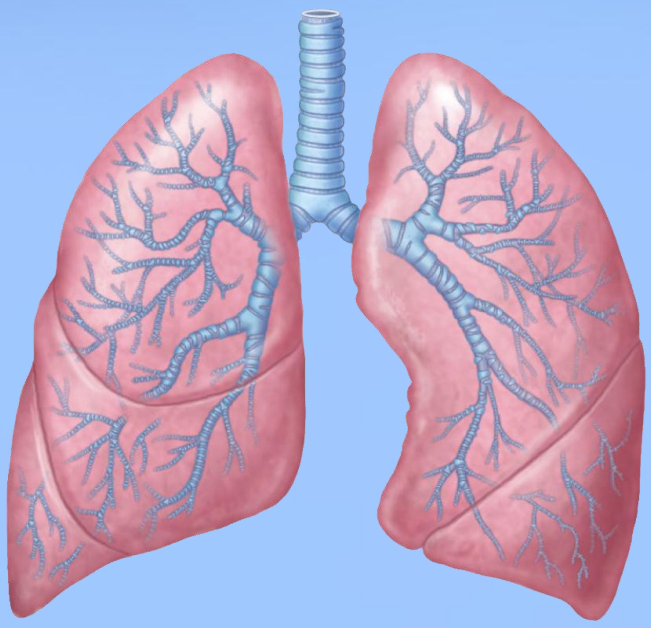
Physiology Values



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Respiratory Block

Lecture 1 (Functional organization of the respiratory system)

Volume of air go to respiratory zone	350 ml
Volume of air stay at conducting zone (Dead space)	150 ml
Dust particles enter to airways	
Nose and pharynx	10um
Tracheo-bronchial tree	2-10um
within the alveoli	0.1-2um
remain in the air stream	Less than 0.1um
Cilia beat per minute	1000-1500 cycles / min
Cilia move particles at rate	16 mm/min

Lecture 2 (Mechanics of pulmonary ventilation)

Atmospheric pressure (PB)		760mmHg = 0
Intra-alveolar pressure		
Between breathes (end of inspiration and expiration)		P_{ALV} = PB = 0
During inspiration		-1 mmHg
During expiration		+1 mmHg
Intrapleural pressure (IPP)		
Between breathes (end of inspiration and expiration)		-5 cmH2O
during resting inspiration (peak inspiration)		-7.5 cm H2O
Forced	inspiration	-20 to -40 cm H2O
	expiration	+ 30 cm H2O
Compliance of lung		
For both lungs in adult		200 ml of air /cm H2O
For lungs and thorax together		110 ml/cm H2O

Lecture 3 (Lung volumes and capacities)

Lung volumes	
Tidal volume (TV)	500 ml
Inspiratory reserve (IRV)	3000 ml
Expiratory reserve (ERV)	1100 ml
Residual volume (RV)	1200 ml
Lung capacities	
Inspiratory capacity (IC)	3500 ml
functional residual capacity (FRC)	2300 ml
vital capacity (VC)	4600 ml
total lung capacity (TLC)	5800ml
FEV_1 / FVC Ratio	- Normal = 80% - Restrictive diseases (normal or increased) - COPD (decreased)

Minute respiratory volume	**Usually 6 L\min** **(TV x Respiratory rate = MRV)**
Respiratory Rate	**Normal between 12-18 /min** **Abnormal may 2-4 /min**
Alveolar ventilation rate	**4.2 L/min** **(Respiratory rate x [TV- dead space])**

Lecture 4 (Lung Function in health and disease)

Decline in [FEV1] after age of 30	
None-smoker	**25-30 ml/year**
Smoker	**60-70 ml/year**

Lecture 5 (Gas transfer: diffusion of o2 and co2)

Diffusion coefficient	
O2	**1**
Co2	**20**
NO2	**0.53**
O2 and co2 conc. In the alveoli	
At rest	**250 ml of o2**
During exercise	**1000 ml of o2**
Normal co2 excretion	**200 ml/min**
Partial pressure of o2 and co2	
O2 conc. In atmosphere	**21%**
Co2 conc. In atmosphere	**0.04%**
Atmosphere pressure	**760 mmHg**
Pco2 in the air	**0.3 mmHg**
Pco2 in the alveoli	**40 mmHg**
Pco2 in the arterial blood (pulmonary capillaries)	**40 mmHg**
Pco2 in the venous blood (interstitial space)	**45 mmHg**
Pco2 in the tissues	**46 mmHg**
Po2 in the air	**160 mmHg**
Po2 in the alveoli	**104 mmHg**
Po2 in the arterial blood (pulmonary capillaries)	**95 mmHg**
Po2 in the venous blood (interstitial space)	**40 mmHg**
Po2 in the tissues	**20 mmHg**

Lecture 6 (oxygen and carbon dioxide transport)

O2 content in 100 ml of blood	
When blood is 100% saturated with o2	
1 ml of HB carries	1.34 m o2
O2 content	20 ml/100 ml
When blood is only 97% saturated with o2	
O2 content	19.4 ml/100 ml
Amount of o2 released from HB to tissues	
Normal condition	5 ml /100 ml blood
So, O2 content in venous blood	14.4 ml/100 ml blood
During strenuous	15 ml/100 ml blood
So, o2 content in venous blood	4.4 ml/100 ml blood
O2 transport forms in blood	
Dissolved in plasma	3%
Bound to HB (oxyhemoglobin)	97%
P50	
Normal	26.5 mmHg
Fetal HB	20 mmHg
Utilization coefficient	
At rest	5 ml/20ml=25%
During exercise	15 ml/20ml=75%
Dissolved o2	
At normal arterial po2 95 mmHg	0.29 ml /100 ml blood
When po2 falls to 40 mmHg	0.12 ml remains dissolved
O2 that transported in dissolved state	0.17 ml/ 100 ml blood
Co2 transport forms	
dissolved	7%
Bicarbonate	70%
Carbaminohemoglobin	23%
Blood PH	
Arterial blood PH	7.41
Venous blood PH	7.37(higher pco2)
Arterial and venous blood PH change	0.04
Respiratory quotient	
Normal	4/5=82% = 0.825
CHO diet	1
Fats diet	0.7
Each 100ml of blood carry 4 ml of co2 from the tissues/min	

Lecture 7 (Hypoxia and cyanosis)

Hypercapnea	**PCO2 increases above 52 mmHg**
Cyanosis	**Reduced (deoxygenated) hemoglobin in blood to more than 5 g/dl.**
Pulmonary blood flow rate	**5 (L\min)**
Ventilation –perfusion ratio (V/Q ratio)	
Average	**0.8**
At the apex of the lung	**3**
At the base of the lung	**0.6**
Ventilation/perfusion abnormalities	
Physiologic dead space	**more than normal**
physiologic shunt	**less than normal**

Lecture 8(Control of Breathing)

stretch receptors transmit signals	**When tidal volume is 1 L or more**
Respiratory Acidosis	**-PCO2 increases -pH decreases.**
Respiratory Alkalosis	**- PCO2 decreases (35 mmHg). -pH increases.**

Lecture 9 (effects of low and high altitude)

Effects of increased barometric pressure	
10 meter of depth sea water (33 feet)	Surrounding pressure increases by 1 atmosphere
31 meter of depth sea water (100 feet)	Surrounding pressure increases by 4 atmosphere
Effects of depth on the volume of the gases	
1 L (sea level)	1/2 L at 33 feet
Effects of low pressure on the body	
At the sea level	Atmospheric pressure=760 mmHg
At 10,000 feet	523 mmHg
At 50,000 feet	87 mmHg
Alveolar po2 at different altitudes	
At the sea level	Po2 = 159 mmHg
At 20,000 feet	Po2 = 40 mmHg
At 50,000 feet	Po2 = 18 mmHg
Effects of acute hypoxia	
Beginning of hypoxia at altitude	12,000 feet
Beginning of twitching or convulsions	18,000 feet
Un acclimatization person enter into coma	23,000 feet

Lecture 10 (effects of exercise on the respiratory system)

Diffusion capacity	
O2	
At rest	21 ml/ min/ mmHg
	11 mmHg
Oxygen difference across is 11 mmHg	230 ml
During rest tissues consume	250 ml o2 / min
At exercise	65 ml / min / mmHg
Co2	
At rest	400 ml / min / mmHg
During exercise	1200 – 1300 ml/min/mmHg

Both O2 and CO2 may increase 20-folds during exercise

Relation between exercise duration & energy source	
Glycogen lactic acid system	1.3 – 1.6 min
Phosphagen system	8 – 10 sec
Aerobic system	Unlimited time

O2 consumption	
Normal	250 ml /min
Untrained average male	3600 ml / min
Athletically trained average male	4000 ml /min
Male marathon runners	5100 ml / min
Maximum pulmonary ventilation	100-110 L/min
Oxygen DEPT	11.5 L
Maximum Breathing capacity	150-170 L/min

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Good luck ☺