YAKEEN NEET 2.0

2026

BREATHING AND EXHANGE OF GASES

ZOOLOGY | Lecture – 3

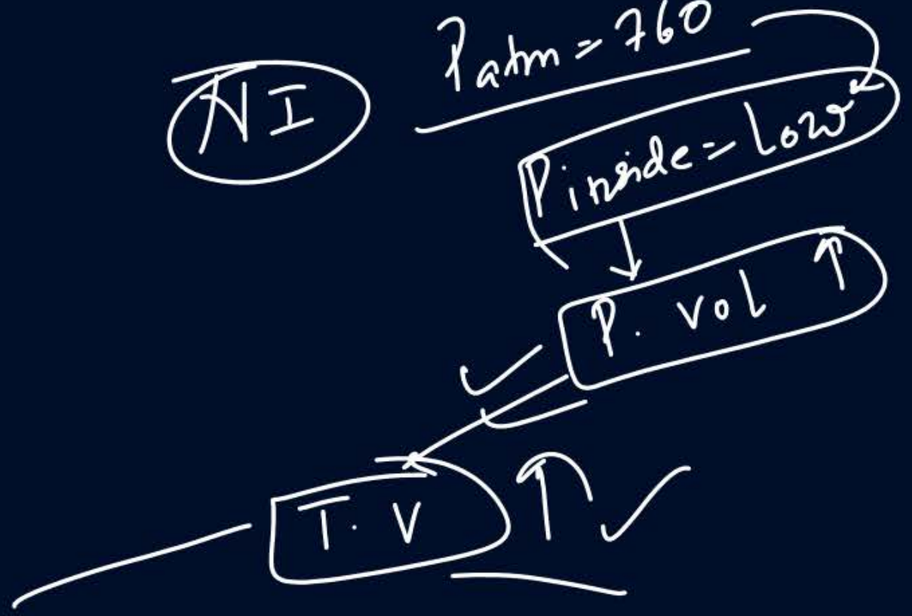
By- SAMAPTI MAM

Topics to be covered

1. RESPIRATOERY VOLYUMES,CAPACITIES, EXCHANGE OF GASES
2.
3.
4.

MY TELEGRAM

#Samaghiexpress



① Normal Exhalation :

Patm (760 mm Hg) ← air — Plungs (HIGH) (Intrapulmonary Press ↑)

↓ Intrapulmonary Vol

↓ VOLUME OF THORACIC CHAMBER

Diaphragm
↓
Relax
↓
Becomes DOME from FLAT
↓
Vol. of thoracic chamber ↓ anterio-posteriorly, ↓ in Intrapulmonary VOLUME
↓
↑ in INTRAPULMONARY Press ↑

EICM
↓
Relaxation
↓
Ribs & Sternum move inward & slightly downward
↓
Vol. of thoracic chamber ↓ dorso-ventrally, ↓ in Intrapulmonary Vol ↓
↓
↑ in INTRAPULMONARY PRESS ↑

→ air out ←

Note

Normal inhalation: ACTIVE PROCESS

" Exhalation: PASSIVE "

- One can ↑ the strength of Breathing & do forceful Breathing by using addi-tional set of muscles : Abdominal muscles & IICM

ACTIVE

Forceful Exhalation

Patm (760) ← air — Intrapulmonary Press ↑↑↑

Intrapulmonary vol ↓↓↓

Volume of Thoracic chamber ↓↓↓

(i) Abdominal muscle

CONTRACTS, PUSH Diap-hragm upward

Vol of T. chamber ↓ anteri-or posteriorly, Vol. of Lungs ↓

Intrapulmonary Press ↑

Air out

(ii) IICM

CONTRACTS

Ribs & sternum move inward & downward

Vol. of T. chamber ↓ dorsoventrally, Intrapulm-onary Vol ↓

Intrapulmonary Press ↑

14.2 Mechanism of Breathing

Breathing involves two stages : **inspiration** during which atmospheric air is drawn in and **expiration** by which the alveolar air is released out. The movement of air into and out of the lungs is carried out by creating a pressure gradient between the lungs and the atmosphere. Inspiration can occur if the pressure within the lungs (intra-pulmonary pressure) is less than the atmospheric pressure, i.e., there is a negative pressure in the lungs with respect to atmospheric pressure. Similarly, expiration takes place when the intra-pulmonary pressure is higher than the atmospheric pressure. The diaphragm and a specialised set of muscles – external and internal intercostals between the ribs, help in generation of such gradients. Inspiration is initiated by the contraction of diaphragm which increases the volume of thoracic chamber in the antero-posterior axis. The contraction of external inter-costal muscles lifts up the ribs and the

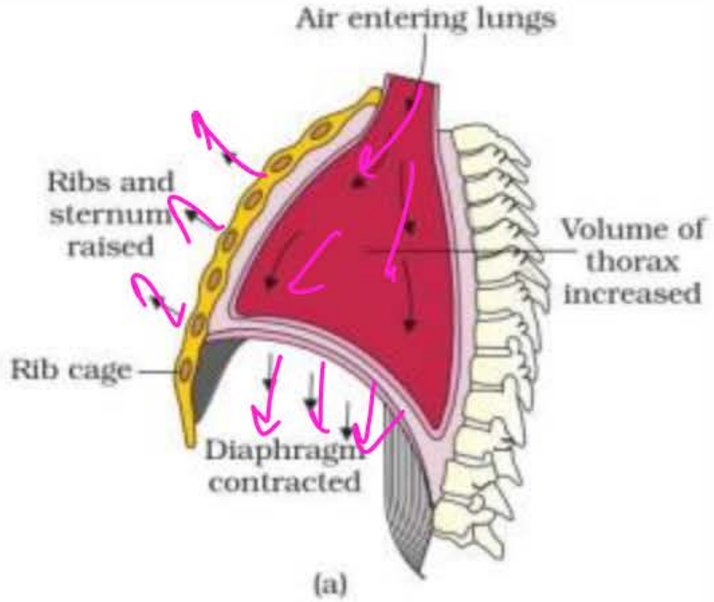


Figure 14.2 Mechanism of breathing showing : (a) inspiration (b) expiration

sternum causing an increase in the volume of the thoracic chamber in the dorso-ventral axis. The overall increase in the thoracic volume causes a similar increase in pulmonary volume. An increase in pulmonary volume decreases the intra-pulmonary pressure to less than the atmospheric pressure which forces the air from outside to move into the lungs, i.e., inspiration (Figure 14.2a). Relaxation of the diaphragm and the inter-costal muscles returns the diaphragm and sternum to their normal positions and reduce the thoracic volume and thereby the pulmonary volume. This leads to an increase in intra-pulmonary pressure to slightly above the atmospheric pressure causing the expulsion of air from the lungs, i.e., expiration (Figure 14.2b). We have the ability to increase the strength of inspiration and expiration with the help of additional muscles in the abdomen. On an average, a healthy human breathes 12-16 times/minute. The volume of air involved in breathing movements can be estimated by using a spirometer which helps in clinical assessment of pulmonary functions.

- Humans have NEGATIVE PRESSURE BREATHING,
  Frogs: POSITIVE PRESSURE BREATHING (अतिरिक्त Gyaan)

Respiratory Volumes & Capacities:

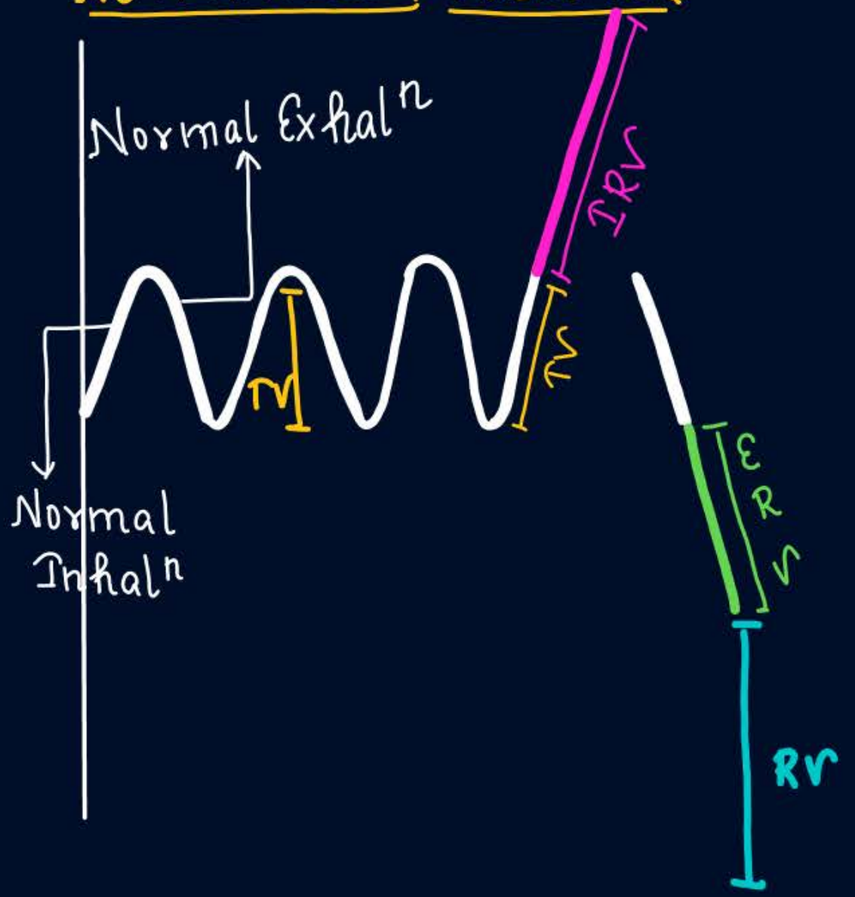
The different volume of air a person inhales/exhales at different condition.

Are formed by combination of respiratory vol.

Adults Breathing rate: 12-16 time/min

SPIROMETER: A device used to measure various respiratory volumes & capacities except Residual volume.

RESPIRATORY-VOLUMES:



① Tidal volume (TV): The volume of air, a person normally inhales/exhales.

TV = 500 ml MRV = TV × BR

Minute Respiratory Volume = 500 × (12–16) = 6000–8000 ml/min

② Inspiratory Reserve volume (IRV):

The additional vol. of air a person can inhale after normal inhalation. (by forceful inhalation)

IRV = 2500 – 3000 ml

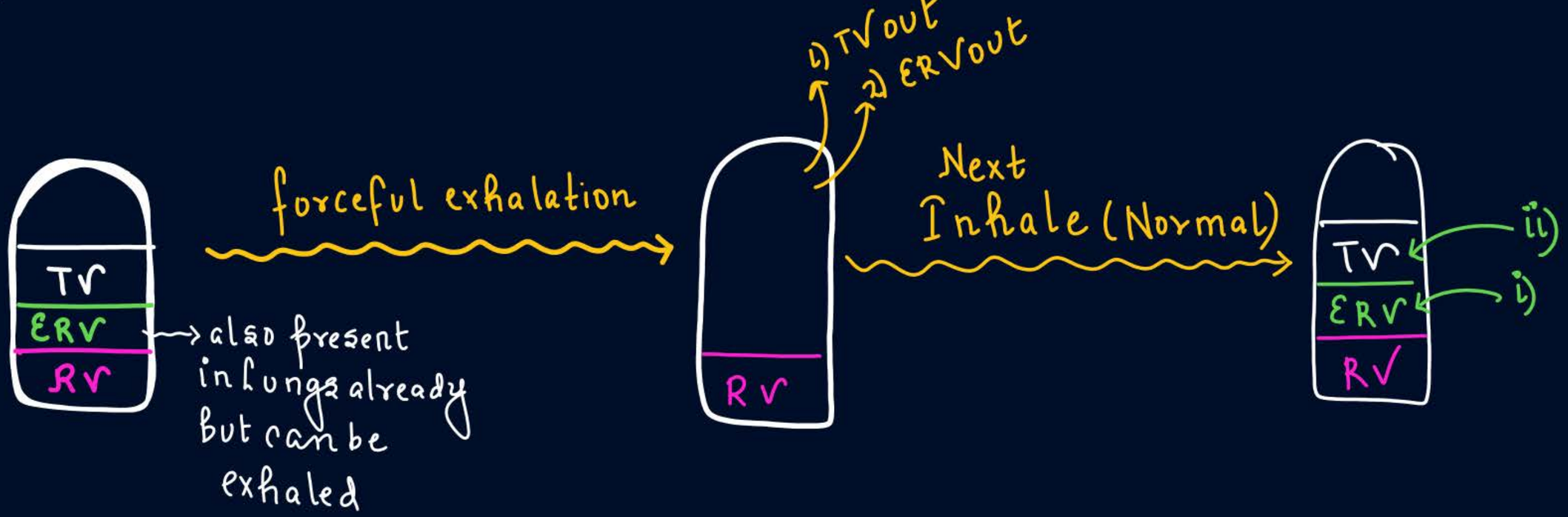
③ Expiratory Reserve Volume (ERV): The additional vol. of air a person can exhale by forceful exhalation after Normal exhalation.

ERV = 1000 – 1100 ml

④ Residual vol. (RV): Even after forceful exhalation some amt. of air present in Lungs (prevents its collapse).

RV = 1100 – 1200 ml

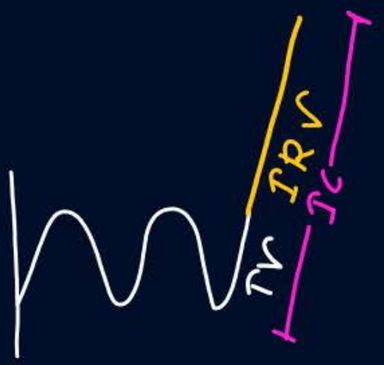
Basics


TV
ERV
RV
also present in lungs already but can be exhaled
forceful exhalation
1) TV out
2) ERV out
RV
Next Inhale (Normal)
TV
ERV
RV
ii)
i)

RESPIRATORY CAPACITIES:

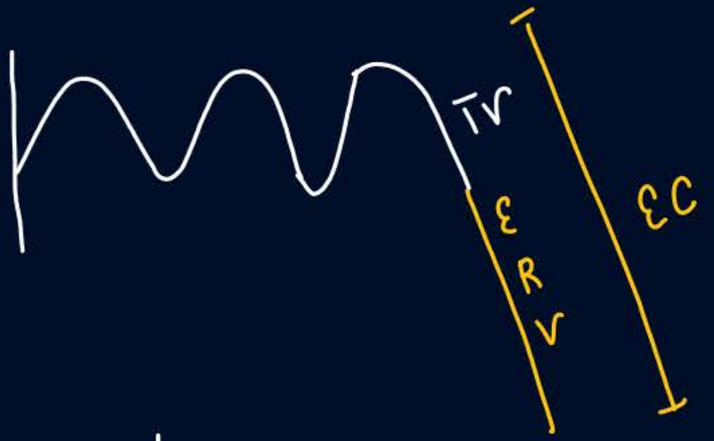
i) **Inspiratory Capacity (IC):** Total vol. of air a person can inhale after normal exhalation.

$$IC = TV + IRV$$



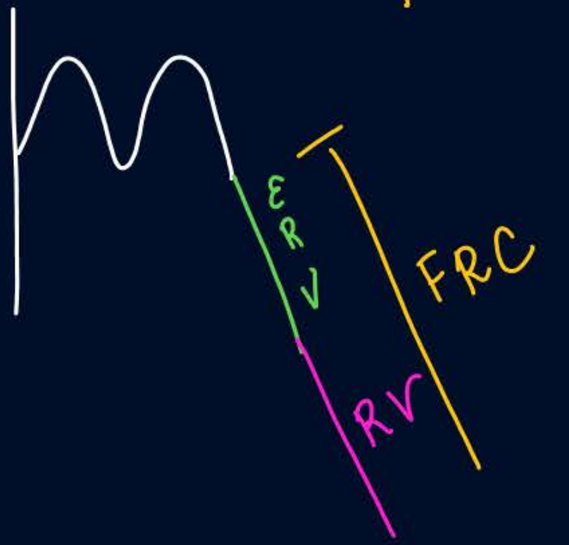
ii) **Expiratory capacity:** Total vol. of air a person can exhale after normal inhaln

$$EC = TV + ERV$$



iii) **Functional Residual capacity: (FRC):** The amount of air present in lungs after Normal Exhalation

$$FRC = ERV + RV$$

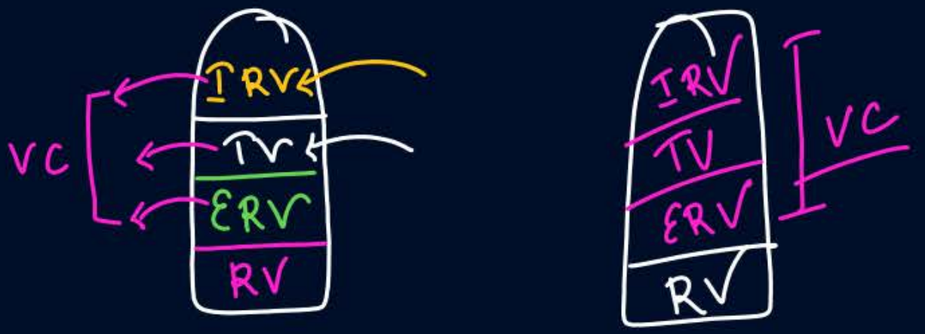


iv) Vital Capacity (VC): Total volume of air a person can exhale after forceful inhalation.

'OR'

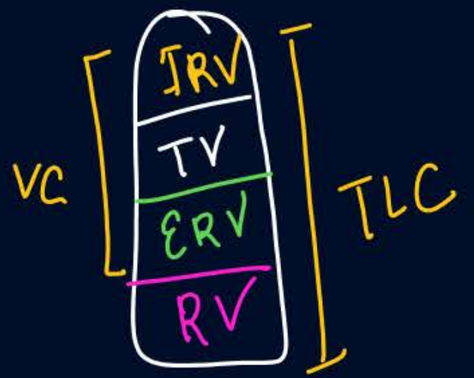
Total volume of air a person can inhale after forceful exhalation.

$$VC = IRV + TV + ERV$$



v) Total Lung Capacity (TLC): Total volume of air present in lungs after forceful inhalation.

$$TLC = VC + RV$$



14.2.1 Respiratory Volumes and Capacities

Tidal Volume (TV): Volume of air inspired or expired during a normal respiration. It is approx. 500 mL., i.e., a healthy man can inspire or expire approximately 6000 to 8000 mL of air per minute.

Inspiratory Reserve Volume (IRV): A person can inspire by a forcible inspiration. This averages 2500 mL to 3000 mL.

Expiratory Reserve Volume (ERV): A person can expire by a forcible expiration. This averages 1000 mL to 1100 mL.

MRV = TV X BR

TV — IRV

Residual Volume (RV): Volume of air remaining in the lungs even after a forcible expiration. This averages 1100 mL to 1200 mL.

By adding up a few respiratory volumes described above, one can derive various pulmonary capacities, which can be used in clinical diagnosis.

Inspiratory Capacity (IC): Total volume of air a person can inspire after a normal expiration. This includes tidal volume and inspiratory reserve volume (TV+IRV).

Expiratory Capacity (EC): Total volume of air a person can expire after a normal inspiration. This includes tidal volume and expiratory reserve volume (TV+ERV).

Functional Residual Capacity (FRC): Volume of air that will remain in the lungs after a normal expiration. This includes ERV+RV.

Vital Capacity (VC): The maximum volume of air a person can breathe in after a forced expiration. This includes ERV, TV and IRV or the maximum volume of air a person can breathe out after a forced inspiration.

Total Lung Capacity (TLC): Total volume of air accommodated in the lungs at the end of a forced inspiration. This includes RV, ERV, TV and IRV or vital capacity + residual volume.

NCERT CATALYST

QUESTION

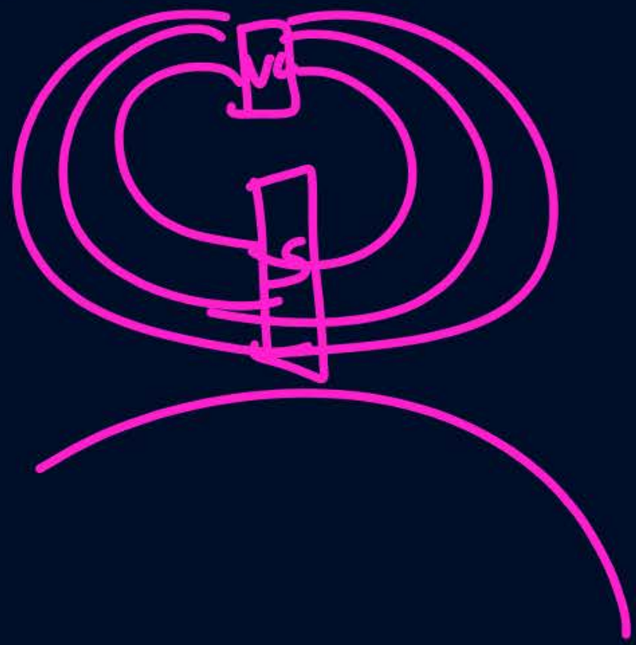
Given below are two statements.

Statement I: The lungs are situated in the thoracic chamber

Statement II: The thoracic chamber is formed dorsally by the vertebral column, ventrally by the sternum, laterally by the ribs.

In the light of the above statements, choose the most appropriate answer from the options given below.

1. Statement I is correct but Statement II is incorrect.
2. Statement I is incorrect but Statement II is correct.
3. Both Statement I and Statement II are correct.
4. Both Statement I and Statement II are incorrect.



QUESTION

Given below are two statements.

Statement I: The part starting with the external nostrils up to the terminal bronchioles constitute the conducting part

Statement II: The conducting part transports the atmospheric air to the alveoli, clears it from foreign particles, humidifies and also brings the air to body temperature.

1. Statement I is correct but Statement II is incorrect.
2. Statement I is incorrect but Statement II is correct.
3. Both Statement I and Statement II are correct.
4. Both Statement I and Statement II are incorrect.

QUESTION

Statement-I: The first step in respiration is breathing.

Statement-II: Inspiration and expiration are carried out by creating pressure gradients between the atmosphere and the lungs.

1. Statement I and Statement II both are correct.
2. Statement I is correct, but Statement II is incorrect.
3. Statement I is incorrect, but Statement II is correct.
4. Statement I and Statement II both are incorrect.

QUESTION

Statement-I: Lungs are covered by a double layered pleura.

Statement-II: Alveoli are thin, irregular-walled, and vascularised , bag-like structures.

1. Statement I and Statement II both are correct.
2. Statement I is correct, but Statement II is incorrect.
3. Statement I is incorrect, but Statement II is correct.
4. Statement I and Statement II both are incorrect.

QUESTION

Statement-I: An increase in pulmonary volume increases the intra-pulmonary pressure more than the atmospheric pressure.
Statement-II: Relaxation of the diaphragm and the external inter-costal muscles reduces the thoracic volume.

1. Statement I and Statement II both are correct.
2. Statement I is correct, but Statement II is incorrect.
3. Statement I is incorrect, but Statement II is correct.
4. Statement I and Statement II both are incorrect.

QUESTION

Statement-I: During normal exhalation diaphragm and EICM relaxes
Statement-II: Relaxation of diaphragm and EICM decreases the volume of thoracic chamber dorsoventrally and anterio posteriorly respectively

1. Statement I and Statement II both are correct.
2. Statement I is correct, but Statement II is incorrect.
3. Statement I is incorrect, but Statement II is correct.
4. Statement I and Statement II both are incorrect.

QUESTION

Respiration through skin is called as;

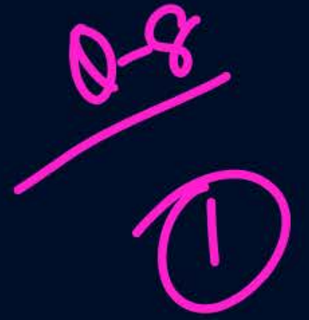
1. branchial respiration.
2. cutaneous respiration.
3. pulmonary respiration.
4. tracheal respiration.

Q-7
(2)

QUESTION

Which of the following is the site of actual diffusion of O_2 and CO_2 between blood and atmospheric air?

1. Exchange part
2. Conducting part
3. External nostrils
4. Terminal bronchioles



QUESTION

Epiglottis helps to;

1. produce sound.
2. reduces friction on the lung-surface.
3. prevent the entry of food into the larynx.
4. All of these

Q-9
3

QUESTION

Read the following statements and identify 'X'.

I. 'X' humidifies the air to body temperature.

II. 'X' clears it from foreign particles.

1. Conducting part
2. Alveoli
3. Alveolar ducts
4. Exchange part

Q-10

1

QUESTION

Complete the analogy.
Outer pleural membrane: Thoracic lining : : Inner pleural membrane:

1. Lung surface
2. Sternum
3. Diaphragm
4. Vertebral column

Q-11
1

QUESTION

Statement-I: The anatomical setup of lungs in thorax is such that any change in the volume of the thoracic cavity will be reflected in the lung cavity

Statement-II: Such an arrangement is essential for breathing, as it can directly alter the pulmonary volume.

1. Statement I and Statement II both are correct.
2. Statement I is correct, but Statement II is incorrect.
3. Statement I is incorrect, but Statement II is correct.
4. Statement I and Statement II both are incorrect.

H.W

QUESTION

Arrange the following in the order of increasing volume.

(A) Tidal volume
(B) Residual volume
(C) Inspiratory reserve volume
(D) Vital capacity

1. A < B < C < D
2. A < C < B < D
3. A < D < C < B
4. A < D < B < C

QUESTION

The volume of air remaining in the lungs even after a normal expiration is called;

1. tidal volume (TV).
2. residual volume (RV).
3. functional residual capacity (FRC).
4. vital capacity (VC).

QUESTION

Statement-I: Measurement of various respiratory volumes using spirometer is of no clinical assessment in pulmonary function
Statement-II: All the respiratory volumes can be measured using a spirometer

1. Statement I and Statement II both are correct.
2. Statement I is correct, but Statement II is incorrect.
3. Statement I is incorrect, but Statement II is correct.
4. Statement I and Statement II both are incorrect.

QUESTION

What is the pulmonary volume of air inhaled by a person under normal condition after he forcefully exhales out?

1. TV
2. TV+IRV+ERV
3. TV+ERV
4. TV+IRV

QUESTION

Statement-I: The partial pressure of gases, solubility, and the thickness of diffusion membrane are essential factors for exchange of gases
Statement-II: All the factors in our body are favourable for diffusion of O_2 from tissue to alveoli and that of CO_2 from alveoli to tissue.

1. Statement I and Statement II both are correct.
2. Statement I is correct, but Statement II is incorrect.
3. Statement I is incorrect, but Statement II is correct.
4. Statement I and Statement II both are incorrect.

Homework

- REVISE CLAASNOTES / ZOOLOGY MED EASY

MODULE HW
Module -1
Prarambh exercise 1- 7-26

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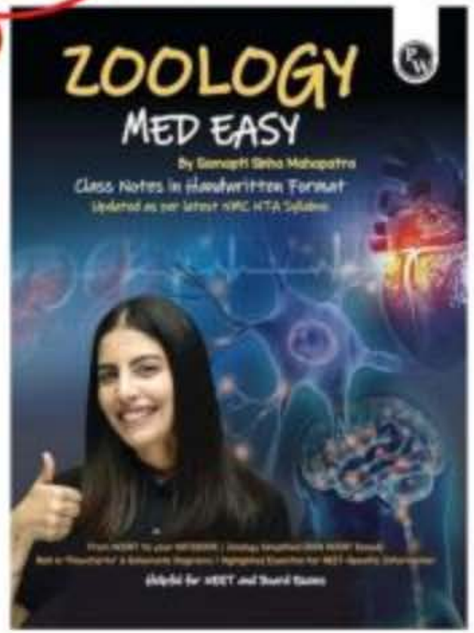

THANK YOU