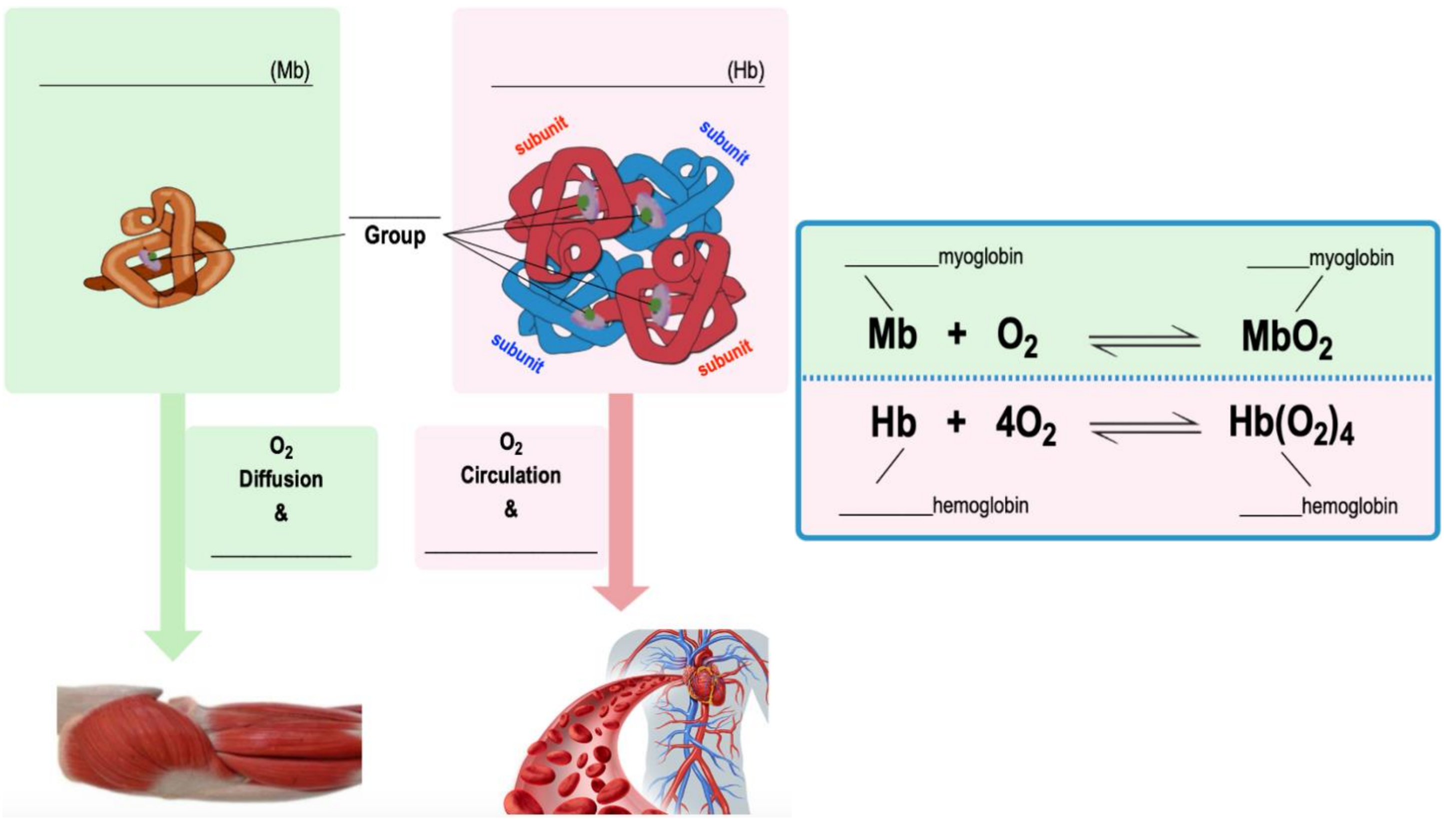
CONCEPT: MYOGLOBIN VS HEMOGLOBIN

- Myoglobin (____) & hemoglobin (____): well-studied proteins & great examples for many protein/enzyme concepts.
  - □ Mb & Hb are *not* technically enzymes; HOWEVER, allosteric regulation does not only apply to enzymes.
  - □ *Myoglobin*: ____________ protein facilitating oxygen *diffusion*, *storage* & *supply* to *muscle tissues* in vertebrates.
  - □ *Hemoglobin*: hetero*tetrameric* *allosteric* protein (2 α & 2 β subunits) that *circulates* & *transports* oxygen via blood.
- Both are capable of *reversibly* binding _______________ gas (O_2) due to their __________ prosthetic group(s).
- Though Mb & Hb need to bind O_2, they also need to _______________ O_2 (*reversible binding*).



PRACTICE: Which of the following statements are true?

a) Both myoglobin and hemoglobin irreversibly bind oxygen gas (O_2).

b) Myoglobin has a single subunit, whereas hemoglobin has four identical subunits.

c) Hemoglobin and myoglobin each contain a single heme group.

d) Each individual subunit of hemoglobin contains a heme group.

e) Hemoglobin transports, stores and supplies oxygen in the muscle tissue.

f) A and B.

g) A and C.

h) B and C.

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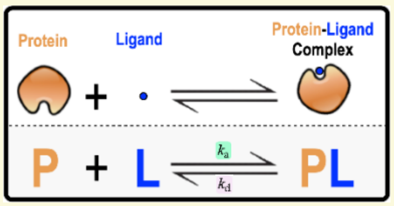
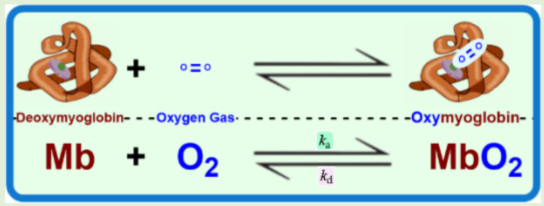
Myoglobin's Protein-Ligand Interactions

●Protein-ligand *affinity* (____) & *fractional saturation* (____ or ____) applies *directly* to myoglobin.

□ Recall: *Fractional Saturation* (θ or Y): the ratio of *oxygenated* protein over *total* protein: $\theta = \frac{[PL]}{[PL] + [P]}$

Review	New
	
$K_d = \frac{[P] + [L]}{[PL]} = \frac{k_d}{k_a} = \frac{1}{K_a}$	$K_d = \frac{[\quad] + [\quad]}{[\quad O_2]} = \frac{k_d}{k_a} = \frac{1}{K_a}$
$\theta = Y = \frac{[PL]}{[PL] + [P]} = \frac{[L]}{[L] + K_d}$	$\theta = Y = \frac{[\quad O_2]}{[\quad O_2] + [\quad]} = \frac{[\quad]}{[\quad] + K_d}$

PRACTICE: If Mb's K_d = 2.5 M and the $[O_2]$ = 7.5 M, what % saturated will Mb be?

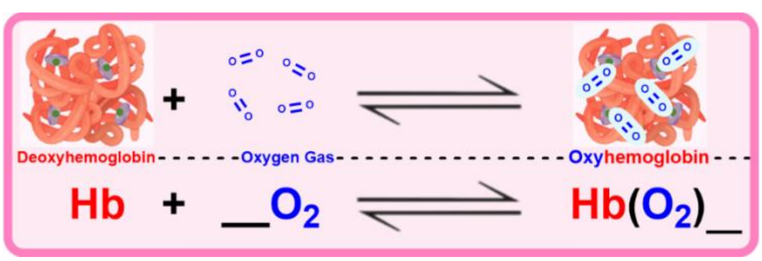
a) 12% c) 0.75%

b) 75% d) 64%

Hemoglobin's Protein-Ligand Interactions

●Hb's protein-ligand interactions are _________ complicated than Mb's since Hb has a more complex structure.

●Recall: Hemoglobin is an *allosteric* protein with ________________ *subunits*, *each* of which can bind a ligand (O_2).



n = # of **L**-binding sites

●Recall: *Coefficients* in a reaction (#'s in *front* of molecules) are included into K_{eq} as __________________.

$$K_d = \frac{[Hb] + [O_2]^{\_\_}}{[Hb(O_2)\_\_]} = \frac{k_d}{k_a} = \frac{1}{K_a}$$

$$\theta = Y = \frac{[Hb(O_2)\_\_]}{[Hb(O_2)\_\_] + [Hb]} = \frac{[O_2]^{\_\_}}{[O_2]^{\_\_} + K_d}$$

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PRACTICE: The differences between hemoglobin and myoglobin include:

a) Hemoglobin is a tetramer whereas myoglobin is a monomer.

b) Hemoglobin exhibits a sigmoidal O_2 saturation curve while myoglobin exhibits a hyperbolic curve.

c) Hemoglobin exhibits O_2 binding cooperativity while myoglobin does not.

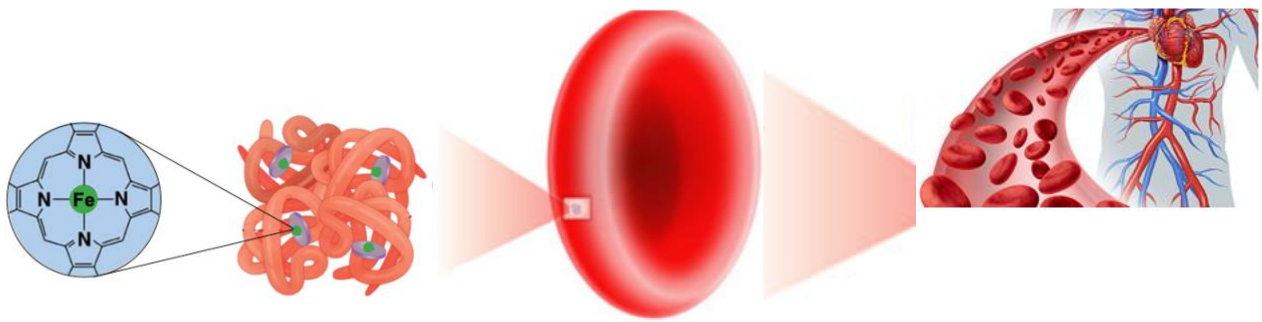
d) All of the above.

More Background Info on Hemoglobin

●Hemoglobin is found within _______ *blood cells* (*RBC* or *erythrocytes*).

□ Each RBC has ~270 million molecules of hemoglobin.

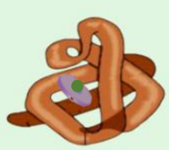
□ One drop of blood the size of a pinhead has ~5 million RBC.



________________ ________________ ________________

Myoglobin vs. Hemoglobin Recap

●Let's recap some of the similarities & differences between myoglobin & hemoglobin:

	# Of Subunits	# Of Heme Groups	Located in:	Reversibly Bind O_2?
________________ 				
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