Report Session 1: **Introduction of Respiratory System**

Student 1 name: _____

Student 2 name: _____

Questionnaire

Please, after a carefully reading of given references, answer the following questions:

(1) How gas exchange is regulated?

(2) Which muscles are implicated in the breathing process and which is their function?

(3) What is the activity of diaphragm during active expiration?

(4) Where is located respiratory control center anatomically?

(5) Which volumes are described in the documentation and what are the relationships between them?

(6) Why does total ventilation increase during exercise?

(7) Which are normal values of P_aCO_2, P_aO_2, breathing frequency and tidal volume at rest?

Students have to deliver the short answers via Intranet before starting next Lab Session.

Report Session 2: **Respiratory System Response under Ventilatory Stimuli**

Student 1 name: _____

Student 2 name: _____

EXERCISE 1

Variable	Otis' equation	Mead's equation	Widdicombe's equation
V_T (l)			
V_E (l/min)			
f (breaths/min)			
Q (l/min)			
PaO_2 (torr)			
$PaCO_2$ (torr)			

Table 2.1: Results of simulation in resting conditions with three different equations to calculate the respiratory frequency

Comments:

EXERCISE 2

Variable	Sea Level		2500 (m) of Altitude	
	Rest	**Exerc**	**Rest**	**Exerc**
V_T (l)				
V_E (l/min)				
f (breaths/min)				
Q (l/min)				
PaO_2 (torr)				
$PaCO_2$ (torr)				

Table 2.2: Results of exercise simulation at sea level and at 2500 m of altitude

Comments at sea level:

Comments at high altitude:

EXERCISE 3

	Stimulus Level				
Variable	**0**	**1**	**2**	**3**	**4**
V_T (l)					
V_E (l/min)					
f (breaths/min)					
Q (l/min)					
PaO_2 (torr)					
$PaCO_2$ (torr)					

Table 2.3: Results of incremental hypercapnia simulation with Otis' equation to calculate respiratory frequency

Comments:

EXERCISE 4

	Stimulus Level				
Variable	**0**	**1**	**2**	**3**	**4**
f (breaths/min) for Mead					
f (breaths/min)for Widdicombe					
V_T (l) for Mead					
V_T (l) for Widdicombe					
V_E (l/min) for Mead					
V_E (l/min) for Widdicombe					

Table 2.4: Results of incremental hypercapnia simulation with Mead and Widdicombe's equation

EXERCISE 5

Comments:

EXERCISE 6

Equation	Prediction Error (%)	
	V_T	f
Otis		
Mead		
Widdicombe		

Table 2.5: Prediction error during hypercapnia with different equations to calculate respiratory frequency

Comments:

Students have to deliver all the results (Tables, Plots and Comments) via Intranet before starting next Lab Session.

Report Session 3: **Respiratory Diseases based on Mechanical Loads**

Student 1 name: _____

Student 2 name: _____

EXERCISE 1

Variable	Sea Level		2500 (m) of Altitude	
	R=2.6	**R=3.6**	**R=2.6**	**R=3.6**
V_T (l)				
V_E (l/min)				
f (breaths/min)				
Q (l/min)				
PaO_2 (torr)				
$PaCO_2$ (torr)				

Table 3.1: Results of variation of airway resistance at sea level and at high altitude

EXERCISE 2

Variable	Sea Level		2500 (m) of Altitude	
	E=10	**E=20**	**E=10**	**E=20**
V_T (l)				
V_E (l/min)				
f (breaths/min)				
Q (l/min)				
PaO_2 (torr)				
$PaCO_2$ (torr)				

Table 3.2: Results of variation of elastance at sea level and at high altitude

EXERCISE 3

	Stimulus Level				
Variable	**0.2**	**0.4**	**0.6**	**0.8**	**1**
V_T (l)					
V_E (l/min)					
f (breaths/min)					
Q (l/min)					
PaO_2 (torr)					
$PaCO_2$ (torr)					

Table 3.3: Results of incremental exercise simulation in a normal subject

EXERCISE 4

	Stimulus Level				
Variable	**0.2**	**0.4**	**0.6**	**0.8**	**1**
V_T (l)					
V_E (l/min)					
f (breaths/min)					
Q (l/min)					
PaO_2 (torr)					
$PaCO_2$ (torr)					

Table 3.4: Results of incremental exercise simulation in a restrictive patient with E=20 cmH_2O/l

EXERCISE 5

	Stimulus Level				
Variable	**0.2**	**0.4**	**0.6**	**0.8**	**1**
V_T (l)					
V_E (l/min)					
f (breaths/min)					
Q (l/min)					
PaO_2 (torr)					
$PaCO_2$ (torr)					

Table 3.5: Results of incremental exercise simulation in a restrictive patient with E=30 cmH_2O/l

EXERCISE 6

Settling time:

EXERCISE 7

Comments:

EXERCISE 8

Elastance (cmH_2O/l)	Prediction Error (%)	
	V_T	f
10		
20		
30		

Table 3.6: Prediction error in exercise with different values of elastance

Questionnaire

Please, answer the following questions from the results obtained in this Lab Session:

(1) Obtain conclusions from the data in table 3.1. How does an increase of airway resistance effect in the respiratory pattern?

(2) Obtain conclusions from the data in table 3.1. How does an increase of respiratory elastance effect in the respiratory pattern?

(3) Which is the effect of hypoxia in patients with higher respiratory elastance?

(4) Which is the effect of exercise in patients with higher respiratory elastance?

(5) Obtain conclusions from Figure 3.1 and table 3.1. Experimental data from a restrictive patient could be predicted by RespiLab using higher values of elastance? Which elastance value obtains the best prediction of respiratory system response during exercise for the selected restrictive patient with?

(6) Are the graphs of V_T *vs* V_E and F *vs* V_E coherent with the prediction error you found?

Students have to deliver all the results (Tables and Plots) and answers via Intranet by next week.