Oxygenation

**KEY TERMS**

**Accessory muscles of respiration**—Use of intercostal, abdominal, and trapezius muscles to help expand the chest cavity.

**Aspiration**—Breathing foreign matter into the lungs.

**Barrel chest**—Increase in anteroposterior diameter of the thoracic cavity.

**Clubbing**—Bulbous swelling of the soft tissue of the end of the phalanges of fingers, causing the nail plates to be equal to or greater than 180°.

**Cor pulmonale**—Right-sided heart failure.

**Diaphragmatic (abdominal) breathing**—Expansion of the abdomen on deep inhalation and tightening of the abdominal muscles on exhalation, increasing the amount of air entering and exiting the lungs.

**Dyspnea**—Difficulty breathing.

**Exertional dyspnea**—Difficulty breathing with activity.

**Expectoration**—Coughing up and spitting out of sputum.

**Expiratory reserve volume**—Maximum amount of air that can be exhaled after exhalation of the tidal volume.

**External respiration**—Gas exchange at the alveolar-capillary junction.

**Exertional dyspnea**—Difficulty breathing with activity.

**Hypercarbia (hypocapnia)**—Increased level of carbon dioxide in the blood.

**Hypocarbia (hypocapnia)**—Decreased level of carbon dioxide in the blood.

**Hypoxia**—Decreased level of oxygen in the blood.

**Hypoxemia**—Inadequate oxygen in organs and tissues.

**Inspiratory reserve volume**—Maximum amount of air that can be inhaled beyond the tidal volume.

**Incentive spirometer**—Device that provides a visual goal to increase the volume of breaths.

**Internal respiration**—Gas exchange at the capillary-tissue junction.

**Nasal flaring**—Widening of nares during inhalation that reduces resistance to airflow.

**Nebulizer**—Device with a mouthpiece or mask placed over the nose that produces a medicated aerosol spray that is inhaled.

**Orthopnea**—Difficulty breathing in the supine position, necessitating an upright position to breathe.

**Orthopneic (tripod) position**—Forward leaning position utilized while sitting to facilitate breathing.

**Oximetry**—Identification of the oxygen saturation of arterial blood.

**Paroxysmal nocturnal dyspnea**—Extreme shortness of breath during sleep that causes an abrupt awakening and immediate need to assume the upright position for relief.

**Pneumothorax**—Air or gas in the pleural cavity.

**Postural drainage**—Sequential positioning of a patient in a variety of positions that use gravity to drain secretions from lobes of the lungs.

**Preoxygenate**—Administration of oxygen before a procedure.

**Pursed-lip breathing**—Exhalation through the mouth with lips creating a small opening to prolong exhalation, which keeps alveoli open longer for gas exchange.

**Residual volume**—Amount of air remaining in the lungs after forceful exhalation.

**Retractions**—Recession of intercostal, supraclavicular, and subcostal tissues during inspiration because of excessive negative pressure required to increase depth of respirations.

**Sleep apnea**—Transient, brief absences of breathing during sleep.

**Sputum**—Mucus secretions from the respiratory tract.

**Stridor**—High-pitched sound heard on inhalation with acute laryngeal obstruction.

**Subcutaneous emphysema**—Air in tissue beneath the layers of the skin.

**Tactile fremitus**—Vibration felt on the palmar surface of the hands when the patient vocalizes “99” repeatedly.

**Tidal volume**—Amount of air moving in and out of the lungs with a normal breath.

**Total lung capacity**—A combination of the inspiratory capacity and the functional residual capacity.

**Vital capacity**—Amount of air that is forcefully exhaled after forcefully inhaling with the deepest inspiratory effort possible.

**Wheeze**—Musical, whistling sound caused when air flows through narrowed airways.
The Respiratory System

The exchange of oxygen and carbon dioxide in the body is essential for life. This exchange takes place in the lungs and at the cellular level. The mechanisms of respiration are complex and require an integration of factors involving the nervous system, chemoreceptors in the cardiovascular system, as well as the respiratory system. Knowledge of the anatomy and physiology that influences breathing is the basis for understanding how to best care for patients with oxygenation problems.

A. Structures of the Respiratory System (Fig. 19.1)

1. Airways.
   a. Consist of upper airways (located above the larynx; include nasal passages, oral cavity, and pharynx) and lower airways (located below the larynx; include trachea, bronchi, and bronchioles).
   b. Humidify the air: Moist mucous membranes add water to the inhaled air.

   c. Warm the air: Heat is transferred from the blood circulating in the capillary beds of the airways to the inhaled air.
   d. Filter the air: Sticky mucus traps debris, and tiny hair-like projections from the walls of the airway (cilia) move debris up and out of the airway.

2. Lungs.
   a. Soft, spongy, cone-shaped organs.
   b. Right lung has three lobes, and left lung has two lobes.
   c. Each lung extends from its top portion (apex), which is just above the clavicle, to its bottom portion (base), which rests on the diaphragm.
   d. Composed of tiny, thin-walled air sacks (alveoli) surrounded by an extensive network of capillaries.
   e. Alveoli consist of type I cells that are involved with gas exchange and type II cells that produce a lipoprotein that lowers the surface tension to facilitate alveoli inflation.

Fig 19.1 Anterior view of the respiratory system. The upper airway lies above the larynx. The lower airway, located below the larynx, is considered sterile. (From Wilkinson and Treas [2011]. Fundamentals of nursing. Vol. 1, 2nd ed. Philadelphia: F. A. Davis, with permission.)
B. Functions of the Respiratory System
1. Ventilation.
   a. Movement of air into and out of the lungs through the process of breathing.
   b. Involves inhalation and exhalation.
      (1) Inhalation: Expansion of the chest cavity and lungs resulting from contraction of the diaphragm that pulls the chest cavity downward and contraction of the intercostal muscles that pulls the ribs outward; lung expansion causes negative pressure that draws air into the respiratory system.
      (2) Exhalation: Chest cavity and lungs return to their original size and position when the diaphragm and intercostal muscles relax; this is a passive response that requires no effort.
   c. Factors that affect adequacy of ventilation.
      (1) Respiratory rate and depth: Fast, deep respirations result in hyperventilation; slow, shallow respirations result in hypoventilation.
      (2) Lung compliance: Extent of effort to inflate the lungs; conditions such as pulmonary edema and inadequate surfactant cause reduced lung compliance.
      (3) Airway resistance: Impairment of airflow within the airways; conditions that reduce the diameter of the airways, such as excess respiratory secretions and bronchospasms, cause increased airway resistance.
      (4) Lung elasticity: Ability of elastin fibers to return to their original position during exhalation; conditions that overstretch the alveoli, such as emphysema, result in a reduction of elastic recoil, leaving excess air trapped in the alveoli at the end of exhalation.
2. Respiration.
   a. Exchange of gases that provides oxygenation of blood and body tissues and elimination of carbon dioxide from the lungs.
   b. Occurs at two levels, known as external and internal respiration (Fig. 19.2).
      (1) External respiration.
         (a) Involves alveolar-capillary gas exchange.
         (b) Oxygen diffuses from the alveoli, through the alveolar capillaries, and into the blood.
         (c) Carbon dioxide diffuses out of the blood, through the alveolar capillaries, and into the alveoli.
         (d) Rate of diffusion depends on the thickness of the membranes and extent of lung tissue.
         (e) Conditions that impair external respiration include pleural effusion, pneumothorax, bronchospasm, and excessive secretions.
      (2) Internal respiration.
         (a) Involves capillary-tissue gas exchange.
         (b) Oxygen diffuses from the blood, through the peripheral capillaries, and into tissue cells; oxygen is used for cellular metabolism.
         (c) Carbon dioxide, which is a waste product of cellular metabolism, diffuses from tissue cells, through the peripheral capillaries, and is transported via the blood to the lungs for exhalation.
         (d) The effectiveness of internal respiration depends on adequate peripheral circulation and external respiration.
         (e) Conditions that impair internal respiration include peripheral arterial and venous occlusive diseases; decreased cardiac output; impaired oxygen-carrying capacity of the blood, such as in anemia; and conditions that increase metabolism, such as fever, cancer, and hyperthyroidism.
   c. Regulated by various mechanisms.
      (1) The respiratory center, located in the medulla oblongata in the brainstem, sends impulses to the phrenic nerve, which precipitate contraction of the muscles of the diaphragm and intercostal muscles.
      (2) Chemoreceptors in the medulla, carotid arteries, and aorta identify changes in the level of circulating carbon dioxide, pH,
and oxygen and send a message to the medulla to increase or decrease respirations accordingly.
(a) When the carbon dioxide level increases and the pH and oxygen levels decrease, the rate and depth of respirations increase.
(b) When the carbon dioxide level decreases and the oxygen and pH levels increase, the rate and depth of respirations return to normal.
(3) The system involves a feedback loop to return to usual respirations when circulating gases and pH are within expected levels.
(4) Regulation of respirations is usually under involuntary control; however, voluntary control via messages from the cerebral cortex can override involuntary control by the medulla for activities such as swimming, talking, swallowing, and whistling.

c. Can be disturbed by problems that affect gas exchange.
(1) Hypoxemia: Decreased level of oxygen in the blood due to ineffective external respiration related to lung or pulmonary circulation problems.
(2) Hypoxia: Inadequate oxygen in organs and tissues due to hypoxemia or circulatory disorders.
(a) Early clinical indicators: Restlessness, irritability, anxiety, tachypnea, tachycardia, headache, disorientation, and decreased level of consciousness.
(b) Late clinical indicators: Retractions, bradypnea, bradycardia, cardiac dysrhythmias, and cyanosis.
(3) Hypercarbia (hypercapnia): Increased level of carbon dioxide in the blood; may be due to an acute problem, such as airway obstruction or drug overdose, or associated with chronic lung diseases.
(4) Hypocarbia (hypocapnia): Decreased level of carbon dioxide in the blood due to hyperventilation.
(5) Infections: Conditions include upper respiratory infections, such as colds; conditions that affect the lower respiratory tract, such as bronchitis, pneumonia, and tuberculosis; and conditions that can involve both the upper and lower respiratory tracts, such as influenza.
(6) Conditions that impede inhalation: Includes such conditions as fractured ribs, kyphosis, laryngospasm, and food/foreign body obstruction.

(7) Alveolar-capillary membrane problems: Includes conditions that interfere with the exchange of gases within the alveoli, such as pulmonary edema, emphysema, and pulmonary fibrosis.
(8) Inadequate lung surface for gas exchange: Includes such conditions as alveolar collapse, incomplete expansion of the lung (atelectasis), pleural effusion, and pneumothorax.
(9) Pulmonary circulation problems: Includes conditions that interfere with circulation to the alveolar capillary beds, thrombus entry into pulmonary artery (pulmonary embolus); and increased pressure within the pulmonary arterial system causing right-sided heart failure (cor pulmonale).

II. Factors That Influence Respiratory Functioning

The respiratory system does not function within an enclosed vacuum. It interacts with other physiological processes within the body and with issues external to the body. Factors that influence respiratory functioning include a person’s age, multiple environmental stressors, various lifestyle behaviors, and pregnancy. Understanding these factors provides a basis for future nursing assessments and nursing interventions in relation to a patient’s respiratory status.

A. Developmental Level

1. Infants (particularly premature infants).
   a. Airways are narrow, small, and immature.
   b. Central nervous system is immature, leading to impaired breathing patterns and periods of apnea.
   c. Small structures and immature immune systems increase the risk of respiratory infections.
   d. Putting small objects in mouth may lead to mechanical obstruction of the airway.
   e. Respiratory distress and sudden infant death syndrome are associated with this age group.

2. Toddlers and preschoolers.
   a. Tonsils and adenoids are large, increasing the risk of tonsillitis.
   b. Putting small objects in the mouth may lead to mechanical obstruction of the airway.
   c. Exposure to children in preschool and transmission of infection via toys increases the risk of upper respiratory infections.
   d. Viral infections, croup, and pneumonia are associated with this age group.

   a. Although the lungs are developed, they are still vulnerable to infections and exercise-induced asthma.
b. Exposure to children in school and after-school activities increases the risk of acquiring a respiratory infection.

4. Adolescents.
   a. Lungs develop adult characteristics.
   b. Vulnerability to peer pressure lead this age group to engage in habits that can impair the lungs, such as smoking and inhaling drugs or toxins.
   c. Although lung diseases generally are uncommon, exercise precipitated asthma continues to be evident.

5. Young and middle-aged adults.
   a. Prior habits that impair the lungs may continue into adulthood.
   b. Subtle progressive respiratory system changes begin in middle adulthood.
   c. Issues such as anesthetics, infections, and diseases may stress the respiratory system, which is becoming less efficient.

6. Older adults.
   a. Reduced lung compliance, increased airway resistance, and decreased lung elasticity impair ventilation.
   b. Drier mucus, fewer cilia, a less effective cough, air trapping in the alveoli, and declining immunity increase the risk of respiratory tract infections.
   c. Problems such as gastroesophageal reflux disease (GERD) and brain attack may result in aspiration, which also can precipitate a respiratory tract infection.

B. Environmental Factors
1. Air quality: Air pollution, such as cigarette smoke, automobile emissions, mold spores, and radon, can precipitate disease in vulnerable people (e.g., infants, toddlers, older adults, people with heart or lung disease).

2. Pulmonary allergens: Allergens, such as dust, animal dander, cockroach particles, environmental grasses, and foods such as peanuts and gluten, can precipitate respiratory hypersensitivity responses and allergies.

3. Altitude: Low oxygen levels place strain on the cardiopulmonary system and lead to increased ventilation, production of red blood cells and hemoglobin, and vascularity of lungs and body tissues.

C. Lifestyle Factors
1. Smoking tobacco and inhaling secondhand smoke.
   a. Tobacco smoke contains tars, toxins, and nicotine; tars and toxins are known to precipitate cancer and nicotine constricts bronchioles.
   b. Smoke also causes mucus membrane inflammation, increases respiratory secretions, breaks down elastin, and decreases the numbers and efficiency of cilia.

   c. Prolonged use results in chronic bronchitis, smaller diameter of airways, and loss of alveolar elasticity, leading to emphysema.

2. Improper nutrition: Inappropriate balance of proteins, carbohydrates, and fats may reduce the immune system, impair cellular function, impede tissue repair, and cause obesity.

3. Lack of exercise: Sedentary lifestyle results in a depressed metabolic rate and an inability of the cardiopulmonary system to respond when any situation causes an increased metabolic rate; regular exercise increases the heart and respiratory rates, which helps condition the body so that the body can better adapt to physical or emotional stressors.

4. Obesity.
   a. A body mass index more than 30 increases the risk of respiratory infections because excess abdominal adipose tissue limits chest expansion and gas exchange in the alveoli.
   b. Sleep apnea occurs due to increased neck girth and fat deposits in the upper airway that obstruct the pharynx.

5. Occupational hazards.
   a. Toxic agents include chemical fumes from cleaning products, carbon monoxide from automobile or machine combustion, particles from construction debris, such as asbestos, and coal dust from coal mines.
   b. Toxic agents can cause chronic inflammation of the mucous membranes of the respiratory system and lung cancer.

6. Substance use or abuse.
   a. Alcohol and medications that depress the respiratory center in the medulla (e.g., opioids, sedatives, anxiolytics, and hypnotics) can cause hypoventilation, aspiration, apnea, and death.
   b. Stimulants, such as amphetamines and cocaine, hallucinogens, and marijuana, also adversely affect lung tissue, increase the risk of aspiration, and depress respirations.

D. Pregnancy
1. Body metabolism increases by 15 percent and oxygen consumption increases by 15 to 25 percent.

2. The enlarging uterus rises into the abdominal cavity, limiting enlargement of the chest cavity and downward movement of the diaphragm.

3. Maternal respiratory rate increases and the mother may experience shortness of breath with activity.

III. Respiratory System Assessment

A respiratory assessment can be performed as part of a comprehensive health assessment or as a focused assessment. It begins with obtaining a health history to identify risk factors for potential respiratory problems. The physical
examination includes assessing breathing patterns and breath sounds; determining whether the results of inspection, palpation, and percussion of the thoracic cavity are significant; exploring the characteristics of a cough if present; and examining the characteristics of sputum. Data collected from these assessments help determine whether the patient’s respiratory status is functioning adequately or further definitive action is required by the nurse or primary health-care provider.

A. Obtain a Health History to Identify Risk Factors
   1. Identify age and assess for developmental stressors and changes.
   2. Identify environmental and occupational stressors.
   3. Identify lifestyle behaviors that impact the cardiopulmonary system.
   4. Obtain list of prescribed, over-the-counter, and "recreational" medications taken by the patient.
   5. Assess overall physical and emotional health status and determine whether the patient has any problems that impact the respiratory status.

B. Assess Breathing Patterns
   1. Perform assessment of breathing patterns unobtrusively because involuntary breathing efforts are more desirable to assess than voluntary breathing efforts.
   2. Note the patient's position.
      a. Sitting allows the chest to expand and the diaphragm to move downward with inspirations.
      b. Difficulty breathing in the supine position (orthopnea) may occur because the abdominal organs press against the diaphragm and impede chest expansion.
      c. Leaning forward while sitting (orthopneic, tripod position) (Fig. 19.3) increases the thoracic area, allowing for greater chest expansion.
      d. Extreme shortness of breath during sleep that causes an abrupt awakening and immediate need to assume the upright position for relief (paroxysmal nocturnal dyspnea).
   3. Observe the rate, depth, and rhythm of respirations. (Table 19.1; see also the section “Measurement of Respiration” in Chapter 11, “Physical Assessment,” page 255.)
   4. Identify the degree of respiratory effort.
      a. Breathing should be effortless.
      b. Difficulty breathing (dyspnea) and difficulty breathing with activity (exercise dyspnea) occur with inadequate oxygenation.
      c. Shortness of breath and fatigue are subjective symptoms that can be reported only by the patient.
      d. Physical signs usually accompany difficulty breathing.
   5. Identify signs of increased respiratory effort.
      a. Use of accessory muscles of respiration: Use of intercostal, abdominal, and trapezius muscles to help expand the chest cavity.

   b. Retractions: Intercostal, supraclavicular, and subcostal tissues recede during inspiration as a result of excessive negative pressure required to increase the depth of respirations.
   c. Nasal flaring: Widening of the nares during inhalation to reduce resistance to airflow; more common in infants and young children.
   d. Grunting immediately before exhalation: Closed glottis at the height of inspiration keeps alveoli open to enhance gas exchange; grunt occurs when air is expelled through the larynx.
   e. Pursed-lip breathing: Exhalation through the mouth with lips positioned to create a small opening to prolong exhalation; keeps alveoli open longer for gas exchange and more efficiently expels trapped air.

C. Perform Inspection
   1. Determine whether the chest expands and recoils with inhalation and exhalation, respectively.
      a. Movement should be symmetrical.
      b. Asymmetrical expansion may indicate a pneumothorax.
   2. Measure the chest’s anteroposterior-to-lateral ratio, which should be 1:2.
      a. An increase in the anteroposterior diameter (barrel chest) is associated with chronic retention of carbon dioxide, which occurs with chronic obstructive pulmonary disease (Fig. 19-4).
### Table 19.1 Breathing Patterns

<table>
<thead>
<tr>
<th>Pattern</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eupnea (normal)</td>
<td>• 12 to 20 breaths/minute.</td>
</tr>
<tr>
<td></td>
<td>• Not too deep or too shallow.</td>
</tr>
<tr>
<td></td>
<td>• Unlabored.</td>
</tr>
<tr>
<td></td>
<td>• Regular rhythm.</td>
</tr>
<tr>
<td>Bradypnea</td>
<td>• Less than 12 breaths/minute.</td>
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<tr>
<td></td>
<td>• Regular rhythm.</td>
</tr>
<tr>
<td></td>
<td>• Associated with neuromuscular disorders, electrolyte imbalances, and opioid medications.</td>
</tr>
<tr>
<td>Tachypnea</td>
<td>• More than 20 breaths/minute.</td>
</tr>
<tr>
<td></td>
<td>• Regular rhythm.</td>
</tr>
<tr>
<td></td>
<td>• Associated with physical exertion, anxiety, pain, and central nervous system and metabolic disorders.</td>
</tr>
<tr>
<td>Kussmaul</td>
<td>• Increased rate and depth of respirations.</td>
</tr>
<tr>
<td></td>
<td>• Regular rhythm.</td>
</tr>
<tr>
<td></td>
<td>• Associated with metabolic acidosis, fear, and panic.</td>
</tr>
<tr>
<td>Biot</td>
<td>• Varying depths of respirations (usually shallow), alternating with periods of apnea.</td>
</tr>
<tr>
<td></td>
<td>• Irregular rhythm.</td>
</tr>
<tr>
<td></td>
<td>• Associated with severe, persistent increased intracranial pressure and damage to the respiratory</td>
</tr>
<tr>
<td></td>
<td>center in the medulla.</td>
</tr>
<tr>
<td>Cheyne-Stokes (periodic breathing)</td>
<td>• Gradual increase in depth of respirations, followed by a gradual decrease and then a period of</td>
</tr>
<tr>
<td></td>
<td>apnea.</td>
</tr>
<tr>
<td></td>
<td>• Regular rhythm.</td>
</tr>
<tr>
<td></td>
<td>• Associated with increased intracranial pressure, drug poisoning, and damage to the respiratory</td>
</tr>
<tr>
<td></td>
<td>center in the medulla.</td>
</tr>
<tr>
<td>Apnea</td>
<td>• Absence of breathing.</td>
</tr>
<tr>
<td></td>
<td>• Respiratory arrest.</td>
</tr>
<tr>
<td></td>
<td>• Requires mechanical ventilation or cardiopulmonary resuscitation.</td>
</tr>
</tbody>
</table>


![Normal adult chest](Image)

**Fig 19.4** Anteroposterior diameter of chest: Normal adult chest, barrel chest. (From Wilkinson and Treas [2011], *Fundamentals of nursing*, Vol. 1, 2nd ed. Philadelphia: F. A. Davis, with permission.)

3. Assess the mucous membranes, which should be pink, moist, and intact.
   a. Dry mucous membranes indicate dehydration or a side effect of such medications as anticholinergics.
   b. Pale or bluish color indicates inadequate oxygenation.

4. Assess the lips, which should be slightly lighter or darker than skin color.
   a. Pale lips may indicate anemia or hypoxia.
   b. Cherry-red lips may indicate carbon monoxide poisoning or acidosis.
   c. Pallor around the lips (circumoral pallor) may indicate inadequate oxygenation.
5. Assess the fingers and nail plate angles for signs of bulbous swelling of the soft tissue of the end of the phalanx of fingers causing the nail plate to be equal to or greater than 180° (clubbing), which indicates prolonged inadequate oxygenation. (see Fig. 16.1)

6. Assess the color of fingers and nails.
   a. Yellow or brown color indicates nicotine stains from a prolonged history of smoking.
   b. Pallor or cyanosis indicates impaired oxygenation.

D. Perform Palpation

1. Follow a sequence similar to that used for auscultation of breath sounds (see page 577).

2. Assess the extent of respiratory excursion: Place your hands on either side of the patient’s vertebrae and have the patient inhale (Fig. 19.5); provides a gross measurement of chest expansion on inspiration.
   a. Lack of movement on one side is associated with pneumothorax and lobectomy.
   b. Limited excursion is associated with obstructive airway diseases.

3. Assess tactile fremitus: Place the palmar surface of your hands on the patient’s chest wall while keeping the fingers raised off of the chest wall; vibrations should be detected when the patient vocalizes “99” repeatedly (Fig. 19.6).
   a. Increased tactile fremitus is associated with pulmonary edema.
   b. Decreased tactile fremitus is associated with decreased air movement related to obstructive airway diseases.

4. Assess for tenderness, masses, and crackling: air in subcutaneous tissue when compressed by palpation exhibits a crackling sensation (subcutaneous emphysema); air leaking into subcutaneous tissue usually is due to a pneumothorax or associated with a chest tube site.

E. Perform Percussion

1. Follow a sequence similar to that for auscultation of breath sounds (see page 577).

2. Percuss over the intercostal spaces rather than over the ribs or scapulae.

3. Note whether sounds are drum-like (tympanic), hollow (resonant), hyperresonant (echoing), quiet and thudding (dull), or quiet and flat (flat) to determine whether underlying structures are solid or hollow and contain fluid or air.

4. Assess diaphragmatic excursion: Percuss the base of the lung at the posterior chest while the patient holds a deep breath and then while the patient holds a breath after exhalation; mark each point and measure the difference to determine diaphragmatic excursion (Fig. 19.7).

F. Assess for Presence of Coughing and Sputum

1. Recognize that coughing is a protective mechanism to remove mucus and debris from the respiratory airways.
2. Coughing and sputum can be caused by irritants such as smoke, dust, and chemical fumes; food, fluid, or a foreign object that gets lodged in the respiratory airways; and inflammation associated with respiratory tract infections or tumors.

3. Identify whether mucus is being produced by the mucous membranes of the trachea, bronchi, and lungs (sputum).

4. Identify whether coughing is not bringing up sputum (nonproductive cough) or bringing up sputum (productive cough).

5. Identify the characteristics of sputum.
   a. Amount: From slight to copious.
   b. When produced: From once to continuous; in the a.m.; when lying down; after behaviors such as smoking.
   c. Color:
      (1) Clear/white: Associated with viral infections.
      (2) Yellow/green: Associated with bacterial infection.
      (3) Black: Associated with inhalation of smoke, soot, or coal dust.
      (4) Red/rust colored: Associated with the presence of blood (hemoptysis), tuberculosis, and pneumococcal pneumonia.
      (5) Pink/frothy: Associated with pulmonary edema.
   d. Odor: Foul smelling, associated with bacterial infections such as pneumonia and abscesses of the lung.

6. Obtain a sputum specimen for culture and sensitivity (C&S) (see the section "Culture and Sensitivity of Sputum" under "Respiratory System Diagnostic Tests and Related Nursing Care," page 582).

G. Auscultate Breath Sounds

1. Clean the ear pieces and diaphragm of the stethoscope before and after use; have a dedicated stethoscope for a patient in isolation.

2. Place the patient in a sitting position to provide access to the patient’s anterior, posterior, and lateral chest; warm the diaphragm of the stethoscope with your hands before use to promote patient comfort.

3. Place the diaphragm directly on the patient’s skin and follow a systematic sequence to ensure all lung fields are assessed (Fig. 19.8).

4. Instruct the patient to breathe deeply through the mouth; provide for a period of regular breathing when necessary to prevent hyperventilation and respiratory alkalosis.

5. Note the duration of inspiration and expiration.

6. Note the pitch, intensity, and other characteristics of sounds; if you hear air moving through fluid,
7. Identify expected breath sounds: Bronchial, bronchovesicular, and vesicular (Fig. 19.9 and Table 19.2).

8. Identify abnormal breath sounds: Crackles (rales), rhonchi (sonorous wheezes), stridor, wheezes (sibilant wheezes), and pleural friction rub (Fig. 19.10 and Table 19.3).

IV. Respiratory System Diagnostic Tests and Related Nursing Care

Physical examination alone may be inadequate to provide comprehensive information concerning a patient’s respiratory status. Additional diagnostic tests may be ordered by the primary health-care provider. Some are essential to arrive at a medical diagnosis (e.g., tuberculin skin testing, sputum C&S), whereas others are employed to identify specific information about a patient’s oxygenation status or the extent of functioning of a patient’s respiratory system (e.g., pulse oximetry, peak expiratory flow rate). Nurses must understand these tests because some of them are performed by the nurse and all of them require patient teaching.

A. Pulse Oximetry

1. Identifies the percentage of arterial oxygen saturation by assessing the percentage of hemoglobin molecules carrying oxygen (Fig. 19.11). (See the section “Measurement of Arterial Blood Oxygen Saturation” in Chapter 11, “Physical Assessment,” page 261.)

2. Can be used intermittently or continuously.

3. Expected value is 95 to 100 percent.

   a. Verify the primary health-care provider’s order (e.g., intermittent or continuous assessment; while receiving oxygen or on room air).
   b. Explain to the patient that the test is noninvasive and will cause no discomfort.
   c. Select the site to be used for the sensor, such as a fingertip, toe, ear lobe, or forehead; use the appropriate sensor for the chosen site and patient size.

![Fig 19.9 Locations of normal breath sounds. (From Wilkinson and Tress [2011]. Fundamentals of nursing, Vol. 1, 2nd ed. Philadelphia: F. A. Davis, with permission.)](image-url)
Table 19.2 Recognizing Normal Breath Sounds

<table>
<thead>
<tr>
<th>Breath Sound</th>
<th>Description</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bronchial</td>
<td>• Caused by air moving through the trachea.</td>
<td>• Over the trachea anteriorly.</td>
</tr>
<tr>
<td>Inspiration</td>
<td>• Loud, high-pitched, hollow, blowing sound.</td>
<td>• Nape of the neck posteriorly.</td>
</tr>
<tr>
<td>Expiration</td>
<td>• Inspiration shorter than expiration.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bronchovesicular</td>
<td>• Caused by air moving through large bronchi.</td>
<td>• Over the first and second intercostal space on either side of the sternum anteriorly.</td>
</tr>
<tr>
<td>Inspiration</td>
<td>• Medium-pitched, medium intensity, blowing sounds.</td>
<td>• Between the scapulae posteriorly.</td>
</tr>
<tr>
<td>Expiration</td>
<td>• Inspiration and expiration equal in length.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vesicular</td>
<td>• Caused by air moving through smaller airways of the respiratory tract.</td>
<td>• Over the periphery of the lung.</td>
</tr>
<tr>
<td>Inspiration</td>
<td>• Soft, low-pitched, breezy sounds.</td>
<td></td>
</tr>
<tr>
<td>Expiration</td>
<td>• Inspiration is louder, higher pitched, and longer than expiration.</td>
<td></td>
</tr>
</tbody>
</table>


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*Fig 19.30* Location of abnormal breath sounds: Crackles—yellow; rhonchi—orange and blue; wheeze—pink; pleural friction rub—green. (Adapted from Wilkinson and Treas [2011]. Fundamentals of nursing. Vol. 1, 2nd ed. Philadelphia: F. A. Davis, with permission.)

d. Change the pulse oximetry sensor site every 2 hours to prevent tissue necrosis from pressure if monitoring is continuous.

e. Ensure the site is dry, has no dark nail polish or artificial nails, and has adequate circulation as determined by a capillary refill of less than 3 seconds.

f. Document the results in the patient’s clinical record, and notify the primary health-care provider if the results are outside the expected
Table 19.3 Distinguishing Abnormal Breath Sounds

<table>
<thead>
<tr>
<th>Breath Sound</th>
<th>Description and Location</th>
<th>Etiology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crackles (rales)</td>
<td>• Air bubbling through moisture in the alveoli.</td>
<td>• Inflammation due to pneumonia or bronchitis.</td>
</tr>
<tr>
<td></td>
<td>• Not cleared by coughing.</td>
<td>• Hypervolemia due to congestive heart failure.</td>
</tr>
<tr>
<td></td>
<td>• Heard in periphery of lung.</td>
<td>• Alteration in structure or function, such as in emphysema.</td>
</tr>
<tr>
<td></td>
<td>• Classified as:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Fine: Soft, high-pitched crackling sound heard at height of inspiration.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Medium: Lower-pitched, popping sound heard during the middle of inspiration.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Coarse: Loud, bubbling sound heard throughout inspiration.</td>
<td></td>
</tr>
<tr>
<td>Rhonchi (sonorous wheeze)</td>
<td>• Mucus accumulated in large bronchi.</td>
<td>• Inflammation due to bronchitis.</td>
</tr>
<tr>
<td></td>
<td>• Loud, coarse, low-pitched sound heard during inspiration and/or expiration.</td>
<td>• Narrowed airways.</td>
</tr>
<tr>
<td></td>
<td>• May be cleared by coughing.</td>
<td>• Alteration in structure or function, such as in emphysema or fibrotic lungs.</td>
</tr>
<tr>
<td>Wheeze (sibilant wheeze)</td>
<td>• Air moving through narrowed airways.</td>
<td>• Narrowing of small airways by spasms, inflammatory process, mucus accumulation, or tumors.</td>
</tr>
<tr>
<td></td>
<td>• High-pitched, musical sound that may be heard throughout inspiration and expiration; more prominent during expiration.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Heard over bronchi.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• May be audible without a stethoscope.</td>
<td></td>
</tr>
<tr>
<td>Pleural Friction Rub</td>
<td>• Inframed pleural surfaces rubbing together.</td>
<td>• Inflammation of the pleural membranes (pleurisy).</td>
</tr>
<tr>
<td></td>
<td>• Low-pitched, grating sound during inspiration and/or expiration; more prominent at height of inspiration.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Disappears when the breath is held (versus pericardial friction rub, which continues when the breath is held).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Heard at lateral, anterior, base of lung.</td>
<td></td>
</tr>
<tr>
<td>Stridor</td>
<td>• High-pitched crowing sound; more prominent during inspiration.</td>
<td>• Tracheal or laryngeal spasm.</td>
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<tr>
<td></td>
<td>• Heard over larynx and trachea.</td>
<td>• Partial airway obstruction.</td>
</tr>
<tr>
<td></td>
<td>• May be audible without a stethoscope.</td>
<td></td>
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</tbody>
</table>

Figures from Dillon (2007); Nursing health assessment: Clinical pocket guide, 2nd ed. F.A. Davis Company, with permission.


range, as indicated by the provider or hospital policy (e.g., generally less than 92%).

B. Peak Expiratory Flow Rate (PEFR)

1. Identifies the amount of air that can be exhaled with forcible effort, expressed in liters per minute (Fig. 19.12).
2. Compared to the individual’s “personal best” baseline result to determine dosage and effectiveness of respiratory medications.
   a. Green: Peak flow is within 80 to 100 percent of personal best baseline; continue prescriptions as ordered.
   b. Yellow: Peak flow is within 50 to 80 percent of personal best baseline; reflects onset of airway changes that are reducing peak flow by 20 to
50 percent; may require increase in dosage of maintenance medications or use of rescue therapies.

3. Nursing care.
   a. Instruct the patient to take a deep breath and to forcefully exhale with lips sealed around the mouthpiece.
   b. Obtain three readings, and document the highest reading.
   c. Implement the prescribed treatment protocol based on PEFR results.
   d. Teach the patient how to perform the test at home, keep a record of results, and determine treatment protocols based on results.

C. Pulmonary Function Tests
   1. Identifies lung capacity, volume, and flow rates (Fig. 19.13).
      a. Tidal volume: Amount of air moving in and out of the lungs with a normal breath (e.g., 500 mL); normally increases when oxygen demand increases and decreases with conditions such as obstructive lung diseases, muscular weakness, and paralysis of the diaphragm.
      b. Inspiratory reserve volume: Maximum amount of air that can be inhaled beyond the tidal volume (e.g., 2,000 to 3,000 mL); reflects the extent to which tidal volume can increase when oxygen demand increases.
      c. Expiratory reserve volume: Maximum amount of air that can be exhaled after exhalation of the tidal volume (e.g., 1,000 to 1,500 mL); decreases with conditions that collapse the alveoli and airways, thus trapping air in the lungs.
      d. Residual volume: Amount of air remaining in the lungs after forceful exhalation (e.g., 1,000 to 1,500 mL); increases with conditions that trap air in the lungs.
      e. Vital capacity: Amount of air that is forcefully exhaled after forcefully inhaling with the deepest inspiratory effort possible (e.g., 3,000 to 4,500 mL); reflects a combination of the inspiratory reserve volume, tidal volume, and the expiratory reserve volume.

2. Nursing care.
   a. Identify patients who may not be capable of participating in the test, such as those who have pain on inspiration or expiration, are cognitively impaired, or have a lowered level of consciousness.
   b. Teach the patient to avoid smoking, bronchodilators, metered-dose inhalers, and aerosol therapies for 6 hours before the test unless otherwise indicated by the primary health-care provider.
c. Obtain current weight and height measurements, and record the results on the patient's clinical record.
d. List all prescribed medications on the laboratory form.
e. Explain that deep breathing may precipitate light-headedness and instruct the patient to report this occurrence to the test administrator.
f. Encourage rest after the test because it commonly causes fatigue in patients with respiratory problems.

DID YOU KNOW?
Inhalation studies may precipitate an asthmatic episode. Therefore, some medications may be permitted before a diagnostic test of the respiratory system.

D. Tuberculin Skin Testing
1. Identifies past or present exposure to tubercle bacilli but does not diagnose that the patient has tuberculosis (TB); patients with positive purified protein derivative (PPD) results require a chest x-ray and sputum culture for a definitive diagnosis.
2. PPD of the tubercle bacillus is inserted via an intradermal injection.
3. Annual testing is recommended for health-care workers, immigrants from countries with an increased incidence of tuberculosis, and people residing in congregate living environments, such as prisons, low-income housing, and dormitories.
   a. Determine whether the patient has a contraindication for the test (e.g., had tuberculosis, had a previous positive test, has a history of hypersensitivity to skin tests, has eczema, is receiving chemotherapy, or is pregnant).
   b. Determine whether the patient is taking steroids or immunosuppressants because these substances can cause a false-negative result.
   c. Explain that the test results must be evaluated 48 to 72 hours after PPD injection, otherwise results may be inaccurate.
   d. Perform intradermal injection on the forearm and encircle the area with an indelible pen. (See the section “Intradermal (ID) Injections” in Chapter 14, “Medication Administration,” page 389.)
   e. Measure the diameter of a raised, thickened area (induration) if it occurs, not redness; ≤ 5 mm is a negative reaction; >5 mm, ≥10 mm, or ≥15 mm associated with subgroups of the population indicates a positive response.
   f. Refer patients with a positive result to their primary health-care provider for additional testing.

E. Culture and Sensitivity (C&S) of Sputum
1. The culture result identifies organisms in the sputum.
2. The sensitivity result suggests appropriate antimicrobial agents for treatment.
3. Nursing care.
   a. Obtain the sputum specimen before initiation of antibiotic therapy, otherwise the result of the test may be inaccurate.
   b. Place the patient in the semi-Fowler or Fowler position.
   c. Obtain the specimen.
      (1) Via expectoration: Have the patient breathe deeply several times, cough deeply, and expel sputum directly into the specimen container.
      (2) Via suction.
         (a) Use an inline sputum specimen container.
         (b) Administer oxygen before the procedure for 2 minutes (preoxygenate) to increase the serum oxygen level because suctioning will interfere with the intake of oxygen during the procedure.
   d. (c) Don protective eyewear and sterile gloves. Keep one hand sterile and one hand clean.
      (d) Hold the catheter with the sterile gloved hand while attaching it to the suction source tubing and lubricate the tip of the suction catheter with sterile normal saline solution (Fig. 19.14a).
      (e) Use the sterile gloved hand to insert the catheter through the nasopharynx, endotracheal tube, or tracheostomy tube and advance it to the trachea.
      (f) Apply suction with the clean gloved hand for 5 to 10 seconds when the patient coughs.
      (g) Remove the suction tubing and connect the tubing on the specimen container to the attached adapter (Fig. 19.14b).
   d. Label the container with the patient's name, identification number, test, and collection date and time.
   e. Place the specimen in a biohazard bag and immediately send it to the laboratory.

V. Nursing Care for Patients With Respiratory Problems

Nursing interventions related to the respiratory system involve activities concerning the promotion of efficient respiratory functioning, the prevention of respiratory
5. Ensure that supplemental oxygen is humidified.
6. Perform chest physiotherapy for patients too weak to cough or at risk for retained secretions; perform the procedure between meals to prevent nausea and vomiting or an unpleasant taste in the mouth that may limit eating; administer a prescribed nebulizer treatment before the procedure to dilate airways and provide humidification; perform oral care after the procedure to limit an unpleasant taste in the mouth. Chest physiotherapy may be implemented by a respiratory therapist.
   a. Postural drainage: Place the patient sequentially in a variety of positions so that it permits gravity to drain secretions from all lobes of the lungs.
   b. Percussion: Strike the chest wall using cupped hands to generate sounds and slight negative pressure that loosen secretions (Fig. 19.15).
   c. Vibration: Apply vibrations to the chest wall with the hands (Fig. 19.16) or a vibrator to loosen secretions; alternatively, an inflatable vest (high-frequency chest wall oscillation vest) can be worn that generates pulses of air into the vest that vibrate the patient's chest wall, loosening secretions.
7. Teach the patient how to use a vibratory positive expiratory pressure device to vibrate the airways (which loosens mucus from the walls), intermittently.
increase endobronchial pressure (which helps maintain airway patency during exhalation), and maximize expiratory airflow (which facilitates movement of mucus toward the mouth) (Fig. 19.17).

a. Sit in a chair with the head tilted slightly upward.
b. Hold the stem of the device horizontal to the floor; this angle may be raised or lowered to achieve the maximum fluttering effect; vibrations during exhalation can be felt internally by the patient or by the nurse by placing one hand on the patient’s back and one hand on the chest.
c. Slowly inhale to about 75 percent of a usual breath; hold the breath for 2 to 3 seconds and suppress coughing.
d. Place the mouthpiece in the mouth with the lips firmly around the stem.
e. Exhale through the device at a somewhat fast but not forceful speed while keeping cheeks stiff (stiff cheeks allow airways to vibrate rather than the cheeks).
f. Repeat steps c through e 5 to 10 times.
g. Perform two additional breaths through the device, but this time inhale fully and exhale forcefully with each breath.
h. Cough to raise mucus to the mouth, and then expectorate the mucus.
i. Perform the technique as prescribed because it is goal based rather than time based; usually, it is performed in the morning and late afternoon or evening.
j. Disassemble the device, rinse all components with tap water, dry with a clean towel, reassemble, and store in a dry place; clean with a mild soap or detergent every 2 days and then rinse, dry, reassemble, and store the device.

B. Promote Lung Expansion

1. Have the patient assume a position that allows the diaphragm to contract without pressure from abdominal organs and permits thoracic excursion, such as semi-Fowler, high-Fowler, or orthopneic (tripod) position.
2. Encourage an intake of air in which the abdomen expands on deep inhalation and abdominal muscles tighten on exhalation (diaphragmatic [abdominal] breathing) to increase the amount of air entering and exiting the lungs.
3. Encourage the patient to exhale through the mouth with the lips positioned to create a small opening (pursed-lip breathing) to prolong exhalation. Doing so keeps alveoli open longer for gas exchange and more efficiently expels trapped air. This is a beneficial breathing technique for patients with obstructive airway diseases, such as emphysema, asthma, and chronic bronchitis.
4. Encourage use of an incentive spirometer 10 times every hour to help prevent atelectasis and reexpand collapsed alveoli; device promotes deep breaths by providing a visual goal to progressively increase the volume of breaths (Fig. 19.18).
5. Administer prescribed bronchodilators and nebulizer treatments. (See Chapter 14 for nursing interventions specific to administering medications via an aerosol handheld nebulizer, page 376.)

C. Maintain a Balance Between Rest and Activity

1. Organize care so that the patient has uninterrupted periods of rest.
2. Anticipate the patient’s needs and assist with care.
3. Pace activities so that the patient does not experience dyspnea.
4. Encourage use of a shower stool rather than standing when showering.
5. Teach the patient to place several chairs throughout the home so that the patient can rest when walking from one place to another.
6. Encourage the patient to schedule rest periods or short naps several times a day.
7. Refer the patient to a social service agency to arrange for a motorized chair.

D. Maintain a Patent Airway

1. Keep suction apparatus at the bedside.
2. Maintain aspiration precautions for a patient who has a decreased level of consciousness, difficulty swallowing, or a diminished or absent gag or cough reflex.
   a. Maintain the patient in a side-lying position to promote drainage of secretions from the mouth.
   b. Request medications in liquid form or crush medications (if not enteric coated or sustained release) and place them in a teaspoon of applesauce to promote swallowing.
   c. Provide thick liquids, such as nectars, or use a thickening agent.
d. Place the patient in the high-Fowler position for meals; have a nursing team member assist with the entire meal and ensure that patient’s mouth is empty of food after the meal.
e. Offer small, frequent meals; alter the consistency of food as indicated, such as mechanical soft, soft, chopped, and pureed; feed slowly.
f. Keep the patient in the semi- or high-Fowler position for at least 30 minutes after meals.

3. Maintain aspiration precautions for patients receiving enteral feedings.
   a. Maintain the head of the bed at 30° if the patient is receiving continuous tube feedings.
   b. Raise the head of the bed to 45° before the patient receives an intermittent tube feeding; intermittent tube feedings have a larger volume than continuous tube feedings, which increases the risk of aspiration; maintain head elevation for at least 30 minutes after the feeding.
   c. Aspire gastric contents to ensure that the nasogastric tube is in the stomach and to measure residual volume; hold the next feeding if the residual volume exceeds the parameter indicated by the primary health-care provider or facility policy (depends on amount and frequency of feedings).

4. Assess for signs of excessive secretions in the airways, such as rattling sounds in the throat, shortness of breath, ineffective cough, and rhonchi or crackles on auscultation.

5. Suction the patient if respiratory secretions compromise the airway.
   a. Commonalities of nursing care related to suctioning.
      (1) Wash your hands.
      (2) Provide for the patient’s privacy.
   b. Oropharyngeal suctioning.
      (1) Don clean gloves.
      (2) Obtain equipment.
         (a) Yankauer (tonsil-tip) suction tube (Fig. 19.19) to remove secretions from the oral cavity.
         (b) Suction catheter (e.g., 12 to 18 French for adults, 8 to 10 French for children, and 5 to 8 French for infants) to remove secretions from the oropharyngeal or nasopharyngeal area.
      (3) Lubricate the tip of the tube or catheter with sterile normal saline solution.
      (4) Advance the tube or catheter (3 to 4 inches) along the inside of the cheek to the pharyngeal area, avoiding the center of the tongue limits gagging.
(5) Apply negative pressure for only 10 to 15 seconds to remove secretions and prevent hypoxia.

(6) Suction the cheek pouches and under the tongue to remove pocketed secretions (Fig. 19.20).

c. Nasopharyngeal suctioning.
   (1) Don clean gloves.
   (2) Measure from the tip of the patient’s nose to the tip of the patient’s earlobe to determine the extent the catheter should be inserted (Fig. 19.21a).
   (3) Lubricate the tip of the catheter with water-soluble jelly.
   (4) Extend the patient’s head and advance the catheter into a nares the predetermined length, usually 5 to 6 inches (Fig. 19.21b).
   (5) Apply intermittent negative pressure for 10 to 15 seconds only when rotating and withdrawing the catheter.
   (6) Suction normal saline solution to clear the catheter of secretions.
   (7) Repeat previous steps alternating nares and waiting 30 seconds between each pass of the catheter to allow the patient time to breathe.

d. Endotracheal and tracheal suctioning.
   (1) Preoxygenate the patient by using a resuscitation bag connected to an oxygen source; compress the bag 3 to 5 times.
   (2) Do not preoxygenate if the patient has copious secretions because doing so can force secretions deeper into the lung and delay their removal.
   (3) Don sterile gloves.
   (4) Lubricate the tip of the catheter with sterile normal saline solution.
   (5) Advance the catheter without applying negative pressure until resistance is felt (usually just above the bifurcation of the mainstream bronchi; endotracheal tube—usually 5 to 6 inches for an adult; tracheostomy tube—usually 2 to 3 inches for an adult).
   (6) Apply intermittent negative pressure for 10 to 15 seconds only when rotating and withdrawing the catheter (Fig. 19.22).

E. Institute Basic Life Support (Cardiopulmonary Resuscitation [CPR]) (Table 19.4)

1. Perform external cardiac compression and ventilation to increase blood flow to the heart and brain,
following the sequence of Circulation, Airway, Breathing (CAB).
2. Shake the patient by the shoulder and shout, “Are you okay?” to assess level of consciousness.
3. If no response, call for help or activate EMS system to ensure help and the presence of a defibrillator and resuscitative medications.
4. Palpate the carotid pulse for adult or brachial or femoral pulse for an infant or child to assess circulation.
5. Deliver 30 external cardiac compressions to promote cardiac output (ensure victim is on a hard surface in supine position).
6. Assess and establish an airway: open the airway (head tilt–chin lift maneuver or jaw thrust without neck hyperextension if cervical injury is suspected) to listen, look, and feel for air exchange.
7. If the patient is not breathing, give 2 breaths to instill air into the lungs (maintain head-tilt or jaw thrust maneuver while pinching victim’s nostrils).
8. Maintain the ratio of compressions to ventilations for 5 cycles and then reassess the pulse.
9. If successful, discontinue CPR and position the victim in a side-lying (recovery) position.
10. If unsuccessful, resume compressions and then ventilations according to appropriate age and number of rescuers ratio; terminate CPR when ordered by the primary health-care provider or when rescuer exhaustion occurs.

F. Prevent and Manage Partial and Total Airway Obstructions
1. Education for family members with small children.
   a. Ensure toys are as large as a clenched fist and inspect toys for small removable parts.
   b. Store plastic bags where they cannot be reached by small children.
   c. Cut food into very small pieces, and avoid foods such as olives, grapes, and frankfurters.
   d. Do not give small children hard candy, nuts, popcorn, marshmallows, chewing gum, or balloons.
   e. Discuss how and when to perform the universal choking sign (Fig. 19.23).

<table>
<thead>
<tr>
<th>Table 19.4 Performing CPR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CPR</strong></td>
</tr>
<tr>
<td>Rate of compressions</td>
</tr>
<tr>
<td></td>
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<tr>
<td></td>
</tr>
<tr>
<td>Compression landmark</td>
</tr>
<tr>
<td>Depth of compressions</td>
</tr>
<tr>
<td>Ratio of compressions to ventilations</td>
</tr>
<tr>
<td>Compression method “Hard and fast” with complete chest recoil</td>
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</tbody>
</table>
hands, collecting appropriate equipment, identifying the patient, providing privacy, and explaining the procedure to the patient.
b. Obtain vital signs, measure the patient’s pulse oximetry level (may not be a reliable indicator for patients with COPD or impaired peripheral circulation), and perform a focused respiratory assessment, including auscultation of breath sounds, before initiation of therapy to have baseline data.
c. Initiate oxygen flow according to the manufacturer’s directions, and place the device on the patient.
d. Hang an “oxygen in use” sign near the patient’s bed, use cotton gowns and linens to prevent static electricity, and prohibit smoking and open flames near the patient because oxygen supports combustion.
e. Routinely monitor delivery of oxygen, ensuring that all connections are secure.
f. Assess the patient’s skin where elastic straps, the mask, or oxygen tubing may produce pressure or friction that could cause skin trauma (e.g., nares and top of ears with a nasal cannula, ears, bridge of the nose, and zygomatic archs with masks).

### Table 19.5 Airway Obstructions

<table>
<thead>
<tr>
<th></th>
<th>Infant (&lt; 1 year)</th>
<th>Child/Adolescent (&gt;1 year)</th>
<th>Adult</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assess extent of obstruction</strong></td>
<td></td>
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<td></td>
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<tr>
<td>Partial Obstruction</td>
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<tr>
<td>Can cough and make sounds.</td>
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<tr>
<td>Total Obstruction</td>
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<tr>
<td>Cannot cough, make sounds, or speak; has difficulty breathing, pallor, and cyanosis.</td>
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<tr>
<td>In addition, a child or adult may encircle the throat with the hands (universal choking sign). Nurse should ask the victim, “Are you choking?”</td>
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<tr>
<td><strong>Victim is conscious</strong></td>
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<tr>
<td>Partial Obstruction</td>
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<tr>
<td>Continue to monitor; allow the victim’s efforts to dislodge the object.</td>
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<tr>
<td><strong>Total Obstruction in an Infant</strong></td>
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<tr>
<td>Deliver 5 back blows followed by 5 chest thrusts.</td>
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<tr>
<td>Repeat until object is expelled or victim is unresponsive.</td>
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<tr>
<td><strong>Total Obstruction in a Child or an Adult</strong></td>
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<tr>
<td>Activate EMS system.</td>
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<tr>
<td>Ask victim, “Can I help?”</td>
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<tr>
<td>Perform abdominal thrust maneuver until the object is expelled or victim is unresponsive.</td>
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<tr>
<td><strong>How to perform the abdominal thrust maneuver</strong></td>
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<tr>
<td>Encircle a conscious victim’s waist with intertwined clenched fists.</td>
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<tr>
<td>Thrust upward and inward against the victim’s diaphragm.</td>
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<tr>
<td>Repeat thrusts until the object is expelled or the victim becomes unresponsive.</td>
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</tr>
<tr>
<td><strong>Victim is unconscious</strong></td>
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<tr>
<td>Head tilt–chin lift maneuver; inspect the mouth; remove the object if present in the pharynx.</td>
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<tr>
<td>Implement cardiopulmonary resuscitation, but inspect the mouth before each two rescue breaths.</td>
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Making the Connection

Avoidance of High Levels of Oxygen Therapy and Patients With Obstructive Respiratory Diseases

The carbon dioxide level in the body is the primary regulator of breathing because increased or decreased levels affect the pH of the blood. Changes in the oxygen level in the blood do not change the blood’s pH. Normally, when the carbon dioxide level in the body increases and pH and oxygen levels decrease, the chemoreceptors in the carotid arteries, aorta, and medulla identify these changes and send a message to the medulla to increase respirations accordingly. However, people with obstructive airway disease become accustomed to increased carbon dioxide levels and their stimulus to breathe is no longer increased levels of carbon dioxide but rather low oxygen levels. Therefore, when administering oxygen to people with obstructive airway diseases, the delivery of oxygen should not exceed 2 L/minute. Excessive exogenous oxygen decreases the respiratory drive, resulting in decreased breathing and increased carbon dioxide retention. In addition, the Haldane effect suggests that the adverse effects of increased oxygen are caused by the inability of oxygen-saturated hemoglobin molecules to transport carbon dioxide. Both issues relate to excessive levels of carbon dioxide in the body associated with excessive exogenous oxygen (CO₂ narcosis). Patients with obstructive airway diseases who are receiving oxygen should be assessed for the clinical manifestation of CO₂ narcosis, which include decreased rate and depth of respirations, confusion, decreased level of consciousness, tremors, convulsions, and even death.

g. Routinely assess the patient’s vital signs, pulse oximetry, breath sounds, and other patient responses, and evaluate data in relation to expected outcomes of interventions.

h. Document the procedure and the patient’s response in the patient’s clinical record.

2. For nursing care for patients receiving oxygen via specific oxygen delivery systems, see Table 19.6.

3. Care for a patient with an artificial airway.
   a. Device used to permit air to enter and exit the lungs, thereby maintaining an open airway.
   b. Used for patients who are unconscious, at risk for airway obstruction, or require mechanical ventilation.
   c. Should be suctioned only when necessary to maintain an open airway and limit trauma to mucous membranes of the respiratory tract.
   d. Nursing care varies by type of device (Table 19.7).

VI. Medications That Affect the Respiratory System

When a person is diagnosed with a respiratory problem, the primary health-care provider can prescribe appropriate medications to dilate the respiratory airways, increase the volume and decrease the viscosity of respiratory secretions, and limit coughing. Nurses should know the mechanisms of action, therapeutic and nontherapeutic effects, and nursing care related to the common bronchodilators, expectorants, and antitussives (Table 19.8).

<table>
<thead>
<tr>
<th>Table 19.6 Oxygen Delivery Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type</strong></td>
</tr>
</tbody>
</table>
| Simple face mask                   | • Delivers oxygen to the nose and mouth via a clear, flexible mask.  
   • *Lttter flow*: 5 to 10 L/minute.  
   • *Fraction of inspired oxygen (FI O₂)*: 40% to 60%, depending on liter flow. | 
|                                   | **Advantages**  
   • Patient may breathe through the nose or mouth.  
   **Disadvantages**  
   • Some patients feel claustrophobic.  
   • Some patients feel hot because the mask retains body heat.  
   • The mask must be removed for eating and drinking.  
   • Speech is muffled. |  
|                                   | **Place the mask securely over the nose and mouth with the elastic straps above the ears.**  
| Nasal cannula                     | • Delivers oxygen to the nares via clear, flexible prongs.  
   • *Lttter flow*: 1 to 6 L/minute.  
   • *FI O₂*: 24% to 44%, depending on liter flow. |  
|                                   | **Advantages**  
   • The device is comparatively comfortable.  
   • The patient may eat, drink, and talk unimpeded.  
   **Disadvantages**  
   • It may dry the nasal mucosa and irritate the nares.  
   • Device’s effectiveness decreases if the patient breathes through the mouth. |  
|                                   | **Place the nasal prongs curved downward into the nares with the elastic straps wrapped around the ears and the slider under the chin.**  
|                                   | **Humidify oxygen if the flow rate is ≥3 L/minute.** |  

Continued
### Table 19.6 Oxygen Delivery Systems—cont’d

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Advantages</th>
<th>Nursing Care</th>
</tr>
</thead>
</table>
| Partial rebreather mask | • Delivers oxygen to the nose and mouth via a clear, flexible mask with an attached bag (reservoir).  
• Some exhaled air is rebreathed; most exhaled air is discharged through ports on the side of the mask.  
• Liter flow: 6 to 15 L/minute.  
• \( \text{FIO}_2 \): 50% to 90%, depending on liter flow. | • Advantages:  
  - Rebreathing some exhaled carbon dioxide lowers the pH of the gas, which stimulates breathing and helps prevent carbon dioxide narcosis.  
• Disadvantages:  
  - Some patients feel claustrophobic. | • Flood the reservoir with oxygen before attaching the mask to the patient.  
• Ensure that the reservoir does not collapse during inhalation; a higher flow rate is required if this occurs. |
| Nonrebreather mask | • Delivers oxygen to the nose and mouth via a clear, flexible mask with an attached bag (reservoir).  
• All exhaled air is discharged through ports on the side of the mask.  
• Liter flow: 6 to 15 L/minute.  
• \( \text{FIO}_2 \): 70% to 100%, depending on liter flow. | • Advantages:  
  - This is the only oxygen delivery system that can deliver 100% oxygen when liter flow is 15 L/minute. It allows higher \( \text{FIO}_2 \) levels because the reservoir fills with oxygen.  
  - When the air in the reservoir is depleted when the patient inhales, the reservoir is then refilled by the oxygen flow.  
• Disadvantages:  
  - Some patients feel claustrophobic. | • Flood the reservoir with oxygen before attaching the mask to the patient.  
• Ensure that the reservoir remains half full during inhalation; if not, a higher flow rate is required. |
| Venturi mask       | • Delivers oxygen to the nose and mouth via a clear, flexible mask with a valve and tubing attached between the mask and the oxygen tubing.  
• Interchangeable color-coded valves permit a specific mix of room air and oxygen to deliver a precise percentage of oxygen.  
• Exhaled air is discharged through ports on the side of the mask to keep carbon dioxide buildup to a minimum.  
• Liter flow: Depends on valve being used.  
• \( \text{FIO}_2 \): 24% to 60%, depending on color-coded valve used. | • Advantages:  
  - Precise percentages of oxygen can be delivered to individualize therapy to meet specific patient’s needs, particularly those with an obstructive respiratory disease.  
• Disadvantages:  
  - Some patients feel claustrophobic.  
  - Color codes of valves may differ among manufacturers. | • Connect the color-coded valve consistent with the \( \text{FIO}_2 \), ordered by the primary health-care provider.  
• Set the oxygen flow rate indicated on the color-coded plastic valve. |
| Face tent          | • Delivers oxygen to the nose and mouth via a clear mask that fits under the chin and is open on the top.  
• Liter flow: 8 to 12 L/minute.  
• \( \text{FIO}_2 \): 30% to 55%. | • Advantages:  
  - Most patients do not feel claustrophobic.  
  - High levels of humidity can be used.  
• Disadvantages:  
  - Exact levels of oxygen cannot be delivered. | • Monitor pulse oximetry routinely because the percentage of oxygen delivered is not precise. |

### Table 19.7 Types of Artificial Airways

<table>
<thead>
<tr>
<th>Type of Tube</th>
<th>Nursing Care</th>
<th>Illustration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oropharyngeal</td>
<td>- Begin insertion with the inner curve of the device facing the nose (a).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Rotate the device 180° when the airway reaches the posterior wall of the pharynx (b).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Do not tape the airway in place.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Remove the device as soon as the patient's gag reflex returns.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Used only for patients who are unconscious (often postoperative patients immediately after surgery) because it can precipitate gagging, vomiting, and laryngospasm in conscious patients.</td>
<td></td>
</tr>
</tbody>
</table>

| Nasopharyngeal        | - Advance the airway along the floor of the nostril to the posterior pharynx; the outer flange should rest just outside the nostril and the distal tip of the tube in the posterior pharynx, which can be visualized by depressing the patient's tongue with a tongue blade and inspecting the posterior pharynx. |              |
|                       | - Feel for the passage of air at the outer flange.                          |              |
|                       | - Auscultate for bilateral breath sounds.                                   |              |
|                       | - Remove the tube every 8 hours to assess for mucus membrane irritation and to clean the tube. |              |
|                       | - Flexible tube that extends from the nares to the pharynx.                |              |
|                       | - Provides an avenue for air to enter and exit the lungs.                  |              |
|                       | - Used for patients who are semiconscious and at risk for airway obstruction. |              |
|                       | - Does not stimulate gagging.                                              |              |

| Tracheostomy          | - Insertion of a tube into the trachea through an incision in the neck.     |              |
|                       | - Provides an airway to bypass an upper airway obstruction.                 |              |
|                       | - May be temporary or permanent.                                            |              |
|                       | - Has three parts: Outer cannula (with or without an inflatable cuff); obturator that fills the blunt end of the outer cannula to promote ease of insertion into the tracheostomy; and inner cannula (disposable or can be cleaned). |              |
|                       | - Cuff on an outer cannula is inflated to prevent aspiration of fluids or prevent an air leak if the patient is receiving mechanical ventilation "pillow" expands when cuff is inflated. |              |

| Tracheostomy Care     | - Maintain the outer cannula in place with twill ties or Velcro tracheostomy tube holders. |              |
|                       | - Record the type and size of the tracheostomy tube.                       |              |

| Tracheostomy Tube     | - Provide tracheostomy care routinely, at least every 8 hours.             |              |
|                       | - Don clean gloves and remove the dressing under tracheostomy tube and the inner cannula. |              |
|                       | - Don sterile gloves and replace the inner cannula with a new inner cannula if disposable OR remove the inner cannula and clean with ½ hydrogen peroxide and ½ normal saline solution, rinse with normal saline, and dry the internal lumen with pipe cleaners. |              |
|                       | - Clean around the stoma with normal saline solution using a cotton-tipped applicator; clean the faceplate of the tracheostomy tube with 4 x 4 gauze dampened with normal saline solution. |              |
|                       | - Replace the twill ties every 24 hours; do not remove old ties until the new ties are in place. |              |
|                       | - If the tracheal stoma is permanent, teach the patient to perform self-care, to wear a stoma bib to protect the tracheal opening from debris and warm air, to avoid water-related activities, and to wear a tracheal shield when showering. |              |

| Endotracheal          | - Insertion of tube into the trachea through the mouth or nose (intubation). |              |
|                       | - Provides airway for mechanical ventilation.                               |              |
|                       | - Has an inflatable cuff to provide a seal to prevent an air leak.           |              |
|                       | - Maintain cuff inflation with minimal occlusive volume to prevent necrosis of the mucous membranes. |              |
|                       | - Inflate the cuff with the volume of air recommended by the manufacturer; cuff pressure usually is 20 to 25 mm Hg. |              |
|                       | - Place the stethoscope over the carotid pulse.                            |              |
|                       | - Reinflatable 1 mL of air back into the cuff.                              |              |
|                       | - Assess placement of the tube.                                             |              |
|                       | - Assess for symmetrical chest movements.                                   |              |
|                       | - Auscultate the bilateral lung fields to ensure the tube has not slipped into the right main bronchus. |              |

## Table 19.8 Medications That Affect the Respiratory System

<table>
<thead>
<tr>
<th>Mechanism of Action</th>
<th>Examples</th>
<th>Nontherapeutic Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bronchodilators</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sympathomimetics (beta-adrenergic agonists)</td>
<td>• albuterol (Proventil)</td>
<td>• Tachycardia</td>
</tr>
<tr>
<td>• Stimulate beta receptors to dilate bronchioles.</td>
<td>• metaproterenol</td>
<td>• Tremors</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Anxiety</td>
</tr>
<tr>
<td>Xanthines</td>
<td>• aminophylline</td>
<td>• Tachycardia</td>
</tr>
<tr>
<td>• Relax bronchial smooth muscle.</td>
<td>• theophylline</td>
<td>• Tremors</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Anxiety</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Nausea and vomiting</td>
</tr>
<tr>
<td><strong>Anticholinergics</strong></td>
<td>• ipratropium (Atrovent)</td>
<td>• Dizziness</td>
</tr>
<tr>
<td>• Decrease action of acetylcholine receptors in</td>
<td>• tiotropium (Spiriva)</td>
<td>• Headache</td>
</tr>
<tr>
<td>bronchial smooth muscle.</td>
<td></td>
<td>• Palpitations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Nervousness</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Dry mouth</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Blurred vision</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Urinary retention</td>
</tr>
<tr>
<td>Leukotriene receptor antagonists</td>
<td>• montelukast (Singulair)</td>
<td>• Headache</td>
</tr>
<tr>
<td>• Inhibit leukotriene synthesis or activity.</td>
<td>• zafirlukast (Accolate)</td>
<td>• Weakness</td>
</tr>
<tr>
<td>• Minimize inflammation and edema.</td>
<td>• zileuton (Zyflo)</td>
<td>• Nausea and vomiting</td>
</tr>
<tr>
<td><strong>Inhaled and nasal route steroids</strong></td>
<td>• budesonide (Pulmicort)</td>
<td></td>
</tr>
<tr>
<td>• Decrease inflammatory response and edema.</td>
<td>• fluticasone (Flonase)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• triamcinolone acetonide (Azmacort)</td>
<td></td>
</tr>
<tr>
<td><strong>Mast cell stabilizers</strong></td>
<td>• cromolyn sodium (Intal)</td>
<td><strong>Uncommon but may include:</strong></td>
</tr>
<tr>
<td>• Stabilize mast cells to decrease histamine</td>
<td>• nedocromil (Tilade)</td>
<td>• Hoarseness</td>
</tr>
<tr>
<td>release.</td>
<td></td>
<td>• Nausea</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Dry, irritated throat</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Coughing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Bad taste in mouth</td>
</tr>
<tr>
<td><strong>Combination agents</strong></td>
<td>• albuterol and ipratropium (Combivent)</td>
<td></td>
</tr>
<tr>
<td>• Depends on individual action of agents.</td>
<td>• budesonide and formoterol (Symbicort)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• fluticasone and salmeterol (Advair)</td>
<td></td>
</tr>
<tr>
<td><strong>Expectorants</strong></td>
<td>• guaifenesin (Mucinex, Robitussin)</td>
<td><strong>Uncommon but may include:</strong></td>
</tr>
<tr>
<td>• Increase volume and decrease viscosity of</td>
<td></td>
<td>• Nausea and vomiting</td>
</tr>
<tr>
<td>respiratory secretions in trachea and bronchi.</td>
<td></td>
<td>• Headache</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Sore throat</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Upper respiratory infection</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Additional effects depending on individual agents</td>
</tr>
<tr>
<td><strong>Antitussives</strong></td>
<td>• codeine</td>
<td></td>
</tr>
<tr>
<td>• Suppress cough reflex.</td>
<td>• dextromethorphan (DM suffix in cough</td>
<td><strong>Sedation at high doses</strong></td>
</tr>
<tr>
<td></td>
<td>preparations)</td>
<td></td>
</tr>
</tbody>
</table>
A nurse is admitting a 72-year-old obese woman to a medical unit after the patient was stabilized in and transferred from the emergency department. The patient has a history of obstructive airway disease. In addition, she was a smoker (two packs a day for 30 years) but stopped at age 48, had asthma as a child, and was diagnosed with emphysema at age 68. Last month, the patient had an episode of bronchitis. Today, she was exposed to environmental smoke as a result of a house fire in her neighborhood. She tells the admitting nurse, “After breathing the smoke from the fire, I started wheezing, my voice became hoarse, my chest felt tight, and I could barely catch my breath. I used my rescue inhaler several times, but it didn’t help, so I came to the hospital. I feel better since they gave me oxygen, a nebulizer treatment, and medications in the emergency department.” The nurse reviews the patient’s clinical record from the emergency department.

### Vital Signs
- Temperature: 99.6°F orally.
- Respiration: 32 breaths/minute, shallow, labored.
- Pulse: 115 beats/minute.
- Blood pressure: 170/84 mm Hg.

### Primary Health-Care Provider’s Orders
- High-flow humidified oxygen 100% nonrebreather mask.
- Chest x-ray.
- Complete blood count.
- Basic metabolic panel.
- EKG.
- Carboxy hemoglobin level (carbon monoxide level in the blood).
- Support orthopenic/tripod position.
- Dexamethasone (Decadron) 10 mg, IMB, every 8 hours.
- IVF: 0.9% Sodium Chloride 100 mL/hour.
- Albuterol/Atovent nebulized solution 1 unit dose each via nebulizer mask every 4 hours.
- Albuterol nebulized solution 1 unit dose via nebulizer mask every 2 hours, pm for breakthrough wheezing or respiratory distress.

### Assessments on Admission to the Emergency Department
- Oxygen saturation 88%.
- Patient is restless.
- Sitting on the side of the bed, leaning forward, and resting arms on a pillow on the overbed table.
- Circumoral pallor; capillary refill of toenails delayed; 4 seconds.
- Reported shortness of breath and fatigue.
- Subclavicular retractions noted on inspiration.
- Stridor on inspiration.
CASE STUDY: Putting It All Together

Case Study Questions

A. Which assessment noted on the patient’s clinical record from the emergency department should cause the nurse the most concern and why?

B. Identify nine signs and symptoms of impaired respiratory function for which the nurse should assess the patient.
   1.
   2.
   3.
   4.
   5.
   6.
   7.
   8.
   9.

C. Identify five factors that placed this patient at risk for a problem with pulmonary function and explain why.
   1.
   2.
   3.
   4.
   5.

D. Identify at least ten independent nursing actions the nurse should implement when caring for this patient.
   1.
   2.
   3.
   4.
   5.
   6.
   7.
   8.
   9.
   10.
### REVIEW QUESTIONS

1. An unconscious patient has excessive oral secretions. In which position should the nurse place the patient to help prevent aspiration?
   1. Sims’
   2. Supine
   3. Fowler
   4. Contour

2. A nurse is to perform a purified protein derivative (PPD) test on a patient who was exposed to a person with the diagnosis of tuberculosis. What are essential nursing interventions related to this test? Select all that apply.
   1. Encircle the injection site with an indelible pen.
   2. Identify if the patient is taking an immunosuppressant.
   3. Determine if the patient has a previous positive reaction.
   4. Inject the purified protein derivative via an intradermal injection.
   5. Explain that the results must be evaluated within twenty-four hours.

3. A patient is scheduled to have pulmonary function tests. What should the nurse instruct the patient to do before the test?
   1. Avoid smoking for 6 hours before the test.
   2. Take a bronchodilator 1 hour before the test.
   3. Abstain from food for 2 hours before the test.
   4. Drink 8 oz of water immediately before the test.

4. A nurse documents that a patient is experiencing Kussmaul respirations. What observations about the patient’s respirations did the nurse make to come to this conclusion?
   1. More than twenty breaths/minute
   2. Increased rate and depth of respirations
   3. Varying depths of respirations, generally shallow, alternating with periods of apnea
   4. Gradual increase in depth of inhalations, followed by a gradual decrease, and then a period of apnea

5. An older adult patient asks a nurse, "Why am I experiencing more frequent respiratory tract infections now that I am older?" Which information about the aging process should the nurse include in a response to the patient’s question? Select all that apply.
   1. Thoracic and expiratory muscles are weaker.
   2. There is an increase in the cough and laryngeal reflexes.
   3. Vital capacity increases as the residual volume decreases.
   4. The rib cage becomes more rigid due to calcification of costal cartilage.
   5. Decreased mobility associated with aging causes less effective gas exchange.

6. A nurse is caring for a patient with a bacterial infection of the lungs. What type of sputum should the nurse anticipate the patient to expectorate?
   1. Yellow-green
   2. Clear white
   3. Pink frothy
   4. Red rust

7. A nurse is monitoring a patient’s respiratory status. What should the nurse instruct the patient to do when teaching about the use of the device in the photograph?
   1. "Inhale and exhale normally."
   2. "Hold the inhalation for several seconds."
   3. "First fully inflate your lungs before you exhale fully."
   4. "Inhale slowly and as deeply as possible through the mouthpiece."

8. A nurse is caring for a patient who is experiencing a laryngeal spasm. For which clinical indicator should the nurse assess the patient?
   1. Stridor
   2. Wheezes
   3. Crackles
   4. Rhonchi

9. Which independent nursing actions are associated with caring for a patient who is experiencing hypoxemia? Select all that apply.
   1. Elevate the head of the bed.
   2. Attach a pulse oximeter to the patient’s finger.
   3. Remain calm and speak in a normal tone of voice.
   4. Administer oxygen at 4 L/minute via a nonrebreather mask.
   5. Encourage the patient to cough when the patient has secretions.
10. A nurse is caring for a patient requiring continuous pulse oximetry. What should the nurse do when using this monitoring device?
   1. Explain that the test is noninvasive but may cause discomfort.
   2. Dampen the site slightly before applying the sensor.
   3. Ensure that capillary refill is more than 4 seconds.
   4. Change the site of the device every 2 hours.

11. An older adult comes to the clinic reporting shortness of breath and yellow mucus. What factors in the patient’s history may have contributed to this situation? Select all that apply.
   1. ________ Has a body mass index of 35
   2. ________ Smokes 1 pack of cigarettes a day
   3. ________ Drinks 1 glass of wine with dinner
   4. ________ Takes a 2-mile walk every morning
   5. ________ Reports eating a vegetarian diet for the last 3 years

12. A nurse identifies that a patient is experiencing exertional dyspnea. Difficulty breathing in relation to what behavior led the nurse to this conclusion?
   1. Eating
   2. Exercise
   3. Lying down
   4. Leaning forward while sitting

13. A nurse is teaching a patient how to use a vibratory positive expiratory pressure device to facilitate expectoration of respiratory secretions. What should the nurse teach the patient to do to ensure an expected outcome?
   1. Sit in a chair with the chin tilted slightly toward the chest.
   2. Forcefully inhale 50% of a usual breath and hold it for 3 seconds.
   3. Place the mouthpiece in the mouth with the lips firmly around the stem while keeping the cheeks relaxed.
   4. Complete the procedure with 2 additional breaths using the device but fully and exhale forcefully with each breath.

14. When a nurse is performing a physical assessment, the patient reports feeling short of breath. For what signs of dyspnea should the nurse assess the patient? Select all that apply.
   1. ________ Pursed-lip breathing
   2. ________ Supraventricular retractions
   3. ________ Grunting just before exhaling
   4. ________ Oxygen saturation level of 96%
   5. ________ Respiratory rate of 20 breaths per minute

15. A patient who had been in a house fire is experiencing a productive cough. What color should the nurse expect the patient’s sputum to exhibit?
   1. Yellow
   2. White
   3. Black
   4. Red

16. A nurse must obtain a sputum specimen from a patient with an endotracheal tube. Place the following steps in the order in which they should be performed.
   1. Verify the order and wash the hands.
   2. Don a protective eye shield and sterile gloves.
   3. Apply suction when the patient coughs or when meeting resistance.
   4. Lubricate the catheter tip with normal saline and advance it into the endotracheal tube.
   5. Remove the catheter and attach the tubing on the specimen container to the attached adapter.
   Answer: __________

17. A nurse is auscultating a patient’s breath sounds. What action should the nurse employ?
   1. Place the patient in the supine position.
   2. Instruct the patient to breathe in through the nose.
   3. Keep the stethoscope at each site for at least one minute.
   4. Identify the breath sound heard before moving to the next site.

18. When auscultating breath sounds the nurse identifies the presence of stridor. What should the nurse do?
   1. Notify the primary health-care provider immediately.
   2. Plan to reassess the patient in one hour.
   3. Implement oropharyngeal suctioning.
   4. Arrange for an x-ray examination.
19. A patient arrives in the emergency department with portable oxygen at 3 liters/minute via nasal cannula. The nurse in the emergency department obtains the patient’s health history and vital signs and performs a focused physical assessment.

**Patient’s Clinical Record**

**Health History From Spouse**

68-year-old man, lives with wife.
60-year history of asthma, 10-year history of emphysema.
Gave up smoking 3 years ago because of progressive shortness of breath.
For years he has been using oxygen 2 liters/minute via nasal cannula whenever the shortness of breath intensifies.
Patient has had a cold for 5 days and has been using the oxygen without relief.
Wife increased the oxygen to 3 L/minute 6 hours ago.
Patient has been lethargic all day; when he had profuse sweating, the wife brought him to the emergency department.

**Vital Signs**

Temperature: 100.2°F orally.
Pulse: 92 beats/minute, regular.
Respiration: 10 breaths/minute, shallow, regular.
Blood Pressure: 150/88 mm Hg.

**Focused Physical Assessment**

Reports feeling drowsy and dizzy.
Confused and unable to report recent facts concerning his condition.
Exhibiting fine muscle twitching (fasciculations).
Auscultation reveals bilateral rhonchi and wheezes.
Oxygen saturation: 84%.

What should the nurse do first based on this information?
1. Walk the patient from the triage area to a bed.
2. Reduce the oxygen flow rate to 2 liters per minute.
3. Increase the oxygen flow rate to 6 liters per minute.
4. Encourage the patient to perform pursed lip breathing.

20. A nurse is caring for a patient who is to have an oropharyngeal tube in place while recovering from general anesthesia. Which nursing action is associated with this tube?
1. Secure the tube in position by taping it in place.
2. Remove the tube occasionally to assess for irritation of the nose.
3. Begin the tube’s insertion with the inner curve facing the tongue.
4. Rotate the tube 180 degrees when it reaches the end wall of the pharynx.

21. A patient with chronic obstructive pulmonary disease (COPD) who is receiving 2 L/minute of oxygen via nasal cannula has dyspnea and is using accessory muscles of respiration to breathe. The patient’s oxygen saturation is 88 percent. Place the following actions in order that they should be performed beginning with what the nurse should do first.
1. Obtain the patient’s vital signs.
2. Teach the patient pursed-lip breathing.
3. Place the patient in the high-Fowler position.
4. Inform the patient’s primary health-care provider.
5. Monitor the patient’s pulse oximetry level continuously.

Answer: ____________________

22. A patient is admitted to the emergency department after sustaining injuries in an automobile collision. The patient is semiconscious and the nurse is concerned about maintaining the patient’s airway while diagnostic tests are completed. Which should the nurse anticipate will be ordered by the primary health-care provider?
1. Endotracheal tube
2. Tracheostomy tube
3. Oropharyngeal tube
4. Nasopharyngeal tube

23. A primary health-care provider orders 60 percent oxygen for a patient. Which oxygen delivery equipment should the nurse use to administer the oxygen to this patient?
1. Nonrebreather mask
2. Nasal cannula
3. Venturi mask
4. Face tent

24. A nurse must perform nasopharyngeal suctioning. Place the following actions in the order in which they should be performed.
1. Don sterile gloves.
2. Open the suction kit.
3. Lubricate the suction catheter tip.
4. Place the patient in the high-Fowler position.
5. Insert suction catheter into the patient’s nasopharynx.
6. Determine the distance between the patient’s nose and earlobe with the catheter.

Answer: ____________________

25. A primary health-care provider orders oxygen 4 L/minute via nasal cannula. What nursing action is essential?
1. Position the prongs in the patient’s nares so that they curve upward.
2. Secure elastic straps around the patient’s head.
3. Ensure that the oxygen is humidified.
4. Provide oral hygiene every shift.
26. A nurse is caring for a patient receiving intermittent enteral feedings. Which nursing intervention should the nurse implement to reduce the risk of aspiration?
1. Hold the feeding if the residual exceeds the indicated parameter.
2. Keep the head of the bed elevated 30° at all times.
3. Suction the patient before initiating the feeding.
4. Thicken the formula with a thickening solution.

27. A nurse is planning a class for parents about how they can reduce the risk of their toddlers experiencing an airway obstruction. Which information should the nurse include in the program? Select all that apply.
1. _______ Cut hot dogs into small pieces.
2. _______ Do not give toddlers marshmallows.
3. _______ Teach a toddler the universal sign for choking.
4. _______ Ensure that toys are larger than a clenched fist.
5. _______ Store plastic bags where they cannot be reached by small children.

28. A nurse is caring for an adult patient with excessive respiratory secretions. What should the nurse do when suctioning this patient?
1. Set the wall pressure at approximately 60 mm Hg.
2. Evaluate breath sounds after the procedure.
3. Place the patient in a lateral position.
4. Use a sterile 8 French catheter.

29. A nurse is caring for a patient with a history of chronic obstructive pulmonary disease. Which is the most important nursing action when administering oxygen via a nasal cannula to this patient?
1. Assess the ears for irritation due to the oxygen tubing.
2. Hang an “oxygen in use” sign near the patient’s bed.
3. Monitor the patient’s oxygen saturation routinely.
4. Limit oxygen flow rate to 2 L/minute.

30. A primary health-care provider orders 100 percent oxygen for a patient experiencing respiratory difficulty. Which type of oxygen mask should the nurse use when implementing this order?
1. 

2. 

3. 

4.
31. A patient has a respiratory rate of 24 breaths/minute and is having shortness of breath. What should the nurse do first?
   1. Administer 100% oxygen.
   2. Obtain an oxygen saturation level.
   3. Elevate the head of the patient’s bed to a 60-degree angle.
   4. Inform the primary health-care provider of the patient’s status.

32. A nurse is admitting a patient to a unit from the emergency department. The nurse reviews the patient’s clinical record and assesses the patient.

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Patient’s Clinical Record

Vital Signs
Temperature: 104°F rectally.
Pulse: 100 beats/minute and regular.
Respirations: 17 breaths/minute and shallow.
Blood pressure: 138/88 mm Hg.

Transfer Nurse’s Note 10-9-2013 1330
Patient transferred to room via stretcher from the emergency department with side rails raised. Patient in semi-Fowler position. Skin appears flushed and patient is diaphoretic. Patient states that she feels warm, has no pain but is very sleepy. IV in right hand set at ordered rate of 125 mL/hour. IV in left hand is an intravenous lock. Both IVs are dry and intact, no clinical indicators of infiltration or inflammation noted. Patient attempted to void on a bedpan but was unsuccessful. Has not voided since 1030. Oxygen running at 2 L/minute via nasal cannula. Tylenol 650 mg administered at 1000.

Primary Health-Care Provider’s Orders 10-9-2013
1. Bedrest.
2. Regular diet.
3. Vital signs every 4 hours.
4. I&O.
5. Tylenol 650 mg PO every 4 hours pm for temperature 101.2°F.
6. IVF 1000 mL 0.45% NaCl with 20 mEq KCl at 125 mL/hour.
7. Oxygen 2 L via nasal cannula.

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33. A patient has a respiratory rate of 24 with mild labored breathing. The nurse raises the head of the patient’s bed, but the patient’s breathing does not improve. What should be the nurse’s next action?
   1. Perform cupping and clapping on the patient’s back.
   2. Call the patient’s primary health-care provider.
   3. Obtain a pulse oximetry level and vital signs.
   4. Administer one hundred percent oxygen.

34. A nurse is caring for a patient receiving a steroidal nasal spray. For which nontherapeutic effect should the nurse assess the patient?
   1. Dry mouth
   2. Blurred vision
   3. Urinary retention
   4. Oral fungal infection

35. A patient has a respiratory infection and the primary health-care provider prescribes ciprofloxacin (Cipro) 400 mg IVPB every 8 hours. The vial of ciprofloxacin states that there is 50 mg per mL. How many mL should be obtained to prepare the prescribed IVPB? Record your answer using a whole number.
   Answer: __________ mL.

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What concern should be the priority?
1. Urinary retention
2. Respiratory status
3. Increased temperature
4. Potential for dehydration
REVIEW ANSWERS

1. ANSWER: 1.
Rationales:
1. The Sims’ position is the most effective position to prevent aspiration, particularly in an unconscious patient because excessive oral secretions will drain out of the side of the mouth. In addition, this position will be easy to maintain in a patient who is unconscious.
2. The supine position will not aid in the prevention of aspiration because lying on the back will promote the flow of secretions to the back of the oropharynx and trachea.
3. The Fowler position may assist in the prevention of aspiration but will not be as effective another position. In addition, an unconscious patient may have difficulty maintaining the Fowler position.
4. The contour position will have minimal effect in preventing aspiration because the head will not be elevated enough. In addition, an unconscious patient may have difficulty maintaining this position.
TEST-TAKING TIP: Identify the equally plausible options. Options 3 and 4 are equally plausible because both positions elevate the head of the bed and position the body in a sitting position.
Content Area: Oxygenation
Integrated Processes: Nursing Process: Implementation
Client Need: Physiological Integrity; Physiological Adaptation
Cognitive Level: Application

2. ANSWER: 1, 2, 3, 4.
Rationales:
1. This ensures that the appropriate site is evaluated.
2. Immunosuppressants can cause a false-positive result.
3. A severe reaction may occur when the purified protein derivative (PPD) is injected into a patient who had a previous positive reaction; the patient has been immunosensitized.
4. The intradermal route is used for this test. The allergen is injected just below the epidermis where a reaction will be able to be observed.
5. This will result in an inaccurate evaluation. The site of the intradermal injection of PPD should be evaluated within 48 to 72 hours after the PPD is injected.
TEST-TAKING TIP: Identify the clang association. The words purified protein derivative in the stem and in option 4 is a clang association. Examine option 4 carefully because more often than not, an option with a clang association is a correct answer.
Content Area: Oxygenation
Integrated Processes: Nursing Process: Implementation
Client Need: Physiological Integrity; Reduction of Risk Potential
Cognitive Level: Analysis

3. ANSWER: 1.
Rationales:
1. Smoking constricts the bronchi and bronchioles, which will cause inaccurate test results; therefore, the patient should be instructed to avoid smoking for 6 hours before the test.
2. This should be done when advised to do so by the primary health-care provider. Medications that influence the respiratory tract may invalidate test results.
3. It is not necessary to abstain from food for any length of time before the test.
4. It is not necessary to drink fluid before the test.
Content Area: Oxygenation
Integrated Processes: Communication/Documentation;
Nursing Process: Implementation
Client Need: Physiological Integrity; Reduction of Risk Potential
Cognitive Level: Application

4. ANSWER: 2.
Rationales:
1. This is tachypnea. Respirations should be between 12 to 20 breaths/minute, have a regular rhythm, and be unlabored.
2. This is Kussmaul respirations.
3. This is Biot respirations.
4. This is Cheyne-Stokes respirations.
TEST-TAKING TIP: Identify the clang associations. The word respirations in the stem and in options 2 and 3 are clang associations. Examine these options carefully.
Content Area: Oxygenation
Integrated Processes: Communication/Documentation;
Nursing Process: Assessment
Client Need: Physiological Integrity; Reduction of Risk Potential
Cognitive Level: Analysis

5. ANSWER: 1, 4, 5.
Rationales:
1. This is true. There is a loss of muscle tone due to a more sedentary life style and an increase in thoracic rigidity as one ages.
2. The opposite is true. As one ages there is an increase in airway resistance, a loss of muscle tone, and a reduced elastic recoil in the lungs and thoracic muscles, which all contribute to a decrease in the cough and laryngeal reflexes.
3. The opposite is true. As the residual volume increases, the vital capacity decreases with aging.
4. This is true. With less lung expansion, the risk of respiratory infection increases. This is due to insufficient lung inflation and decreased ability to expel foreign or accumulated material.
5. This is true. A more sedentary life style associated with aging causes less effective gas exchange and decreased lung inflation, increasing the risk of respiratory infection.
Content Area: Oxygenation
Integrated Processes: Communication/Documentation;
Nursing Process: Planning
Client Need: Health Promotion and Maintenance
Cognitive Level: Application

6. ANSWER: 1.
Rationales:
1. Yellow-green colored sputum is associated with bacterial infections. It consists of cellular debris, phagocytic cells, and microorganisms.
2. Clear white colored sputum is associated with viral infections.
3. Frothy sputum is associated with fluid in the lung due to pulmonary edema. The pink color is related to blood in the sputum.
4. Red rust colored sputum is associated with the presence of blood (hemoptysis).

**Content Area:** Oxygenation  
**Integrated Processes:** Nursing Process: Analysis  
**Client Need:** Physiological Integrity; Reduction of Risk Potential  
**Cognitive Level:** Application

7. **ANSWER:** 3  
**Rationales:**  
1. This is not the correct way to use this device.  
2. This instruction is associated with a nebulizer treatment, not the device in the photograph. Holding the inhalation for several seconds when using a nebulizer facilitates longer contact of the fine mist of a nebulized drug to be in contact with the alveoli.  
3. This device is used to monitor peak expiratory flow rates. The patient should exhale fully into the peak flowmeter after fully inflating the lungs with a deep breath. It measures in liters per minute the volume of air a person can exhale after fully inflating the lungs.  
4. This instruction is associated with an incentive spirometer, not the device in the photograph. An incentive spirometer promotes deep breathing, stimulates coughing to help remove mucus from the respiratory system, and prevents atelectasis.  

**TEST-TAKING TIP:** Identify the options that are opposites. Options 1 and 3 are opposites. More often than not, an option that is an opposite is the correct answer. Examine these options carefully.

**Content Area:** Oxygenation  
**Integrated Processes:** Teaching/Learning; Nursing Process: Implementation  
**Client Need:** Physiological Integrity; Physiological Adaptation  
**Cognitive Level:** Analysis

8. **ANSWER:** 1  
**Rationales:**  
1. Laryngeal spasm is characterized by stridor, which is a high-pitched crowning sound more prominent during expiration; it is caused by constriction of the larynx.  
2. A wheeze is a high-pitched, musical sound that may be heard more prominently during expiration. It is associated with narrowing of small airways by spasms, inflammatory processes, mucus accumulation, or tumors.  
3. Crackles, also known as rales, are fine, medium, or coarse sounds caused by air bubbling through moisture in the alveoli. It is associated with inflammation due to conditions as pneumonia, bronchitis, hypervolemia due to congestive heart failure, or emphysema.  
4. Rhonchi, also known as a sonorous wheeze, is a loud, coarse, low-pitched sound heard during inspiration and/or expiration. It may be cleared by coughing. It is associated with inflammation due to bronchitis, narrowed airways, alterations in structure or function associated with emphysema, and fibrotic lungs.

**Content Area:** Oxygenation  
**Integrated Processes:** Nursing Process: Implementation  
**Client Need:** Physiological Integrity; Reduction of Risk Potential  
**Cognitive Level:** Application

9. **ANSWER:** 1, 2, 3, 5  
**Rationales:**  
1. Elevating the head of the bed is an independent nursing action. It does not require an order from a primary health-care provider. Raising the head of the bed uses gravity to move abdominal organs away from the diaphragm, facilitating respirations.  
2. This is an independent function of the nurse. The nurse does not need an order from a primary health-care provider to monitor a patient's oxygen saturation level.  
3. These are independent functions of the nurse. Impaired oxygenation is a frightening experience. It is important for the nurse to remain calm and not contribute to the patient's fear and/or anxiety.  
4. The nurse can administer 2 L/minute of oxygen by nasal cannula in an emergency without an order from a primary health-care provider. Other oxygen delivery systems, such as a nonrebreather mask or elevating the oxygen level higher than 2 liters per minute, require an order from a primary health-care provider.  
5. Coughing facilitates expulsion of secretions from the respiratory tract. When secretions are cleared from the respiratory tract, more air can be inhaled into the alveoli and carbon dioxide exhaled.

**Content Area:** Oxygenation  
**Integrated Processes:** Nursing Process: Implementation  
**Client Need:** Physiological Integrity; Physiological Adaptation  
**Cognitive Level:** Application

10. **ANSWER:** 4  
**Rationales:**  
1. A pulse oximetry sensor does not cause discomfort.  
2. The skin should be dry before applying the sensor.  
3. Capillary refill should be less than 3 seconds otherwise the test results will not be able to accurately test oxygen saturation because circulation to the area is compromised.  
4. The sensor site should be changed every 2 hours to prevent tissue necrosis from pressure if monitoring is continuous.  

**TEST-TAKING TIP:** Identify the clang association. The word device in the stem and in option 4 is a clang association. Examine option 4 carefully.

**Content Area:** Oxygenation  
**Integrated Processes:** Nursing Process: Implementation  
**Client Need:** Physiological Integrity; Reduction of Risk Potential  
**Cognitive Level:** Application

11. **ANSWER:** 1, 2  
**Rationales:**  
1. A body mass index more than 30 increases the risk for respiratory problems because abdominal adipose tissue limits chest expansion and gas exchange in the alveoli.  
2. Tobacco smoke contains tars, toxins, and nicotine. Tars and toxins irritate the mucous membranes of the respiratory system making them more vulnerable to disease processes. Nicotine constricts blood vessels, which impairs oxygenation of body tissues.  
3. One glass of wine has been reported to promote cardiopulmonary functioning. Excessive intake of alcohol may depress the respiratory center, resulting in hyperventilation and aspiration.
4. Exercise increases the metabolic rate and functioning of the heart and lungs; these responses condition the body, which promotes adaptation to physical stressors.
5. A vegetarian diet provides all the basic nutrients required for a healthy diet. An imbalance of proteins, carbohydrates, and fats may reduce the immune system and impair cellular functioning.

Content Area: Oxygenation
Integrated Processes: Communication/Documentation; Nursing Process: Assessment
Client Need: Health Promotion and Maintenance
Cognitive Level: Analysis

12. ANSWER: 2.
Rationales:
1. Although a full stomach impedes contraction of the diaphragm and expansion of the thoracic cavity, its relationship to dyspnea is not known as exertional dyspnea.
2. Exercise increases the metabolic rate causing an increase in the heart and respiratory rates. Exertion increases the demand for oxygen; when the body cannot meet the demand for oxygen, difficulty breathing results and is known as exertional dyspnea.
3. Difficulty breathing when lying down necessitating having to sit up to breathe is known as orthopnea.
4. Leaning forward when sitting in an effort to expand the thoracic cavity is a sign of difficulty breathing but is not known as exertional dyspnea; it is known as using the orthopneic or tripod position to facilitate breathing.

TEST-TAKING TIP: Identify the word in the stem that is a clang association. The word exertional in the stem and exercise in option 2 are associated and is an obscure clang association.

Content Area: Oxygenation
Integrated Processes: Nursing Process: Analysis
Client Need: Physiological Integrity; Reduction of Risk Potential
Cognitive Level: Application

Rationales:
1. The patient should sit in a chair with the head slightly tilted upward. This position facilitates movement of gases in and out of the upper airway and pharynx.
2. The patient should slowly, not forcefully, inhale 75 percent, not 50 percent, of a usual breath and then hold the breath for 2 to 3 seconds.
3. Although the lips should be firmly around the stem, the cheeks should be kept still because this allows the airways to vibrate rather than the cheeks during the procedure.
4. This is the correct way to end the procedure. This helps to clear the lower airways once the upper airways are treated.

TEST-TAKING TIP: Identify the clang association. The word device in the stem and in option 4 is a clang association. Examine option 4 carefully.

Content Area: Oxygenation
Integrated Processes: Teaching/Learning; Nursing Process: Implementation
Client Need: Physiological Integrity; Reduction of Risk Potential
Cognitive Level: Application

14. ANSWER: 1, 2, 3.
Rationales:
1. Making the opening to the mouth smaller during exhalation slows the flow of air out of the respiratory tract, which keeps the alveoli open longer for gas exchange and limits the collapse of small air passages that trap air in the respiratory tract.
2. Retractions reflect the use of accessory muscles of respiration, indicating the need for an increased effort to bring air into the respiratory tract.
3. Closing the glottis at the height of inspiration keeps air in the alveoli slightly longer, which promotes gas exchange in the alveolar capillary beds. A grunt results when the glottis opens during exhalation, as air passes through the vocal cords.
4. This value is within expected limits. The expected value for oxygen saturation is 95 to 100 percent.
5. The expected respiratory rate is 12 to 20 breaths/minute; in addition, it should have a regular rhythm and be unlabored.

Content Area: Oxygenation
Integrated Processes: Nursing Process: Assessment
Client Need: Physiological Integrity; Reduction of Risk Potential
Cognitive Level: Application

15. ANSWER: 3.
Rationales:
1. Yellow and yellowish-green sputum are associated with bacterial infections.
2. White sputum most often is associated with viral infections.
3. Black sputum is associated with exposure to a fire because of the inhalation of smoke.
4. Red sputum reflects blood in the sputum (hemoptysis), which is associated with conditions such as pneumococcal pneumonia and pulmonary edema.

Content Area: Oxygenation
Integrated Processes: Nursing Process: Analysis
Client Need: Physiological Integrity; Reduction of Risk Potential
Cognitive Level: Application

16. ANSWER: 1, 2, 4, 3, 5.
Rationales:
1. Dependent functions of the nurse require an order from an individual with a prescriptive license. Washing the hands limits the transmission of microorganisms.
2. A protective eye shield protects the nurse in the event the splashing of body fluids occurs during the procedure. Wearing sterile gloves maintains the sterility of the catheter that is inserted into the patient’s endotracheal tube and the sterility of the specimen.
3. Lubricating the tip of the catheter with normal saline limits friction and trauma to the mucous membranes of the respiratory tract. Inserting the catheter into the endotracheal tube accesses the trachea where sputum can be obtained.
4. The catheter must be advanced to where sputum can be obtained. Coughing mobilizes sputum, facilitating its removal, and resistance indicates that it has reached the carina of the trachea.
5. The catheter should be removed slowly and the tubing secured to seal the specimen in the collection receptacle.
Chapter 19 Oxygenation 603

**Content Area:** Oxygenation
**Integrated Processes:** Nursing Process: Planning
**Client Need:** Physiological Integrity; Reduction of Risk Potential
**Cognitive Level:** Analysis

17. **ANSWER: 4.**

**Rationales:**
1. The patient should be placed in a sitting position so that the anterior and posterior aspects of the chest are accessible for auscultation.
2. The patient should be instructed to breathe in through the mouth; this reduces the friction associated with air passing through the nasal passages and allows a larger volume of air to enter the lungs.
3. This is not necessary and would prolong the assessment that could result in hyperventilation and fatigue.
4. Each site should be assessed long enough to detect the presence of expected and abnormal breath sounds. The characteristics of the sounds, such as pitch and presence of fluid, length of inhalation and exhalation, and appropriateness of the sounds heard at the site, should be assessed.

**TEST-TAKING TIP:** Identify the clang association. The words *breath sounds* in the stem and *breath sound* in option 4 is a clang association.

**Content Area:** Oxygenation
**Integrated Processes:** Nursing Process: Implementation
**Client Need:** Health Promotion and Maintenance
**Cognitive Level:** Application

18. **ANSWER: 1.**

**Rationales:**
1. Stridor is caused by narrowing of the larynx and/or trachea, which may be life threatening. The patient needs immediate medical supervision.
2. This will allow the patient’s condition to get progressively worse; this intervention does not meet the needs of the patient.
3. Suctioning the patient experiencing laryngospasm is contraindicated. The problem is not excessive secretions. Suctioning a patient experiencing stridor may exacerbate the laryngospasm, precipitating total obstruction of the airway.
4. This will delay medical attention, and the delay may compromise the patient’s physical status. Stridor involves narrowing of the larynx, while an x-ray examination focuses on lung tissue.

**TEST-TAKING TIP:** Identify the options that are opposite. Options 1 and 2 are opposite because option 2 delays doing something for one hour and option 1 does something immediately. Look at these options carefully; more often than not, one of the opposite options is the correct answer.

**Content Area:** Oxygenation
**Integrated Processes:** Nursing Process: Implementation
**Client Need:** Physiological Integrity; Physiological Adaptation
**Cognitive Level:** Analysis

19. **ANSWER: 2.**

**Rationales:**
1. Activity will increase the metabolic rate and the demand for oxygen. The patient should be transferred via a wheelchair. Sitting in a wheelchair promotes thoracic expansion because the diaphragm can expand downward without the abdominal organs compressing against the diaphragm. When transferred to a bed the patient should be maintained in the high-Fowler position.
2. The patient probably is experiencing carbon dioxide narcosis (CO₂ narcosis). Because a person with emphysema has chronically increased carbon dioxide levels (the usual stimulus to breathe in a healthy person), a person with emphysema responds to decreased oxygen levels as the stimulus to breathe. Therefore, the stimulus to breathe decreases when excessive oxygen is administered to a person with emphysema. In addition, with an increase in exogenous oxygen, there is an increase in the degree to which diseased alveoli are perfused with blood relative to other less diseased alveoli, resulting in a larger fraction of blood passing through parts of the lung that are poorly ventilated, which results in retained carbon dioxide. The primary health-care provider should be notified immediately because arterial blood gases may be drawn and the oxygen level lowered even more until the problem is corrected.
3. Administering additional oxygen is contraindicated. This will further complicate this patient’s problem.
4. Although this should eventually be done, it is not the primary nursing intervention. Exhaling through the mouth with the lips positioned to create a small opening to prolong exhalation (pursed-lip breathing) keeps the alveoli open longer for gas exchange and more efficient exhalation of trapped air.

**TEST-TAKING TIP:** Identify the word in the stem that sets a priority. The word *first* in the stem sets a priority. Identify the options with a clang association. The word *first* in the stem and in options 2 and 3 are clang associations. Identify the options that are opposites. Options 2 and 3 are opposites. Consider these options carefully. Often times, one of the opposite options is the correct answer.

**Content Area:** Oxygenation
**Integrated Processes:** Nursing Process: Implementation
**Client Need:** Physiological Integrity; Physiological Adaptation
**Cognitive Level:** Analysis

20. **ANSWER: 4.**

**Rationales:**
1. An oropharyngeal tube should not be taped in place. As the gag reflex returns, the patient will attempt to spit out the tube. If it is taped in place and the gag reflex returns, it may cause retching, laryngospasm, vomiting, and aspiration.
2. An oropharyngeal tube is positioned in the mouth, not the nose. A nasopharyngeal tube is inserted in the nose and extends from the nares to the pharynx. A nasopharyngeal tube is used for patients who are semiconscious and are at risk for airway obstruction because it does not stimulate gagging and vomiting.
3. The tube should initially be inserted with the inner curve of the device facing the nose, not the tongue. This
avoids potential occlusion of the airway. If the curve is facing the tongue, it could push the tongue to the rear of the mouth, occluding the airway.

4. The tube should be rotated from the curve facing the nose 180 degrees into place with the curve facing the tongue.

**TEST-TAKING TIP:** Identify the unique option. Option 4 is unique. It is the only option with a number.

**Content Area:** Oxygenation

**Integrated Processes:** Nursing Process: Implementation

**Client Need:** Physiological Integrity; Physiological Adaptation

**Cognitive Level:** Application

**ANSWER:** 3, 1, 2, 4, 5.

**Rationales:**
3. Placing a patient in the high-Fowler position will lower the abdominal viscera, thus allowing the lungs to expand more effectively. Relieving distress is the priority.

1. Obtaining the patient’s vital signs is important but should be performed after implementing an intervention that may relieve the patient’s current distress.

2. Teaching the patient pursed-lip breathing will help the patient exhale more slowly, which will keep the alveoli expanded and prevent collapse of the bronchioles. This is done after an initial intervention to relieve the distress and collect more data. Teaching the patient pursed-lip breathing may take a little time.

4. The patient is the priority. Informing the patient’s health-care provider about the patient’s status will be necessary after attempts to alleviate the patient’s distress are instituted first.

5. The nurse already knows that the patient’s oxygen saturation is 88 percent. After performing essential nursing interventions to improve the patient’s physical status, the nurse should continue to monitor the patient’s oxygen saturation level. This will provide data about the patient’s response to care or identify a progressive deterioration of the patient’s respiratory status.

**Content Area:** Oxygenation

**Integrated Processes:** Nursing Process: Planning

**Client Need:** Physiological Integrity; Physiological Adaptation

**Cognitive Level:** Application

**ANSWER:** 4.

**Rationales:**
1. This tube is inappropriate in this situation. An endotracheal tube has an inflatable cuff to provide a seal, preventing an air leak when a patient is receiving mechanical ventilation.

2. This tube is inappropriate in this situation. A tracheostomy tube is used for a patient with an upper airway obstruction. This tube is surgically inserted and circumvents an obstruction. It can be temporary or permanent.

3. An oropharyngeal tube is contraindicated for a semi-conscious patient because it may stimulate gagging, laryngospasm, vomiting, and aspiration.

4. This is the most appropriate tube for the patient in this situation. It maintains the airway without stimulating a gag reflex.

**Content Area:** Oxygenation

**Integrated Processes:** Nursing Process: Planning

**Client Need:** Physiological Integrity; Physiological Adaptation

**Cognitive Level:** Application

**ANSWER:** 3.

**Rationales:**
1. The curved prongs should be positioned in the nose with the curve facing downward. This follows the natural curve of the internal pathway of the nose.
2. A nasal cannula oxygen delivery system does not include elastic straps. The tubing of a nasal cannula is wrapped around the ears and the slider is positioned under the chin.
3. An oxygen flow rate higher than 3 L/minute can dry the mucous membranes. Humidification of oxygen helps minimize drying of the mucous membranes.
4. Oral care should be provided every 4 hours because oxygen therapy can dry mucous membranes.

**TEST-TAKING TIP:** Identify the word in the stem that sets a priority. The word essential in the stem sets a priority. Identify the slang association. The word oxygen in the stem and in option 3 is a slang association.

**Content Area:** Oxygenation  
**Integrated Processes:** Nursing Process: Implementation  
**Client Need:** Physiological Integrity; Physiological Adaptation  
**Cognitive Level:** Application

28. **ANSWER:** 2.

**Rationale:**
1. Wall suction pressure should be set between 100 and 150 mm Hg for adults, and 100 and 120 mm Hg for children, and 50 and 95 mm Hg for infants.
2. The nurse should assess breath sounds after suctioning to ensure that the patient’s airway is patent. In addition, pulse oximetry should be assessed before and after suctioning because it is objective data that reflects arterial blood oxygen saturation. After suctioning, a patient’s oxygen saturation level should increase.
3. A patient should be positioned in a semi- or high-Fowler position when being suctioned. These positions use gravity to move abdominal organs away from the thoracic cavity, facilitating lung expansion.
4. A 12 to 18 French catheter is used when suctioning an adult. An 8 to 10 French catheter is used when suctioning a child and a 5 to 8 French catheter is used when suctioning an infant. The higher the catheter gauge, the larger the lumen.

**TEST-TAKING TIP:** Identify the unique option. Option 2 is unique because it is the only option that involves the evaluation step of the nursing process. Options 1, 2, and 4 all involve interventions associated with suctioning.

**Content Area:** Oxygenation  
**Integrated Processes:** Nursing Process: Implementation  
**Client Need:** Physiological Integrity; Physiological Adaptation  
**Cognitive Level:** Application

29. **ANSWER:** 4.

**Rationale:**
1. Although this should be done, it is not the priority.
2. Although hanging an “oxygen in use” sign is important, it is not the priority.
3. Although this may be done, it is not a reliable indicator for patients with chronic obstruction pulmonary disease or impaired peripheral circulation. The nurse should assess for signs of carbon dioxide narcosis, such as mental confusion and lethargy.
4. Do not exceed 2 L/minute for patients with chronic obstructive lung disease because their bodies have become accustomed to increased carbon dioxide levels and their stimulus to breathe is a low oxygen level; assess for signs of carbon dioxide narcosis, such as mental confusion and lethargy.

**TEST-TAKING TIP:** Identify the word in the stem that sets a priority. The word most in the stem sets a priority.

**Content Area:** Oxygenation  
**Integrated Processes:** Nursing Process: Implementation  
**Client Need:** Physiological Integrity; Physiological Adaptation  
**Cognitive Level:** Application
30. ANSWER: 2.

Rationales:
1. This mask will not deliver 100 percent oxygen. This is a simple face mask that is set at 5 to 10 L of oxygen and delivers 40 to 60 percent oxygen.
2. This is a nonrebreather mask that is used to deliver 100 percent oxygen. It has one or two side vents that open only when the patient exhales and remains closed on inspiration. This mask prevents mixing of room air with oxygen and does not allow entry of exhaled air. It can deliver 70 to 100 percent oxygen.
3. This mask will not deliver 100 percent oxygen. This is a Venturi mask. This mask allows for an exact mixing of room air and oxygen so that a specific amount of oxygen is delivered. Valves and oxygen flow rates are used to control the specific percentage of oxygen to be delivered.
4. This mask will not deliver 100 percent oxygen. This is a face tent. It does not deliver an exact amount of oxygen because the top is open; however, it does allow for delivery of high amounts of humidity. Because a face tent does not deliver precise amounts of oxygen, it is essential that the patient’s oxygen saturation be assessed.

Content Area: Oxygenation
Integrated Processes: Nursing Process: Implementation
Client Need: Physiological Integrity; Physiological Adaptation
Cognitive Level: Analysis

31. ANSWER: 3.

Rationales:
1. Although oxygen may be needed, it is premature to administer oxygen without obtaining more data. In addition, administering oxygen will need a health-care provider’s order unless it is an emergency situation.
2. Obtaining a pulse oximetry level will provide useful data, but it will not assist in alleviating the patient’s symptoms.
3. Elevating the head of the bed should be the first intervention because it is the least invasive, does not require a health-care provider’s order, and may alleviate the problem. Raising the head of the bed allows the abdominal organs to drop by gravity, facilitating expansion of the thoracic cavity during inhalation.
4. Notifying the patient’s primary health-care provider may be necessary, but it is premature if done before additional data are collected and other interventions are attempted to alleviate the problem.

TEST-TAKING TIP: Identify the word in the stem that sets a priority. The word first in the stem sets a priority.

Content Area: Oxygenation
Integrated Processes: Nursing Process: Implementation
Client Need: Physiological Integrity; Physiological Adaptation
Cognitive Level: Application

32. ANSWER: 2.

Rationales:
1. Although the patient has not voided in 4 hours and 15 minutes and should be encouraged to void, it is not as serious a concern as another option at this time. If the patient has not voided in 8 hours, the patient’s primary health-care provider should be informed.
2. Respirations of 17 shallow breaths per minute are a concern. One would expect the respiratory rate to be higher in light of the elevated temperature and concurrent increase in the basal metabolic rate. Also, the patient currently is receiving 2 L per minute of oxygen that obviously is ineffective in improving the patient’s respiratory status.
3. Although the temperature is high, the patient was administered Tylenol 650 mg at 1300. Also, the patient may be in the defervescent phase of fever abatement, as indicated by the clinical indicators of flushed appearance, diaphoresis, and reports of feeling warm.
4. Although the patient may have been dehydrated on admission to the emergency department, the patient has been receiving 125 mL per hour of fluid for the past several hours and will continue to receive IV fluid until discontinued by the primary health-care provider.

TEST-TAKING TIP: Identify the word in the stem that sets a priority. The word priority in the stem sets a priority.

Content Area: Oxygenation
Integrated Processes: Nursing Process: Analysis
Client Need: Physiological Integrity; Reduction of Risk Potential
Cognitive Level: Analysis

33. ANSWER: 3.

Rationales:
1. Cupping and clapping are unnecessary. There is no indication that the patient is having difficulty mobilizing respiratory secretions.
2. Calling the patient’s primary health-care provider at this time is premature. More information is needed regarding the patient’s status.
3. Vital signs, including oxygen saturation, are essential pieces of data that should be obtained to provide a better understanding of the patient’s cardiorespiratory status. This information will direct future interventions.
4. Administering oxygen may be needed, but it is premature without gathering more information about the patient’s status.

TEST-TAKING TIP: Identify the word in the stem that sets a priority. The word next in the stem sets a priority.

Content Area: Oxygenation
Integrated Processes: Nursing Process: Implementation
Client Need: Physiological Integrity; Physiological Adaptation
Cognitive Level: Application

34. ANSWER: 4.

Rationales:
1. Dry mouth is associated with an anticholinergic bronchodilator.
2. Blurred vision is associated with an anticholinergic bronchodilator.
3. Urinary retention is associated with an anticholinergic bronchodilator.
4. Steroidal nasal sprays can depress the immune system, which can lead to an oropharyngeal fungal infection.

Content Area: Oxygenation
Integrated Processes: Nursing Process: Implementation
Client Need: Physiological Integrity; Pharmacological and Parenteral Therapies
Cognitive Level: Application
35. **ANSWER: 8.**

**Rationale:**
Solve the problem using ratio and proportion.

\[
\frac{\text{Desire} \ 400 \ mg}{\text{Have} \ 50 \ mg} = \frac{x \ mL}{1 \ mL}
\]

\[
50x = 400 \times 1
\]

\[
50x = 400
\]

\[
x = \frac{400}{50}
\]

\[
x = 8 \ mL
\]

**Content Area:** Medication Administration

**Integrated Processes:** Nursing Process: Planning

**Client Need:** Physiological Integrity; Pharmacological and Parenteral Therapies

**Cognitive Level:** Application