Chapter 11

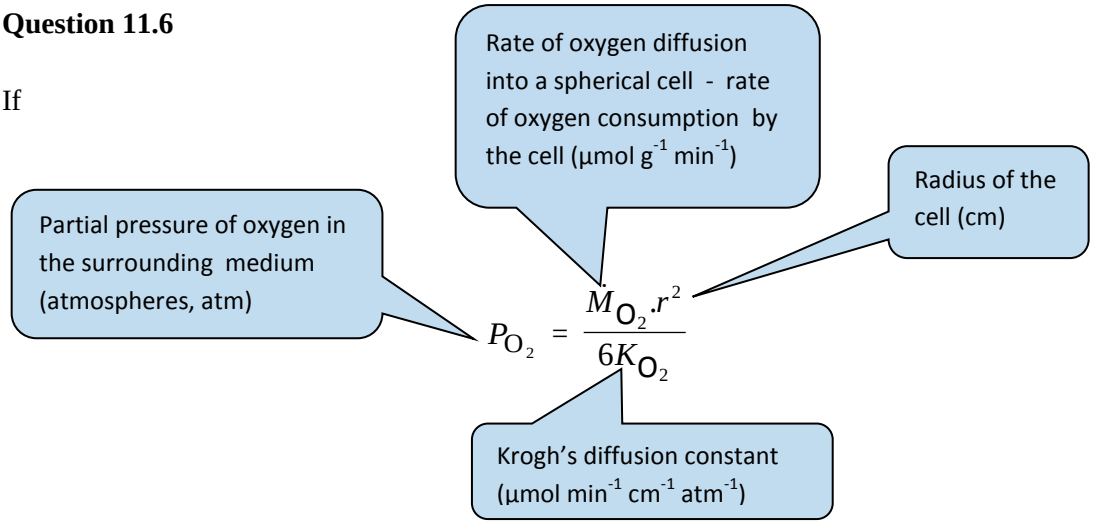
Question 11.2

Standard temperature and pressure (STP) = 273 K and 101.3 kPa, respectively.

So at STP, the volume of the oxygen consumed by the fish would be: 51 mL × $\frac{273}{288} \times \frac{101.3}{99}$ = 49.5 mL.
As 1 mmol of a gas occupies 22.4 mL, 49.5 mL = $\frac{49.5}{22.4}$ = **2.21 mmol O_2**

Question 11.6

If



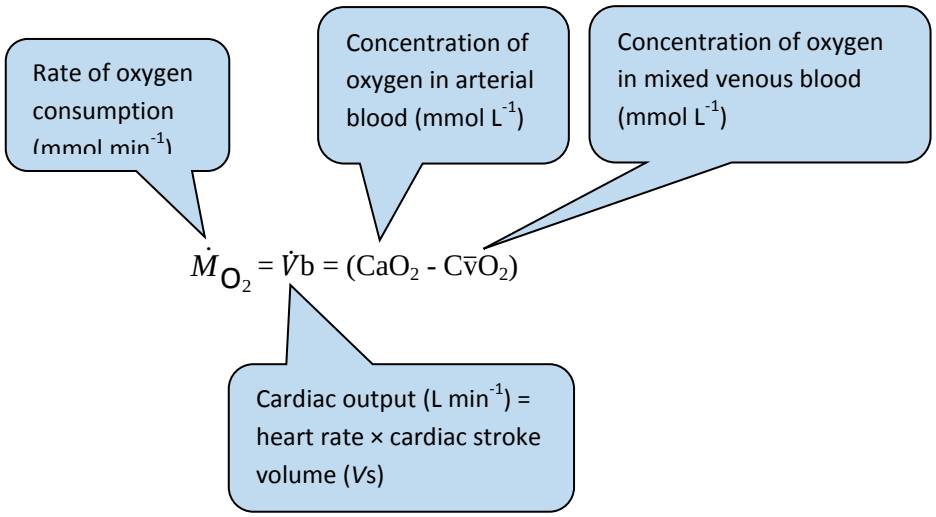
Partial pressure at the centre of the organism is 0 kPa, and $P_{O_2} = \frac{20.95}{101.3}$ atm = 0.207 atm

$r^2 = \frac{6K_{O_2}}{\dot{M}_{O_2}} P_{O_2}$ and r = $\sqrt{\frac{6K_{O_2}}{\dot{M}_{O_2}} P_{O_2}}$

which means that $r = \sqrt{\frac{6 \times 0.000638 \times 207}{0.05}}$ = 0.126 cm and the **diameter is 0.25 cm**

Question 11.7

If



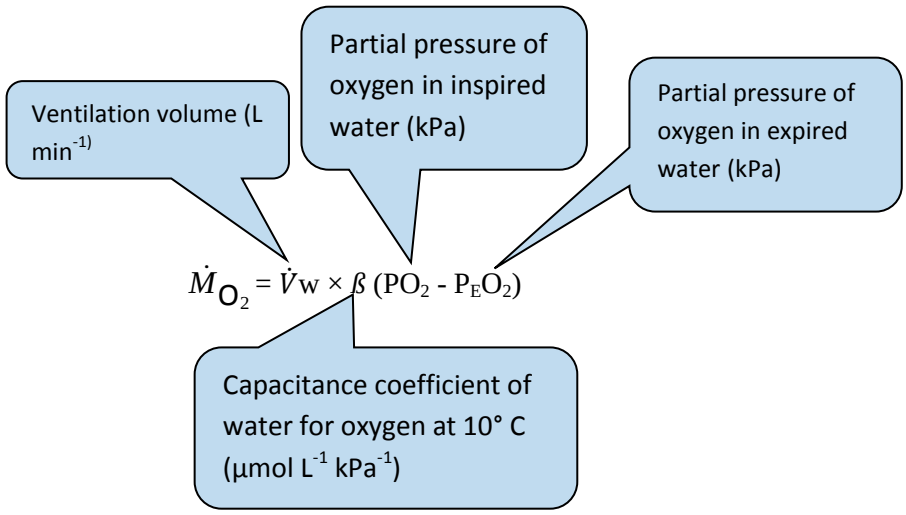
$$\dot{V}b = \frac{\dot{M}_{O_2}}{CaO_2 - C\bar{v}O_2}$$

$\dot{M}_{O_2}$ = 234 μmol min^{-1} = 0.234 mmol min^{-1}

Therefore, $\dot{V}b = \frac{0.234}{3.7}$ = 0.0632 L min^{-1} = **63.2 mL min^{-1}**

Cardiac stroke volume = $\frac{63.2}{51}$ = **1.24 mL**

Question 11.8



The concentration of oxygen in the water = ß × P_IO_2

Therefore, $\frac{\dot{M}_{O_2}}{\dot{V}w}$ = (ß P_IO_2 - ß P_EO_2), and ß P_EO_2 = ß P_IO_2 – $\frac{\dot{M}_{O_2}}{\dot{V}w}$

ß P_IO_2 = 16.8 × 20.2 = 339.4 μmol L^{-1} and $\frac{\dot{M}_{O_2}}{\dot{V}w}$ = $\frac{234}{2.04}$ = 114.7 μmol L^{-1},

thus ß P_EO_2 = 339.4 –114.7 = 224.7 μmol L^{-1} and

P_EO_2 = $\frac{224.7}{16.8}$ = **13.4 kPa**