KEY – Answers in bold below

CASE 1: A 10 yr old girl ran a long race in a late morning gym class. Afterwards she felt unusually fatigued and, because she remained lethargic during the afternoon, she was sent to the school nurse. The nurse notes the following symptoms:

The girl is drowsy and has difficulty following directions or answering questions.
She says she is "tired" and her muscles feel weak.
She complains of generalized pain in her torso and muscles of her arms and legs.
She exhibits shortness of breath.
Her skin is slightly bluish in her fingertips/palms/lips.

The nurse forms a diagnosis of sickle cell anemia, a condition that is serious, but not immediantly life-threatening. The girl's parents then take her to a pediatrician who collects blood and confirms the diagnosis with the following results:

Low hematocrit (red blood cell #) , low level of hemoglobin.
Stained blood smear shows that numerous red blood cells cells have a hooked shape.

The red blood cell has specializations to fit through small blood vessels and transport higher gas levels than other cells. Part of these specializations come from cell membrane proteins. With sickle cell anemia, the red blood cell (RBC) is misshapen because of a mutation. Answer the following questions about this cell:

1. Name the four basic tissue types and circle the one that the RBC belongs to.
Epithelial, <u>Connective</u>, Nervous, Muscle (from Ch 3)

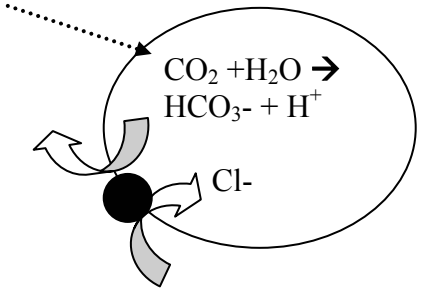
2. What allows the cell membrane to be flexible enough to bend easily as the RBC moves through blood vessels? **Cell membranes are made of phospholipids which are pretty flexible. Another lipid, cholesterol, can also contribute to a flexible membrane, but is not necessary. The phospholipid bilayer is considered fairly 'fluid'.**

3. What kind of membrane protein is responsible for the cell's concave shape?
structural protein

4. State the variables that will affect the rate of oxygen diffusion across the cell surface.
see Fick's law of diffusion. variables: concentration gradient, membrane thickness, molecule size and lipophilicity (resistance) and membrane surface area

5. RBC's can effect the CO_2 concentration gradient across their surface. ICF enzymes facilitate the reaction $CO_2 + H_2O \rightarrow HCO_3^- + H^+$. A membrane antiporter then exchanges HCO_3^- with Cl^-. On the cells below, write in the direction of the reaction and of the antiporter under the conditions of …

<u>picking up CO_2 in muscle</u>



<u>dropping off CO_2 in lungs</u>