A 17-year-old male develops pneumonia, diabetic ketoacidosis, and metabolic acidosis. Respiratory compensation to a metabolic acidosis consists of hyperventilation to lower the arterial PCO2. The cause of the hyperventilation is described by which of the following statements?

H+ stimulates peripheral chemoreceptors.

CO2 produced from the reaction of the acid with bicarbonate stimulates central chemoreceptors.

A decrease in the bicarbonate concentration stimulates ventilation.

H+ stimulates central chemoreceptors.

A 21-year-old woman is admitted to the intensive care unit for an opiate drug overdose that probably has suppressed her central chemoreceptor response to CO2, diminishing the drive for ventilation. Her respiratory rate is diminished at eight breaths per minute. Which of the following is the best course of action for this patient?

Leaving the patient on room air

Administration of oxygen by mask

Administration of benzodiazepine for possible alcohol withdrawal

Placing the patient on a low opiate infusion to prevent opiate withdrawal

A respiratory acidosis that results in an increase in the concentration of hydrogen ion in arterial blood from 40 meq/L (pH 7.4) to 50 meq/L (pH 7.3) would

Stimulate the peripheral chemoreceptors

Decrease the amount of ammonium excreted in the urine

Inhibit the central chemoreceptors

Increase the pH of the urine

Decrease the concentration of HCO3− in arterial blood

The basic respiratory rhythm is generated in the

Dorsal medulla

Apneustic center

Nucleus parabrachialis
Pneumotaxic center

Cerebrum

Peripheral and central chemoreceptors may both contribute to the increased ventilation that occurs as a result of
An increase in arterial carbon dioxide tension
A decrease in arterial oxygen content
A decrease in arterial blood pressure
A decrease in arterial oxygen tension
An increase in arterial pH

Complete transection of the brainstem above the pons would
Prevent any voluntary holding of breath
Result in cessation of all breathing movements
Prevent the central chemoreceptors from exerting any control over ventilation
Prevent the peripheral chemoreceptors from exerting any control over ventilation
Abolish the Hering-Breuer reflex

Which one of the following is the most likely cause of a high arterial PCO2?
Depressed medullary respiratory centers
Increased metabolic activity
Increased alveolar dead space
Alveolar capillary block
Increased alveolar ventilation

During moderate aerobic exercise,
Alveolar ventilation increases
PaO2 increases
PaCO2 decreases
Arterial pH decreases
Blood lactate level increases

The activity of the central chemoreceptors is stimulated by
An increase in the PCO2 of blood flowing through the brain
A decrease in the PO2 of blood flowing through the brain
A decrease in the oxygen content of blood flowing through the brain
A decrease in the metabolic rate of the surrounding brain tissue
An increase in the pH of the CSF

In an acclimatized person at high altitudes, oxygen delivery to the tissues may be adequate at rest because of
An increase in hemoglobin concentration
The presence of an acidosis
A decrease in the number of tissue capillaries
The presence of a normal arterial PO2
The presence of a lower-than-normal arterial PCO2

Which of the following will increase as a result of stimulating parasympathetic nerves to the bronchial smooth muscle?
Resistive work of breathing
Lung compliance
Airway diameter
Elastic work of breathing
Anatomic dead space

Enzymes within the lung are responsible for the activation of
Angiotensin II
Bradykinin
Prostaglandins
Serotonin
Leukotrienes

When a person ascends to a high altitude, alveolar ventilation increases. Alveolar ventilation continues to increase over the next several days because
The pH of the cerebrospinal fluid decreases
The central chemoreceptors become more sensitive to low oxygen tensions
The peripheral chemoreceptors increase their firing rate
The plasma concentration of 2,3-DPG increases
The oxygen-carrying capacity of hemoglobin increases

Hyperventilation in response to a stressful situation leads to
A decrease in the blood flow to the brain
An increase in the activity of the central chemoreceptors
A decrease in pH of the arterial blood
An increase in the resistance of the pulmonary blood vessels
A decrease in the excitability of nerve and muscle cells

A 14-year-old adolescent girl presents with a lump in the neck. Fine needle aspiration biopsy reveals acinic cell carcinoma of the parotid gland. During the parotidectomy, there is compression injury of the glossopharyngeal nerve. As a result, which of the following respiratory reflexes will be impaired?

Carotid body chemoreceptor reflex
Aortic baroreceptor reflex
Hering–Breuer inflation reflex
Irritant airway reflex
Juxta pulmonary capillary (J) receptor reflex

A 68-year-old man with chronic obstructive pulmonary disease (COPD) entered the emergency department complaining of shortness of breath. His respirations were 35 per minute and labored. He had a productive cough and rales were heard over all lung fields. The patient had a rather ashen complexion and his nail beds gave clear evidence of cyanosis. An arterial blood sample was obtained and a chest x-ray was ordered. The patient was then placed on an O2 mask delivering 40% O2. One half hour later, the physician was called to the bedside by the nurse who found the patient unresponsive. The patient’s complexion had changed to a flushed pink with no trace of cyanosis. His respirations were quiet at a rate of 6 per minute and a tidal volume of 300 mL. Repeat arterial blood gases showed that his arterial PCO2 had increased from 55 to 70 mm Hg, and his PaO2 increased from 55 to 70 mm Hg. Oxygen therapy most likely resulted in which of the following?

Alveolar hypoventilation
Elimination of the hypercapnic drive
Hypoxic pulmonary vasoconstriction
Increased firing of carotid body chemoreceptors
Oxygen toxicity

An 18-year-old male college freshman living in a dormitory contracts meningitis, which causes a centrally mediated increase in his respiratory rate. The pacemaker neurons responsible for respiratory rhythmogenesis are located in which of the following regions of the brain?

- Pre-Bötzinger complex in the ventral respiratory group
- Apneustic center in the pons
- Central chemoreceptors in the medulla
- Inspiratory neurons in the dorsal respiratory group
- Pontine respiratory groups

A 5-month-old infant is admitted to the hospital for evaluation because of repeated episodes of sleep apnea. During a ventilatory response test, his ventilation did not increase when PaCO2 was increased, but decreased during hyperoxia. Which of the following is the most likely cause of this infant’s apnea?

- Dysfunctional central chemoreceptors
- Bronchospasm
- Decreased irritant receptor sensitivity
- Diaphragmatic fatigue
- Peripheral chemoreceptor hypersensitivity

A 24-year-old presents with a chief complaint of fatigue and daytime somnolence. His wife has noticed that he stops breathing for periods of 30 to 60 seconds while he is sleeping and that this happens many times throughout the night. His physician orders pulmonary function testing including ventilatory response curves and polysomnography. The tests confirm apneic episodes during sleep. During a ventilatory responsiveness test, his alveolar ventilation increased as predicted in response to breathing 5% CO2, but his ventilatory response to breathing 16% O2 was depressed. Which of the following conditions are consistent with these findings?

- Decreased peripheral chemoreceptor sensitivity
- Central hypoventilation syndrome (Ondine curse)
- Decreased central chemoreceptor sensitivity
- Obstructive sleep apnea
- Spinal cord injury affecting the fourth cervical vertebra
An 18-year-old man is life-flighted to a Level 1 trauma center after being thrown from his motorcycle. It is determined that he has a brain tran-section above the pons. How will this lesion affect the control of breathing in this patient?

The limbic system will no longer be able to exert any control over ventilation.
All breathing movements will cease.
The central chemoreceptors will no longer be able to exert any control over ventilation.
The peripheral chemoreceptors will no longer be able to exert any control over ventilation.
The Hering–Breuer reflex will be abolished.

A healthy 32-year-old woman undergoes pulmonary exercise stress testing prior to starting a training regimen in preparation for her first marathon. Normally, during moderate aerobic exercise, which of the following occurs?
Alveolar ventilation increases
Arterial pH decreases
Arterial lactate level increases
PaCO2 decreases
PaO2 increases

A 36-year-old man visits his doctor because his wife has long complained of his snoring, but recently observed that his breathing stops for a couple of minutes at a time while he is sleeping. He undergoes polysomnography and ventilatory response testing to ascertain the extent and cause of his sleep apnea. The activity of the central chemoreceptors is stimulated by which of the following?
An increase in the PCO2 of blood flowing through the brain
A decrease in the metabolic rate of the surrounding brain tissue
A decrease in the PO2 of blood flowing through the brain
An increase in the pH of the CSF
Hypoxemia, hypercapnia, and metabolic acidosis

A patient complains of paroxysmal episodes of not being able to catch her breath. When no abnormalities are detected with conventional pulmonary function screening, the pulmonologist orders a methacholine challenge test. Which of the following will increase as a result of stimulating cholinergic receptors on the bronchial smooth muscle?
Resistive work of breathing
Airway diameter
Anatomic dead space
Compliance of the lungs
Elastic work of breathing