
Q1. After you donate blood, which of the formed elements would increase ?

Q2. Why do people with severe kidney disease commonly become anemic ?

Q3. A patient 'X', is taking the medication verapamil, a drug that blocks the calcium channels in cardiac muscle cells. What effect should the medication have on patient 'X's stroke volume (SV). Definition of SV: The amount of blood ejected by a ventricle during a single beat.

Q4. A patient's ECG recording shows a consistent pattern of two P waves followed by a normal QRS complex and T wave. What is the possible cause of this abnormal wave pattern.

Q5. How would extended use of antibiotics affect blood clotting ?

Q6. A test for prothrombin time is used to determine deficiencies in the extrinsic clotting pathway and is prolonged if any of the factor are deficient. A test for activated partial thromboplastin time is used in a similar fashion to detect deficiencies in the intrinsic clotting pathway. Which factor would be deficient if a person had a prolonged prothrombin time but a normal partial thromboplastin time?

Q7. If the cells of the SA node failed to function, how would the heart rate be affected ?

Q8. The erythrocyte (RBC) has a average volume of $100 \mu\text{m}^3$. The mean concentration of hemoglobin in erythrocytes is 32 g/100ml.

a. What is the weight of the hemoglobin contained in erythrocytes?

b. How many hemoglobin molecules are there in an erythrocyte?

Q9. Suppose you are running a blood disease diagnostic center. You have a control blood sample which lacks Factor VIII. Factor VIII is responsible for blood clotting. Deficiency of Factor VIII causes classic hemophilia. Now you received another blood sample which is suspected to have a lack of Factor VIII. What is the simple experiment you can do in 5 minutes to prove whether the new sample lacks factor VIII or not.

Q 10. Dicoumarol is a vitamin K antagonist. Dicoumarol is found in spoiled sweet clover and causes fetal hemorrhagic disease in cattle fed on this hay. This coumarin derivative is used clinically as an anticoagulant to prevent thromboses in patients prone to clot formation.

a. After reading the above paragraph, could you name the molecule which is affected by vitamin K antagonist Dicoumarol.

b. A similar molecule, warfarin, a vitamin K antagonist is used as a rat poison. Could you suggest how this could be used as a rat poison.

Q11. Is the following statement(s) true(T) or false(F):

- a. All biological membranes are asymmetric
- b. Lipid bilayers are highly impermeable to ions and most polar molecules.
- c. Fibrinogen is converted by thrombin into a fibrin clot
- d. fetal hemoglobin has a lower oxygen affinity than maternal hemoglobin
- e. The quaternary structure of hemoglobin changes markedly on oxygenation
- f. The cooperative binding of oxygen makes hemoglobin a more efficient oxygen transporter. g. Only ferri-hemoglobin, +3 oxidation state, can bind oxygen.
- h. The iron atom in heme binds to four nitrogens in the center of the protoporphyrin ring. The iron can form two additional bonds one on either side of the heme plane. These bonding sites are termed the fifth and sixth coordination position.
- i. A histidine residue (E7), termed the distal histidine, is near the heme but not bonded to it. j. Biological membranes are fluid mosaics of lipid and proteins.
- k. Carbohydrate units are located on the extracellular side of the plasma membranes
- l. Gap junctions allows ions and small molecules to flow between communicating cells
- m. Biochemically, the ABO blood group system involves the oligosaccharides attached to sphingolipids and proteins on red blood cells and other cells.
- n. Fenestrated capillaries are capillaries that contain “windows” or pores that span the endothelial lining.

Q12. In 1863, Joseph Lister showed that blood stayed fluid in the excised jugular vein of an ox, but that is rapidly clotted when it was transferred to a glass vessel. This unphysiologic surface activated a reaction sequence that has become known as the extrinsic clotting pathway.

- a. Read the above lines and say whether this statement is true or false.

Q13. The oxygen affinity of hemoglobin within red cells is lower than that of hemoglobin in free solution. as early as 1921, Joseph Barcroft wondered, “Is there some third substance presentwhich forms an integral part of the oxygen-hemoglobin complex?” Indeed there is. Reinhold Benesch and Ruth Benesch showed in 1967 that 2,3-bisphosphoglycerate (BPG, also nown as 2,3-diphosphoglycerate, DPG) binds to hemoglobin and has a large on its affinity for oxygen. BPG lowers the oxygen affinity of hemoglobin. BPG

diminishes the oxygen affinity of hemoglobin by binding to deoxyhemoglobin but not to the oxygenated form.

a. Please draw the graph to show this effect of BPG. The x-axis will be oxygen pressure (partial pressure of oxygen in torrs) and the y-axis will be saturation. Note: Draw the two curves with BPG and without BPG.

Q14. In addition to the Na⁺-K⁺ ATPase, eukaryotic cells contain other ATP-driven pumps. One such pump is the H⁺-K⁺ ATPase, in which a hydrogen ion is extruded from the cytoplasm in exchange for a potassium ion at the expense of ATP hydrolysis. Given that the interior of most animal cells is electrically negative with respect to the exterior, explain why the Na⁺-K⁺ ATPase can contribute to the membrane potential but the H⁺-K⁺ATPase cannot.

Q15. Is the following statement(s) true(T) or false(F)

- a. The smaller T wave indicates ventricular repolarization.
- b. The small P wave accompanies the depolarization of the atria. The atria begins contracting about 100 msec after the start of the P wave.
- c. The QRS complex appears as the ventricles repolarize.
- d. Bradycardia is a condition in which the heart rate is faster than normal.
- e. The connection between the AV node and the AV bundle, or bundle of His, is the only electrical connection between the atria and the ventricles.
- f. Extension of the P-R interval to more than 0.2 seconds can indicate damage to the conducting pathways or AV node.
- g. During late ventricular diastole all chambers are relaxed and the ventricles fill passively.
- h. During the first phase of ventricular systole: Ventricular contraction pushes AV valves closed but does not create enough pressure to open semilunar valves.

Q16. Why is multinucleate condition important in skeletal muscle fibers?

Q17. The primary determinant of the resting membrane potential is

- a. the membrane permeability to sodium
- b. the membrane permeability to potassium
- c. intracellular negatively charged proteins
- d. negatively charged chloride ions in the cerebrospinal fluid (CSF)

Q18. An individual took antibiotic cephalosporin, and his platelet count dropped to 50,000/ μ l. What signs and symptoms will she exhibit?

Q19. Erythropoietin directly stimulates RBC formation by

- a. increasing rates of mitotic divisions in erythroblasts
- b. speeding up maturation of RBC
- c. accelerating the rate of hemoglobin synthesis
- d. a, b and c are correct

A person with Type A blood has

- a. antigen A in the plasma
- b. anti-B antibodies in the plasma
- c. anti-A antibodies on the RBC
- d. antigen B on the RBC membrane

Hemolytic disease of the newborn may result if

- a. the mother is Rh-positive and the father is Rh-negative
- b. both the father and the mother are Rh-negative
- c. both the father and the mother are Rh-positive
- d. an Rh-negative mother carries an Rh-positive fetus

Q20. How would the level of bilirubin in the blood be affected by a disease that causes damage to the liver?

Q21. Is the following statement correct or incorrect.

Fibrin clots are lysed by plasmin. Plasmin is formed by proteolytic activation of plasminogen, an inactive precursor.

Q22. Thyroid gland secretes hormone calcitonin. Calcitonin secretion takes place in response to increased levels of calcium ions in the blood. If this secretion of hormone calcitonin is controlled by negative feedback, what effect would calcitonin have on blood calcium level?

Q23. A chemical imbalance in the heart muscle cells results in the following situation: It results in cessation of the heart to pump blood; the cessation of the blood flow will in turn cause other tissue and organs to stop functioning. This situation supports the view that

- all organisms are composed of cells
- all levels of organization within an organism are interdependent
- chemical molecules make up cells
- all cells are independent of each other
- congenital defects can be life threatening

Q24. Why is positive feedback helpful in blood clotting but unsuitable for the regulation of body temperature?

Q25. How much iron is there in the hemoglobin of a 65-kg individual? Note: The blood volume is 65 ml/kg of body weight. The hemoglobin concentration in blood is 14.5 g/100ml.

Q26. The conductance of a lipid bilayer membrane containing a carrier antibiotic decreased abruptly when the temperature was lowered from 40°C to 36°C. In contrast, there was little change in conductance of the same bilayer membrane when it contained a channel-forming antibiotic. why?

Q27. Gamma-aminobutyric acid (GABA) opens ion channels that are specific for the flow of chloride ions. The GABAA receptor channel is of immense importance in medical pharmacology since this receptor is the target for anxiety reducing drugs like Diazepam or Valium.

a. The extracellular concentration of chloride ions is 120 mM and the intracellular concentration is 4 mM. In which direction will chloride ion flow through an open channel when the membrane potential is in the range of -60 mV to +30 mV.

b. What is the net effect of chloride channel opening on the excitability of the neurons?

Q28. Calculate the free-energy change for the transport of an uncharged species from a concentration of 5 mM outside a cell to a concentration of 150 mM inside. assume that the temperature is 25°C.

Note: The standard free energy change (ΔG) for the movement of an uncharged molecule from one side of a membrane at a concentration C_1 to the other at concentration C_2 is given by $\Delta G = 2.3 RT \log C_2/C_1$

Q29. Solution A and B are separated by a selectively permeable barrier. Over time, the level of fluid on side A increases. Which solution initially had the higher concentration of solute?

Q30. In a healthy individual, where would the blood pressure be greater- at the aorta or at the inferior vena cava? Explain.

Q31. What effect would drinking large amounts of caffeinated coffee have on the heart?

Q32. T and B cells can be activated only by

- a. pathogens
- b. interleukins, interferons, and colony-stimulating factors
- c. cells infected with viruses, bacteria, or cancer cells
- d. exposure to a specific antigen at a specific site on a cell membrane.

Red blood cells that are damaged or defective are removed from the bloodstream by the

- a. thymus
- b. lymph node
- c. spleen
- d. tonsils

Q33. Please read the paragraph carefully:

The way in which adrenaline acts on the sinoatrial (SA) node to accelerate the heart rate has hitherto been obscure. However, in various other parts of the heart adrenaline increases the slow inward ($\text{Ca}^{2+}/\text{Na}^{+}$) current^{1–4}, and voltage-recording experiments have indicated that adrenaline also has this action in the sinus region^{5–7}. In the voltage-clamp experiments reported here, we find that adrenaline does indeed increase the slow inward current in the SA node of the rabbit, but that it also augments the outward current which would tend to decelerate pacemaker depolarisation. We find that an additional current, i_f , is activated within the range of voltage where the pacemaker depolarisation occurs: this could be important both in normal pacemaking and in adrenaline-induced acceleration.

Give a suitable title for this paragraph:
