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The amount of oxygen in the blood is calculated using the formula:

[1.34 x Hb x (SaO2/100)] + 0.003 x PO2 = 20.8ml

Oxygen is carried in the blood in two forms: dissolved and bound to hemoglobin. Dissolved oxygen obeys Henry's law – the amount of oxygen dissolved is proportional to the partial pressure. For each mmHg of PO_2 there is 0.003 ml O_2/dl (100ml of blood). If this was the only source of oxygen, then with a normal cardiac output of 5L/min, oxygen delivery would only be 15 ml/min. Tissue O_2 requirements at rest are somewhere in the region of 250ml/min, so this source, at normal atmospheric pressure, is inadequate.

Hemoglobin is the main carrier of oxygen. Each gram of hemoglobin can carry 1.34ml of oxygen. This means that with a hemoglobin concentration of 15g/dl, the O2 content is approximately 20ml/100ml. With a normal cardiac output of 5l/min, the delivery of oxygen to the tissues at rest is approximately 1000 ml/min: a huge physiologic reserve.

Hemoglobin has 4 binding sites for oxygen, and if all of these in each hemoglobin molecule were to be occupied, then the oxygen capacity would be filled or saturated. This is rarely the case: under normal conditions, the hemoglobin is 97% to 98% saturated. The amount of oxygen in the blood is thus related to the oxygen saturation of hemoglobin.

Taking all of these factors into account, we can calculate the oxygen content of blood where the PO2 is 100mmHg, and the hemoglobin concentration is 15g/L:

[1.34 x Hb x (saturation/100)] + 0.003 x PO2 = 20.8ml

As one would expect, this figure changes mostly with the hemoglobin concentration: when the patient is anemic the oxygen content falls, when polycytemic, it rises. In either case the O2 saturation of hemoglobin may be 97 – 100%, but there may be a large discrepancy in content.