READING MATERIAL CLASS XI BIOLOGY

CAPTER 17 BREATHING AND EXCHANGE OF GASES

Points To Remember

Breathing : (External respiration) The process of exchange of O_2 from the

atmosphere with CO_2 produced by the cells.

Carbamino haemoglobin : Compound formed in RBCs when CO_2 combine

with haemoglobin.

Inspiration : Oxygen from fresh air taken by lungs and diffuses into the

blood.

Expiration : CO_2 given up by venous blood in the lungs is sent out to exterior.

Respiration : The sum total of physical and chemical processes by which

oxygen and carbohydrates (main food nutrient) etc are assimilated into the system

and the oxidation products like carbon dioxide and water are given off.

Diaphragm : A muscular, membranous partition separating the thoracic

cavity from the abdominal cavity.

Hypoxia Shortage of oxygen in tissues.

Partial Pressure The pressure contributed by an individual gas in a mixture

of gases. It is represented as pO2 for oxygen and pCO2 for carbondioxide.

Pharynx : The tube or cavity which connects the mouth and nasal passages

with oesophagus. It has three parts (i) Nasopharynx (anterior part) (ii) Oropharynx

(middle part) and (iii) Laryngopharynx (posterior part which continues to larynx)

Adam s Apple : The projection formed by the thyroid cartilage and surrounds

the larynx at the front of the neck.

Tidal volume (TV) : volume of air during normal respiration (500 mL.)

Inspiratory Reserve Volume (IRV) : Additional volume of air inspired by a

forcible inspiration. 2500mL to 3000mL.

Expiratory Reserve Volume (ERV) : Additional volume of air, a person

can expire by a forcible expiration.

(RV) volume of air remaining in the lungs even after a forcible expiration(1100mL-1200mL)

PULMONARY CAPACITIES : Use in clinical diagnosis.

Inspiratory capacity (IC) = (TV + IRV) Total volume of air a person can

inspire after a normal expiration.

Expiratory Capacity Total Volume of air a parson can expire after a normal

inspiration E.C. = TV + ERV

Functional Residual Capacity Volume of air that will remain in lungs

after a normal expiration (FRC) = (ERV + RV)

Vital Capacity (VC) = (ERV + TV + IRV) or the maximum volume of air

a person can breath out after a forced inspiration.

Total Lung Capacity : It includes RV, ERV, TV and IRV or vital capacity

+ residual volume.

Pulmonary Anything associated with the lungs is given the pre®x

pulmonary steps involved in respiration

(i) Breathing or pulmonary ventilation (intake or atmospheric air and releasing

out CO_2 rich alveolar air)

(ii) Diffusion of gases (O_2 and CO_2) across alveolar membrane.

(iii) Transport of gases by the blood.

(iv) Diffusion of O_2 and CO_2 between blood and tissues.

(v) Utilisation of O_2 by the cells for catabolic reactions and resultant release of

CO_2.

Inspiration :

If the pressure within the lungs (intrapulmonary pressure) is less than the

atmospheric pressure, i.e., there is negative pressure in the lungs with respect to

the atmospheric pressure.

 The contraction of diagphragm increases the volume of thoracic chamber in

the antero-posterior axis.

 The contraction of external intercoastals muscles lifts up the ribs and the

sternum causing an increase in the volume of thoracic chamber in the dorso ventral axis.

 It causes an increase in pulmonary volume decrease the intra-pulmonary

pressure to less than the atmospheric pressure.

 If forces the air out side to move in to the lungs, i.e., inspiration.

Expiration :

Relexation of diaphragm and sternum to their normal positions and reduce

the thoracic and pulmonary volume.

 It increases in intrapulmonary pressure slightly above the atmospheric pressure.

 It causes the expulsion of air from the lungs, i.e., expiration

Respiratory Tract :

A pair of external nostrils nasal chamber through nasal passage

nasopharynx glottis larynx trachea Left and right primary

bronchi secondary and tertiary bronchi bronchioles vascularised

bag like structures (alveoli) or air-sacs. Each lung is covered with double

layered membrane known as pleura with pleural ¯uid between them.

Respiratory organs in animals :

(i) Protozoans, annelids Frogs Body surface

(ii) Fishes, tadpole stage of frog and many other aquatic animals Gills

(iii) Insects and a few other arthropods Tracheal tubes

(iv) All land vertebrates (amphibians, reptiles, aves and mammal) Lungs.

Conditions required for cutaneous respiration

Skin should be moist and thin. It should be highly vascularised.

Physiology of Respiration :

(a) Exchange of gases Diffusion of gases takes place from the region of higher

partial pressure to lower (lesser) partial pressure)

(i) pO_2 in alveolar air = 104 mm Hg.

(ii) pO_2 in venous blood = 40 mm Hg.

O_2 diffuses from alveoli to venous blood.

(iii) pCO_2 in venous blood = 45 mm Hg.

pCO_2 in alveolar air = 40 mm Hg.

CO_2 diffuses from venous blood to alveoli

(b) Transport of O_2 by the blood About 10% of CO_2 forms carbonic acid

with water of plasma.

(c) Transport of CO_2 in the blood

About 20% of CO_2 is transported by combining with free amino group of

Haemoglobin in RBC.

70% of CO_2 is transported as bicarbonates of sodium ($NaHCO_3$) and potassium ($KHCO_3$)

Regulation of Respiration

A specialised centre in medulla of brain controls the respiratory rhythm.

Another region in the pons region of the brain called pneumotaxic centre

can moderate the functions of respiratory rhythm centre. Neural signal from

pneumotaxic centre can reduce the duration of respiration thereby increasing

the respiratory rate. Chemosensitive area present near the rhythm centre, aortic

arch can sense the change in CO_2 & H^+ concentration, which in turn send signal

to rhythm centre to make necessary adjustment so that those substances can be eliminated.