

## Crafton Hills College Course Outline

1. **Discipline:** Respiratory Care
2. **Department:** Allied Health Services
3. **Course Title:** Pulmonary Assessment and Pharmacology
4. **Course I.D:** RESP 103
5. **Prerequisite(s):** Acceptance into the Respiratory Care Program, Proof of a clear Department of Justice background check and RESP 051X4.

**Corequisite(s):** RESP 101, RESP 102 and RESP 104

**Departmental Recommendation(s):** None

6. **Semester Units:** 3

7. **Minimum Semester Hours:**

Lecture: 48      Lab: 0      Clinic: 0      Field: 0

8. **Need for the Course:**

The Crafton Hills College Respiratory Care Program must comply with the standards of Committee on Accreditation for Respiratory Care as well as standards specified by the Respiratory Care Board of California for accreditation in order to be accredited. This course is one in a series of courses leading to a Certificate of Completion in the Certified Respiratory Therapist Program and will help prepare the student for employment as a Respiratory Care Practitioner.

The student must be prepared for the patient encounter. The student must be able to perform a basic interview and assess the patient in order to safely evaluate his/her condition. In addition, the student must be familiar with the drugs and medications currently pertinent to patient care. This course provides students with these opportunities.

9. **Goals for the Course:**

This course is appropriate to the college's mission in that it is part of a complete vocational education program leading to employment. This is one in a series of courses integral to a complete vocational education program to train the Respiratory Care Practitioner. This series of courses and completion of an Associate Degree will provide students with the cognitive and psychomotor skills necessary to make him/her eligible for the entry-level examination process and successful practice at this level as a Respiratory Care Practitioner.

This course provides an understanding of the basic interview and assessment techniques that are appropriate for safe and effective evaluation of a patient's condition. It also provides the student with the familiarity required of drugs and medications used in patient care today. This course is required for the Certificate of Completion in both the Certified Respiratory Therapist and the Registered Respiratory Therapist Programs.

**10. Catalog Description:**

Preparation for the patient encounter through the understanding of basic interviewing and assessing techniques essential to the safe and effective practice of respiratory care. This course also offers the student the introductory knowledge of drugs and medications pertinent to patient care today.

**11. Schedule Description:**

Preparation for the patient encounter through the understanding of basic interviewing and assessing techniques essential to the safe and effective practice of respiratory care.

**12. Entrance Skills:**

**A. Requisite Skills:**

**Upon entering this course, students must be able to:**

1. Verify their acceptance into the Respiratory Care Program and provide proof of a clear Department of Justice background check
2. Perform cardiopulmonary resuscitation (RESP 051X4)
3. Perform adult one-rescuer cardiopulmonary resuscitation (RESP 051X4)
4. Perform adult foreign body airway obstruction management: conscious (RESP 051X4)
5. Perform adult foreign body airway obstruction management: unconscious (RESP 051X4)
6. Perform child one-rescuer cardiopulmonary resuscitation (RESP 051X4)
7. Perform child foreign body airway obstruction management: conscious (RESP 051X4)
8. Perform child foreign body airway obstruction management: unconscious (RESP 051X4)
9. Perform infant cardiopulmonary resuscitation (RESP 051X4)
10. Perform infant foreign body airway obstruction management: conscious (RESP 051X4)
11. Perform infant foreign body airway obstruction management: unconscious (RESP 051X4)
12. Perform adult two-rescuer cardiopulmonary resuscitation (RESP 051X4)
13. Perform child two-rescuer cardiopulmonary resuscitation (RESP 051X4)
14. List and identify one spirometry tracing the four lung volumes and four lung capacities. (RESP 101)
15. Explain the events of a normal breathing cycle in terms of changes in pressure, flow, volume, and the forces that oppose inflation of the lung (RESP 101)
16. Explain the factors contributing to expiratory flow limitations in both health and disease (RESP 101)
17. Differentiate between the mechanical and metabolic work involved in ventilation and their significance in health and disease (RESP 101)
18. Relate the mechanical properties of the lung to regional and local differences in the distribution of ventilation during inspiration in health and disease (RESP 101)
19. Differentiate between the efficiency and effectiveness of ventilation as related to alveolar ventilation and carbon dioxide excretion (RESP 101)
20. Identify the differences among the three primary states of matter, with a special emphasis on the physical properties of fluids (liquids and gases) (RESP 101)
21. Relate the concepts of heat transfer and change of state to the internal energy of matter and the measurement of temperature (RESP 101)

22. Apply the standard laws of gas behavior to explain changes in the temperature, pressure, volume, or mass of an ideal gas (RESP 101)
23. Explain how the behavior of gases deviates from ideal under extremes of pressure and temperature (RESP 101)
24. Relate the key principles of hydrodynamics to the behavior of fluids in motion and their application in respiratory care (RESP 101)
25. Identify the hydrogen ion regulation in body fluids for acid-base balance (RESP 101)
26. Identify the normal acid excretion mechanisms of the body (RESP 101)
27. Employ the parameters of the Henderson-Hasselbalch equation to differentiate among the four primary (uncompensated) and four secondary (compensated) states of acid-base imbalance (RESP 101)
28. Identify the four primary clinical states of acid-base imbalance according to underlying causes and mechanisms of compensation and correction (RESP 101)
29. Identify the more common causes of respiratory acidosis, respiratory alkalosis, metabolic acidosis, and metabolic alkalosis (RESP 101)
30. Identify acid-base indicators (RESP 101)
31. Control infection (RESP 102)
  - a. Identify and describe the three major elements necessary for the spread of infection in general and respiratory infections in particular
  - b. Identify the specialized handling equipment procedures to prevent the spread of infection
  - c. Differentiate between the methods for Decontamination, disinfection, and sterilization
  - d. Identify the procedures that contribute most to nosocomial infections and how to prevent the spread of pathogens from these procedures
  - e. Practice procedures mandated by the Occupational Safety and Health Administration for the handling and disposal of infectious waste or equipment
  - f. List and describe the appropriate use of general barrier methods of infection control
  - g. Apply standard precautions and transmission-based isolation procedures according to Centers for Disease Control and Prevention guidelines
  - h. Demonstrate effective hand-washing technique
  - i. Distinguish between various types of isolation procedures and apply applicable precautions for each
  - j. Describe the key components of a departmental bacteriologic surveillance program
  - k. Prepare equipment for the most commonly used methods of decontamination, disinfection, and sterilization
  - l. Practice monitoring techniques for evaluating the effectiveness of infection control procedures
  - m. Practice communication skills needed to explain infection control procedures to patients
  - n. Practice documentation of infection control procedures Identify and describe the characteristics of solutions, including concentrations of solutes.
  - o. Explain osmotic pressure function and what its action is in relation to cell membranes.
  - p. Explain the solute content of a solution using ratio, weight/volume, and percent methods.
  - q. Describe the ionic characteristics of acids, bases, and salts
  - r. Identify the fluid compartments and their location in the body.
  - s. List and identify the seven basic body electrolytes.

- t. Identify the medullary respiratory center.
  - u. Identify the role of the pontine respiratory centers.
  - v. Identify and describe how each of the following reflexes effect the control of breathing: Hering-Breuer inflation reflex, deflation reflex, Head's paradoxical reflex, irritant receptors, J receptors, peripheral proprioceptors, and muscle spindles.
  - w. Identify the chemical control centers of breathing.
  - x. Identify the ventilatory response to exercise.
  - y. Identify and describe abnormal breathing patterns: Cheyne-Stokes, Biot's and apneustic breathing, central neurogenic hypoventilation and hyperventilation.
  - z. Describe the effect of carbon dioxide on cerebral blood flow.
- 32. Perform patient assessment (RESP 102)**
- a. Explain the importance of the repeated interview and cardiopulmonary examination of the respiratory patient and describe how they are performed
  - b. Describe the first step involved in the physical assessment, the so-called "view from the door"
    - i. Critically observe the environment as part of a scene survey
    - ii. Conduct a primary survey
    - iii. Identify and explain the information contained in nursing notes
    - iv. Identify common abnormal breathing patterns one may encounter during the physical assessment
    - v. Identify and describe common parameters to note about sputum
    - vi. Identify and describe diseases associated with purulent green or yellow sputum
  - c. Explain the importance of the patient interview and describe how it is performed
    - i. Use therapeutic communication skills to establish patient rapport and elicit information during a patient interview
    - ii. Identify and describe dyspnea, paroxysmal nocturnal dyspnea, and orthopnea
    - iii. Explain the importance of the patient's occupation, hobbies, location of house, family illnesses, alcohol habits, and tobacco habits
  - d. Explain the importance of the formal examination of the respiratory patient and describe how it is performed
    - i. List the four diagnostic procedures involved
    - ii. Explain the importance of the terms unilateral hyper expansion, sternal deformities, spinal curvature, obesity, scars, hemithorax movement, cyanosis, neck veins, clubbing, and tracheal deviation and how they relate to inspection of the patient
    - iii. Explain the importance of the terms tactile fremitus and chest expansion and how they relate to palpation of the patient
    - iv. Identify and describe the terms immediate percussion, mediate percussion, causes of dullness, and diaphragmatic excursion and how they relate to percussion of the patient
    - v. Explain the importance of auscultation and describe how it is performed
  - e. Differentiate between the proper use of the bell and diaphragm chest pieces
  - f. Identify the sound each piece transmits
  - g. Determine the correct usage of each chest piece when listening to the chest

- h. Identify common errors associated with patient auscultation
  - i. Identify and describe breath sounds
    - i. Normal vesicular
    - ii. Bronchial
    - iii. Tracheal
    - iv. Bronchovesicular
    - v. Absent breath sounds
    - vi. Rhonchi
    - vii. Wheezes
    - viii. Stridor
    - ix. Rales or crackles
    - x. Pleural friction rubs
    - xi. Vocal fremitus
    - xii. Whispered pectoriloquy
    - xiii. Egophony
  - j. Identify and describe bedside pulmonary function assessments
    - i. Tidal volume
    - ii. Respiratory rate
    - iii. Minute ventilation
    - iv. Vital capacity
    - v. Peak expiratory flow rate
    - vi. Positive inspiratory pressure
    - vii. Positive expiratory pressure
  - k. Practice the techniques of simple vital sign measurements
  - l. Perform the elements of a secondary survey
  - m. Practice the techniques of observation, palpation, percussion, and auscultation for physical examination of the chest
  - n. Explain how cultural or ethnic differences may affect the performance of patient assessment techniques
  - o. Practice medical charting for the documentation of performance of patient assessment procedures
  - p. Apply infection control guidelines and standards associated with equipment and procedures, according to occupational Safety and Health Administration regulations and Centers for Disease Control and Prevention guidelines
- 33.** Perform bedside assessment of pulmonary mechanics (RESP 102)
- a. Perform bedside assessment of pulmonary mechanics in the laboratory and clinical settings
  - b. Select, use, and maintain the equipment necessary to perform bedside assessment of pulmonary mechanics, including vane and electronic respirometers
  - c. Apply infection control guidelines and standards associated with each piece of equipment, according to Occupational Safety and Health Administration regulations, Centers for Disease Control and Prevention guidelines, and American Thoracic Society standards
  - d. Given a patient scenario, select the appropriate assessment techniques and/or pulmonary mechanics tests and relate the clinical significance of the measured parameters to treatment decisions
  - e. Explain alternative ways of obtaining data when dealing with patients with limited mental or functional capacity or language barriers
  - f. Practice communication skills needed to instruct patients in the performance of pulmonary mechanics testing
  - g. Practice medical charting for the documentation of performance of bedside pulmonary mechanics procedures

- 34. Operate and maintain oxygen supply systems (RESP 102)**
- a.** Identify and describe the properties of oxygen
  - b.** Identify and describe diaphragm- and piston-type compressors
  - c.** Identify and describe the regulations and codes affecting compressed gas cylinders in specific areas
    - i.** Transportation
    - ii.** Construction
    - iii.** Hydrostatic testing
    - iv.** Pressure releases
  - d.** Compare and contrast distribution systems
    - i.** Bulk oxygen supply systems
    - ii.** Pipeline distribution systems
    - iii.** Station outlets
  - e.** Define, compare, and contrast regulators
    - i.** Single-stage regulators
    - ii.** Multi-stage regulators
    - iii.** Components of a single-stage and a multi-stage regulator
    - iv.** Pre-set and adjustable regulators
  - f.** Identify, compare, and contrast flowmeters
    - i.** Fixed orifice flowmeters
    - ii.** Variable orifice flowmeters
    - iii.** Compensated and uncompensated flowmeters
  - g.** Identify the contents of medical gas cylinders
  - h.** Identify the markings on a medical gas cylinder as defined by the Department of Transportation
  - i.** Differentiate between the American Standard Safety System index for large cylinders, the Diameter Index Safety System, and the Pin Index Safety System for small cylinders
  - j.** Demonstrate the safe handling, transport, and storage of medical gas cylinders
  - k.** Identify the components of a bulk liquid system
  - l.** Identify the components of a reserve system
  - m.** Demonstrate the safe handling and refilling of a portable liquid oxygen system
  - n.** Identify the component parts and troubleshoot an oxygen concentrator
  - o.** Operate and troubleshoot air compressors
    - i.** Diaphragm
    - ii.** Piston
  - p.** Calculate the duration of flow from a gas cylinder
  - q.** Set up and safely operate a blender
  - r.** Locate and identify zone valves in a health care facility
  - s.** Identify and safely use wall outlet quick connect systems
- 35. Perform oxygen analysis (RESP 102)**
- a.** Identify, compare, and contrast the principle of operation of classes of oxygen analyzers
    - i.** Physical analyzers
    - ii.** Electrical analyzers
    - iii.** Electrochemical analyzers
    - iv.** Mass spectrometry
  - b.** Indicate by class which oxygen analyzers could provide a continuous analysis of oxygen
  - c.** Identify which subclass of electrochemical oxygen analyzers has a more rapid response time

- d. Identify by brand name or class which oxygen analyzer is unsafe in an explosive atmosphere
  - e. Identify factors which will affect the accuracy of oxygen analyzers
  - f. Identify, compare, and contrast carbon monoxide and helium gas analyzers
36. Given a specific oxygen analyzer, identify the type and its component parts
37. Calibrate both the polarographic analyzer and the galvanic fuel cell analyzer on room air and 100 percent oxygen
- a. Given an oxygen delivery apparatus, analyze the  $FIO_2$
  - b. Perform routine maintenance procedures such as fuel cell or electrode replacement and battery check
38. Operate and maintain oxygen administration devices (RESP 102)
- a. Define hypoxia and hypoxemia, and describe the relationship between the two
  - b. List and describe the indications for oxygen therapy
  - c. Identify and describe the causes of hypoxia
  - d. List the physiologic effects of hypoxia
  - e. List the clinical manifestations of hypoxia
  - f. Identify the contraindications of oxygen therapy
  - g. Identify and describe the potential hazards of oxygen therapy
  - h. Recognize and/or describe the potential  $FIO_2$  range and liter flow range for a nasal cannula
  - i. Recognize and/or describe the potential  $FIO_2$  range and liter flow range for a simple oxygen mask
  - j. Recognize and/or describe the potential  $FIO_2$  range and liter flow range for a nonrebreathing mask
  - k. Recognize and/or describe the potential  $FIO_2$  range and liter flow range for a partial rebreathing mask
  - l. Recognize and/or list the physical differences between a nonrebreathing mask and a partial rebreathing mask
  - m. List the advantages and disadvantages of using a nasal cannula
  - n. Recognize what factors will potentially decrease the  $FIO_2$  delivered to a patient using a low-flow system
  - o. Recognize and describe both a low-flow and a high-flow oxygen system (device)
  - p. Explain what an oxygen blender is used for and how it operates
  - q. Identify and describe two methods for adjusting the  $FIO_2$  on a Venturi mask
  - r. Describe the proper operation of a partial rebreather mask (with reservoir)
  - s. Identify and assemble various oxygen delivery devices such as the nasal cannula, simple mask, partial rebreathing and nonrebreathing masks, air entrainment (Venturi) masks, oxygen hoods, oxygen tents, and aerosol generators
  - t. Classify each oxygen delivery device as high flow or low flow
  - u. Given a patient scenario, select and administer the indicated oxygen device
  - v. Demonstrate effective communication skills needed for patient-practitioner interaction
  - w. Calculate inspiratory flow demands and total flows delivered for a given  $FIO_2$ , using air-to-oxygen mixing ratios
  - x. Assess a patient for response to oxygen therapy
  - y. Identify and correct common problems associated with oxygen delivery devices

- 39. Operate and maintain humidity devices (RESP 102)**
- a.** Define and know the unit of measurement of given terms
    - i.** Humidity
    - ii.** Absolute humidity
    - iii.** Relative humidity
    - iv.** Body humidity
    - v.** Humidity deficit or body humidity deficit
    - vi.** Vapor
    - vii.** Water vapor tension
  - b.** Calculate the relative humidity of a given gas
  - c.** Calculate the body humidity deficit of a given gas
  - d.** Identify the maximum water content at body temperature (37°C)
  - e.** Identify the water vapor pressure (PH<sub>2</sub>O) at body temperature and describe the factors that affect it
  - f.** Identify and/or list the indications for humidity therapy
  - g.** Identify and/or list the contraindications for humidity therapy
  - h.** Identify and/or list the hazards of humidifiers
  - i.** Identify and/or list and describe the three main factors that influence the efficiency of a humidifier
  - j.** Describe how a passover humidifier works and trace the flow of gas through it
    - i.** Identify the relative humidity these devices can achieve at room temperature
    - ii.** Identify where these devices are used
  - k.** Trace the flow of gas through a bubble-diffuser type of humidifier and describe how it works
    - i.** Describe the difference between a bubble humidifier and a diffuser humidifier
    - ii.** Identify the relative humidity of these devices
    - iii.** Describe how the flow rate affects the humidity output of these devices and why
    - iv.** Explain the therapeutic value of these devices
  - l.** Trace the flow of gas through a jet humidifier and explain how it works
  - m.** Trace the flow of gas through an underwater jet humidifier and explain how it works
  - n.** Trace the flow of gas through a cascade humidifier, explain how it works, and list the variables that will affect the temperature of the cascade at the proximal airway
  - o.** Trace the flow of gas through a heated wick-type humidifier and explain how it works
  - p.** Explain how the hygroscopic condenser humidifier (heat-moisture exchanger or artificial nose) works
  - q.** Identify the components of the heat and moisture exchanger and bubble, cascade, and wick humidifiers
  - r.** Differentiate between the types of humidifiers, including their clinical uses, advantages, and disadvantages
  - s.** Assemble and operate the various types of humidifiers
  - t.** Perform monitoring, maintenance, and troubleshooting techniques
  - u.** Relate, according to American Association for Respiratory Care clinical practice guidelines, the proper amount of humidification for patients with artificial airways
- 40. Operate and maintain aerosol generators (RESP 102)**

- a. Identify calculations, define given terms, and identify abbreviations used in aerosol therapy
  - i. Specific temperature conversions
    - (a) Temperature on Fahrenheit scale
    - (b) Temperature on Celsius scale
    - (c) Temperature on Kelvin scale
  - ii. Critical temperature
  - iii. Critical pressure
  - iv. Boiling point
  - v. Vapor pressure
  - vi. Vapor
  - vii. Humidity
  - viii. Absolute humidity
  - ix. Relative humidity
  - x. Water vapor capacity
  - xi. Water vapor pressure
  - xii. Dew point
  - xiii. Body humidity
  - xiv. Humidity deficit
  - xv. Heat capacity (or specific heat)
  - xvi. Heat of vaporization
  - xvii. Colloid
  - xviii. Sol (as in aerosol)
  - xix. Aerosol
  - xx. Smoke
  - xxi. Fogs and mists
- b. Given abbreviations
  - i. ATPD: Ambient temperature and pressure, dry
  - ii. ATPS: Ambient temperature and pressure, saturated with water vapor
  - iii. BTPD: Body temperature, ambient pressure, dry
  - iv. BTPS: Body temperature, ambient pressure, saturated with water vapor
  - v. STPD: Standard temperature (0°C), standard pressure (760 mm Hg), dry
- c. Identify factors that influence an aerosol's characteristics and its ability to penetrate the bronchial tree
  - i. Identify the factor most responsible for the tendency of aerosol particles to be removed from suspension
  - ii. Identify the three factors we can have a degree of influence over that relate to an aerosol's penetration and deposition
  - iii. Select the optimal particle size of aerosol deposition within the alveoli
- d. Recognize important considerations that relate to aerosol physics
  - i. Match the area of the airway (depth) where three saline solutions of varying toxicity (hypertonic, isotonic, and hypotonic) theoretically should deposit
  - ii. Identify the approximate percentage of aerosolized medication that actually reaches the lower portion of the bronchial tree
- e. Identify the indications and hazards associated with the use of aerosol therapy
  - i. Identify the objectives for delivering aerosol therapy
  - ii. Identify the potential hazards of aerosol therapy that can occur regardless of the device being used

- iii. Recognize the hazards that are more often associated with ultrasonic-type nebulizers
  - f. Identify the characteristics and considerations involved with various devices used for delivery of aerosol therapy
    - i. Choose the particle size range that is most often produced by ultrasonic nebulizers
    - ii. Recognize the factors that influence the particle size and output of ultrasonic nebulizers
    - iii. Identify the most effective type of pneumatic nebulizer
  - g. Recognize important considerations that relate to environmental chambers
    - i. Define given environmental chambers
    - ii. Identify important characteristics of croupette and child-adult mist tent operation
    - iii. Identify important characteristics of oxygen hood operation
  - h. Differentiate between the types of aerosol generators by operating principle
  - i. Given a specific clinical situation, select and apply the appropriate aerosol delivery device
  - j. Discuss the limitations of each type of aerosol delivery device
  - k. Practice communication skills needed to explain the application of an aerosol device to a patient and confirm patient understanding
  - l. Practice medical charting for the therapeutic application of an aerosol delivery device
  - m. Apply infection control guidelines and standards associated with aerosol delivery equipment and procedures, according to Occupational Safety and Health Administration regulations and Centers for Disease Control and Prevention guidelines
- 41. Perform aerosol therapy and administer medication (RESP 102)
  - a. Practice calculation of drug dosages
  - b. Select and use various aerosol delivery devices and adjunctive equipment given specific clinical situations
  - c. Discuss the indications, advantages, disadvantages, limitations, contraindications, and hazards of each type of aerosol delivery device and method used for medication delivery
  - d. Obtain a sputum specimen for analysis using sputum induction techniques
  - e. Chart an aerosol medication treatment
  - f. Practice communication skills needed for the administration of an aerosol medication treatment
  - g. Apply infection control guidelines and standards associated with equipment and procedures used for aerosol medication delivery, according to Occupational Safety and Health Administration regulations and Centers for Disease Control and Prevention guidelines
- 42. Perform hyperinflation techniques (RESP 102)
- 43. Identify the basic concepts of Bird Respirators (RESP 102)
  - a. Identify and compare the component parts and controls of various IPPB devices
    - i. Describe the “opposing forces” principle incorporated in Bird respirators
    - ii. Describe the relationship of the clutch plates, magnets, diaphragm, sensitivity control knob, pressure control knob, and the ceramic switch on the Bird Mark 7
    - iii. Describe the function of the flow rate control on the Mark 7

- iv. Describe the function of the Air-Mix control on the Mark 7
  - v. Explain the function of the Venturi jet and the Venturi gate on the Mark 7
  - vi. Describe the function of the pneumatic expiratory timing device on the Mark 7
  - vii. Identify all external, internal, and manifold parts of the Bird Mark 7
  - viii. Describe the Bird Mark 7 respiratory patient circuits and explain their function
    - (a) Identify the components of an adult breathing circuit
    - (b) Test the circuit for leaks
  - ix. Compare the differences and similarities of the Bird Mark 7 and Bird Mark 7A
44. The students will understand these concepts of IPPB Therapy (RESP 102)
45. Identify the basic concepts of IPPB
- a. List and describe the physiological effects of IPPB therapy
  - b. Identify the indications for IPPB therapy
  - c. List the information for assessment of a beneficial outcome of IPPB
  - d. Identify hazards/complications of IPPB therapy
  - e. Identify the contraindications of IPPB therapy
  - f. Recognize the procedures for infection control in administering IPPB therapy
  - g. Know the procedure for IPPB therapy; identify considerations that should be taken into account when delivering IPPB therapy to a patient
  - h. Set up circuit on pressure ventilator
  - i. Test the circuit for leaks
  - j. Operate the controls of a pressure limited ventilator
  - k. Initiate and monitor pressure limited ventilation
  - l. Compare the interrelationships between pressure, volume, flow, and time
  - m. Relate the changes that might occur in the parameters of pressure, volume, flow, and time with changes in compliance and resistance
  - n. Chart data related to pressure limited ventilation in the medical record
46. The students will understand these concepts of Incentive Spirometry (RESP 102)
- a. Identify the therapeutic objectives of incentive spirometry
  - b. Identify diagnoses or conditions for initiating incentive spirometry
  - c. List and explain the results of incentive spirometry
  - d. Identify and describe the contraindications of incentive spirometry
  - e. Identify and describe the hazards of incentive spirometry
  - f. Educate the patient on incentive spirometry
    - i. Inform the patient of the therapeutic objectives of incentive spirometry
    - ii. Instruct the patient in the correct use of the incentive spirometer
  - g. Identify the length of continued use of the incentive spirometer
  - h. Explain the ordering protocol for incentive spirometry
    - i. Identify who is authorized to initiate incentive spirometry
    - ii. Identify and describe the information to be included in the order
  - i. Identify, describe, and explain the steps required, and the key points to be considered, in the performance of incentive spirometry
  - j. Practice the communication skills needed for the instruction of patients in the techniques of sustained maximal inspiration and hyperinflation therapy
  - k. Perform and monitor incentive spirometry therapy using both flow and volume devices
  - l. Practice medical charting for the therapeutic procedures of hyperinflation

47. Perform bronchial hygiene techniques (RESP 102)
- a. Identify aspects of performing postural drainage on a hospitalized patient
    - i. Recognize the necessity of performing postural drainage on upper lobes
    - ii. Recognize how long after meals postural drainage should be performed
    - iii. Recognize the use of supplemental oxygen on all patients receiving postural drainage
    - iv. Identify diseases that place patients at risk for the development of hemoptysis
  - b. Differentiate between the various factors involved in the proper performance and charting of the postural drainage procedure
    - i. Recognize factors involved and properly administer percussion and vibration
    - ii. Identify the two factors to be utilized in selecting specific segments for postural drainage
    - iii. List at least five factors that should be recorded when charting any postural drainage treatment
    - iv. Choose the correct cycles-per-second setting when using the G-5 percussor-vibrator
    - v. Recognize various factors that can assist in the performance of postural drainage on an infant
    - vi. List three contraindications for the use of postural drainage
  - c. Identify factors involved in effective utilization of the cough mechanism
    - i. Recognize factors that can act to improve the effectiveness of a patient's cough
    - ii. Identify the most vital factor in sputum management
  - d. Identify each lobe and segment of the lungs and the corresponding bronchi on a lung model
  - e. Properly position and perform postural drainage, percussion, and vibration techniques for all lung lobes and segments
  - f. After reviewing x-ray reports and assessing physical examination results, perform chest physical therapy techniques to the appropriate lobes and segments
  - g. Instruct and monitor a patient on coughing, splinting, and pursed-lip breathing exercises.
  - h. List the indications, contradictions, and hazards for positive expiratory therapy.
  - i. Practice directed cough and manually-assisted cough techniques to improve cough effectiveness according to American Association for Respiratory Care clinical practice guidelines
  - j. Instruct and monitor a patient on diaphragmatic, thoracic expansion, and relaxation breathing exercises
  - k. Perform positive expiratory pressure mask therapy according to American Association for Respiratory Care clinical practice guidelines
  - l. Perform inspiratory muscle training techniques
  - m. Perform intra-airway vibrational therapy using the vest airway clearance system.
48. Operate and maintain manual resuscitators and perform manual ventilation (RESP 102)
- a. Describe how a manual resuscitator works.
    - i. Describe the patient valve during inhalation and exhalation.
    - ii. Describe the gas intake valve during inhalation and exhalation.

- b. List the criteria for the selection of adequate manual resuscitators and masks
  - c. List and describe the three main ways in which the oxygen percentage delivered by a manual resuscitator can be increased
  - d. List the main hazards of manual resuscitation
  - e. Identify and differentiate the types of patient valves and how each operates during inspiration and expiration
  - f. Assemble and disassemble each type of device
  - g. Explain the purpose of a pressure relief valve on a manual resuscitator, and demonstrate its operation
  - h. Compare the variability in positive pressure, volume delivery, and FIO<sub>2</sub> using different ventilation techniques
  - i. Describe gas-powered resuscitators
  - j. Describe a non-self-inflating bag device
  - k. Identify and discuss the advantages and disadvantages of self-filling and flow-filling bags
  - l. Demonstrate effective manual ventilation techniques with mouth-to-mask devices, bag-valve-mask devices, and bag-valve resuscitators to an artificial airway and a spontaneously breathing subject
  - m. Discuss the relationship between resistance, compliance, and the amount of positive pressure necessary to accomplish ventilation
- 49. Maintain pharyngeal airways (RESP 102)**
- a. Identify various types of airway adjuncts, including oropharyngeal and nasopharyngeal airways, laryngeal mask airway, the Esophageal-Tracheal Combitube, and esophageal obturator/esophageal gastric tube airway
  - b. Given a clinical scenario, select the most appropriate artificial airway
  - c. Measure a subject for the appropriate size airway
  - d. Identify the type of patient for whom an oropharyngeal airway is indicated
  - e. Identify the type of patient for whom a nasopharyngeal airway is indicated
  - f. Insert nasopharyngeal, oropharyngeal, esophageal, and esophageal-tracheal airways
- 50. Perform suctioning (RESP 102)**
- a. Describe the various types of suctioning
    - i. Identify the various types of suction devices and accessories, including Yankauer (tonsillar) catheter, Coudé or Bronchitrach-L angle-tip endobronchial catheters, closed suction system devices, and sputum traps
  - b. List and apply the indications for suctioning
  - c. List the hazards/complications of suctioning
  - d. List the potential contraindications for suctioning
  - e. Determine, after a suctioning procedure, if the procedure was successful
    - i. Determine the proper suction catheter size for a given airway
  - f. List the equipment needed for suctioning
    - i. Demonstrate the proper aseptic donning of gloves and handling of the sterile contents of a suction kit
  - g. Explain the procedure for suctioning, both artificial airway and nasotracheal
    - i. Aseptically perform nasotracheal suctioning on an airway management trainer using appropriate personal protective equipment

- ii. Perform endotracheal suctioning on an intubated airway management trainer using appropriate personal protective equipment
    - iii. Perform tracheobronchial lavage during suctioning
    - iv. Demonstrate the proper disposal of contaminated suction equipment
  - h. Collect a sputum specimen during suctioning
- 51. Perform endotracheal intubation (RESP 102)
  - a. Identify upper airway anatomy, both adult and infant
  - b. Recognize anatomical location of airway structures
  - c. Identify proper oral endotracheal tube size for various patient requirements
  - d. Differentiate between various types of laryngoscope blades and their uses
  - e. Select correct statements regarding the performance of oral tracheal intubation and extubation
  - f. Demonstrate under direct supervision the proper performance of oral intubation and extubation on a practice manikin
    - i. Identify, select, prepare, and correct malfunctions of equipment necessary for endotracheal intubation of the infant and adult
    - ii. Assess the potential difficulty of intubation using the Mallampati classification
    - iii. Test an artificial airway for cuff leaks
    - iv. Insert a nasotracheal tube into an adult airway management trainer using direct vision and blind technique
    - v. Verify the proper positioning of an artificial airway and secure it in place
    - vi. Apply infection control guidelines and standards according to Occupational Safety and Health Administration regulations and Centers for Disease Control and Prevention guidelines while performing endotracheal intubation
  - g. Determine, via clinical assessment, the need for extubation
  - h. Extubate a patient and evaluate the patient's respiratory status after extubation
  - i. Provide appropriate postextubation airway care, including oxygenation, humidification, and pharmacological treatment
- 52. Perform tracheostomies and artificial airway maintenance (RESP 102)
  - a. Recognize the four indications for artificial airways and the reasons for these indications
  - b. Identify the most common cause of upper airway obstruction
  - c. Recognize the characteristic sound present with upper airway obstruction
  - d. Identify other common causes of airway obstruction
  - e. Identify and describe the important aspects involved in understanding the airway's normal reflexes
    - i. Identify the normal airway reflexes
    - ii. Identify the actions for which the pharyngeal reflex is responsible
    - iii. Identify the actions for which the laryngeal reflex is responsible
  - f. Identify and describe the important considerations regarding the various types of artificial airways and their care
    - i. Identify the important consideration to be aware of when ventilating a patient who has a tracheostomy button
    - ii. Identify the important points to be considered whenever an artificial airway is to be maintained longer than 72 hours

- iii. Identify, describe, and explain the appropriate steps involved in determining an artificial airway's cuff minimal occlusive volume
- iv. Identify, describe, and explain the appropriate steps involved in determining an artificial airway's cuff minimal leak
- v. Determine the advantages of using a nasotracheal tube over an orotracheal tube
- vi. Identify the important consideration that must be taken into account when one places an artificial airway that will allow direct access to the lower airway
- g. Identify and describe specific information regarding the complications that are present with the use of artificial airways
  - i. Identify the most often seen complication of artificial airways
  - ii. Identify the main clinical indicator for the presence of glottic edema
  - iii. Determine which complication would necessitate re-establishment of an airway
  - iv. Identify the types of therapy indicated for the treatment of glottic edema
- h. Identify the markings found on orotracheal, nasotracheal, and tracheostomy tubes and explain their specific meanings
- i. Practice communication skills needed for assessing the level of patient comprehension while instructing patients in airway care procedures
- j. Practice medical charting for airway care procedures
- k. Apply infection control guidelines and standards associated with equipment and procedures, according to Occupational Safety and Health Administration regulations and Centers for Disease Control and Prevention guidelines
- l. Resecure an endotracheal tube in place by changing cloth tape and commercial endotracheal tube holders
- m. Reposition an endotracheal tube and assess the proper size and placement
- n. Perform minimum occluding volume and minimal leak technique cuff inflation procedures
- o. Measure airway cuff pressures using aneroid and mercury pressure manometers
- p. Identify airway emergencies and take appropriate actions to ensure patient ventilation and oxygenation, as well as troubleshoot equipment, including cuff leaks, tube obstructions, tube malpositions, and inadvertent extubation
- q. Identify the various types of tracheostomy tubes, buttons, and adjuncts and their component parts
- r. Perform tracheostomy care, including equipment cleaning and stoma care
- s. Change a tracheostomy tube on an adult airway management trainer
- t. Provide for adequate patient communication with an artificial airway in place
- 53. Perform arterial blood gas sampling (RESP 102)
  - a. Identify reasons for arterial blood gas collection
  - b. Recognize the hazards/complications of arterial blood gas sampling and their causes
  - c. Recognize the contraindications for arterial blood gas sampling
  - d. Identify the three main sampling sites for arterial puncture
  - e. Identify equipment that is necessary for arterial sampling

- f. Explain the infection control procedures to be followed in obtaining an arterial sample
    - i. Apply infection control guidelines and standards associated with equipment and procedures, according to Occupational Safety and Health Administration regulations and Centers for Disease Control and Prevention guidelines
  - g. List and identify pertinent information relating to the performance of an arterial puncture
    - i. Practice communication skills needed to explain blood sampling procedures to patients
    - ii. Practice medical charting and documentation of performance of blood gas sampling procedures
    - iii. Assemble and prepare the equipment necessary for performance of arterial puncture and arterial line sampling
    - iv. Review the medical record for information essential to the safe performance of arterial sampling
    - v. Demonstrate the safe performance of arterial puncture and arterial line sampling
    - vi. Demonstrate safe postpuncture care
    - vii. Prepare an anaerobic blood gas sample for transport
- 54.** Recognize and describe the indications, contraindications, and hazards of the following respiratory care procedures: (RESP 104)
- a. Adult Continuous Positive Airway Pressure/BiLevel Positive Airway Pressure Setup
  - b. Aerosol Oxygen Therapy
  - c. Aerosolized Medication Therapy (Hand-held Nebulizer Treatment)
  - d. Arterial Blood Gas Puncture and Analysis
  - e. Assembling Ventilator and Testing Function
  - f. Blood Pressure Measurement
  - g. Changing Ventilator Circuits
  - h. Chest Physiotherapy
  - i. Drawing Arterial Blood Gases from an Arterial Line
  - j. Electrocardiograms
  - k. Endotracheal Suctioning
  - l. Extubation
  - m. Incentive Spirometry
  - n. Initiation of Oxygen Therapy via Nasal Cannula
  - o. Intermittent Positive Pressure Breathing
  - p. Medical Gas Cylinders and Delivery Equipment
  - q. Metered Dose Medication Administration
  - r. Minimal Leak Technique/Minimum Occluding Volume
  - s. Nasotracheal Suctioning
  - t. Patient Assessment
  - u. Setting Up a Non-Rebreathing Oxygen Mask
  - v. Setting Up a Partial Rebreathing Oxygen Mask
  - w. Setting Up a Simple Oxygen Mask
  - x. Setting Up a Venturi Mask
  - y. Setting Up and Monitoring an Aerosol/Oxygen Tent
  - z. Sputum Collection for Laboratory Analysis
  - aa. Taping Endotracheal Tube
  - bb. Tracheostomy Care
  - cc. Ventilating with a Resuscitation Bag
  - dd. Ventilator Check and Flow Studies

**13. Course Objectives:**

**Upon satisfactory completion of the course, students will be able to:**

- A.** Prepare for the patient encounter
  - 1. Recognize the purpose(s) of the pre-interaction, introductory, initial assessment, treatment and monitoring, and follow-up stages of patient-clinician interaction
  - 2. Recognize the approximate distances and appropriate activities for proper conduct within the social, personal, and intimate spaces
  - 3. Recognize the value of clinician's being aware of territoriality
  - 4. Describe techniques that convey genuine concern during patient-clinician interaction
  - 5. Describe the general premise of universal precautions and methods by which it is practiced
- B.** Perform an interview and obtain a respiratory history
  - 1. Describe the importance of properly obtaining and recording a patient history
  - 2. Recognize factors which can influence communication between the patient and clinician during the interview
  - 3. Describe techniques for structuring the interview
  - 4. Describe the techniques used to facilitate conversational interviewing
  - 5. Recognize alternate sources that are available for the patient history
  - 6. Describe or recognize the components of a complete health history
  - 7. Recognize the definition, cause(s), characteristics, and typical diseases associated with the following pulmonary symptoms:
    - a. Cough
    - b. Shortness of breath (including orthopnea, paroxysmal nocturnal dyspnea, and platypnea)
    - c. Sputum production
    - d. Fever
    - e. Hemoptysis
    - f. Chest pain
    - g. Dependent edema
- C.** Obtain vital signs
  - 1. Recognize the four classic vital signs and the value of monitoring their trends
  - 2. Identify the clinical significance of abnormal sensorium
  - 3. Recognize what the Glasgow Coma Scale is useful for assessing and its predictive value in terms of patient outcome
  - 4. Recognize the normal values of the following vital signs and common causes of deviation from normal in the adult:
    - a. Pulse
    - b. Respiratory rate
    - c. Blood pressure
    - d. Temperature
  - 5. Recognize the following issues related to body temperature measurement:
    - a. Types of devices commonly used
    - b. Factors affecting the accuracy of devices
    - c. Common sites and temperature ranges of those sites for measurement
    - d. Proper method in neonates
  - 6. Describe how fever affects the following:
    - a. Oxygen consumption and carbon dioxide production
    - b. Respiratory rate
    - c. Pulse
  - 7. Define the following terms:
    - a. Fever

- b. Tachycardia
  - c. Bradycardia
  - d. Pulsus paradoxus
  - e. Pulsus alternans
  - f. Tachypnea
  - g. Bradypnea
  - h. Systolic blood pressure
  - i. Diastolic blood pressure
  - j. Hypertension
  - k. Hypotension
  - l. Pulse pressure
  - m. Posture hypotension
8. Recognize or list the technique, common sites for palpation, and characteristics to evaluate for the pulse
  9. Describe the technique for determining respiratory rate and blood pressure
  10. Recognize how hypotension affects perfusion and tissue oxygen delivery
  11. Recognize the factors which cause erroneously elevated blood pressure measurements
  12. Identify the mechanism by which pulsus paradoxus is produced
- D. Perform a physical examination of the patient with cardiopulmonary disease**
1. Recognize the Four components of physical examination
  2. Recognize the importance of reviewing the history of present illness prior to performing a physical exam
  3. Recognize the significance of the following during examination of the head and neck:
    - a. Nasal flaring
    - b. Cyanosis
    - c. Pursed-lip breathing
    - d. Changes in pupillary size in response to light
    - e. Jugular venous distention
    - f. Deviated tracheal position
  4. Describe the correct method for measuring jugular venous pressure and expected normal findings
  5. Define the following terminology used to classify thoracic configuration during inspection of the chest:
    - a. Pectus carinatum
    - b. Pectus excavatum
    - c. Kyphosis
    - d. Scoliosis
    - e. Kyphoscoliosis
    - f. Barrel chest
    - g. Flail chest
  6. Recognize the topographic position of the following:
    - a. Thoracic cage landmarks (suprasternal notch, sternal angle [angle of Louis], vertebral spinous processes [seventh cervical vertebra and first thoracic vertebra])
    - b. Lung fissures (oblique [major] and horizontal [minor])
    - c. Tracheal bifurcation anteriorly and posteriorly
    - d. Right and left diaphragm anteriorly and posteriorly
    - e. Lung borders
  7. Define the following terms used to describe breathing pattern during inspection of the chest:
    - a. Apnea
    - b. Biot's

- c. Cheyne-Stokes
  - d. Kussmaul's
  - e. Apneustic
  - f. Paradoxical
  - g. Asthmatic
8. Identify the breathing patterns associated with restrictive and obstructive lung disease
  9. Recognize the clinical significance of accessory muscle usage and retractions/bulging
  10. Recognize the significance of a "clavicular lift" greater than 5 mm during inspiration in patients with chronic obstructive pulmonary disease
  11. Define the following terms and recognize their significance:
    - a. Abdominal paradox
    - b. Respiratory alternans
    - c. Peripheral cyanosis
    - d. Central cyanosis
  12. Identify causes for increased and decreased tactile fremitus
  13. Identify causes for decreased thoracic expansion as assessed during chest palpation
  14. Recognize a description of subcutaneous emphysema and its clinical significance
  15. Identify causes of increased and decreased resonance during percussion of the lung
  16. Describe the four basic parts of a stethoscope and their uses
  17. Recognize the proper technique for auscultation of the lungs
  18. Recognize the four characteristics of breath sounds that should be evaluated by the examiner during auscultation
  19. Recognize a definition of the following terminology used to describe lung sounds and the mechanisms responsible for producing the sounds:
    - a. Bronchial or tracheal
    - b. Bronchovesicular
    - c. Vesicular (normal)
    - d. Diminished or reduced
    - e. Harsh
  20. Recognize a definition of the following terminology used to describe abnormal (adventitious) lung sounds and the mechanisms responsible for producing the sounds
    - a. Crackles (rales)
    - b. Wheezes
    - c. Stridor
    - d. Pleural friction rub
  21. Recognize qualifying adjectives that can be used to describe lung sounds and the importance of using these qualifying adjectives
  22. Recognize the significance of the following auscultatory findings:
    - a. Monophonic wheeze
    - b. Polyphonic wheeze
    - c. Late-inspiratory crackles
    - d. Inspiratory and expiratory crackles
    - e. Pleural friction rub
    - f. Stridor
  23. Recognize a definition of egophony and bronchophony and the causes for each condition
  24. Recognize the topographic location of the apex and base of the heart during examination of the precordium

25. Recognize a definition of point of maximal impulse (PMI), its normal location, and the factors which may cause a shift of the PMI to the right or left
  26. Recognize the best location for auscultating sounds produced by the aortic, pulmonic, mitral, and tricuspid valves
  27. Recognize what produces the first, second, third, and fourth heart sounds
  28. Describe what is meant by a "gallop rhythm" and what it signifies
  29. Recognize factors that increase or decrease the intensity of the heart sounds
  30. Recognize a definition of the second heart sound "splitting" and the loud heart sound indicative of the forceful closure of the pulmonic valve and what they signify
  31. Describe the factors that cause systolic and diastolic heart murmurs
  32. Recognize a definition and the significance of hepatomegaly in the cardiopulmonary patient
  33. Recognize a definition and the significance of the following during examination of the extremities
    - a. Digital clubbing
    - b. Cyanosis
    - c. Pedal edema
    - d. Capillary refill
    - e. Peripheral skin temperature
  34. Recognize the general physical signs of the following abnormal pulmonary pathologies:
    - a. Acute airway obstruction
    - b. Chronic airway obstruction
    - c. Consolidation
    - d. Pneumothorax
    - e. Pleural effusion
    - f. Local bronchial obstruction
    - g. Diffuse interstitial fibrosis
    - h. Acute upper airway obstruction
- E. Perform clinical laboratory studies**
1. Identify the components that make up the formed elements and plasma of the blood
  2. Define blood serum and describe how it is obtained
  3. Recognize the normal values, and significance of the following hematology lab tests:
    - a. Red blood cells
    - b. Hematocrit
    - c. Hemoglobin
    - d. Erythrocyte indices (mean cell volume, mean cell hemoglobin, mean cell hemoglobin concentration)
    - e. White blood cells
    - f. White cell differential
    - g. Reticulocyte count
    - h. Sedimentation rate
    - i. Platelet count
    - j. Coagulation studies (bleeding time, activated partial thromboplastin time, prothrombin time)
  4. Define anemia and the most common cause of anemia
  5. Identify the potential affect anemia has on oxygen carrying capacity and tissue oxygenation
  6. Define left shift in terms of the white blood cell differential and its clinical significance

7. Define primary, secondary, and relative polycythemia and identify how polycythemia affects blood oxygen transport and myocardial work
8. Define leukocytosis and leukopenia
9. Recognize the causes for the following white cell abnormalities:
  - a. Neutrophilia
  - b. Eosinophilia
  - c. Lymphocytosis
  - d. Lymphocytopenia
  - e. Monocytosis
10. Identify the affect that acquired immunodeficiency syndrome (AIDS) and AIDS-related complex has on the ratio of T helper to T suppresser cells
11. Define leukemia and myeloproliferative disorders
12. Recognize the normal values, and significance of the following chemistry lab tests:
  - a. Electrolytes
  - b. Anion gap
  - c. Sweat electrolyte concentration
  - d. Blood urea nitrogen and creatinine
  - e. Enzymes (aspartate aminotransferase, alanine aminotransferase, alkaline phosphatase, acid phosphatase, lactic dehydrogenase, creatine kinase, amylase, lipase)
  - f. Glucose
  - g. Protein (immunoglobulins, albumin)
  - h. Lipids (triglycerides, cholesterol, high-density lipoproteins, low-density lipoproteins)
  - i. Tumor markers
  - j. Drug monitoring
13. Identify the therapeutic level for theophylline and factors which affect its metabolism and clearance
14. Recognize a definition of the following medical microbiology terms:
  - a. Normal flora
  - b. Gram stain
  - c. Culture
  - d. Sensitivity
15. Recognize the type of organism a Ziehl-Neelsen stain is used to identify
16. Recognize the methods for obtaining a fresh and uncontaminated sputum sample
17. Identify the factors involved in the macroscopic (gross) sputum examination
18. Identify the characteristic appearance of the sputum from a patient with bronchiectasis
19. Identify the microscopic criteria used to determine whether a sputum sample is reliable
20. Recognize the significance of sputum eosinophilia
21. Recognize some of the organisms responsible for producing pneumonia and the most common cause of bacterial pneumonia
22. Identify the indications and method of obtaining a bronchoalveolar lavage
23. Identify the significance of the following during pleural fluid examination:
  - a. Increased pleural fluid amount
  - b. "Milky" pleural fluid
  - c. Hemorrhagic pleural fluid
  - d. Low protein content (< 3g/dL)
  - e. High protein content (> 3d/dL)
24. Identify the significance of the following tests performed during a urinalysis:
  - a. Specific gravity

- b. Hydrogen ion concentration
  - c. Protein content
  - d. Glucose concentration
  - e. Ketones
  - f. Bilirubin
  - g. Blood
  - h. Urobilinogen
  - i. Nitrates
  - j. Sedimentary constituents
25. Describe or identify the purpose of histologic and cytologic examinations
26. Identify the malignant tumors responsible for producing the majority of primary lung cancer
27. Recognize the types of pulmonary samples that can be examined cytologically
28. Recognize the following regarding skin testing:
- a. Diseases diagnosed
  - b. Procedures for testing
  - c. Significance and causes of anergy
  - d. Use of the purified protein derivative
  - e. When a purified protein derivative is considered positive
  - f. Effect of bacille Calmette-Guérin purified protein derivative
- F.** Interpret blood gases
1. Recognize why arterial blood is useful in determining respiratory status instead of venous blood
  2. Identify the importance of reviewing the laboratory data that reflects clotting ability prior to performing an arterial puncture
  3. Identify the common sites for arterial puncture
  4. Identify the test used to determine collateral circulation of the radial artery, how to perform this procedure, and how to interpret its results
  5. Recognize how the following factors would generally affect blood gas analysis:
    - a. Air bubbles in the syringe
    - b. Not putting the sample on ice
  6. Identify the normal duration of arterial puncture site compression
  7. Identify the normal values for the following blood gas parameters at sea level and on room air
    - a. Hydrogen ion concentration
    - b. Partial pressure of oxygen in arterial blood
    - c. Partial pressure of carbon dioxide in arterial blood
    - d. Plasma bicarbonate concentration
    - e. Percent saturation of hemoglobin with oxygen in the blood
    - f. Difference in pressure between alveoli and arterial blood of oxygen
    - g. Content of oxygen in arterial blood
    - h. Base excess
    - i. Partial pressure of oxygen in mixed venous blood
  8. Recognize the significance and the factors that affect the following indices of oxygenation:
    - a. Partial pressure of oxygen in arterial blood
    - b. Difference in pressure between alveoli and arterial blood of oxygen
    - c. Percent saturation of hemoglobin with oxygen in arterial blood
    - d. Content of oxygen in arterial blood
    - e. Partial pressure of oxygen in mixed venous blood
    - f. Arteriovenous oxygen content
    - g. Carboxyhemoglobin
  9. Recognize a definition of hypoxia and hypoxemia
  10. Identify the general classifications of hypoxemia

11. Identify the physiologic causes, mechanisms, and most common physiologic cause of hypoxemia
  12. Describe how the physiologic causes of hypoxemia respond to supplemental oxygen administration
  13. Describe how increases and decreases in partial pressure of carbon dioxide in arterial blood, body temperature, and blood hydrogen ion concentration affect the oxyhemoglobin dissociation curve and related percent saturation of hemoglobin with oxygen in arterial blood measurements/oxyhemoglobin affinity
  14. Recognize how shifts in the oxyhemoglobin dissociation curve affect oxygen transport at the tissues and lungs
  15. Identify a definition, the normal value, and the significance of measuring partial pressure of oxygen at 50% hemoglobin saturation
  16. Recognize a definition, the significance, and the factors that affect the following acid-base parameters:
    - a. Hydrogen ion concentration
    - b. Partial pressure of carbon dioxide in arterial blood
    - c. Plasma bicarbonate concentration
    - d. Standard bicarbonate concentration
    - e. Base excess
  17. Identify the Henderson-Hasselbalch equation and the ratio of plasma bicarbonate concentration to partial pressure of carbon dioxide in arterial blood needed to maintain a hydrogen ion concentration of 7.40
  18. Define simple and mixed acid-base abnormalities
  19. For the following simple acid-base disorders identify the basic mechanism of impairment, how the disorder is compensated for, common causes, and the expected values of compensating components:
    - a. Respiratory acidosis
    - b. Respiratory alkalosis
    - c. Metabolic acidosis
    - d. Metabolic alkalosis
  20. For the simple acid-base disorders, identify the degree of compensation present given hydrogen ion concentration, partial pressure of carbon dioxide in arterial blood, plasma bicarbonate concentration and base excess values
  21. Recognize a definition of mixed acid-base disorders, common causes, and given hydrogen ion concentration, partial pressure of carbon dioxide in arterial blood, plasma bicarbonate concentration and base excess values, interpret the following mixed acid-base disorders:
    - a. Metabolic and respiratory alkalosis
    - b. Metabolic and respiratory acidosis
  22. Recognize the relative speed of the respiratory and metabolic compensatory mechanisms
  23. Recognize the significance of the 95% confidence-limit bands as used to assess acid-base status
  24. Given the results of an arterial blood gas, interpret the acid-base and oxygenation status of the patient
- G. Perform pulmonary function tests**
1. Recognize the general purpose of performing pulmonary function tests
  2. Recognize the situations in which pulmonary function tests are indicated
  3. Identify a definition of the following terms:
    - a. Spirometer
    - b. Spirograph
    - c. Spirogram
  4. Identify how the following factors affect pulmonary function test measurements
    - a. Height and weight

- b. Gender
  - c. Age
  - d. Patient effort
5. Identify the standard equipment found in a pulmonary function test lab and its basic uses
  6. Recognize the primary abnormalities associated with obstructive and restrictive lung disease
  7. Given a specific site of airway obstruction, identify the part of the spirogram affected
  8. Identify the criteria for establishing a restrictive defect and the diseases that can cause restrictive patterns
  9. Identify two diseases that exhibit combined restrictive and obstructive defects
  10. Recognize a definition, approximate normal value, factors affecting, and significance of the following spirometric volumes and capacities:
    - a. Tidal volume
    - b. Minute volume
    - c. Total lung capacity
    - d. Vital capacity and slow vital capacity
    - e. Residual volume
    - f. Expiratory reserve volume
    - g. Functional residual capacity
    - h. Inspiratory reserve volume
    - i. Inspiratory capacity
    - j. Maximal voluntary ventilation
  11. Identify the theory and methods used to measure residual volume and functional residual capacity using the following techniques:
    - a. Body plethysmography
    - b. Open circuit nitrogen washout
    - c. Closed circuit helium dilution
  12. Identify a definition, approximate normal value, factors affecting, and significance of the following spirometric flow measurements:
    - a. Forced expiratory volume at one second
    - b. Forced expiratory volume at three seconds
    - c. Forced expiratory flow 25% to 75%
    - d. Peak expiratory flow
  13. Given a description of a flow volume loop or a tracing of a flow volume loop, identify the respective patterns for obstructive and restrictive disease
  14. Identify the following regarding before and after pulmonary function testing bronchodilator assessment:
    - a. Purpose
    - b. Criteria for improvement
    - c. Validity in asthma versus other chronic obstructive pulmonary diseases
  15. Identify the method of measurement, normal value, factors affecting, and significance of the following specialized pulmonary function studies:
    - a. Diffusion capacity
    - b. Airway resistance
    - c. Compliance studies
    - d. Nitrogen washout
    - e. Closing volume (single breath nitrogen test)
    - f. Volume of isoflow
    - g. Respiratory quotient
    - h. Bronchoprovocation testing
    - i. Work of breathing

16. Recognize the general applications to respiratory care and pulmonary medicine of the following exercise tests:
    - a. Stress electrocardiograph
    - b. Ventilatory capacity
    - c. Blood gases before and after exercise
    - d. Exercise challenge
    - e. Anaerobic threshold
    - f. Maximal oxygen uptake
  17. Identify the significance of the following applications of pulmonary function testing:
    - a. Smoking cessation
    - b. Intensive care
    - c. Surgery
    - d. Sleep apnea
    - e. Environmental lung diseases
  18. Given a pulmonary function test, interpret the results in terms of obstructive, restrictive, or normal lung function
- H. Perform the clinical application of the chest radiograph**
1. Identify the general method of how x-rays are produced
  2. Recognize the following regarding the density of the object being x-rayed:
    - a. Relative amount of penetration depending on object density
    - b. Definition of radiolucent and radiopaque
    - c. Four classifications of radiographic density
  3. Recognize how the distance between the x-ray source, film and patient affects the radiographic appearance of anatomic structures on the film
  4. Recognize the standard distance between the x-ray source and film for a posteroanterior chest film
  5. Identify the indications for the use of a chest x-ray
  6. Recognize the technique, indications, and advantages/disadvantages of the following chest radiographic views:
    - a. Posteroanterior
    - b. Left lateral
    - c. Anteroposterior
    - d. Lateral decubitus
    - e. Apical lordotic
    - f. Oblique
    - g. Expiratory
  7. Identify the correct position for endotracheal tube placement on a chest radiograph
  8. Identify the value in assessing a chest radiograph in the following situations
    - a. Central venous pressure line insertion
    - b. Pulmonary artery catheter placement
    - c. Nasogastric tube placement
    - d. Chest tube insertion
    - e. Thoracentesis
    - f. Percardiocentesis
    - g. Bronchoscopy
  9. Identify the technique, indications, and advantages/disadvantages for tomography and computerized tomography
  10. Identify the relative use and indications for magnetic resonance imaging in lung disease
  11. Recognize the technique and indications for performing lung scans
  12. Identify how the following problems affect lung scans:
    - a. Thromboembolism

- b. Atelectasis
    - c. Pneumonia
  - 13. Recognize the technique and indications for the use of pulmonary angiography
  - 14. Recognize the proper technique for assessing the following during technical evaluation of the chest x-ray:
    - a. Placement on view box
    - b. Adequacy of exposure
    - c. Patient rotation
    - d. Depth of inspiration
  - 15. Recognize the proper technique for performing a systematic descriptive evaluation (interpretation) of the chest x-ray
  - 16. Identify the significance of the following special radiographic evaluation signs:
    - a. Silhouette sign
    - b. Air bronchogram
  - 17. Recognize the limitations of the chest radiograph
  - 18. Recognize the typical clinical and chest radiographic findings for the following lung diseases:
    - a. Atelectasis
    - b. Pneumothorax
    - c. Hyperinflation
    - d. Interstitial lung disease
    - e. Congestive heart failure
    - f. Pleural effusion
    - g. Consolidation
- I. Perform bedside interpretation of electrocardiogram tracings
  - 1. List or identify the clinical value of the electrocardiogram
  - 2. Identify the clinical findings that indicate the need for an electrocardiogram recording
  - 3. Identify the key components of the electrical conduction system of the heart and the role of each component
  - 4. Recognize a definition of depolarization and repolarization
  - 5. Identify the specific electrical activity of the heart associated with each wave and interval of the normal electrocardiogram
  - 6. Identify normal values for the P-R interval and the QRS complex
  - 7. Given a 12-lead electrocardiogram recording, identify the ventricular rate and position of the mean QRS vector
  - 8. List the steps for electrocardiogram interpretation
  - 9. Identify the criteria for each of the following abnormalities:
    - a. Sinus bradycardia
    - b. Sinus tachycardia
    - c. Sinus dysrhythmia
    - d. Premature atrial contraction
    - e. Atrial flutter
    - f. Atrial fibrillation
    - g. Premature ventricular contractions
    - h. Ventricular tachycardia
    - i. Ventricular fibrillation
    - j. Asystole
    - k. First, second, and third degree atrial-ventricular block
  - 10. Identify the electrocardiogram abnormalities associated with chronic obstructive lung disease
- J. Perform respiratory assessment of neonatal and pediatric patients
  - 1. Identify the type of information found in the pregnancy history, labor history, and delivery history and the clinical significance of common findings

2. Identify the value of the Apgar scoring system and the five physical criteria used in this scoring system
  3. Identify the Apgar scores that indicate normal status, moderate depression, and severe depression of the newborn
  4. Identify normal values for the vital signs in newborns and the clinical implications of abnormalities
  5. Identify the clinical implications of retractions, nasal flaring, and grunting
  6. Identify the normal time for capillary refill and the clinical significance of poor capillary refill in the infant
  7. Identify the clinical significance of abdominal distention in the infant
  8. Recognize true statements regarding the technique for auscultation of the infant
  9. Identify the clinical implications of abnormal breath sounds in the infant
  10. Identify potential causes of murmurs heard during auscultation of the infant precordium
  11. Identify normal values for the white and red blood cell count and partial differential for the infant at birth, 7 days of age, and 14 days of age
  12. Identify the possible causes of abnormalities in the white blood cell and red blood cell counts in the infant
  13. Identify the clinical implications for abnormalities in blood glucose, total protein and albumin, serum enzymes, and electrolytes
  14. Identify normal values for arterial hydrogen ion concentration, partial pressure of oxygen, partial pressure of carbon dioxide, plasma bicarbonate concentration, and base excess at birth, 24 hours after birth, and one month to two years after birth
  15. Identify which blood gas parameter is significantly different for capillary blood vs. arterial blood
  16. Identify the factors that can lead to misleading results from the transcutaneous oxygen monitor
  17. Identify the lung volumes that can be measured in the newborn and the clinical value of such measurements
  18. Identify the clinical findings that suggest the need for a chest radiograph in the infant
- K.** Perform the physical assessment of the critically ill patient
1. Identify the importance of the physical assessment in the critically ill patient
  2. Recognize the factors that can cause airway occlusion
  3. Recognize the conditions that can predispose patients to aspiration
  4. Identify the signs of partial and complete airway obstruction
  5. Identify factors which may cause airway obstruction of an artificial airway
  6. Recognize the significance of evaluating the following items in regards to artificial airways:
    - a. Position and depth
    - b. Security of tube in the airway and equipment connections
    - c. Health of tissue around site of insertion
    - d. Cuff pressure
    - e. Ventilator alarms
    - f. Signs of problems associated with long-term intubation
    - g. Relationship between size of airway and work of breathing
  7. Identify the indications and hazards of extubation
  8. Recognize the significance and factors that affect respiratory rate, rhythm, and lung sounds in a critically ill patient
  9. Recognize the significance of asymmetrical and paradoxical chest wall movement and paradoxical abdominal movement
  10. Recognize a definition, cause(s), physical assessment findings, and significance of the following problems:

- a. Pleural effusion
  - b. Pneumothorax
  - c. Tension pneumothorax
  - d. Subcutaneous emphysema
  - e. Pneumomediastinum
  - f. Reexpansion pulmonary edema
11. Identify the methods used to drain the pleural space and complications associated with those methods
  12. Identify the purpose and correct function of one-, two-, or three-bottle closed chest drainage systems
  13. Identify the normal findings/values, and the significance of the following parameters as they relate to the assessment of circulation:
    - a. Peripheral skin temperature
    - b. Capillary refill time
    - c. Cyanosis
    - d. Urine output
    - e. Level of consciousness
    - f. Heart rate and rhythm
    - g. Arterial pressure
    - h. Jugular venous pressure, hepatomegaly, and peripheraledema
- L. Perform respiratory monitoring in the intensive care unit**
1. Identify the methods, normal values, and significance of measuring the following lung volumes and flows in the intensive care unit:
    - a. Tidal volume
    - b. Vital capacity
    - c. Functional residual capacity
  2. Recognize the methods, normal values, and significance of measuring the following airway pressures or related indices in the intensive care unit:
    - a. Peak pressure
    - b. Static pressure
    - c. Compliance
    - d. Airway resistance
    - e. Mean airway pressure
    - f. Maximum inspiratory pressure
  3. Recognize the methods and significance of measuring the fraction of inspired oxygen concentration and exhaled carbon dioxide in the intensive care unit
  4. Identify the components of oxygen transport and their significance
  5. Identify the components involved in the clinical evaluation of oxygenation and their significance
  6. Recognize how the following parameters can be used to evaluate tissue oxygen delivery and utilization:
    - a. Oxygen delivery/availability
    - b. Oxygen consumption
    - c. Mixed venous oxygen tension
    - d. Venous saturation
    - e. Arterial to mixed venous oxygen content difference
    - f. Oxygen extraction ratio
    - g. Blood lactate
  7. Recognize the value of the following noninvasive methods of monitoring oxygenation and oxygen delivery:
    - a. Pulse oximetry
    - b. Transcutaneous monitoring
    - c. Conjunctival monitoring
- M. Perform cardiac output assessment**

1. Define cardiac output and venous return
  2. Recognize the following regarding cardiac output:
    - a. Method of calculation
    - b. Range of normal values
    - c. Effect of sympathetic nervous stimulation
  3. Recognize the following regarding the distribution of blood flow:
    - a. Affect of metabolism and reduced oxygen availability on the regulation of blood flow through organs
    - b. Percent of total blood volume in venous system
    - c. Affect of blood loss (hypovolemia) on circulatory function
    - d. Basal distribution of blood flow to organs vs. distribution during cardiac failure
    - e. Effect of mechanical ventilation
  4. Identify the normal values, method of calculation, and significance of the following indicators of cardiac output:
    - a. Cardiac index
    - b. Ejection fraction
    - c. Stroke volume
    - d. End-diastolic volume
    - e. Cardiac work
    - f. Ventricular stroke work
  5. Recognize the following regarding preload:
    - a. Definition
    - b. Values used to measure preload of the left and right ventricles
    - c. Factors affecting preload
    - d. Clinical value of ventricular function curves
    - e. Effect of mechanical ventilation
  6. Recognize the following for afterload:
    - a. Definition
    - b. Factors affecting afterload
    - c. How it is measured
    - d. Effect of vasodilators
    - e. How to calculate systemic and pulmonary vascular resistance
    - f. Effect of mechanical ventilation
  7. Identify the following regarding contractility:
    - a. Definition
    - b. Factors affecting contractility
    - c. How it is assessed
  8. Recognize the technique for obtaining cardiac output via the following invasive methods:
    - a. Dye dilution
    - b. Thermodilution
    - c. Fick
  9. Recognize the noninvasive methods for evaluating cardiac performance
- N. Invasively monitor hemodynamic pressures**
1. Recognize the following regarding arterial cannulation:
    - a. Indications
    - b. Cannulation sites
    - c. Possible complications
    - d. Normal pressures and their significance
    - e. Pressure waveforms
    - f. Significance of respiratory variation in the pressure waveform
    - g. Method of direct aortic pressure measurement and its significance
  2. Identify the following regarding central venous pressure monitoring:

- a. Significance
- b. Factors affecting measurement
- c. Insertion sites
- d. Types of catheters
- e. Correct technique for pressure measurement
- f. Parts of the central venous pressure waveform
- g. Affect of respiratory motion on the central venous pressure waveform
- h. Normal value for central venous pressure
- i. Relationship to left ventricular function
- 3. Recognize the following regarding pulmonary artery pressure monitoring:
  - a. Synonyms for the catheter
  - b. Indications and complications
  - c. Catheter description
  - d. Sizes used for adults and children
  - e. Position of distal and proximal catheter lumens
  - f. Average amount of air required to fill the catheter balloon
  - g. Procedure for placement of the catheter
  - h. Two synonyms for pulmonary capillary wedge pressure and the normal value for pulmonary capillary wedge pressure and pulmonary artery pressure
  - i. Relationship between pulmonary artery diastolic pressure and pulmonary capillary wedge pressure
  - j. Significance of pulmonary artery pressure and pulmonary capillary wedge pressure measurements
  - k. Importance and verification of Zone II catheter placement
  - l. Factors which affect the measurement of pulmonary capillary wedge pressure
  - m. Technique for wedging the balloon
  - n. Affect of positive end-expiratory pressure on pulmonary capillary wedge pressure measurements
- O. Perform nutritional assessment of patients with respiratory disease
  - 1. Recognize how nutrition and respiratory are interrelated
  - 2. Recognize the functional importance of oxygen in nutrition
  - 3. Identify the nutritional significance of measuring oxygen uptake
  - 4. Identify the value of determining the basal metabolic rate and basal energy expenditure
  - 5. Recognize how starvation affects the following:
    - a. Body weight
    - b. Muscle mass (diaphragm and other respiratory musculature)
    - c. Forced vital capacity, forced expiratory volume in one second, and carbon monoxide diffusing capacity
    - d. Surfactant production
  - 6. Recognize how some respiratory treatment modalities may inhibit the nutritional status of patients
  - 7. Identify the by-products of anaerobic (without oxygen) metabolism
  - 8. Identify oxygen's importance in terms of adenosine triphosphate
  - 9. Recognize how fat, carbohydrate, and protein metabolism affect the respiratory quotient
  - 10. Recognize the daily nutritional requirements for carbohydrate, protein, and fat
  - 11. Identify the protein requirements for normal and severely catabolic patients
  - 12. Recognize the significance of measuring nitrogen balance
  - 13. Recognize the problems associated with a low protein diet
  - 14. Recognize the advantages and disadvantages of a high carbohydrate diet in regards to the pulmonary system

15. Identify the importance of vitamins and minerals in respiratory function
  16. Recognize the methods available for meeting nutritional requirements and their advantages and disadvantages
  17. Recognize the methods for assessing nutritional status
  18. Identify the role of the respiratory care practitioner in nutritional assessment in relation to inspection, auscultation, and laboratory findings
- P.** Perform assessment of sleep and breathing
1. Identify the percent of adult males believed to have problems related to sleep apnea
  2. Identify the characteristics of non-rapid eye movement and rapid eye movement sleep
  3. Identify the physiologic affect of the different types and stages of sleep on the cardiovascular and respiratory systems in the healthy adult
  4. Recognize a definition of central, obstructive, and mixed sleep apnea
  5. Identify the factors believed to be responsible for the pathophysiology of obstructive sleep apnea
  6. Identify the clinical features of patients with obstructive sleep apnea
  7. Identify the sleep characteristics that may be useful in screening the patient for obstructive sleep apnea
  8. Identify the parameters typically monitored during a polysomnogram
  9. Identify the criteria for mild, moderate, and severe sleep apnea
  10. Identify the age at which the peak incidence of sudden infant death occurs
  11. Identify the abnormalities associated with obstructive sleep apnea in infants and children
  12. Recognize the importance of identifying sleep-related breathing disorders in patients with preexisting lung disease
- Q.** Perform assessment of the home care patient
1. Identify the importance and benefits of respiratory home care
  2. Identify the type of patients that receive home respiratory care
  3. Recognize the key elements involved in home respiratory care assessment
  4. Recognize the role of the Respiratory Care Practitioner in home care
  5. Recognize how accreditation by the Joint Committee for the Accreditation of Hospital Organizations has affected respiratory home care
  6. Identify the components involved in the initial home care evaluation
  7. Recognize the purpose and the procedure for performing a plan of care for a patient
  8. Recognize the purpose of performing follow-up care
- R.** Perform pulmonary rehabilitation assessment
1. Identify the general purpose of pulmonary rehabilitation programs
  2. Identify the pathologic conditions and general evaluation criteria for acceptance into pulmonary rehabilitation programs
  3. Recognize the conditions for which a pulmonary rehabilitation program would be contraindicated
  4. Recognize the importance and methods of assessing the following in terms of pulmonary rehabilitation:
    - a. Medical history and symptoms
    - b. Physical examination
    - c. Medical lab testing
    - d. Exercise ability
    - e. Nutritional status
    - f. Quality of life
    - g. Activities of daily living
    - h. Education
    - i. Patient outcome

- S. Identify the indication, action, concentration, and dosage for the following pharmacologic agents:
1. Antiinfectives
  2. Antiinflammatories/corticosteroids
  3. Bronchodilators
  4. Cardiac agents
  5. Diuretics
  6. Mucolytics/Proteolytics
  7. Narcotics
  8. Sedatives/Muscle relaxants
  9. Surfactants
  10. Vasoactive agents
  11. Saline
- T. Identify the indication, action, concentration, and dosage for pharmacologic agents termed "ACLS drugs"

**14. Representative Texts and Instructional Materials:**

Skidmore-Roth, L. (2005). *Mosby's Nursing Drug Reference*. St. Louis, MO: Mosby, Inc.

Kacmarek, R. M.; Mack, C. W.; and Dimas, S. (1990). *The Essentials of Respiratory Care (3/e)*. St. Louis, MO: The C.V. Mosby Company.

Wilkins, R. L.; Krider, S. J.; and Sheldon, R. L. (2000). *Clinical Assessment in Respiratory Care (4/e)*. St. Louis, MO: The C.V. Mosby Company.

**15. Course Content:**

- A. Preparing for the patient encounter
- B. Interviewing and respiratory history
- C. Vital signs
- D. Physical examination of the patient with cardiopulmonary disease
- E. Clinical laboratory studies
- F. Interpretation of blood gases
- G. Pulmonary function testing
- H. Clinical application of the chest radiograph
- I. Bedside interpretation of electrocardiogram tracings
- J. Respiratory assessment of neonatal and pediatric patients
- K. Physical assessment of the critically ill patient
- L. Respiratory monitoring in the intensive care unit
- M. Cardiac output assessment
- N. Invasively monitored hemodynamic pressures
- O. Nutritional assessment of patients with respiratory disease
- P. Assessment of sleep and breathing
- Q. Assessment of the home care patient
- R. Pulmonary rehabilitation assessment
- S. Pharmacologic agents
- T. ACLS drugs

**16. Methods of Instruction:**

- A. Lecture and feedback sessions
- B. Audio-visual presentations using computer technology
- C. Reading assignment reviews

D. Mathematical calculations

**17. Assignments and Methods of Evaluation:**

A. Quizzes on each Content Section (approximately 20% of the final grade)

B. Three examinations (approximately 60% of the final grade)

C. Final examination (approximately 20% of the final grade)

**18. Distributed Education Methods of Instruction:** None