

Purposes: agglutination = combat infection; clotting = prevent blood loss

Mechanism: agglutination = antibody release from white blood cell; clotting = cascade of enzymatic reactions starting from thrombocytes and ending with fibrin production.

4. Many of the functions of blood are sensitive to pH and temperature changes because they are a factor of protein activity. Denaturing these proteins would affect their function.

G-7. CONCEPT CHECK-UP QUESTIONS:

1. a. Oxygen is attached to hemoglobin (forming HbO₂) when it is transported to systemic capillaries.
b. Oxygen is released because the ability of hemoglobin to hold on to it lessens due to a slightly increased temperature and lowered pH.
2. At the arteriole end these substances are under the influence of blood pressure (about 35 or 40mmHg), and they "leak" through the capillary wall. At the venule end, the blood pressure is greatly lessened but the osmotic pressure is heightened due to the retention of proteins in the plasma. The osmotic pressure draws the materials back in.
3. a. Capillary-fluid tissue exchange can contribute to tissue swelling if the capillaries become too leaky and a greater than normal amount of fluid gets forced into tissue spaces at the arteriole end (as happens when histamines are present).
b. The ongoing activity of the lymphatic system will slowly (eventually) reduce the swelling by drawing the excess fluids into lymph and returning them to the circulatory system.
4. Essentially, capillary-fluid exchange in pulmonary capillaries would be very similar to that of systemic capillaries, only reversing the gas exchange part of the process. Specifically, with the arrival of blood at a pulmonary capillary, blood pressure forces water and CO₂ out of the blood. At the venule side, osmotic pressure draws water back in. O₂ enters as well.

UNIT G REVIEW QUESTIONS

CHECK YOUR KNOWLEDGE OF DIAGRAMS:

1. a. A= aorta (aortic arch) – transports oxygenated blood from the left ventricle towards systemic capillary beds
B= left pulmonary artery – transports deoxygenated blood from the right ventricle to the left lung
C= left pulmonary vein – returns oxygenated blood to the left atrium from the left lung
D= dorsal aorta – same as aorta (just a name change because of its location)
E= superior (or anterior) vena cava transports deoxygenated blood to the right atrium from the anterior part of the body
F= right pulmonary artery – transports deoxygenated blood from the right ventricle to the right lung
G= inferior (or posterior) vena cava transports deoxygenated blood to the right atrium from the posterior part of the body
b. The cluster of blood vessels at X is made up of the carotid and subclavian arteries. The carotids (the two in the middle) take blood to the head. The subclavians travel under the clavicle and feed part of the upper body and arms (branches of these form the brachial arteries).
2. H= Blood pressure forces fluid – mostly water with oxygen and nutrients, out of the (leaky) capillaries. This feeds the tissues.
I= Osmotic pressure draws fluid – again mostly water, but this time with carbon dioxide and ammonia, back into the capillaries. This transports wastes away from the tissues.

CHECK YOUR UNDERSTANDING OF CONCEPTS:

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|------|-------|-------|-------|-------|
| 1. A | 9. A | 17. A | 25. C | 33. A |
| 2. B | 10. B | 18. C | 26. A | 34. D |
| 3. B | 11. C | 19. D | 27. B | 35. B |
| 4. D | 12. A | 20. D | 28. D | 36. B |
| 5. C | 13. C | 21. D | 29. C | |
| 6. A | 14. B | 22. A | 30. D | |
| 7. B | 15. B | 23. A | 31. B | |
| 8. B | 16. B | 24. C | 32. B | |

UNIT H – RESPIRATORY SYSTEM

H-1. CONCEPT CHECK-UP QUESTIONS:

1. The four parts of respiration are: breathing (inhaling and exhaling), external respiration (gas exchange at the lungs), internal respiration (gas exchange at the alveoli), and cellular respiration (making ATP in cells).
2. The nasal passageways are specialized by having a mucus lining, which filters out and traps particulate matter from the air that gets breathed in. They also house white blood cells in the sinus region, which help destroy pathogenic material and fight infection.
3. a. Large air passageways are held open (prevented from collapse) by cartilaginous rings.
b. The cartilaginous rings of the trachea are C-shaped to accommodate the flexibility needed for peristaltic activity of the esophagus. This would not be possible with O-shaped rings.

- The nervous system is associated with the lungs to detect when exhalation is required. The stretch receptors on alveolar surfaces do this. The circulatory system association with the lungs provides a means for the excretion of CO_2 (and some H_2O) and the entry of O_2 into blood.

H-2. CONCEPT CHECK-UP QUESTIONS:

- The respiratory centre is the medulla oblongata. It is in the brain stem. It initiates inhalation in response to elevated concentrations of CO_2 and H^{1+} in plasma. It also responds to the stretch receptors on the surfaces of the alveoli to signal the end of inhalation.
- Impulses from the medulla oblongata cause the simultaneous contraction of the diaphragm and the intercostal muscles. The diaphragm becomes straighter (flattens; moves down) when it contracts. When the intercostal muscles contract, they move the rib cage up and out.
 - The combined effect of their contraction increases the volume of the thoracic cavity, which lowers the internal air pressure thus air is drawn in through the trachea.
- The pleural membranes provide a lubricated, frictionless surface on the inner wall of the thoracic cavity for the lung tissue to slide against. They also seal the lungs from the rest of the body to help ensure that the trachea provides the only passageway in or out of the thoracic cavity. In this way, they help prevent lung collapse. Further, they help the lung tissue to adhere to the body wall, which helps expand the lungs during inhalation.
- Energy is required for inhalation, but not for exhalation.
- Inhaled air is warmed to body temperature, humidified to about 100% humidity and cleaned of debris before it reaches the alveoli.

H-3. CONCEPT CHECK-UP QUESTIONS:

- Carbonic anhydrase catalyzes the reversible reaction between water and carbon dioxide as they form carbonic acid ($T = 38^\circ\text{C}$; $\text{pH} = 7.35$). At $T = 37^\circ\text{C}$ and a pH of about 7.38, this reaction reverses.
- Depending on the conditions, hemoglobin normally transports oxygen (HbO_2 ; oxyhemoglobin), hydrogen (HHb ; reduced hemoglobin), and carbon dioxide (HbCO_2 ; carbaminohemoglobin).
- The formation of HHb in venous blood is important because it removes free H^{1+} from the plasma, thus preventing the pH from lowering.
 - The pH is also prevented from dropping by the formation of HCO_3^{1-} , which is a buffer. Both of these ions (H^{1+} and HCO_3^{1-}) result from the dissociation of carbonic acid.
- Most of the carbon dioxide is transported as bicarbonate ions, some is bonded to hemoglobin (HbCO_2), and a little of it is transported as CO_2 in the plasma.

UNIT H REVIEW QUESTIONS

CHECK YOUR KNOWLEDGE OF DIAGRAMS:

- Before – Hemoglobin has released oxygen, which has been forced along with water out of the capillaries and into the extracellular fluid. As well, the cells manufacture carbon dioxide, which has diffused into the extracellular fluid.
After – Oxygen, which is depleted in the cells, will diffuse into them. Carbon dioxide will get drawn into the capillary along with water as a result of the osmotic pressure that is generated because of the globulin concentration in the blood.
- A= trachea. It conducts air between the pharynx and the bronchi.
B= bronchus. It conducts air between the trachea and the bronchioles.
C= ribs. These protect contents of the thoracic cavity, namely the lungs and heart. Between the ribs are the intercostal muscles, which play a role in the breathing process.
D= diaphragm. It is a sheet-like muscle, which contracts to increase the volume of the thoracic cavity. This draws air down the trachea.
E= epiglottis. It is a flap of tissue that covers the top of the trachea when swallowing.
F= cartilage rings. These protect the trachea and hold it open, preventing its collapse.
G= right lung. It is made up of millions of alveoli for external respiration.
H= pleural membrane(s). These provide a frictionless surface for the lungs against the ribcage.

CHECK YOUR UNDERSTANDING OF CONCEPTS:

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|------|-------|-------|-------|-------|
| 1. D | 7. A | 13. D | 19. B | 25. B |
| 2. B | 8. D | 14. A | 20. A | 26. A |
| 3. C | 9. D | 15. B | 21. A | 27. C |
| 4. B | 10. A | 16. C | 22. A | |
| 5. D | 11. D | 17. A | 23. D | |
| 6. C | 12. B | 18. C | 24. D | |