

1-2015

## AHRC 250.01: Respiratory Care Laboratory II

Nicholas J. Arthur

*University of Montana - Missoula*, [nicholas.arthur@umontana.edu](mailto:nicholas.arthur@umontana.edu)

Let us know how access to this document benefits you.

Follow this and additional works at: <https://scholarworks.umt.edu/syllabi>

---

### Recommended Citation

Arthur, Nicholas J., "AHRC 250.01: Respiratory Care Laboratory II" (2015). *Syllabi*. 3055.  
<https://scholarworks.umt.edu/syllabi/3055>

This Syllabus is brought to you for free and open access by the Course Syllabi at ScholarWorks at University of Montana. It has been accepted for inclusion in Syllabi by an authorized administrator of ScholarWorks at University of Montana. For more information, please contact [scholarworks@mail.lib.umt.edu](mailto:scholarworks@mail.lib.umt.edu).

**The University of Montana – Missoula College  
Respiratory Care Program**

**COURSE NUMBER AND TITLE:** AHRC 250T Respiratory Care Lab II

**DATE REVISED:** Spring 2015

**SEMESTER CREDITS:** 2

**CONTACT HOURS:** The lab will be conducted in 2 sections to allow for better utilization of facilities and equipment. Signup sheet will be posted for the following times: **Monday. 1230 – 1600hrs, Friday. 1300 – 1630hrs**

**PREREQUISITE:** RES 101T, 129T, 130T, 131T, 235T, 150T

**FACULTY:**

Nick Arthur

[nicholas.arthur@umontana.edu](mailto:nicholas.arthur@umontana.edu)

243-7836 (office)

Office: GH 04

Office Hours: By Appointment

**RELATIONSHIP TO PROGRAM:**

This course provides opportunities to apply cognitive skills gained in RES 231t to psychomotor skills through various laboratory activities and simulated hospital experiences.

**COURSE DESCRIPTION:** Application of AHRC 231T, Respiratory Critical Care, to cognitive and psychomotor skills in preparation for critical care clinical rotations.

**METHODS OF INSTRUCTION:** Demonstrations & short lecture, cd tutorials, videos, and participation in structured laboratory activities.

**STUDENT ASSESSMENT METHODS AND GRADING PROCEDURES:**

**APPROXIMATE BREAKDOWN**

Completed Lab Checkoffs- 30%

Mid-term exam/practicum -25%

**PB 840& Avea tutorial post-tests - 20%**

Final lab exam/practicum -25%

***GRADING SCALE***

A = 4.0	95 – 100%	C- = 1.67	70 – 73%
A- = 3.67	90 – 94%	D+ = 1.33	67 – 69%
B+ = 3.33	87 – 89%	D = 1.00	64 – 66%
B = 3.00	84 – 86%	D- = .067	60 – 63%
B- = 2.67	80 – 83%	F = 0.00	
C+ = 2.33	77 – 79%		
C = 2.00	74 – 76%		

Students must have a “B-” final grade in order to progress within the Respiratory Care program. Test questions will be based on unit objectives. Unit objectives are to be used as study guides.

**PROFICIENCY EVALUATIONS:** Evaluation is based upon the following:

1. Completion of several peer and laboratory instructor competency checks.
2. Laboratory quizzes, presentations, and assigned homework.
3. Midterm exam/practicum
4. A final exam/practicum.

**METHODS TO IMPROVE COURSE:** Student evaluations and faculty assessment of course content.

**ATTENDANCE:** Class attendance is an integral part of this course. Exam dates will be announced. Only legitimate reasons for missing an announced exam will be accepted. Failure to appear for scheduled exams will result in 15% point deduction. Expect periodic unannounced quizzes. There is no make-up for missed quizzes.  
SEE: TEST/QUIZ MAKEUP

## **OTHER POLICIES:**

### **ACADEMIC INTEGRITY:**

All students must practice academic honesty. Academic misconduct is subject to an academic penalty by the course instructor and/or a disciplinary sanction by The University. All students need to be familiar with the Student Conduct Code. The Code is available for review online at [http://life.umt.edu/vpsa/student\\_conduct.php](http://life.umt.edu/vpsa/student_conduct.php).

### **DISABILITY ACCOMODATION:**

Eligible students with disabilities will receive appropriate accommodations in this course when requested in a timely way. Please speak with me after class or in my office. Please be prepared to provide a letter from your DSS Coordinator. For more information, visit the Disabilities Services website at <http://www.umt.edu/dss/> or call 406-243-2243 (voice/text)

**Note: Instructor reserves the right to modify syllabi and assignments as needed based on faculty, student, and/or environmental circumstances.**

**Cell Phones/Pagers:** Due to an increasing number of students, who own and use cell phones and pagers, it has become necessary to institute a policy during class times. As you are aware, these tools are distracting to an entire class. However, some students require them for business, which allows them to further their education. Please follow these guidelines:

If the cell phone/pager is not business or emergency related, please turn it off.

Use the vibrating option on your pager.

Do not listen to the messages in class. Please leave class quietly.

**CELL PHONES AND PAGERS MUST BE TURNED OFF DURING EXAM AND CLASS PRESENTATIONS.**

**SEATING:** Many classrooms have chairs to accommodate persons with disabilities. These chairs will display the international disability symbol and are assigned to a particular student. Please refrain from using these chairs or making adjustments to them unless the chair is assigned to you. If you think you may have the need for a specific chair, please contact Disability Student Services. Thank you for your cooperation.

**TEST/QUIZ MAKEUP:** Make-up exams and lab experiences will only be given under extreme circumstances and then only if: a) permission is granted *in advance* by the course instructor, or b) a written excuse is provided by a medical doctor. The burden of proof is on the student, so you must document and prove a justifiable absence. Not following this procedure prior to the exam will automatically result in a 15% point reduction of the subsequently taken exam. Missed tests need to be made up within *one week* of the original date given. You are responsible for contacting the Academic Support Center, 243-7826, to schedule the make-up. Failure to do so will result in a **ZERO** grade for the missed test.

The faculty senate guidelines concerning the issuance of incomplete grades will be followed. Attention to critical dates such as P/NP, drop, etc. is the responsibility of the student. Students wishing to drop the class after the drop deadline will need a documented justifiable reason for doing so. Dropping the class for fear of bad grade or to protect a GPA are **not** justifiable reasons. The principles embodied in the **Student Handbook Code** will be adhered to in this course.

**\*Quizzes:** Failure to be present for quizzes will result in a zero being recorded and used in computing your average. There will be no make-up opportunities for missed quizzes.

**Homework:** It is the expectation that homework will be turned in when due. If you are not present, it is your responsibility to see that it is in my mailbox by 4:00 p.m. on the due date or a zero will be recorded and used in computing your average.

### **INSTRUCTOR EXPECTATIONS:**

Because the course has a great deal of new material, it is very important to study consistently. Some suggestions for better study are:

1. Read the unit objectives at the beginning of each chapter-find out what you are expected to learn.
2. Reading the material before class will help you understand the lecture.
3. Look up definitions to words you do not understand.
4. Attend every class and take notes but do not try to write down everything. Concentrate on concepts.
5. Review your notes as soon after class as possible make sure you can read them!

6. Study notes/material and compare with objectives.
8. Study no more than one hour before taking a short break.
9. Relate information to prior learning/examples to develop a “picture” in your mind.
10. Ask instructor for clarification as needed during or after lecture.
11. Study regularly in a quiet place; set study hours and keep them.
12. Plan something for fun and relaxation - stress management.
13. See your instructor when you think you need help. Your instructor wants you to succeed and will have some ideas which should help.
14. Review for units exams and finals can be made easier by frequent review of chapter content reviews.
15. Be in class and don't miss pop quizzes.

**LABORATORY ETIQUETTE:**

Students will work in groups. Prepare and read materials/exercises before class begins. It is important to actively participate with the equipment. Get direct hands-on experience. Be courteous, the lab will be crowded and cooperation and sharing of equipment is essential. Be attentive to mini-lecture/demonstrations by your instructor. Ask questions. Complete the laboratory exercises in the time allotted and hand it in. Enjoy the lab setting. All conditions are controlled and each performance step is outlined on the checklist. Concentrate on the technical skills and equipment-related aspects.

**A. REQUIRED TEXTS:**

**TITLE:** Egan's Fundamentals of Respiratory Care, 9<sup>th</sup> Ed.  
**AUTHOR:** Wilkins, et al                      **PUBLISHER :** Mosby

**TITLE:** Basic Laboratory Competencies for Respiratory Care, 4th Edition  
**AUTHOR:** White                                      **PUBLISHER :** Delmar

**TITLE:** Clinical Assessment in Respiratory Care, 5<sup>th</sup> Edition  
**AUTHOR:** Wilkins et al                      **PUBLISHER:** Mosby

**VIDEOS AT THE COT LIBRARY – Some may be shown during RES 231T**

- 612.21                      Airway Care – Mosby
- 612.21                      Chest Tubes – Mosby
- 612.133                      Arterial Lines – Springhouse
- 612.28                      Tracheostomy Care – Springhouse
- 617.9                        Chest drainage – Springhouse

**LAB VIDEOS (in-class):** BiPAP Vision, Drager's Airway Pressure Release Ventilation, Viasys Avea Ventilator

**PB 840 & Viasys Avea VENTILATOR Tutorials in Computer Lab (loaded on 5 Computers)**

**COURSE OUTLINE:**

- I. A scrubs dress up day to ensure everyone has the appropriate attire and equipment, including eye protection. Review of basic therapy modalities and hands on any equipment students may feel uneasy about, esp. Nebulizers (SVN & LVN), IPPB or IPV, etc. Ensure students are prepared for Basic Floor Therapy clinicals
- II. Airway Management - identification, selection, and insertion/placement techniques, oral and nasal airways & trouble shooting, Combitube, LMA insertion techniques and troubleshooting, but not heavy emphasis, Endotracheal and tracheostomy tubes, placement, monitoring, general care, troubleshooting and associated competencies. Initiation of Emergency/Transport Ventilation. Chest drainage system monitoring & competency

### **III. Noninvasive Ventilation- Reintroduce Respironics BiPAP Vision for BiLevel; activities & competency**

Introduce Respironics V60 for non invasive BiPAP ventilation.

Practice scenarios using lab manikins. Putting the critical care picture together.

Arterial line management techniques, troubleshooting and competency,

### **IV. Introduce Avian Transport ventilators, & Viasys Avea ventilatory modes & waveform monitoring, activities and begin competencies: Initiate Continuous MV, Monitor Continuous MV, Change a Ventilator Circuit, Ventilator Waveform, CI & Raw interpretation, Monitor Spontaneous Ventilation Parameters.**

Practice scenarios using lab manikins. Putting the critical care picture together.

### **V. Puritan Bennett 840 lab. Students turn in the PB 840 Tutorial post-test at beginning so they can more easily begin activities and competency. Any ventilator related competencies not already completed can be completed now.**

Use PB 840 and Viaysis Avea ventilators during multiple scenarios. More trauma/transport scenarios.

## **COURSE OBJECTIVES:**

1. Identify a variety of airway management techniques as taught in BLS, and utilize tools such as naso and oral pharyngeal airways, combitubes, LMAs, endotracheal and tracheotomy tubes.
2. Perform a variety of airway management techniques as taught in BLS, and utilize tools such as naso and oral pharyngeal airways, combitubes, LMAs, endotracheal and tracheotomy tubes.
3. Demonstrate ability to monitor and trouble shoot problems associated with all airway management techniques and tools.
4. Demonstate competencies for intubation, extubaton, nasopharyngeal and endotracheal suctioning.
5. Demonstate endotracheal tube cuff monitoring and troubleshooting.
6. Identify equipment required for treacheostomy care.
7. Demonstrate competency in tracheostomy care on the manikin.
8. Demonstate competency in oral care.
9. List indications, hazards, and complications of invasive airway tools.
10. Assemble a bag-valve-mask unit, identify it's various components, and describe complications and hazards of it's use along with troubleshooting the unit.
11. Describe methods and equipment to assess ventilatory failure in the critical patient.
12. Describe problem-solving for all advanced airway management tools as outline above.
13. Describe chest drainage system management, monitoring, and troubleshooting competencies.
14. Identify problems associated with patient transport.
15. Assemble equipment required and considerations for safe patient transport within or out of the facility and transport a manikin during a simulation exercise.
16. Demonstate competency for assembly and calibration of capnogrphic monitoring equipment.
17. Identify capnographic waveforms and troubleshoot abnormalities.
18. List indications for arterial line placement and management concerns.
19. Prepare for and draw fake blood from the manikin arm's arterial line.
20. Apply all safety precautions to prepare the blood sample for transport to the lab.
21. Identify proper functioning of the arterial line system post-blood draw.
22. Institute life-saving procedures for emergency simulations using lab manikins and SimMan.
23. Complete the Puritan Bennett 840 cd tutorial and turn in the post-test by the designated date.
24. Demonstrate basic lab competency with the Puritan Bennett 7200 mechanical ventilator, including mode changes and waveform interpretaions using laboratory test lungs in various compliance and resistance settings.

25. Discuss the effect of changing compliance and resistance on ventilator graphics and displayed data.
26. Demonstrate competency with the Puritan Bennett 840 ventilator during “vent lab week” as outlined in the lab competency form.
27. Demonstrate competencies at obtaining spontaneous ventilation parameters on mechanically ventilated patients.
28. Demonstrate competency in assembly of the Respironics BiPAP Vision for use in both CPAP and BiLevel ventilation.
29. Demonstrate competencies at identifying normal and abnormal ventilator waveforms, problem solving, and troubleshooting techniques for all ventilators used during lab.
30. Demonstrate team building and team player sensibilities through participation in all scenarios with lab manikins or SimMan throughout the course.
31. Demonstrate competencies for Initiating & Monitoring mechanical ventilation; change a ventilator circuit.
32. Demonstrate competency with the Viasys Avea ventilator

## RES250T – Respiratory Care Laboratory II-Student Performance Outcomes

### Check Off Log Sheet (completed by Final Lab Meeting)

Student Name:

Check off	Page	Signature (PEER)	Date	Signature (Instructor)	Date
Intubation	441				
Extubation	443				
Nasotracheal suctioning	469				
Endotracheal suctioning	471				
Monitoring cuff pressure	473				
Tracheotomy and stoma care	475				
Oral Care	RES 250 Syllabus				
Monitor Chest Tubes	RES 250 Syllabus				
Arterial Puncture (if not already done)	153				
Arterial line sampling (Clinical Only)	155				
End Tidal monitoring	197				
EKG. (If not already done)	113				
Initiation of Continuous MV	599 & 601				
Monitoring Continuous MV	605				
Changing a Ventilator Circuit	RES 250 Syllabus				
Waveform, C <sub>STAT</sub> & Raw Interpretation	RES 250 Syllabus				
Spontaneous Ventilation Parameters	671				
BiPAP Competency	RES 250 Syllabus & 529				
PB 840 Competency	RES 250 Syllabus				
Viasys Avea Competency	RES 250 Syllabus				

**Clinical & Lab Proficiency Evaluations not in White's Lab Text:**

1. Oral Care
2. Monitor Chest Tube
3. Change a Ventilator Circuit
4. Ventilator Waveform, CI & Raw Interpretations
5. Respironics BiPAP Vision
6. Puritan Bennet 840 (3 pages)
7. Viasys Avea (3 pages)



## Oral Care – Clinical Performance Evaluation

Student name: \_\_\_\_\_ Name of Clinical Affiliate: \_\_\_\_\_

Lab Date: \_\_\_\_\_ Clinical Date: \_\_\_\_\_, Pass \_\_\_\_\_, Fail \_\_\_\_\_

Lab Peer: \_\_\_\_\_ Clinical Preceptor: \_\_\_\_\_

Lab Instructor: \_\_\_\_\_

	<b>PEER</b>	<b>LAB</b>	<b>CLINICAL</b>
Observes Universal Precautions, esp. eye protection _____	_____	_____	_____
Verifies ETT position at last best position _____	_____	_____	_____
Checks ETT or trach cuff pressure _____	_____	_____	_____
Informs patient of procedure _____	_____	_____	_____
Positions patient (semi-Fowlers) _____	_____	_____	_____
Auscultate lung fields _____	_____	_____	_____
Obtain oral care kit or materials needed _____	_____	_____	_____
Suctions trachea as needed _____	_____	_____	_____
Suctions Oropharyngeal secretions _____	_____	_____	_____
What oral care solutions are being used? _____			
Brush teeth 1 – 2 min. (gentle circular motions) _____	_____	_____	_____
Gently brush surface of tongue _____	_____	_____	_____
Use swab if brush causes discomfort, bleeding _____	_____	_____	_____
Apply mouth moisturizer; lip balm if needed _____	_____	_____	_____
Suction oropharynx and trachea as needed _____	_____	_____	_____
Move ETT and secure as indicated _____	_____	_____	_____
Reassess: Auscultate lungs; document ETT position _____	_____	_____	_____
Student's significant learning: _____ ...			

## MONITOR CHEST TUBES - Clinical Performance Evaluation

Student Name: \_\_\_\_\_

Name of Clinical Affiliate: \_\_\_\_\_

Lab Date: \_\_\_\_\_

Clinical Date: \_\_\_\_\_, Pass \_\_\_\_\_, Fail \_\_\_\_\_

Lab Peer: \_\_\_\_\_

Clinical Preceptor: \_\_\_\_\_

Lab Instructor: \_\_\_\_\_

**Identify:**

PEER

LAB

CLINICAL

1. Collection chamber

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

2. Water seal chamber

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

3. Suction control chamber

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

-----  
4. Name two primary purposes of CTs?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

5. Where are pneumothorax CTs generally placed?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

6. Where are fluid drainage CTs generally placed?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

7. What pressure is the vacuum regulator set at?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

8. What's the level in the suction control chamber?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

9. Does the vacuum setting or the water level determine the applied suction?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

11. Name three sources of possible system leaks:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

12. Periodic bubbles (water seal chamber) imply?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

13. Continuous bubbles (water seal) imply?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

14. Why are system leaks potentially dangerous?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

15. Precautions: transporting patients with CTs?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**Additional Clinical Evaluations:**

16. What's the purpose of CT(s) on this patient? \_\_\_\_\_

17. How much fluid is in the collection chamber and what color is it? \_\_\_\_\_

18. Any leaks present? If so, what do you attribute them to? \_\_\_\_\_

19. Can you estimate any ventilator volume loss due to leaks? \_\_\_\_\_

20. What tools are used to trouble shoot system leaks? \_\_\_\_\_

21. If "tidaling" is present, what chamber will show it? \_\_\_\_\_

22. Student significant learning: \_\_\_\_\_ . . .

## Change a Ventilator Circuit - Clinical Performance Evaluation

Student name: \_\_\_\_\_ Name of Clinical Affiliate: \_\_\_\_\_

Lab Date: \_\_\_\_\_ Clinical Date: \_\_\_\_\_, Pass \_\_\_\_\_, Fail \_\_\_\_\_

Lab Peer: \_\_\_\_\_ Clinical Preceptor: \_\_\_\_\_

Lab instructor: \_\_\_\_\_

### **Refer to AARC Clinical Practice Guidelines – Ventilator Circuit Changes**

1. List three bio-hazard precautions you will take to protect yourself:  
a. \_\_\_\_\_, b. \_\_\_\_\_, c. \_\_\_\_\_
2. Assembles equipment: Resuscitation bag available and ready, \_\_\_\_\_  
Aseptically prepares new circuit, \_\_\_\_\_  
Prepares HME or humidifier, \_\_\_\_\_
3. Informs the patient and nurse of the procedure. \_\_\_\_\_
4. Auscultate patient. Suction as needed (100% FIO<sub>2</sub>) before proceeding. \_\_\_\_\_
5. Drains liquid in old circuit into the circuit's fluid collection jar. \_\_\_\_\_
6. Pauses ventilator alarms. \_\_\_\_\_
7. Disconnects and ventilates the patient. \_\_\_\_\_
8. Disposes of old circuit (infectious waste requires a bio-bag). \_\_\_\_\_
9. Empties fluid collection jar into toilet and disposes of jar with circuit. \_\_\_\_\_
10. Makes an efficient and aseptic circuit change-out, within 2 minutes. \_\_\_\_\_
11. Auscultate patient. \_\_\_\_\_
12. Recheck ventilator settings and proper function. \_\_\_\_\_

List two indications (objectives) for changing a ventilator circuit:

1. \_\_\_\_\_, 2. \_\_\_\_\_

List two contraindications for not changing a ventilator circuit:

1. \_\_\_\_\_, 2. \_\_\_\_\_

**VENTILATOR WAVEFORMS, CI & Raw INTERPRETATIONS – Clinical Performance Evaluation**

Student name: \_\_\_\_\_ **Name of Clinical Affiliate:** \_\_\_\_\_

Lab Date: \_\_\_\_\_ **Clinical Date:** \_\_\_\_\_, Pass \_\_\_\_\_, Fail \_\_\_\_\_

Lab Peer: \_\_\_\_\_ **Clinical Preceptor:** \_\_\_\_\_

Lab Instructor: \_\_\_\_\_

	PEER	LAB	CLINICAL
DEFINITIONS: Student accurately describes: Lung Compliance, CI	_____	_____	_____
Student is able to describe conditions of variable lung compliance	_____	_____	_____
Student accurately describes Airway Resistance, Raw	_____	_____	_____
Student is able to describe conditions of variable Airway Resistance	_____	_____	_____
Obtains Compliance, ( $C_{STAT}$ ), value on ventilator	_____	_____	_____
Obtains Resistance, ( $R_{AW}$ ), value on ventilator	_____	_____	_____

**WAVEFORM SELECTION & BASIC INTERPRETATIONS:**

Student selects waveform options and adjusts scalars for best view	_____	_____	_____
Assess: PATIENT EFFORT on Pressure-Time & Pressure-Volume graphics	_____	_____	_____
Assess: AIR TRAPPING (auto PEEP) on Flow-Time graph	_____	_____	_____
Assess: INSPIRATORY FLOW on Mandatory Breaths by Pressure-Time Graph, Identify pressure overshoot.	_____	_____	_____
Assess: COMPLIANCE CHANGES by slope of Pressure-Volume graph	_____	_____	_____
Assess: RESISTANCE CHANGES by Pressure-Volume hysteresis	_____	_____	_____

CLINICAL INTERVENTIONS: Describe ventilator adjustments or therapies made based on above findings:

\_\_\_\_\_

CLINICAL CONCEPTS: What ventilator mode and settings are in place on the patient? \_\_\_\_\_

\_\_\_\_\_

Why this mode and settings are appropriate for the patient at this time? \_\_\_\_\_

\_\_\_\_\_

Student's most significant learning: \_\_\_\_\_...

## NPPV Lab Exercise/Performance Evaluation

**\*Checkoff will be from White p .529\***

**Exercise can be completed using either the Vision BiPAP or the V60 (newest generation of the Respironics BiPAP line). While both operate in a similar fashion, the interface and controls are significantly different and scenarios and exercises should be completed on both machines.**

Initial set up and adjustment of the two BiPAP machines is different in terms of method but involves setting and adjusting essentially the same parameters.

First: Turn on the machine and familiarize yourself with the user interface. Locate the alarm silence and reset as these will be needed during setup. Which machine uses a “soft key” interface? \_\_\_\_\_. Which machine uses a touch screen interface? \_\_\_\_\_

All NIV's must have provision for purging of exhaled CO<sub>2</sub>. This is assured by the presence of a \_\_\_\_\_ in the patient circuit. Both machines must determine how much leak is present in the **patient circuit**. How is this accomplished with the:

A) **Vision?**

B) **V60 ?**

Select **S/T mode** and enter the appropriate parameters **OR** perform the appropriate test to “teach” the machine about circuit leak. (We will be using a test lung for the exercises)

Once this has been accomplished, enter the following ventilator parameters:

IPAP=12    EPAP=4    F<sub>i</sub>O<sub>2</sub>=21%    Backup RR=10    T<sub>i</sub> = 1.25sec

Now look at the alarm screen. Identify the alarms available and determine what would be appropriate initial settings for each. (**For now set Low V<sub>T</sub> = 300ml and Low V<sub>E</sub> = 3L. Other alarms are at your discretion**)

Place the machine on **standby** until you are ready to connect to the test lung (“patient”).

When ready, connect to the test lung and evaluate what the results of your initial settings are in terms of: RR \_\_\_\_\_ V<sub>T</sub> \_\_\_\_\_ V<sub>E</sub> \_\_\_\_\_ PIP \_\_\_\_\_

Look at and analyze the waveforms associated with this setup. Adjust the scale of the waveforms to optimize the graphics. Now try decreasing the compliance characteristics of the test lung. Is there any change in Peak pressure on each breath? \_\_\_\_\_ Any change in delivered V<sub>T</sub>? \_\_\_\_\_ Any Alarms sounding? \_\_\_\_\_

Watch the pressure waveform and note that pressure never falls below the set EPAP. EPAP prevents collapse of airways, as well as collapse of consolidated/atelectatic lung units, at end exhalation (thereby improving shunt situations and increasing FRC). Therefore, EPAP has essentially the same physiological effect as \_\_\_\_\_. Given this knowledge, the primary tools available to improve **PaO<sub>2</sub>** during NIV are increasing \_\_\_\_\_ and/or increasing \_\_\_\_\_. Increase the EPAP to 6. Any effect on V<sub>T</sub>? \_\_\_\_\_. If you now increase the IPAP to 14 does the V<sub>T</sub> return to close to its initial value? \_\_\_\_\_. So an increase in EPAP **without** a corresponding (equal) increase in IPAP will have what effect on V<sub>E</sub>? \_\_\_\_\_ and what likely effect on **PaCO<sub>2</sub>**? \_\_\_\_\_ Effect on **pH**? \_\_\_\_\_

Try triggering/initiating a spontaneous breath. What are the resulting IPAP and EPAP values that you

see graphically? \_\_\_\_\_ Is the spontaneous  $V_T$  similar to those seen with mandatory breaths? \_\_\_\_\_ If not, what would account for the variability?

Return to your initial settings and allow the machine/patient to settle in. (IPAP=12 EPAP=4  $F_iO_2=21\%$  Backup RR=10) **Now increase the IPAP to 16 and evaluate** any changes in  $V_T$  \_\_\_\_\_ and  $V_E$  \_\_\_\_\_. The change you have just made caused an increase in the amount of Pressure support being provided to each breath. Pressure support = IPAP - EPAP. Given the results of the changes made, what is the likely effect of an increase in pressure support in terms of the **PaCO<sub>2</sub>** of your patient?

Take a look at **Rise Time**. The primary purpose of this setting is to improve patient comfort and synchrony with the machine. Make adjustments (First select the maximum value available and observe, then select the minimum available and observe). Watch the waveforms and listen to the test lung to get a sense of the resulting changes in breath delivery.

Now take a look at **I-Time**. This setting is applied to all mandatory machine breaths and determines the duration of the inspiratory phase. Make adjustments (First select the maximum value available and observe, then select the minimum available and observe). Watch the waveforms and listen to the test lung to get a sense of the resulting changes in breath delivery. **Are there any significant changes in  $V_T$  as a result of changes in I-Time?** \_\_\_\_\_ **Why?**

**At these settings, and with this patient, what is the optimal I-time to achieve maximum  $V_T$  while providing the longest E-time possible?** \_\_\_\_\_

**What is the I:E ratio resulting from the optimal I-time setting determined above?** \_\_\_\_\_

**What effect will a longer I-Time have on Expiratory time?** \_\_\_\_\_. **What type of patient could be negatively impacted by a reduction in expiratory time?** \_\_\_\_\_. **Could you imagine any benefits to a prolonged I-Time?**

The V60 has a mode called **AVAPS** (Average Volume Assured Pressure Support). AVAPS compensates for changing pulmonary mechanics (compliance/ $R_{aw}$ ) by adjusting pressure support to achieve a target  $V_T$ . Select the AVAPS mode and enter the following initial settings:

**$V_T = 550ml$  IPAP<sub>MAX</sub> = 20 IPAP<sub>MIN</sub> = 12 EPAP = 4** Observe the resulting process using analysis of the waveforms and of the data displayed as the ventilator works to achieve the desired  $V_T$ . **Try increasing the target  $V_T$  to 650ml** and observe how long it takes to achieve the new  $V_T$ . **Can you see any benefits to this mode of NIV verses standard BiPAP(S/T)?**

# Laboratory Performance Evaluation PURITAN BENNETT 840 VENTILATOR

Student Name: \_\_\_\_\_

Peer: \_\_\_\_\_ Date: \_\_\_\_\_ Lab Instructor: \_\_\_\_\_ Date: \_\_\_\_\_

Peer: Pass \_\_\_\_\_ Needs review \_\_\_\_\_ Lab Instructor: Pass \_\_\_\_\_ Needs review \_\_\_\_\_

**NOTE: This is a lab exercise and does not preclude White's Clinical Lab Competencies check-offs for: Initiation of Continuous Mechanical Ventilation or Monitoring Continuous Mechanical Ventilation.**

## INITIAL TASKS

Attach inspiratory and expiratory filters.

Connect circuit.

Turn on the PB 840, ensuring the circuit is open (no patient attachment cap).

Perform SST then select new patient

## WORK THROUGH THE FOLLOWING SCENARIOS FOR LAB PRACTICE WITH A PARTNER

**INITIAL SETTING: New Patient = Adult female @ IBW 65 kg,**

Mode = A/C

FIO<sub>2</sub> = 25%

Breath Delivery = Volume

Flow = 45 lpm

Rate = 12

Flow Pattern = Square

PEEP = 6

V<sub>T</sub> = 650ml

**The 840 gives you a chance to set the P<sub>peak</sub> alarm/limit from the initial setup screen. Find the touch key and set appropriately.**

Did you set other appropriate Alarm and Apnea Parameters?

Record the set I:E ratio = \_\_\_\_:\_\_\_\_ I time = \_\_\_\_\_ E time = \_\_\_\_\_

## Ventilator should be "Waiting for Patient Attachment."

**Attach test lung. No springs, Raw = 5**

Record the : MAP = \_\_\_\_\_ PIP = \_\_\_\_\_ VE = \_\_\_\_\_

Do Static Maneuver (Insp. Pause): C<sub>stat</sub> = \_\_\_\_\_, R<sub>aw</sub> = \_\_\_\_\_, P<sub>plat</sub> = \_\_\_\_\_

Display waveforms and adjust scalars for: Flow/Time, V<sub>T</sub>/Time, P/Time,

Try creating Patient triggered breaths: Notice waveform characteristics when you mimic Pt.triggered breaths. Try varying the trigger sensitivity from high to low. **How would you evaluate (using which graphics) the effort required to trigger those breaths as you vary the sensitivity?**

Connect an in-line nebulizer (dry) and set flow meter to 8-10 lpm. **What happens and why?**

What solution is there on this machine?

---

Results of ABG's for the patient above, on the current settings are:

pH; 7.43 PaCO<sub>2</sub>; 38 PaO<sub>2</sub>; 95 HCO<sub>3</sub>; 26.

**Would you like to make any changes to your vent settings?**

---

**NEW PROPOSAL** (same Pt.):

**Mode: SIMV, PC, Rate = 10, PEEP = 5, FIO<sub>2</sub> = 21%. I-time (T<sub>I</sub>) = 0.8sec. Rise = 50%. PS = 0**

**Adjust to achieve Mandatory V<sub>T</sub> of approx. 725ml**

P<sub>I</sub> = \_\_\_\_\_ Minute Ventilation = \_\_\_\_\_ V<sub>T</sub> = \_\_\_\_\_

**Reduce I-time to 0.45sec,**

Any changes in V<sub>T</sub> \_\_\_\_\_ Peak pressure \_\_\_\_\_ V<sub>E</sub> \_\_\_\_\_

**If changes are noted, what do you think is responsible? (What is occurring? Can you see this graphically?)**

**Decrease the mandatory rate to 4 and adjust I-time (T<sub>I</sub>) to 1.0sec.**

Now try mimicing patient triggered breaths and observe approximate V<sub>T</sub> from those breaths

**Add PS of 5cmH<sub>2</sub>O.** What happens to Spontaneous V<sub>t</sub> and V<sub>E</sub>? \_\_\_\_\_

**Now increase PS to 10cmH<sub>2</sub>O.** What happens to Spontaneous V<sub>t</sub> and V<sub>E</sub>? \_\_\_\_\_

Results of ABG's for the patient above, **on the original settings for this proposal:** (SIMV, PC, Rate = 10, PEEP = 5, FIO<sub>2</sub> = 21%. I-time (T<sub>I</sub>) = 0.8sec. Target V<sub>T</sub> 725ml.) are as follows: pH; 7.51 PaCO<sub>2</sub>; 31 PaO<sub>2</sub>; 65 HCO<sub>3</sub>; 22. Pt. is only triggering 1 or 2 spontaneous breaths/min at 50 ml. each

**Would you like to make any changes to your vent settings and why?**

**If the Pt. starts to trigger an increased number of spontaneous breaths /min (6 – 8/min) with PS =5 , spontaneous V<sub>t</sub> of 4-5 ml/kg IBW, and seems comfortable with their WOB, what changes might you consider to your settings?**

---

**NEW PROPOSAL:**

**Mode: Spontaneous, PS = 5, CPAP = 5 FIO<sub>2</sub> = 25%**

Rise% = 40, Esens = 20%, Adj Vsens up one.

Use your filter to experience this mode. Note the I:E ratio depends on \_\_\_\_\_?



These would be very typical settings for a spontaneous breathing trial on the vent or to assess readiness for discontinuation of Mechanical ventilation.

Use your mouthpiece to experience this mode and to begin gathering data about yourself:

$V_{T(SPONT)} =$  \_\_\_\_\_  $RR_{(SPONT)} =$  \_\_\_\_\_

$V_{E(SPONT)} =$  \_\_\_\_\_  $VC =$  \_\_\_\_\_

Did you get a RSBI? Where did you find it?

---

### NEW PROPOSAL:

**Mode: BiLEVEL, High PEEP = 12 Low PEEP = 4 PS = 5**

%Rise = 40    Esens=25%    Adj. Vsens down one

Adj.  $T_H$  (high time) to 4 sec. and  $T_L$  (low time) to 2 sec. Rate= \_\_\_\_\_

I:E ratio = \_\_\_\_\_:\_\_\_\_\_. What's different about this I:E? \_\_\_\_\_

**Bi-level** is a similar mode to IMV-PC except that the patient can also trigger pressure supported spontaneous breaths “on top” of mandatory breaths. Mandatory breaths are pressure controlled at what is referred to as  $PEEP_{High}$ , Base end expiratory pressure is now referred to as  $PEEP_{Low}$ . By adjusting the amount of time spent at each level of PEEP we can manipulate the mandatory I: E ratio.

**How might we manipulate mandatory  $V_t$  in this mode? Hint: remember that this is a form of pressure control. How about manipulating spontaneous  $V_t$  ?**

If our patient was in need of increased **Mean Airway Pressures (MAP)** in order to improve  $PaO_2$  values, one technique we discussed was the use of **Inverse Ratio Ventilation** (2:1, 1.5:1, etc). This type of breathing pattern is not typically well tolerated by patients in typical pressure control modes. **Why might this type of Ventilatory strategy be better tolerated in Bi-Level?**

**Try triggering additional breaths above  $PEEP_{HIGH}$  and observe the pressure supported breaths that result. These breaths will alter the ultimate “actual” I:E ratio. If time allows and if you wish too, try this mode for yourself using your filter.** “Better tolerated” is a relative term and patients will need sedation in order to synchronize with the vent when inverse ratios are used. Paralytics will not be used if pt. effort is required to meet any portion of  $V_E$  needs.

## Laboratory Performance Evaluation Lab Performance Evaluation – VIASYS AVEA

Student Name: \_\_\_\_\_

Peer: \_\_\_\_\_ Date: \_\_\_\_\_ Lab Instructor: \_\_\_\_\_ Date: \_\_\_\_\_

Peer: Pass \_\_\_\_\_ Needs review \_\_\_\_\_ Lab Instructor: Pass \_\_\_\_\_ Needs review \_\_\_\_\_

**NOTE: This is a lab exercise and does not preclude White's Clinical Lab Competencies check-offs for: Initiation of Continuous Mechanical Ventilation or Monitoring Continuous Mechanical Ventilation.**

### INITIAL TASKS

Attach inspiratory and expiratory filters.

Connect circuit.

Turn on the Avea, ensuring the circuit is open (no patient attachment cap).

**Once the EST has been completed, select new patient).**

### WORK THROUGH THE FOLLOWING SCENARIOS FOR LAB PRACTICE WITH A PARTNER

**INITIAL SETTING: New Patient = Adult Male @ IBW 60 kg,  
HME in use, Auto Airway Compensation: 8.0 ETT, 28 cm**

Mode = SIMV

FIO<sub>2</sub> = 30%

Breath Delivery = Volume

Flow = 70 lpm

Rate = 16

V<sub>T</sub> = 850 ml

PEEP = 10

Record the I:E ratio = \_\_\_\_\_:\_\_\_\_\_ I time = \_\_\_\_\_ E time = \_\_\_\_\_

### **Attach test lung. No springs, Raw = 20**

Did you set other appropriate Alarm and Apnea Parameters?

**Decrease the peak Flow to 30 L/min.**

Record the I:E ratio = \_\_\_\_\_:\_\_\_\_\_ I time = \_\_\_\_\_ E time = \_\_\_\_\_  
MAP = \_\_\_\_\_ PIP = \_\_\_\_\_

**What changes do you notice in the Flow/time curve? Any clinical significance?**

**Make appropriate adjustments to eliminate Auto PEEP (PEEP<sub>I</sub>).**

**What Flow pattern is being delivered?**

**Return Peak Flow to 70 Lpm.**

Peak Pressure = \_\_\_\_\_ Mean Pressure = \_\_\_\_\_

The Peak pressure being delivered is a bit high. Perform an inspiratory pause to evaluate if alveolar pressures are acceptable.  $P_{PLAT}$  = \_\_\_\_\_ Acceptable? \_\_\_\_\_

By pressing the ADV Settings soft key and then touching the Peak Flow touch key you can select a different flow pattern. **Switch to square Wave. Any changes to I:E ratio or Peak pressure as compared to a decelerating waveform? I:E** \_\_\_\_\_ **Peak Pressure** \_\_\_\_\_

Connect an in-line nebulizer (dry) and start treatment. **What happens and why?**

---

Results of ABG's for the patient above, on the current settings are:

pH; 7.59 PaCO<sub>2</sub>; 30 PaO<sub>2</sub>; 127 HCO<sub>3</sub>; 26.

**Would you like to make any changes to your vent settings?**

---

**NEW PROPOSAL** (New Patient – IBW 65kg.)

**Mode: AC, PC, Rate = 12, PEEP = 5, FIO2 = 30%. I-time (T<sub>I</sub>) = 0.9sec**

**Test lung: No springs, Raw = 5**

**Target V<sub>T</sub> = 800ml**

Record : MAP = \_\_\_\_\_ PIP = \_\_\_\_\_ V<sub>T</sub> = \_\_\_\_\_

**Add one small springs to the test lung. This will simulate a decrease in compliance.**

**Any notable changes to breath delivery ?**

What Inspiratory Pressure is required to restore the previous V<sub>T</sub>? \_\_\_\_\_

What is the resulting Peak Pressure of this adjustment? \_\_\_\_\_ (keep this value in mind for the following question)

Results of ABG's for the patient above, (who is not triggering any additional breaths), on the current settings are:

pH; 7.25 PaCO<sub>2</sub>; 30 PaO<sub>2</sub>; 61 HCO<sub>3</sub>; 21.

**Would you like to make any changes to your vent settings? Why or Why not?**

---

**NEW PROPOSAL**

**Mode AC, VC. Rate = 10, V<sub>T</sub> = 600 ml, PEEP = 5, Peak Flow = 50 L/min**

**Test lung: No springs, Raw = 5**

Record the I:E ratio = \_\_\_\_\_:\_\_\_\_\_ I time = \_\_\_\_\_ E time = \_\_\_\_\_

MAP = \_\_\_\_\_ PIP = \_\_\_\_\_

Increase **R<sub>aw</sub>** on test lung to = 50

Record the: MAP = \_\_\_\_\_ PIP = \_\_\_\_\_

Note the relative changes in recorded pressures. **How would you examine the change in R<sub>AW</sub> using the ventilator graphics? Perform the necessary Pt. manouver for each of the R<sub>AW</sub> values and view the appropriate graphic.(pressure, volume, or flow)**

See if you can answer the following question using only the Ventilator graphics and the “Freeze” key. **In the above two situations PIP has changed quite a bit, has P<sub>plat</sub> changed significantly? What are the approximate P<sub>plat</sub> values for the two R<sub>AW</sub> conditions?( R<sub>AW</sub> = 5, R<sub>AW</sub> = 50 )**

---

### **NEW PROPOSAL**

**Mode CPAP / PSV. PEEP = 5, PSV = 0**

**Test lung: You**

Grab your Bio filter and give it a try.

**If you vary your inspiratory effort does baseline pressure on the pressure waveform change significantly(other than momentarily at beginning inspiration and beginning exhalation)?**

**If not, how does the ventilator accomplish such a remarkable feat?**

**Now add PS = 10**

**What is baseline pressure doing now? (during breaths and between breaths)**

**INSPIRATORY flow** doesn't seem to return to base line during these PS breaths. Is that normal?

By pressing the ADV Settings soft key and then touching the PSV touch key you can modify the Expiratory flow cycling criteria. **Adjust PSV Cycle** to optimize the comfort of your partner. Adjust additional PSV advanced settings as needed.

---