entire amount of gas that enters or exits the alveoli and airways in a minute.
16. The enzyme……………. in the lungs helps break down surfactant, reducing surface tension and preventing alveolar collapse.
17. The \_\_\_\_\_\_\_\_\_\_\_\_\_\_ is a thin, double-layered sac that surrounds each lung, providing a slippery surface for smooth movement during breathing.
18. The primary respiratory centres in the brainstem receive input from peripheral chemoreceptors, including the \_\_\_\_\_\_\_\_\_\_\_\_\_\_ bodies.
19. In high-altitude environments, the body may respond to low oxygen levels by increasing the production of \_\_\_\_\_\_\_\_\_\_\_\_\_\_, promoting red blood cell formation.
20. During \_\_\_\_\_\_\_\_\_\_\_\_\_\_, oxygen and carbon dioxide are exchanged between maternal and foetal blood in the placenta.
21. The \_\_\_\_\_\_\_\_\_\_\_\_\_\_ is a protein responsible for carrying oxygen in avian blood, providing an alternative to haemoglobin**.**
22. The \_\_\_\_\_\_\_\_\_\_\_\_\_\_ reflex is triggered by irritants in the upper respiratory tract, leading to a sudden, forceful expulsion of air.
23. The……………...reflex is activated by irritation in the respiratory passages and aims to remove foreign particles.
24. The respiratory system manages the blood levels of \_\_\_\_\_\_\_\_\_\_\_\_\_\_, which aids in maintaining the body's acid-base balance.
25. The process of exchanging gases between the atmosphere and the lungs is known as…………………
26. The respiratory center receives a signal from the carotid body through…………. nerve.
27. Aortic arch sends their signal to respiratory centre via…………………...nerve
28. **…………………………**act as a pulmonary surfactant.
29. Airflow in neopulmonic parabronchi is**……………**
30. Neopulmonic parabronchi are ……………developed than paleopulmonic parabronchi in songbirds and poultry.
31. Diaphragm is absent in…………
32. Birds have 9 air sacs in which…………...air sac is unpaired
33. Site of gas exchange in birds is………….
34. Site of gas exchange in mammals is………….
35. In mammals, …………cells that secrete surfactants line the alveoli of the lungs, whereas in birds, same cells are called.......

**Matching type questions**

1. Match the following respiratory quotient values with its feed

|  |  |
| --- | --- |
| **Feed** | **RQ** |
| 1. Carbohydrate
 | 1. 0.9
 |
| 1. Fat
 | 1. 1
 |
| 1. Protein
 | 1. 0.82-0.85
 |
| 1. Mixed diet
 | 1. 0.7
 |

1. Match the followings organs with its functions

|  |  |
| --- | --- |
| **Organ** | **Functions** |
| 1. Alveoli
 | 1. voice box
 |
| 1. Larynx
 | 1. Removal of dust from air
 |
| 1. Ciliated epithelium
 | 1. Transport air to and from lungs
 |
| 1. Trachea
 | 1. Site of gas exchange
 |

1. Match the following lung capacities and volumes with the quantities

|  |  |
| --- | --- |
| **Column I** | **Column II** |
| 1. Residual volume
 | 1. 4500 ml
 |
| 1. Vital capacity
 | 1. 6000 ml
 |
| 1. Total lung capacity
 | 1. 3000 ml
 |
| 1. Inspiratory capacity
 | 1. 1500 ml
 |

1. Select the appropriate item from the list below by matching the following columns.

|  |  |
| --- | --- |
| **Column I** | **Column II** |
| 1. Primary site for gas exchange
 | 1. Pons
 |
| 1. O2 dissociation curve
 | 1. alveoli
 |
| 1. Carbonic anhydrase
 | 1. Hb
 |
| 1. Pneumotaxic centre
 | 1. RBC
 |

1. Choose the appropriate choice from the list below by matching the columns.

|  |  |
| --- | --- |
| **Column I** | **Column II** |
| 1. Inspiratory capacity
 | 1. ERV+RV
 |
| 1. Total lung capacity
 | 1. TV+IRV
 |
| 1. Vital capacity
 | 1. ERV+TV+IRV
 |
| 1. Functional residual capacity
 | 1. VC+RV
 |

1. Select the appropriate item from the list below by matching the following columns.

|  |  |
| --- | --- |
| **Column I** | **Column II** |
| 1. Alveoli
 | 1. Lined with hair
 |
| 1. Bronchioles
 | 1. Diffusion of gases
 |
| 1. Nasal chamber
 | 1. Inverted Y- shaped tubes
 |
| 1. Bronchi
 | 1. small air tubes
 |

1. Match the following disorders with their symptoms

|  |  |
| --- | --- |
| **Disorders** | **Symptoms** |
| 1. Asthma
 | 1. Inflammation of nasal tract
 |
| 1. Bronchitis
 | 1. Blown out alveoli
 |
| 1. Emphysema
 | 1. Spasm of bronchial muscles
 |
| 1. Rhinitis
 | 1. Inflammation of bronchi
 |

1. Match the following columns and select the correct option given below

|  |  |
| --- | --- |
| **Column I** | **Column II** |
| 1. Haemoglobin
 | 1. Facilitates the transport of carbon dioxide in plasma
 |
| 1. Carbonic Anhydrase
 | 1. Binds to oxygen and helps in its transport in muscle
 |
| 1. Myoglobin
 | 1. Converts carbon dioxide into bicarbonate ions in RBC
 |
| 1. Bicarbonate ion
 | 1. Carries the majority of oxygen in the blood
 |

1. Match the respiratory muscle with its primary function

|  |  |
| --- | --- |
| **Column I** | **Column II** |
| 1. Diaphragm
 | 1. Elevates the ribs during inhalation
 |
| 1. External Intercostals
 | 1. Contracts to decrease thoracic volume during forced exhalation
 |
| 1. Internal Intercostals
 | 1. Contraction increases thoracic volume during inhalation
 |
| 1. Sternocleidomastoid
 | 1. Increases the volume of the thoracic cavity during inhalation
 |

1. Choose the appropriate choice from the list below by matching the columns.

|  |  |
| --- | --- |
| **Column I** | **Column II** |
| 1. Residual Volume
 | 1. Volume of air in the lungs after a maximal inhalation
 |
| 1. Total Lung Capacity
 | 1. Volume of air that can be forcibly exhaled after a normal tidal volume exhalation
 |
| 1. Forced Vital Capacity
 | 1. Volume of air remaining in the lungs after a normal tidal volume exhalation
 |
| 1. Functional Residual Capacity
 | 1. Volume of air in the lungs at the end of a maximal inhalation
 |

1. Match the respiratory parameter with its unit of measurement

|  |  |
| --- | --- |
| **Respiratory parameter** | **unit of measurement** |
| 1. Tidal Volume
 | 1. Liters per minute
 |
| 1. Minute Ventilation
 | 1. Breaths per minute
 |
| 1. Respiratory Rate
 | 1. Liters
 |
| 1. Inspiratory Capacity
 | 1. Liters per breath
 |

1. Match the lung structure with its primary function

|  |  |
| --- | --- |
| **Lung structure** | **function** |
| 1. Alveolar Capillaries
 | 1. Transport deoxygenated blood to the lungs
 |
| 1. Type II Pneumocytes
 | 1. Conduct air to alveoli
 |
| 1. Respiratory Bronchioles
 | 1. Gas exchange site
 |
| 1. Pulmonary Arteries
 | 1. Secretion of surfactant
 |

1. Match the lung disorder with its characteristic feature

|  |  |
| --- | --- |
| **lung disorder** | **characteristic feature** |
| 1. Pulmonary Fibrosis
 | 1. Excessive mucus production and airway obstruction
 |
| 1. Chronic Obstructive Pulmonary Disease (COPD)
 | 1. Scar tissue formation in the lungs
 |
| 1. Pulmonary Oedema
 | 1. Infection caused by Mycobacterium tuberculosis
 |
| 1. Tuberculosis
 | 1. Accumulation of fluid in the alveoli
 |

1. Match the avian respiratory adaptation with its advantage

|  |  |
| --- | --- |
| **Respiratory adaptation** | **advantage** |
| 1. Unidirectional Airflow
 | 1. Facilitates efficient ventilation during both inhalation and exhalation
 |
| 1. Lack of Diaphragm
 | 1. Reduces weight for efficient flight
 |
| 1. Hollow Bones
 | 1. Allows precise control of airflow direction in the respiratory system
 |
| 1. Air Capillaries
 | 1. Enables continuous gas exchange in the lungs
 |

1. Match the avian respiratory characteristic with its role in thermoregulation

|  |  |
| --- | --- |
| **Respiratory characteristic** | **Role in thermoregulation** |
| 1. Panting
 | 1. Varied temperatures in different regions of the respiratory system |
| 1. Counter-current Heat Exchange
 | 2. Specialized areas for heat exchange |
| 1. Thermal Windows
 | 3. Minimizes heat loss during cold conditions |
| 1. Regional Heterothermy
 | 4. Facilitates efficient cooling during hot conditions |

**Answers**

**Multiple Choice Questions**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| a | b | a | d | c | d | b | a | c | a |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| b | c | d | c | c | a | a | c | d | d |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| d | a | c | a | b | c | b | b | c | b |
| 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| d | a | b | d | a | a | c | d | b | b |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |
| a | b | c | a | b | b | c | d | d | a |
| 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| c | a | b | c | b | b | d | a | a | d |
| 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 |
| c | c | a | c | c | b | c | b | c | a |
| 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 |
| c | c | b | c | a | c | a | a | b | a |
| 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 |
| a | c | d | a | a | b | a | a | b | b |
| 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |
| d | d | d | c | b | d | d | d | d | a |
| 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 | 110 |
| c | d | a | b | a | b | c | b | d | a |
| 111 | 112 | 113 | 114 | 115 | 116 | 117 | 118 | 119 | 120 |
| a | b | c | a | a | d | d | c | a | d |
| 121 | 122 | 123 | 124 | 125 | 126 |  |  |  |  |
| a | c | b | a | a | c |  |  |  |  |

**Fill in the blanks**

1. Lungs
2. Respiration
3. horse, pig
4. pharynx
5. Epiglottis
6. Phrenic
7. Internal intercostals, abdominal
8. external intercostals, diaphragm
9. diaphragm
10. pleurisy
11. nitrogen
12. Beta
13. Increases
14. Phrenic
15. minute volume
16. Phospholipase
17. Pleura
18. Carotid
19. Erythropoietin
20. foetal respiration
21. Hemocyanin
22. Sneezing
23. Cough
24. carbon dioxide
25. ventilation
26. Glossopharyngeal
27. Vagus
28. Dipalmitoylphosphotidycholine (DPPC)
29. bidirectional
30. more
31. birds
32. clavicular
33. parabronchi/tertiary bronchi
34. alveoli
35. Type-II pneumocyte, granular cells (trilaminar cells)

**Matching type questions**

* 1. a-2, b-4, c-1, d-3
	2. a-4, b-1, c-2, d-3
	3. a-4, b-1, c-2, d-3
	4. a-2, b-3, c-4, d-1
	5. a-2, b-4, c-3, d-1
	6. a-2, b-4, c-1, d-3
	7. a-3, b-4, c-2, d-1
	8. a-4, b-3, c-2, d-1
	9. a-4, b-3, c-2, d-1
	10. a-2, b-1, c-4, d-3
	11. a-4, b-1, c-2, d-3
	12. a-3, b-4, c-2, d-1
	13. a-2, b-1, c-4, d-3
	14. a-3, b-1, c-2, d-4
	15. a-4, b-3, c-2, d-1