Vital Signs and Measurements

CHAPTER PRE-TEST

Perform this test without looking at your book. If an answer is “false,” rewrite the sentence to make it true.

1. True or False? Patient weight is measured only to determine how much fat the patient has.
   False. Weight measurement is also used to determine unexpected and inappropriate fluid weight gain known as edema as well as any sudden gain or loss in weight.

2. True or False? A normal pulse rate is between 60 and 120 beats per minute for adults.
   False. The normal adult pulse rate is between 60 and 80 beats per minute.

3. True or False? A normal respiration rate for adults is between 12 and 20 breaths per minute.
   True.

4. True or False? Blood pressure is the amount of pressure the blood exerts on the inside of veins.
   False. Blood pressure is the amount of pressure the blood exerts on the inside of arteries.

5. True or False? High blood pressure is also called hypertension.
   True.

6. True or False? High blood pressure is always caused by inactivity and diet.
   False. High blood pressure can be caused by medication, genetics, stress/emotions, and/or illness.
VOCABULARY BUILDER

Misspelled Words

Find the words below that are misspelled, underline them, and correctly spell them in the space provided. Then, fill in the blanks below with the appropriate terms from the list.

<table>
<thead>
<tr>
<th>apnea</th>
<th>emphasema</th>
<th>hypotension</th>
</tr>
</thead>
<tbody>
<tr>
<td>arhythmia</td>
<td>eupnea</td>
<td>orthopnea</td>
</tr>
<tr>
<td>baseline</td>
<td>frenulum</td>
<td>rhonchi</td>
</tr>
<tr>
<td>bradycardia</td>
<td>hyperpnea</td>
<td>stridor</td>
</tr>
<tr>
<td>bradypnea</td>
<td>hypertension</td>
<td>systolic</td>
</tr>
<tr>
<td>dyspnea</td>
<td>hyperventilation</td>
<td>wheeze</td>
</tr>
<tr>
<td>arrhythmia</td>
<td>hypotension</td>
<td>stridor</td>
</tr>
<tr>
<td>emphysema</td>
<td>orthopnea</td>
<td>wheeze</td>
</tr>
</tbody>
</table>

1. Tiffany comes to the office of Drs. Lewis and King reporting that she cannot breathe well when she lies down. Joe Guerrero, CMA (AAMA), notes __________ orthopnea in her chart.

2. Winston Lewis, MD, warns his patient, Herb, that he is in the early stages of __________ emphysema, a chronic pulmonary condition that causes destruction of the air sacs in the lungs, caused by his smoking.

3. Liz Corbin, CMA (AAMA), writes __________ hyperpnea in Carolyn’s chart after she counts her respirations at 45 breaths per minute.

4. Wanda Slawson, CMA (AAMA), is taking Edith’s temperature orally and is careful to insert the digital thermometer under her tongue, next to the __________ frenulum.

5. Marissa is rushed in to see Dr. King after swallowing a coin. Dr. King can clearly hear a crowing __________ stridor whenever the toddler tries to inhale. This indicates to the doctor that the coin is lodged in the upper airway.

6. At a scheduled examination, Lenny’s pulse is recorded at 40 beats per minute. This is called __________ bradycardia in medical terms.

7. Ludmilla has cut her hand and arrives at the Inner City Health Care clinic in an anxious state. She says she is feeling tingly and lightheaded. Bruce Goldman, CMA (AAMA), notes that her respiratory rate is 35 and that Ludmilla is taking deep, rapid breaths. Bruce suspects __________ hyperventilation and calmly has her breathe slowly into her cupped hands until the tingling goes away.

8. Wanda Slawson, CMA (AAMA), can hear a deep snoring sound in the patient’s throat when he measures Leo’s respirations. This sound is described as __________ rhonchi.

9. Jim’s blood pressure is a high 180/98. The number 180 is called the __________ systolic pressure.

10. Dr. Lewis takes careful note of Mr. Marshall’s 160/100 blood pressure reading and discusses with him the dangers of __________ hypertension and the possible need for lifestyle changes and possible medication to control this condition.

11. Keisha’s breathing is noticeably labored at one of her well-child checkups. Joe Guerrero, CMA (AAMA), notes this as __________ dyspnea in her chart.

12. Three-year-old Chris has had a somewhat persistent chest cold for weeks but has a high-pitched __________ wheeze when he exhales, leading Dr. Lewis to consider asthma as a diagnosis.

13. Kareem has normal respirations. This could be described in the chart notes as __________ eupnea.

14. Liping’s breath sounds are normal, but her respiration rate is very slow, only 8 to 9 breaths a minute. This __________ bradypnea worries Liz Corbin, CMA (AAMA), so she alerts Dr. King immediately.
15. While checking Robert’s pulse, Joe Guerrero, CMA (AAMA), notices an obvious irregularity in the pulse. This is known as an arrhythmia.

16. When Jamar shares that his wife sometimes stops breathing in her sleep for a couple of minutes, Dr. Lewis becomes concerned that she might be experiencing apnea and recommends that a sleep study be performed.

17. Juanita’s resting blood pressure is 60/44. This is hypotension, and Dr. Rice is concerned about this being a side effect of the prescribed medication Juanita is taking.

18. Dr. Susan Rice orders an ECG on her patient Rebecca, just as a baseline for future reference.

LEARNING REVIEW

Short Answer

1. Temperature, pulse, respiration, and blood pressure are collectively referred to as vital signs or cardinal signs.

2. How is heat produced within the body? What part of the brain maintains the balance between heat production and heat loss? What are ways the body cools itself in hot weather and heats itself in cold weather?

   Heat is produced within the body by cellular energy and the action of voluntary and involuntary muscle activity. Heat production and loss is maintained by the hypothalamus in the brain. In cool weather we will shiver to produce more heat, and in warm weather we will sweat to cool through evaporation.

3. List the five ways in which the body loses heat next to each example below.

   a. Ellen climbs into a cold bed. Conduction
   b. Anara enjoys her aerobic workout, which causes her to sweat. Evaporation
   c. On a trip to New York, Richard attends a live studio performance where the temperature in the room was kept at about 58 degrees. Radiation
   d. Christine uses a portable fan when she is working as a seamstress and all the sewing machines and irons tend to make the room too warm. Convection
   e. Liz performs daily yoga breathing exercises. Elimination

4. What is another word for fever?
   Febrile, or pyrexia

5. Explain the differences in the patterns of fevers in the list below.

   Remittent:
   This is a fever that fluctuates but still remains higher than normal.

   Intermittent:
   This is a fever that fluctuates but does return to normal and sometimes even below normal.
Continuous:
This type of fever stays in the above-normal range and does not fluctuate.

6. Circle the correct words to complete the sentences: A(n) (increase/decrease) in temperature may be caused by several factors, such as eating, medications that increase metabolism, exercise, bacterial infections and exposure to heat, pregnancy, stress, and age. A(n) (increase/decrease) in body temperature may result from fasting, inactivity, medications that decrease metabolism, exposure to cold, and age.

7. An aural temperature is taken where?
   In the external ear, near the tympanic membrane.

8. Write the normal ranges of blood pressures for the following age groups:
   Child, age 10 100/65
   Adolescent, age 16 118/75
   Adult <120/80

9. Define the following terms and explain what each factor has to do with blood pressure and how each affects the pressure.

   Blood volume:
   The amount of blood in the arteries. Increased volume increases blood pressure, whereas a decrease in volume will decrease blood pressure, as in the case of a hemorrhage.

   Elasticity of arterial walls:
   The ability of arteries to expand and contract to provide a steady flow of blood. As a person ages, elasticity of vessels is reduced. This can cause an increase in arterial wall resistance, resulting in an increase in blood pressure.

   Lumen of the arteries (peripheral resistance):
   The resistance to blood flow in the arterioles. The smaller the lumen of the arterioles, the more pressure is needed to push blood through. The larger the lumen, the less resistance and, therefore, less pressure is needed to push blood through. The lumen can become smaller from deposits of fatty cholesterol, resulting in an increase in blood pressure.

   Strength of the heart muscle:
   How strong the heart muscle is. Extremely important to blood flow and pressure. A weak heart muscle results in an inefficient pumping action of the heart, leading to a decrease in blood pressure and blood flow.

   Viscosity of the blood:
   Thickness of the blood. If the blood is thickened due to uncontrolled diabetes or high cholesterol, it will be harder to push through the arteries, leading to an increase in blood pressure.
10. List four other factors that influence blood pressure that are not listed in Question 9.

Genetics, diet and weight, activity, and emotional state

11. What is the name of the various sounds sometimes heard during blood pressure measurement?

Korotkoff sounds

12. When measuring blood pressure, it is important to not allow the gauge to move faster than 2 mm Hg per heartbeat.

13. List four types of hypertension and explain each type, whether it is curable, and what its treatment(s) and caus(es) are. Then give an example of each.

<table>
<thead>
<tr>
<th>Type</th>
<th>Description and Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>White Coat hypertension</td>
<td>Hypertension that is caused by anxiety or fear, often if the patient is particularly nervous. For example, when you are taking a test you aren’t prepared for, your blood pressure might go up temporarily.</td>
</tr>
<tr>
<td>Essential/primary hypertension</td>
<td>Caused by genetics, poor health, and cardiac disease. This condition is treatable but not curable. An example is a patient who is making all the lifestyle changes possible but has inherited hypertension from both parents and may always be on medication for it.</td>
</tr>
<tr>
<td>Secondary hypertension</td>
<td>This is a physiological result of another condition, illness, or disease state. Once the underlying cause is corrected, the patient’s hypertension may decrease to a normal range. This condition is treatable and curable. For example, hypertension may occur during pregnancy, but once the baby is born, the pressure usually returns to normal.</td>
</tr>
<tr>
<td>Benign hypertension</td>
<td>Has a slow progression toward malignant hypertension.</td>
</tr>
<tr>
<td>Malignant hypertension</td>
<td>Progresses rapidly with severe damage to the cardiovascular system, and death is possible.</td>
</tr>
</tbody>
</table>

14. List and explain three possible causes of hypotension.

Postural or orthostatic hypotension occurs when one is lying down and gets up too quickly. One's blood pressure does not get a chance to accommodate the change in posture. The blood glow to the brain is temporarily diminished, causing hypotension and possible syncope. This can also be a side effect of certain medications. Other causes are shock-like conditions such as hemorrhage, traumatic or emotional shock, central nervous system disorders, or chronic wasting diseases.
15. A very rapid pulse rate is described medically as **tachycardia**.

16. A very slow pulse rate is described medically as **bradycardia**.

17. The medical term meaning difficulty and/or painful breathing is **dyspnea**.

18. Write the normal pulse ranges for the following age groups:

   - Birth: 130–140 bpm
   - Infants: 110–130 bpm
   - Child, age 1 year: 110–130 bpm
   - Child, age 7–14 years: 76–90 bpm
   - Adult: 60–80 bpm

19. Identify the name of each common pulse site described below and match the site to its proper location on the body in the figure below by placing the correct letter in the space provided.

   a. The site most commonly used for BP reading: **brachial**
   b. The site for blood pressure measurements in the leg: **popliteal**
   c. The site commonly used for infant pulse rates: **apical**
   d. The site used in emergencies and when performing cardiopulmonary resuscitation (CPR): **carotid**
   e. The site used to check for circulation in the lower limbs: **dorsalis pedal or femoral**
   f. The most commonly used site to measure pulse: **radial**
   g. The site used in an emergency to control bleeding in the leg: **femoral**

![Diagram of pulse sites](https://via.placeholder.com/150)
20. List and define four characteristics of the pulse.

(1) **Rate** is the number of pulse beats per minute. (2) **Rhythm** refers to the regularity and timing. (3) **Volume** refers to the strength of the beat that is felt; strong, hard, weak. (4) **Condition of the arterial wall** may be soft and elastic or hard, knotty, and/or wiry.

21. Write the normal range of respiratory rates for each of the following ages.

<table>
<thead>
<tr>
<th>Age</th>
<th>Respiratory Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infant</td>
<td>20–40 respirations per minute</td>
</tr>
<tr>
<td>Child, age 1–7 years</td>
<td>18–30 respirations per minute</td>
</tr>
<tr>
<td>Adult</td>
<td>12–20 respirations per minute</td>
</tr>
</tbody>
</table>

22. List and define three characteristics of respiration.

(1) **Rate** is the number of respirations per minute. (2) **Rhythm** is the pattern of breathing. (3) **Depth** refers to the amount or degree of air; may be described as shallow or deep.

**CERTIFICATION REVIEW**

*These questions are designed to mimic the certification examination. Select the best response.*

1. Which of the following is *not* a routine body measurement?
   a. Chest circumference
   b. Head circumference
   c. Ankle circumference
   d. Height

2. In converting inches to feet, which of the following is true?
   a. 62 inches is 5 feet, 2 inches
   b. 62 inches is 6 feet, 2 inches
   c. 62 inches is 6 feet exactly
   d. 62 inches is 5 feet 6 inches

3. When converting Fahrenheit to Celsius, which of the following is the correct formula?
   a. Fahrenheit temperature minus 32 multiplied by 5/9
   b. Fahrenheit temperature multiplied by 5/9 minus 32
   c. Fahrenheit temperature plus 32 multiplied by 5/9
   d. Fahrenheit temperature multiplied by 9/5 plus 32

4. What is considered a normal pulse and respiration rate for an adult?
   a. Pulse of 76, respiration of 20
   b. Pulse of 80, respiration of 18
   c. Pulse of 56, respiration of 16
   d. Pulse of 20, respiration of 60
   e. Both a. and b. are correct.
5. Which of the following is not a requirement in order to obtain accurate blood pressure?
   a. The cuff should be the proper size.
   b. The cuff should be placed correctly over the radial artery.
   c. The arm should be above heart level.
   d. The deflation should not be faster than 2 mm/degrees per heartbeat.
   e. The patient should be seated with feet on the floor and back supported.

6. A pulse obtained at the intersection of the fifth intercostal space at the mid-clavicular line on the left chest is called the:
   a. femoral pulse
   b. temporal pulse
   c. brachial pulse
   d. apical pulse

7. Malignant hypertension:
   a. is borderline
   b. is below normal
   c. is life threatening
   d. spreads to other parts of the body

**LEARNING APPLICATION**

**Charting Exercises**

Chart the following patient vital signs in the corresponding paper chart record below:

1. On January 4, 20XX you checked Ludmilla in for her office visit at 2:30 PM. Her height was 64 inches, and she weighed 145 pounds. Her temperature taken orally was 99.2 degrees Fahrenheit. You took her pulse rate and respiration rate for 30 seconds and they were 44 and 10, respectively. Her blood pressure measured in her right arm while she was sitting down was 146 over 68. (Be sure to initial your charting.)

01-04-20xx Ht. 5′4″ Wt. 145# T 99.2 P 88 R 20 BP 146/68 rt arm, sitting. B. Dahl, CMA (AAMA) 2:30 P.M.

2. On March 22nd, you checked Abigail in for her checkup at 10:30 AM. Her height was 66½ inches and she weighed 212 pounds. Her temperature taken orally was 97.8 degrees Fahrenheit, her pulse rate was 90 and irregular twice within 60 seconds. Her respiration rate was 15 in 30 seconds and she was breathing with difficulty. Her blood pressure measured in her right arm while she was sitting down was 190 over 94. You notified Dr. King of her pulse and respirations and stayed with the patient to observe her. (Be sure to initial your charting.)

03-22-20xx Ht. 5′6″ Wt. 212# T 97.8 P 90 irreg x2 R 30 and difficult BP 190/94 rt arm, sitting. Dr. King notified of difficult respirations and irregular pulse. Patient was monitored continuously. B. Dahl, CMA (AAMA)
Hands-on Activities

Perform the following exercises and then measure your pulse and respirations. Chart the measurements in the spaces provided using proper documentation.

1. After three minutes of rest, sitting in a chair with your feet flat on the floor
   Student answers should vary.

2. After three minutes of marching in place at a comfortable rate
   Student answers should vary.

3. After three minutes of strong aerobic exercise such as jumping jacks or jogging in place
   Student answers should vary.

4. Note the variations in the characteristics of your pulse and respirations as you moved from rest to strong activity. Calculate the ratio of respiration to pulse for your resting, active, and aerobic rates listed earlier. Show your results below.

   Resting       Student answers should vary.
   Active        Student answers should vary.
   Aerobic       Student answers should vary.

CASE STUDY 1

Wayne lives near Inner City Health Care in a group home for developmentally delayed adults. Wayne has a history of frequent colds and ear infections. He visits the clinic one morning with pain in both ears. He is also drinking a cup of hot coffee.

CASE STUDY REVIEW QUESTIONS

1. What method would Wanda, the CMA (AAMA), use to take Wayne’s temperature?
   The temporal artery or the axillary method. Because of Wayne’s possible ear infection and history of infections in both ears, she cannot use a tympanic thermometer. Because the patient has recently drunk hot coffee, any oral method will give an inaccurate result.

2. How might Wanda explain to Wayne why she is using the axillary method?
   “The coffee might have made your mouth too warm, and since your ears hurt, I would like to take your temperature across your forehead. Is that alright with you?”
CASE STUDY 2

Henry, who is 4 years old, is rushed to Inner City Health Care. He is bleeding profusely from a cut on his head. "He fell down the stairs," sobs his mother, Juanita. Henry does not seem to be fully conscious and appears confused. Dr. James Whitney attends to Henry's laceration, applying direct pressure on the cut to stop the bleeding. He directs clinical assistant Bruce Goldman to call 911 for emergency services. Then Bruce takes Henry's pulse. "What are you doing?" Juanita asks Bruce. "Why doesn't he wake up?"

CASE STUDY REVIEW QUESTIONS

1. What site would Bruce use to take Henry's pulse?

   In an emergency situation like this, Bruce will probably choose the strong and easy-to-find pulse site at the carotid artery to check the child's heart rate. If impractical because of bleeding from his head, an apical pulse can be taken.

2. How might Bruce answer Juanita's questions about what he is doing?

   "The first thing we need to do is to determine how seriously injured your son might be while we get the bleeding controlled. We also need to assess his respiration and heartbeat. Emergency services is on the way. Would you like to sit down? Is there anything we can do for you right now?"

CASE STUDY 3

Abigail, who suffers from many problems related to her advanced age, also has type II diabetes. She is very friendly and has a good rapport with everyone in the clinic—all of whom she says are "just like family"—and she is very eager to please the staff. One winter day she comes to the clinic complaining of flu symptoms. When clinical assistant Audrey asks Abigail to step onto the scale to get her weight, Abigail says, "Oh, do we have to? I just don't feel up to it right now."

CASE STUDY REVIEW QUESTION

1. How might Audrey explain to Abigail about why her weight is important at every visit?

   "Ms. Johnson, because of your diabetes and your symptoms today, we really need to have a weight measurement; Dr. King will need the information along with the rest of your vital signs. Illnesses like colds or influenza can complicate your diabetes and put your blood sugar out of balance. We want to give you the best medical care possible. I promise to help you through this and then you'll be able to rest comfortably for a few minutes while I get Dr. King for your examination."
CHAPTER POST-TEST

1. True or False? Patient weight is measured sometimes to determine how much fluid the patient is retaining.
   True.

2. True or False? A normal pulse rate is between 80 and 100 for adults.
   False. The normal adult pulse rate is between 60 and 80 beats per minute.

3. True or False? A normal respiration rate is between 16 and 20 for adults.
   False. The normal respiration rate for an adult is between 12 and 20 breaths per minute.

4. True or False? Blood pressure is the amount of pressure that is exerted on the inside of the arteries.
   True.

5. True or False? High blood pressure is also called hypotension.
   False. High blood pressure is also called hypertension. Hypotension is low pressure.

6. High blood pressure can be lowered by regular exercise, dietary changes, losing weight, and medications.
   True.

SELF-ASSESSMENT

As you respond to the following questions, think of how your experiences will affect how you treat your patients.

1. Think of the last time you had your height and weight measured. Did you have enough privacy to make you comfortable?
   Answers 1–3 will vary according to each student’s comfort level, confidence, and experiences. The focus of this exercise is to help the students become more aware of their feelings and the potential feelings of their (future) patients. Students need to also remember to educate their patients (according to their provider-employer’s directions) about health care and risk factors. Answer 4 will vary. An alternate activity might be to assign two students, rather than have all the students contact the health department. Have them write up the information obtained, copy it, and distribute it to the other students; or, if you have a Web site for your program, post it to your Web site. You might instruct all students to teach at least three other people about the dangers of mercury, giving them copies of the written instructions of what to do with their mercury thermometers. Student could each turn in a written synopsis of how they would teach/convince others of the dangers of mercury.
2. When you had your blood pressure taken, did the medical assistant share your measurements with you? Did you feel comfortable asking questions?

3. Has any health care provider ever discussed any of your vital signs or body measurements with you? Have you been informed of the health factors related to your vital signs or body measurements?

4. Do you still have mercury thermometers in your home? If so, call the health department to find out where you can take them for disposal and then obtain an electronic or digital thermometer for future use at home. How do you think your patients will feel when you encourage them to do the same? Write out exactly what you will say to them to convince them of the importance of replacing all mercury thermometers with a safer alternative. Explain mercury poisoning to them.