

1 **Preliminary Comments on the ISA from Dr. James Ultman (Updated)**

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4 **Comments on the Executive Summary and Chapter 1**

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6 The executive summary has been shortened by removing redundant material, and has been made
7 more accessible to the non-technical reader.

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9 **Comments on Chapter 4**

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11 Several revisions/additions have led to an improvement to this chapter. Entirely new sections on
12 the structure/function of the respiratory system and breathing rates/habits provide an improved
13 foundation for the later sections on SO₂ absorption and possible mode of action. The inclusion
14 of material on the possible effects of obesity on SO₂ absorption vis-à-vis modification of
15 breathing habit is also recognized.

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17 It appears to me that the value of the Henry's law constant given in the ISA (pg 4-8, line 4) is
18 actually the ratio of molar SO₂ concentration in air to the total SO₂ concentration in water,
19 appearing as dissolved gas and as ions (Eq. 4-1). Strictly speaking, the Henry's law constant is
20 the ratio of the SO₂ partial pressure to the concentration (or mole fraction) of dissolved SO₂ gas
21 only. I suggest instead of Henry's law constant, the authors use another term, perhaps "solubility
22 factor," for both SO₂ with O₃.

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24 The SO₂ mass transfer rates given on pages 4-9 (lines 3-4) and 4-10 (lines 6-12) seem to be
25 based on computations made by the authors of the ISA. The computations rely on an equation
26 for mass transfer rate (Asgharian, Eq. 3) that requires the concentration of SO₂ to be known at
27 the respired gas-ELF liquid interface. It appears that this concentration has been neglected so
28 that local absorption is proportional to the gas-phase Sherwood number=(airway diameter)(gas
29 phase mass transfer coefficient)/(gas phase diffusion coefficient). This is misleading since it is
30 more likely that a transport resistance modulated by diffusion-reaction processes in the ELF
31 produces a non-zero interfacial concentration which opposed absorption. The revised ISA
32 should include a more complete description of the diffusion and reaction processes that
33 contribute to absorption. A justification should be provided for ignoring the influence of ELF
34 diffusion-reaction effects in the ELF. By the way, the assumption of a zero interfacial
35 concentration is not consistent with the occurrence of SO₂ desorption during expiration, which is
36 asserted in other places in the chapter.