Gas exchange essay sample

A. Physical constraints on gas exchange: partial pressure of gassses – pressure exerted by a particular gas in a mix of gases

21% O2 P02= 760mm Hg*. 21 = 159. 6 mm Hg

B. Respiratory medium

1. air : 21% 02, low density, low viscosity, easy to move over a surface and thru vessels 2. water: 4-8ml 02/L, 02 solubility decreased by higher temp and higher salt conc., water dense, viscous, more work to move over surface

C. Diffusion rates

– all 02 and C02 exchange occurs by diffusion

– Fick’s law of diffusion

Qs= DA C2-C1/x *t

Qs= quantity of substance

d= diffusion constant, A= area of surface, C2-C1 conc gradient , x= thickness of surface, t = time Characteristics of respiratory membranes

– large surface area (A)

– large concentration difference (c2-c1)

-thin(small x)

II. Respiratory surfaces

A. Body surface

– amphibians, earthworms

B. Specialized surface

-must be ventilated : respiratory medium moved across surface – maintains high C2-C1

I. Aquatic animals

– gills-projections of body surface

Counter current flow in fish gills

– fig 42. 23, blood flow thru and water flow over gill filament is counter current, maximized o2 exchange 2. Terrestrial animals

a. insects- branching system of air tubules, all body cells w/i diffusion distance tracheole end b. mammals, birds, reptiles lungs: branching system of air tubules, ends in alveoli= air sacs of surrounded by capillaries -alveoli are site of gas exchange

III. Respiratory pigments

A. Structure: metalloproteins that increase solubility of O2 in blood, hemocyanin: metal = Cu, arthropods hemoglobin – metal = Fe, vertebrates, most invertebrates Hemoglobin

– 4 subunits, proteins with quaternary structure, each contains Fe and bins (1) O2 B. Properties

1. Cooperativity – (1) O2 binds, Hb molecule changes shape, easier for 2nd, 3rd, 4th, 02 molecs to bind % saturation of Hb with 02- 25% saturation= 25% of 02 binding sites in a hemoglobin solution are occupied x axis- P02 (mm Hg)

y axis- % saturation of Hb with O2

graph goes up and curves off at the end like an (S) shape fig 42. 31

2. pH sensitivity: Bohr effect

-pH affects O2 affinity of Hb

lower ph decreases Hb O2 affinity

Significance of pH sensitivity

* RBC pH decreases in capillaries supplying body tissues

* co2 +h2o = H2CO3 = HCO23- + H+

* H+ binds to Hb, changing its shape so 02 is relased and diffuses * in lungs

O2 diffuses into RBC

* High O2 displaces H+ from Hb

CO2 diffuses out of RBC and into alveoli

*

CH. 44- Osmoregulation

– controlling solute conc and water gain/loss from body fluids A. Purpose

– Cell fxn requries specific, stable solute conc.

B. Osmolarity

– moles solute/L

– units: mOs m/L

C. Osmotic challenges

1. Conformers & regulators

x axis= external mOsm/L

y axis = internal mOsm/L

2. Marine animals

a. Shark

– body fluid (salt) < seawater

– body fluid osmolarity = 1000 mOsm

– high (urea) and (trimethylamine oxide)

– no water loss