

MULTIPLE CHOICE

1. Which of the following structures is responsible for substantially increasing the surface area of the nasal cavity?
- Nasal septum
 - Nares
 - Turbinates
 - Nasal fossae

ANS: C

The convoluted design of the turbinates greatly increases the surface area of the nasal cavity.

DIF: Recall REF: 4

2. What type of epithelium covers the posterior two-thirds of the nasal mucosa?
- Squamous
 - Squamous, nonciliated
 - Pseudostratified, ciliated columnar
 - Pseudostratified, ciliated columnar with mucus-secreting glands

ANS: D

Squamous, nonciliated epithelium lines the anterior third of the nose; pseudostratified, ciliated columnar epithelium interspersed with many mucus-secreting glands covers the posterior two-thirds, including the turbinates. This mucus-secreting epithelium is called the respiratory mucosa.

DIF: Recall REF: 4

3. Which of the following are the main functions of the nose?
- Humidification
 - Heating
 - Filtering
 - Immunity
- I, II
 - III, IV
 - I, II, III
 - I, II, III, IV

ANS: C

The main functions of the nose are the humidification, heating, and filtering of inspired air.

DIF: Recall REF: 4

4. What size particles do not gain entry to the lower airways due to the filtering capacity of the nose?
- >2 μm
 - >3 μm
 - >4 μm
 - >5 μm

ANS: D

The nose is so efficient as a filter that most particles larger than 5 μm in diameter do not gain entry to the lower airways.

DIF: Recall REF: 5

5. When an endotracheal tube is introduced to a patient requiring mechanical ventilation, which of the following functions of the nose is lost?
- Air-conditioning
 - Antibacterial
 - Antiinflammatory
 - Bactericidal

ANS: A

The process of intubation involves the insertion of an artificial airway, or endotracheal tube through the nose or mouth and into the trachea (Figure 1-4), which means the air-conditioning function of the nose is lost, and unmodified cool, dry gas directly enters the trachea. This places a heavy burden on the tracheal mucosa, which is not designed to accommodate cool, dry gases.

DIF: Application REF: 5

6. Which of the following are lymphoid tissues present in the pharynx?

- I. Adenoid tonsils
- II. Nasal tonsils
- III. Palatine tonsils
- IV. Lingual tonsils
- a. I, II
- b. III, IV
- c. I, II, III
- d. I, III, IV

ANS: D

These tissues include the pharyngeal (adenoid), palatine, and lingual tonsils (see Figure 1-3).

DIF: Recall REF: 5

7. Routine evaluation of the ventilator circuit on a patient in the ICU reveals that there are no water droplets condensed on the inner surface of the ventilator's inspiratory tube and that secretions in the endotracheal tube are thick and difficult to remove when suction is applied. The best therapy to resolve this situation is:

- a. Supply artificial heat and humidity
- b. Extubate the patient
- c. Increase water intake to the patient
- d. Change the ventilator circuit

ANS: A

Bypassing the upper airway in this manner would introduce cool, dry gas directly into the lower trachea unless heat and artificial humidity are supplied to the endotracheal tube.

DIF: Analysis REF: 6

8. What are considered the goals of humidification in mechanical ventilation regarding temperature and relative humidity (RH)?

- a. 35°C to 37°C and 100% RH
- b. 35°C to 37°C and 80% RH
- c. 32°C to 34°C and 80% RH
- d. 32°C to 34°C and 100% RH

ANS: D

The goal of humidification in mechanical ventilation is to duplicate the heat and humidity conditions that would normally exist at this point in the nonintubated trachea: approximately 32°C to 34°C and 100% relative humidity.

DIF: Recall REF: 6

9. Which of the following pairs of reflexes is responsible for preventing aspiration of foreign material into the lungs?

- a. Laryngeal and pharyngeal
- b. Laryngeal and carinal
- c. Pharyngeal and carinal
- d. Laryngeal and vocal cord

ANS: A

Deeply unconscious persons sometimes lose the pharyngeal and laryngeal reflexes and aspirate foreign material into their lungs.

DIF: Recall REF: 6

10. After a tracheal tube is in place, which action will form a seal between the tracheal wall and tube to minimize aspiration of pharyngeal contents?

- a. The tip of the tube is placed against the carina.
- b. The tip of the tube is wedged into the right mainstem bronchus.
- c. The cuff is inflated.
- d. No action is required.

ANS: C

Once it is in place, the cuff is inflated to form a seal between the tracheal wall and tube to minimize aspiration of pharyngeal contents.

DIF: Application REF: 6

11. Even if the endotracheal cuff is properly inflated, pharyngeal secretions will eventually migrate past the cuff into the lower airway. This event could make mechanically ventilated patients susceptible to the development of which of the following disorders?

- a. Asthma
- b. Ventilator-associated pneumonia
- c. Bronchitis
- d. Tracheitis

ANS: B

However, even if the cuff is properly inflated, pharyngeal secretions eventually migrate past the cuff into the lower airway. For this reason, mechanically ventilated patients, in whom endotracheal intubation is required, are susceptible to the development of lung infections, or so-called ventilator-associated pneumonia (VAP).

DIF: Application REF: 6

12. In a deeply unconscious patient, what is the most common threat to upper airway patency?

- a. Cervical spine movement
- b. Bulbar paralysis
- c. Neural compromise
- d. Soft tissue obstruction

ANS: D

Deep unconsciousness may relax pharyngeal muscles enough to allow the base of the tongue to rest against the posterior wall of the pharynx, occluding the upper airway; this is called soft tissue obstruction and is the most common threat to upper airway patency.

DIF: Application REF: 6

13. A 15-year-old patient is brought to the emergency room with severe respiratory distress after aspirating a coin. Which of the following signs is the most suggestive of complete airway obstruction?

- a. Low-pitched snoring sound
- b. Inspiratory effort without sound or air movement
- c. Increased work of breathing
- d. Suprasternal retractions

ANS: B

Partial upper airway obstruction produces a low-pitched snoring sound as inspired air vibrates the base of the tongue against the posterior wall of the pharynx. Complete obstruction causes strong inspiratory efforts without sound or air movement. Soft tissues between the ribs and above the sternum may be sucked inward (intercostal and suprasternal retractions) as the person struggles to inhale.

DIF: Application REF: 6

14. Which of the following maneuvers best describes the sniffing position?

- a. Extending neck and extending jaw
- b. Extending neck and applying pressure on the forehead
- c. Extending neck and pulling chin
- d. Pulling chin and flexing neck

ANS: C

Both forms of soft tissue upper airway obstruction can be easily eliminated by extending the neck and pulling the chin anteriorly (see Figure 1-5, C). This maneuver pulls the tongue forward out of the airway and aligns the oral and nasal cavities with the pharynx-larynx axis. This is sometimes called the sniffing position.

DIF: Recall REF: 6 | 7

15. Which of the following structures is an important landmark during the insertion of a tube into the trachea?

- a. Thyroid cartilage
- b. Cricoid membrane
- c. Vallecula
- d. Oropharynx

ANS: C

The vallecula is an important landmark during the insertion of a tube into the trachea (intubation).

DIF: Recall REF: 7

16. Individuals with obstructive sleep apnea typically have which of the following characteristics?

- I. Snoring
 - II. Obesity
 - III. Narrow neck
 - IV. Daytime sleepiness
- a. I, II, III, IV
 - b. I, II, III
 - c. I, II, IV
 - d. I, III, IV

ANS: C

Most people with OSA are obese, snore loudly during sleep, and complain of daytime sleepiness and fatigue.

DIF: Recall REF: 8

17. What is the most efficacious treatment for patients with obstructive sleep apnea?

- a. Tongue resection
- b. CPAP
- c. Cervical collar
- d. Sleep induction medicine

ANS: B

The most efficacious treatment of OSA is the application of continuous positive airway pressure (CPAP), in which a device blows air under pressure into the nostrils; this acts as an “air splint” that holds the pharyngeal airway open.

DIF: Recall REF: 8

18. Inflammation of which of the following anatomic structures is considered a life-threatening condition?

- a. Vocal cords
- b. Cricoid ring
- c. Vallecula
- d. Epiglottis

ANS: D

Inflammation of the epiglottis (epiglottitis) is a life-threatening emergency in infants and requires immediate placement of an artificial airway by skilled medical personnel.

DIF: Application REF: 8

19. What is the narrowest portion of the airway in the infant?

- a. Vocal cords
- b. Cricoid ring
- c. Vallecula
- d. Epiglottis

ANS: B

The cricoid ring is the narrowest portion of the upper airway in the infant.

DIF: Recall REF: 8

20. In cases when an emergency airway opening is required, where should the incision be made?

- a. Cricothyroid membrane
- b. 1 to 3 cm below the cricoid cartilage
- c. Carina
- d. Corniculate cartilage

ANS: A

The membranous space between the thyroid and cricoid cartilages, the cricothyroid membrane (see Figure 1-6), is sometimes the puncture site for an emergency airway opening when structures above it are occluded. A longer-term surgical opening into the airway (tracheostomy) is generally located 1 to 3 cm below the cricoid cartilage.

DIF: Recall REF: 8

21. What is the narrowest space of the airway that an endotracheal tube will go through in the adult larynx?

- a. Epiglottis
- b. Cricoid ring
- c. Vallecula
- d. Glottis

ANS: D

The glottis is the narrowest part of the adult larynx.

DIF: Recall REF: 9

22. What sound is associated with high-velocity air flowing through a narrowed glottis?

- a. Crackle
- b. Stridor
- c. Grunting
- d. Wheeze

ANS: B

During inspiration, croup causes a characteristic high-pitched crowing sound called stridor. This sound is created by high-velocity air flowing through a narrowed glottis.

DIF: Recall REF: 9

23. A lateral soft tissue x-ray of the neck of a 5-year-old with respiratory distress reveals the classic “thumb sign.” What is the most probable diagnosis?

- a. Croup
- b. Epiglottitis
- c. Laryngitis
- d. Asthma

ANS: B

A lateral soft tissue x-ray of his neck shows that the epiglottis at the base of the tongue is extremely large and balloon shaped, the classic “thumb sign” characteristic of epiglottitis.

DIF: Recall REF: 9

24. Which of the following mechanisms explains why drowning victims often have little water in their lungs?
- Bronchospasm
 - Vasospasm
 - Laryngospasm
 - Glossospasm

ANS: C

The laryngeal reflex, which has sensory and motor components in the vagus nerve, causes the vocal cords inside the larynx to close the tracheal opening (laryngospasm). Laryngospasm occurs if anything except air enters the trachea. Drowning victims often have little water in their lungs because of laryngospasm.

DIF: Application REF: 10

25. Which of the following are characteristics of the trachea?
- It begins at the level of the eighth cervical vertebra.
 - The point of division is called the carina.
 - It is approximately 11 cm long.
 - It ends at the level of the fifth thoracic vertebra.
- I, II
 - II, III, IV
 - I, II, III
 - III, IV

ANS: B

The trachea begins at the level of the sixth cervical vertebra and in the adult extends for approximately 11 cm to the fifth thoracic vertebra. There it divides into the right and left mainstem bronchi, one for each lung (Figure 1-9). The point of division is called the carina. Inspired air becomes 100% saturated with water vapor and is warmed to body temperature (37°C) after it passes through two or three airway subdivisions below the carina.

DIF: Recall REF: 10

26. If an endotracheal tube is inserted too far in the process of intubation, listening to the lungs will reveal:
- Diminished breath sounds on the right side
 - Diminished breath sounds on the left side
 - Diminished breath sounds on both sides
 - No changes in breath sounds

ANS: B

If an endotracheal tube is inserted too far during the process of intubation, its tip is more likely to enter the right bronchus than the left. If this occurs, the left lung cannot be ventilated, a condition the clinician can detect by using a stethoscope to compare the intensity of breath sounds between the left and right sides of the chest while manually ventilating the lung. Diminished breath sounds on the left side of the chest in this context are associated with right mainstem bronchial intubation.

DIF: Analysis REF: 10

27. Which of the following is the term that describes a volume of gas that is approximately 150 mL in the average adult and does not participate in gas exchange?
- Tidal volume
 - Residual volume
 - Anatomical dead space
 - Shunt

ANS: C

The volume of conducting airway gas must be relatively small so that most of the inhaled breath can contact the gas-exchange membrane. The volume of this gas (including the upper airways) is only approximately 150 mL in the average adult, compared with a total inhaled volume per breath of approximately 500 mL. Because the conducting airways do not participate in gas exchange, they are called the anatomical dead space.

DIF: Recall REF: 12

28. If the delicate balance between mucus water content and airway humidity is affected, which of the following will occur to the mucus sheet?
- It may become dehydrated.
 - It may become thick.
 - It may become immobile.
 - It may become infected.
- II, IV
 - I, II, III
 - II, III
 - I, II, III, IV

ANS: C

If the delicate balance between mucus water content and airway humidity is disrupted, the mucus sheet may become dehydrated, thick, and immobile. Conversely, overhydration causes mucus to become thin and watery, destroying the ciliary propulsive mechanism.

DIF: Application REF: 15

29. If during normal breathing, inspired air reaches only 50% relative humidity at 37°C, what will be the humidity deficit as air passes through the trachea?
- 11 mg of water vapor
 - 22 mg of water vapor
 - 33 mg of water vapor
 - 44 mg of water vapor

ANS: B

During normal quiet breathing, inspired air warms to body temperature (37°C) and achieves 100% relative humidity soon after it passes the bifurcation of the trachea. Under these conditions, each liter of air contains approximately 44 mg of water vapor.

DIF: Analysis REF: 16

30. Which of the following conditions are associated with neutrophilic infiltration of the airways?
- Cystic fibrosis
 - COPD
 - Bronchiectasis
 - Asthma
- I, II, IV
 - I, II, III
 - II, III
 - I, II, III, IV

ANS: A

In people with chronic airway inflammation (related to cystic fibrosis, chronic bronchitis, asthma, emphysema, or cigarette smoking), neutrophils invade the airways and release the powerful proteolytic enzyme neutrophil elastase (NE).

DIF: Recall REF: 20

31. Which group of cells accounts for most of the alveolar surface?
- Type I
 - Type II
 - Type III
 - Macrophages

ANS: A

Type I cells comprise most of the alveolar surface and are extremely flat.

DIF: Recall REF: 20

32. Which group of cells contains the lamellar bodies?
- Type I
 - Type II
 - Type III
 - Macrophages

ANS: B

The lamellar bodies are the source of alveolar surfactant phospholipid, a surface tension-reducing agent essential for keeping the alveoli open.

DIF: Recall REF: 21 | 22

33. Which group contains cells that engulf microorganisms and foreign material in the alveolus?
- Type I
 - Type II
 - Type III
 - Macrophages

ANS: D

The main function of macrophages is to engulf microorganisms and foreign material. The alveolar macrophage is the major lung clearance mechanism distal to the terminal bronchiole.

DIF: Recall REF: 22

34. In the presence of high inspired oxygen concentrations, which substances are believed to produce alveolar injury?
- Antitrypsins
 - Oxygen radicals
 - Surfactants
 - Fibrinogens

ANS: B

Overproduction of toxic O₂ radicals occurs in the presence of high inspired oxygen concentrations, leading to alveolar tissue injury through a condition known as oxygen toxicity.

DIF: Recall REF: 22