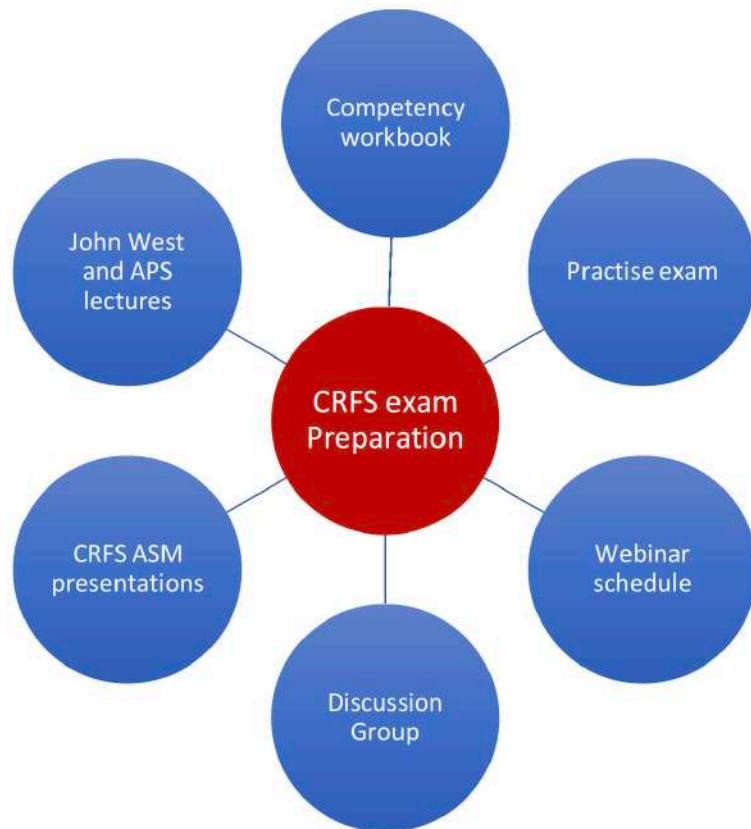


Certified Respiratory Function Scientist Exam Review

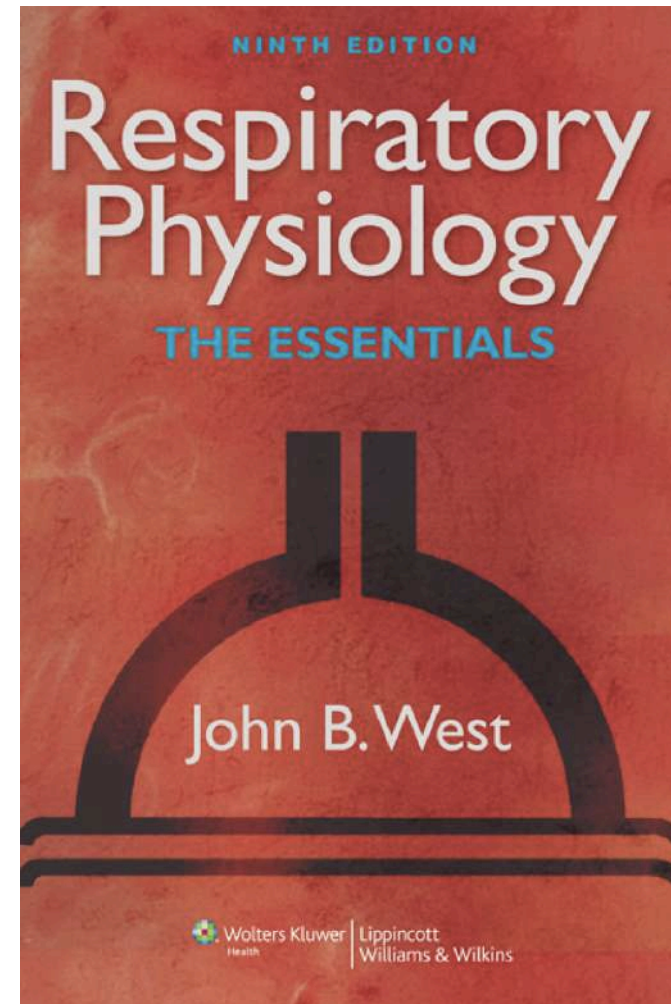
Leigh M Seccombe PhD, MSc



“Examples of question that for the majority were scored incorrect”



<http://anzsrs.org.au/crfs>



Q1

www.menti.com and use code 89 15 29

Who said the famous words

“with great power comes great responsibility”?

A - Voltaire

B - Peter Parker

C - John F Kennedy

D - Donald J Trump

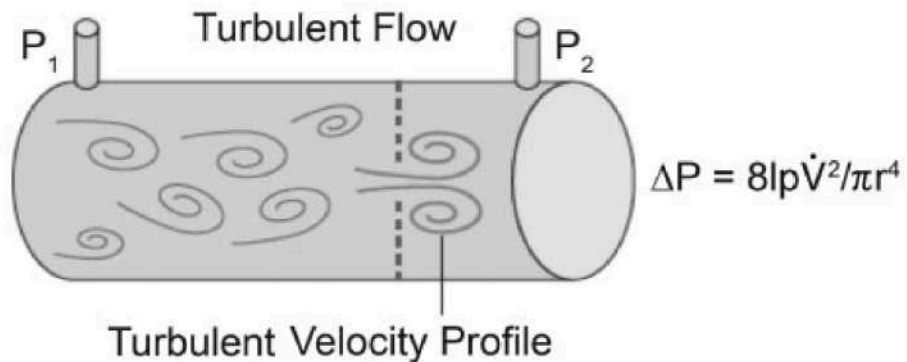
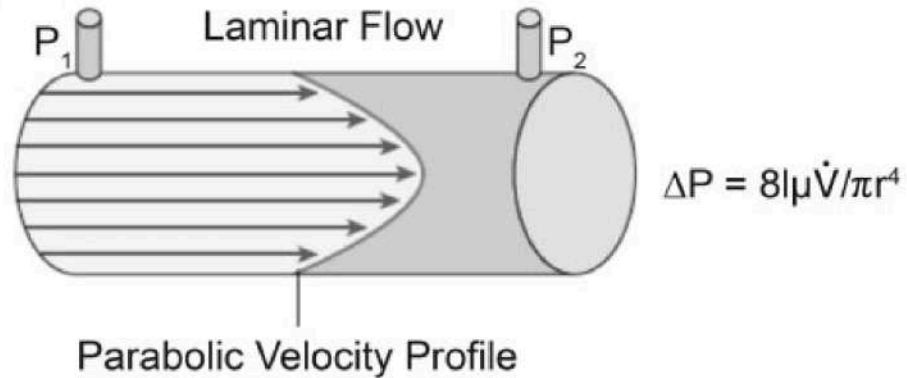
Q1

www.menti.com and use code 89 15 29

Most of the resistance to airflow in the tracheobronchial tree is in the:

- A - Alveoli
- B - Central airways
- C - Peripheral airways
- D - Terminal respiratory bronchioles

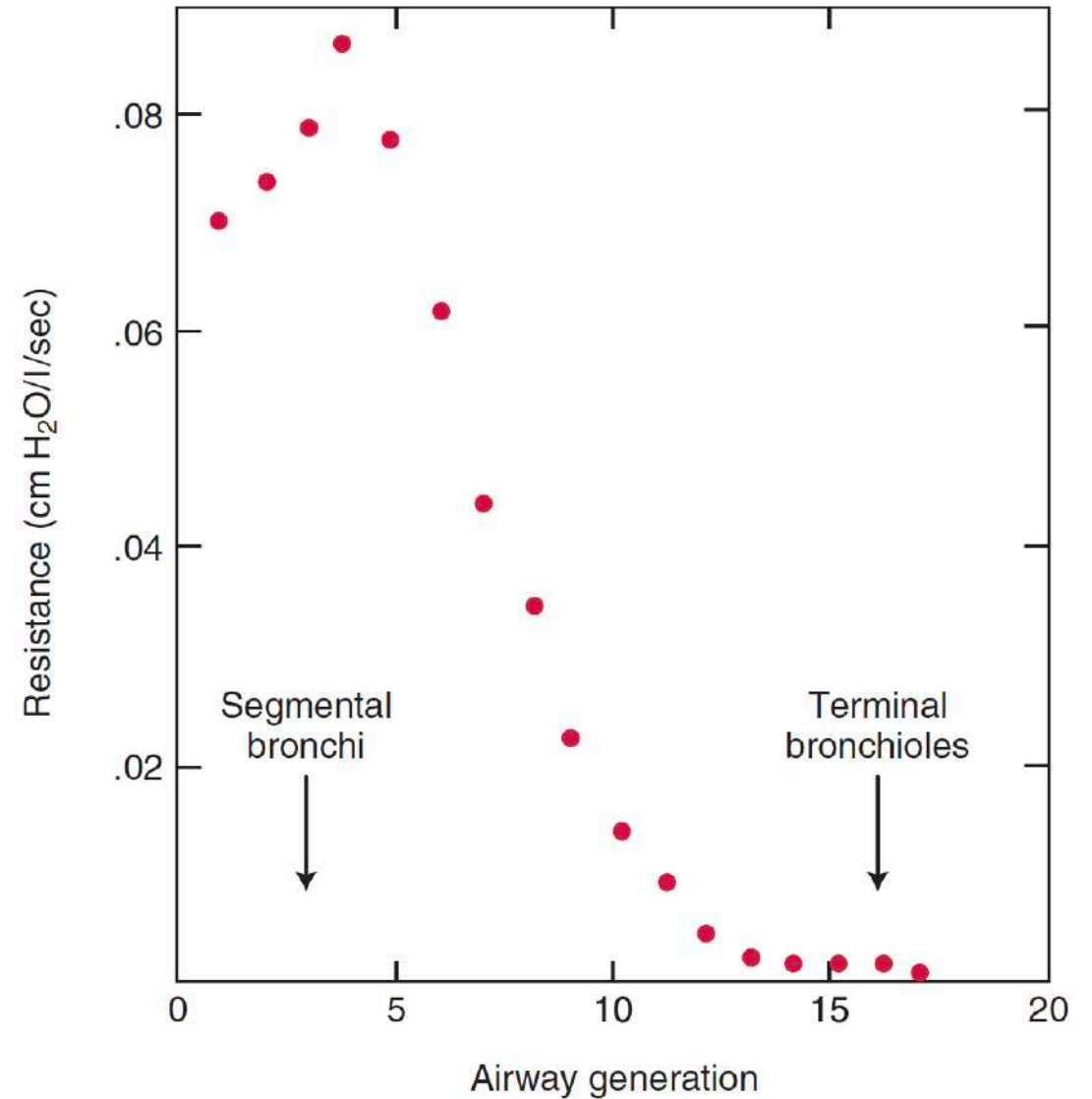
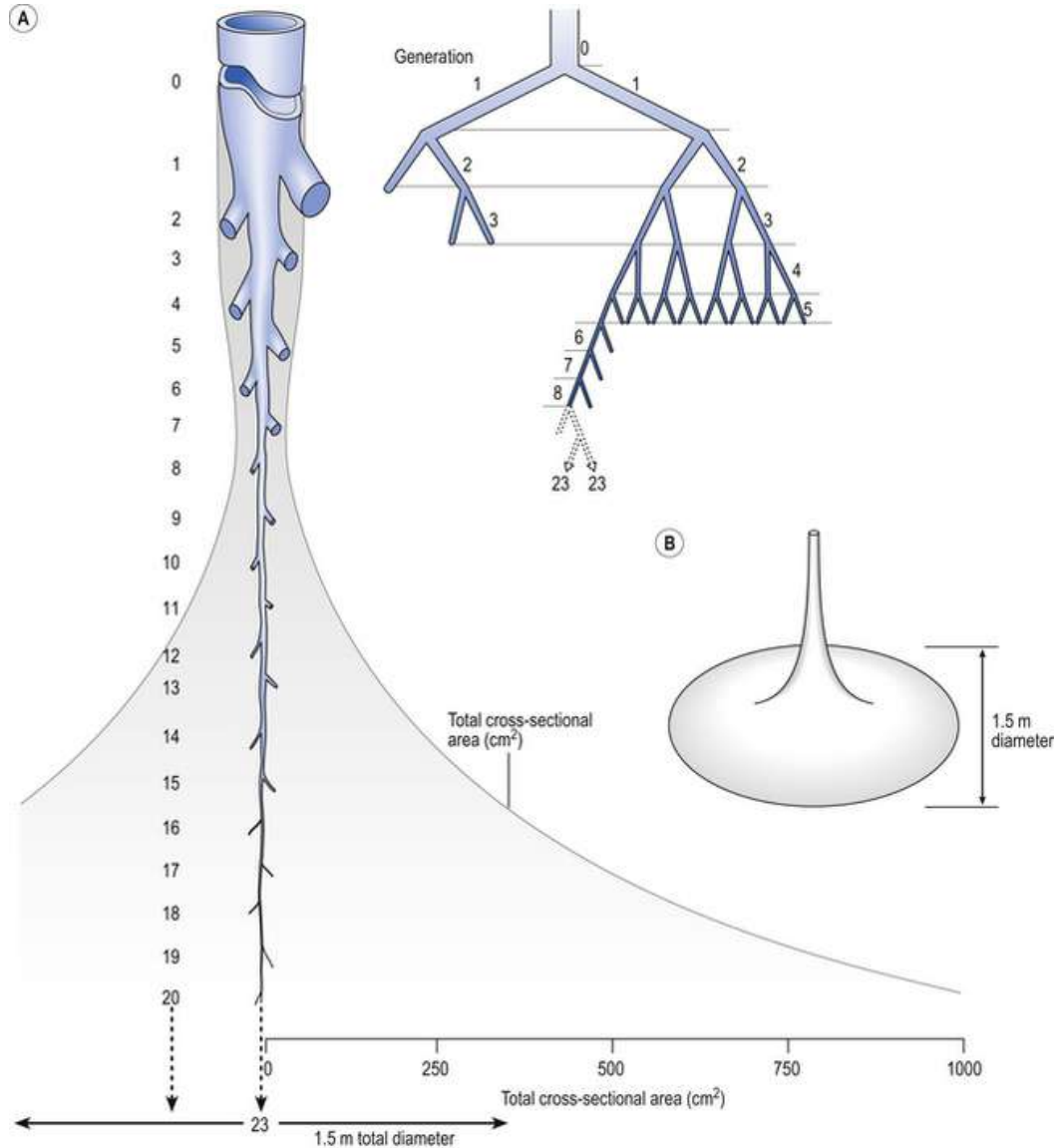
Airways Resistance



Poiseuille equation:

Resistance (R) to flow, is a property of
the length (l) of the tube,
its radius (r)
the viscosity of air

Airways Resistance



Q1

Most of the resistance to airflow in the tracheobronchial tree is in the:

A - Alveoli

B - Central airways

C - Peripheral airways

D - Terminal respiratory bronchioles

Q2

The primary compensatory response to intrapulmonary shunting is:

- A - Selective distribution of blood flow
- B - Decreased O₂ consumption
- C - Increased cardiac output
- D - Decreased peripheral perfusion

Intrapulmonary shunting

Shunt indicated by a low Q_S/Q_T

Q_S = end capillary O_2 content – mixed venous O_2 content

Q_T = cardiac output

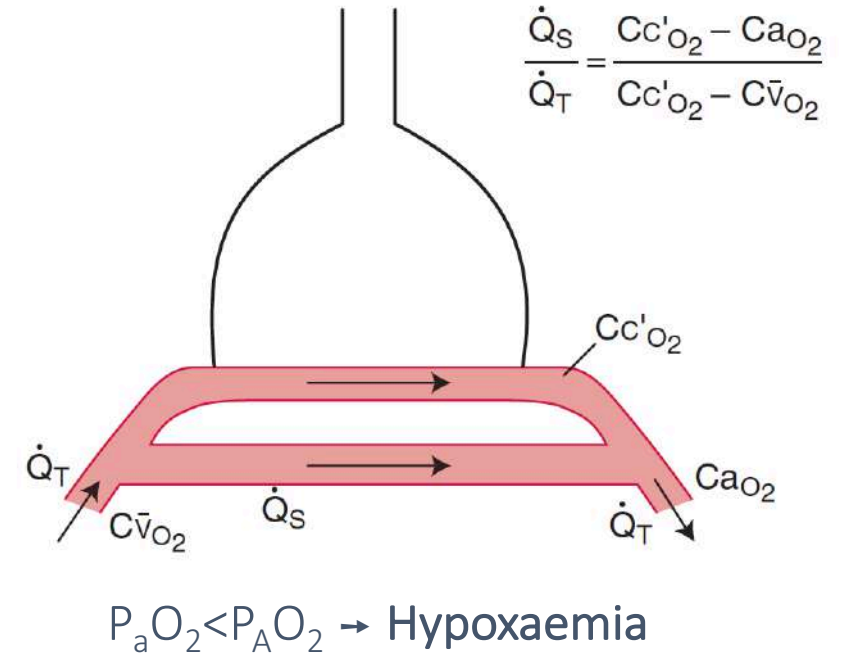
* Intrapulmonary Vs extrapulmonary shunting?

A region of the lung is perfused with little or no ventilation

e.g. atelectasis, pneumonia, pulmonary edema, ARDS

A region of the lung is ventilated without perfusion

e.g. Congenital HD, atrial or ventricular septal defects, patent ductus arteriosus

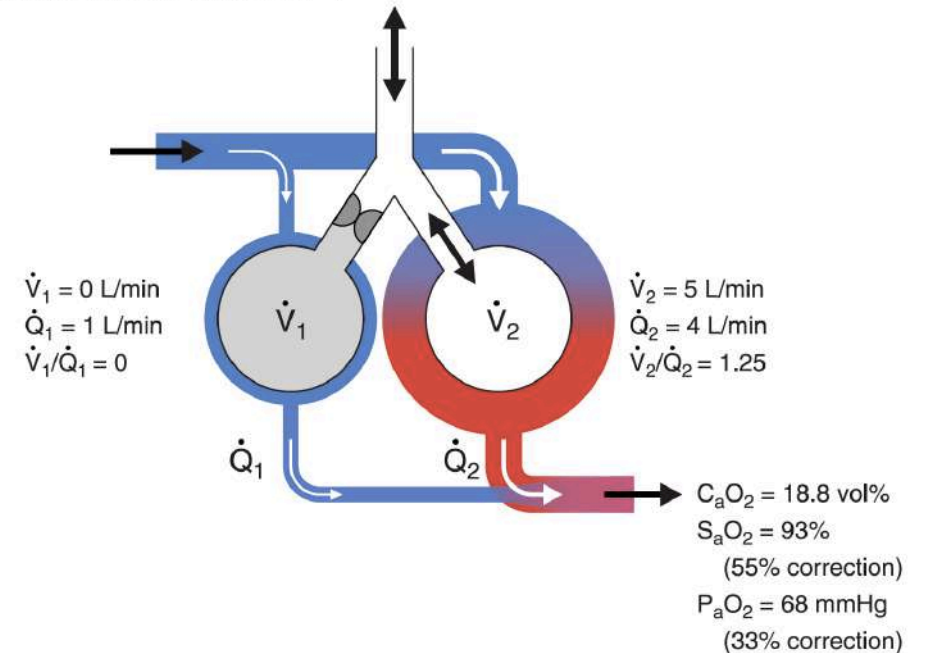


“Compensatory response” to hypoxaemia

Reduction in PaO_2 (and hypercapnia) mitigated by:

- Hypoxic pulmonary vasoconstriction (improve V/Q matching)
- Hyperventilation ($\nearrow V$)
- Increased cardiac output ($\nearrow Q$)

\dot{V}/\dot{Q} Mismatch with HPV



Q2

The primary compensatory response to intrapulmonary shunting is:

A - Selective distribution of blood flow – *does this mean HPV? Occurs constantly..*

~~B - Decreased O₂ consumption~~

C - Increased cardiac output – *mitigate hypoxaemia, prevent L-R shunt?*

~~D - Decreased peripheral perfusion~~

Q3

Which one of the following gases in a healthy subject is diffusion limited?

A - CO₂

B - CO

C - O₂

D - Nitrous oxide

Diffusion

Processes:

1. Molecular diffusion across the membrane

Depends on:

- Alveolar-capillary surface area per unit thickness
- Diffusivity of gas in tissue
- Partial pressure difference

2. Reactive conductance

- chemical combination with Hb

Depends on:

- Reaction rate of gas with [Hb]
- Amount of Hb in pulmonary microcirculation

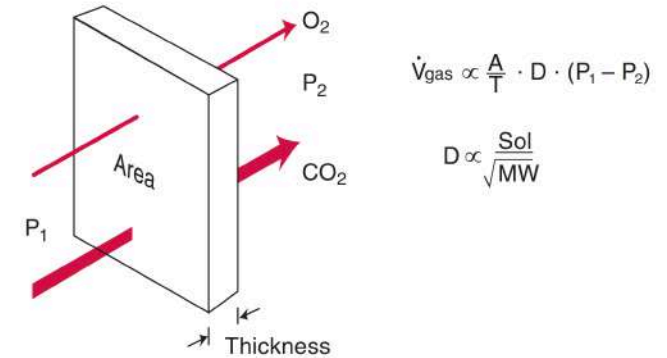
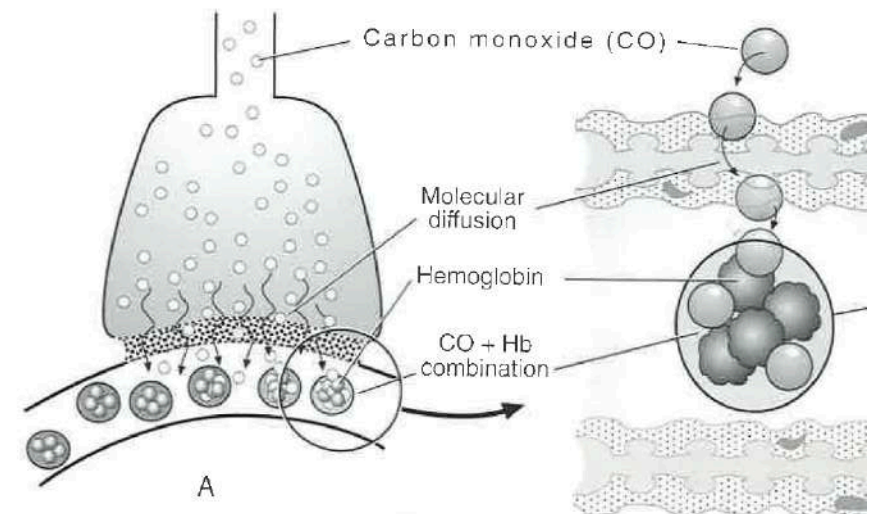


Figure 3-1. Diffusion through a tissue sheet. The amount of gas transferred is proportional to the area (A), a diffusion constant (D), and the difference in partial pressure ($P_1 - P_2$), and is inversely proportional to the thickness (T). The constant is proportional to the gas solubility (Sol) but inversely proportional to the square root of its molecular weight (MW).

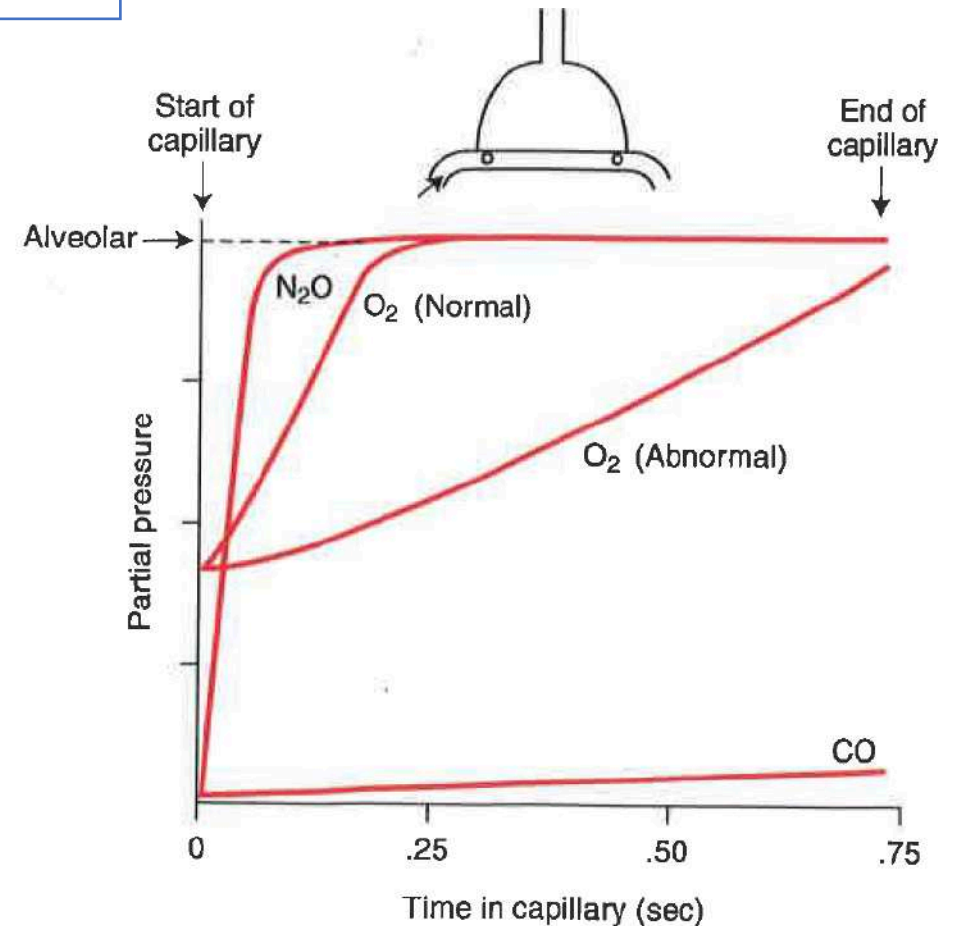


Diffusion

Diffusion limitation - limiting factor is rate of entry across BGB

Perfusion limitation - limiting factor is blood flow

	Molecular diffusivity	Reactive to Hb?
O ₂	When RBC 1/3 rd along capillary	Yes
CO ₂	20x faster than O ₂ as more soluble with similar MW	Yes
CO	Diffuses rapidly - however plasma P _{CO} ≈ 0 No equilibration!	Highly! 200x of O ₂
N ₂ O	Almost instant When RBC 1/10 th along capillary	No



Q3

Which one of the following gases in a healthy subject is diffusion limited?

~~A - CO₂ - highly Hb reactive, rapid equilibration~~

B - CO - highly Hb reactivity, no pp equilibration

C - O₂ - Hb reactive, time for equilibration "usually"

~~D - Nitrous oxide - non-Hb reactive, however rapid equilibration~~

Q4

The following values were obtained from a patient at rest:

RER	1.2	
V_E	20	L min^{-1}
Respiratory Rate	20	bpm

Which of the following could best describe their condition?

- A - Chronic CO_2 retention
- B - Metabolism of free fatty acids
- C - Acute hyperventilation
- D - Metabolism of carbohydrates

Respiratory exchange ratio

RER = respiratory exchange ratio = $\frac{V_{CO_2}}{V_{O_2}}$
RQ = metabolic respiratory quotient

Oxidation of substrates

- Lipid: $C_{16}H_{32}O_2 + 23O_2 \rightarrow 16CO_2 + 16H_2O + 36$ RQ=0.7
- Carbohydrate: $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + 36$ RQ=1.0
- Anaerobic glycolysis: Pyruvate + NADH + H⁺ \rightarrow 2 lactate (La) + NAD RQ >1.0
(buffered by bicarbonate system \rightarrow CO₂)

<i>Resting</i>	RER :	0.8	<i>RER</i>	1.2
	V _E :	6-12 L.min	<i>V_E</i>	20 L min ⁻¹
			<i>Respiratory Rate</i>	20 bpm

Q4

The following values were obtained from a patient at rest:

RER	1.2	
V_E	20	$L \text{ min}^{-1}$
Respiratory Rate	20	bpm

Which of the following could best describe their condition?

- ~~A - Chronic CO_2 retention~~ – Hypoventilation $\rightarrow V_E$
- ~~B - Metabolism of free fatty acids~~ – $RER \cong 0.7$
- C - Acute hyperventilation** – Increased expired $V\text{CO}_2 \rightarrow RER$
- D - Metabolism of carbohydrates – Aerobic: $RER = 1.0$, Anaerobic: $RER > 1.0$

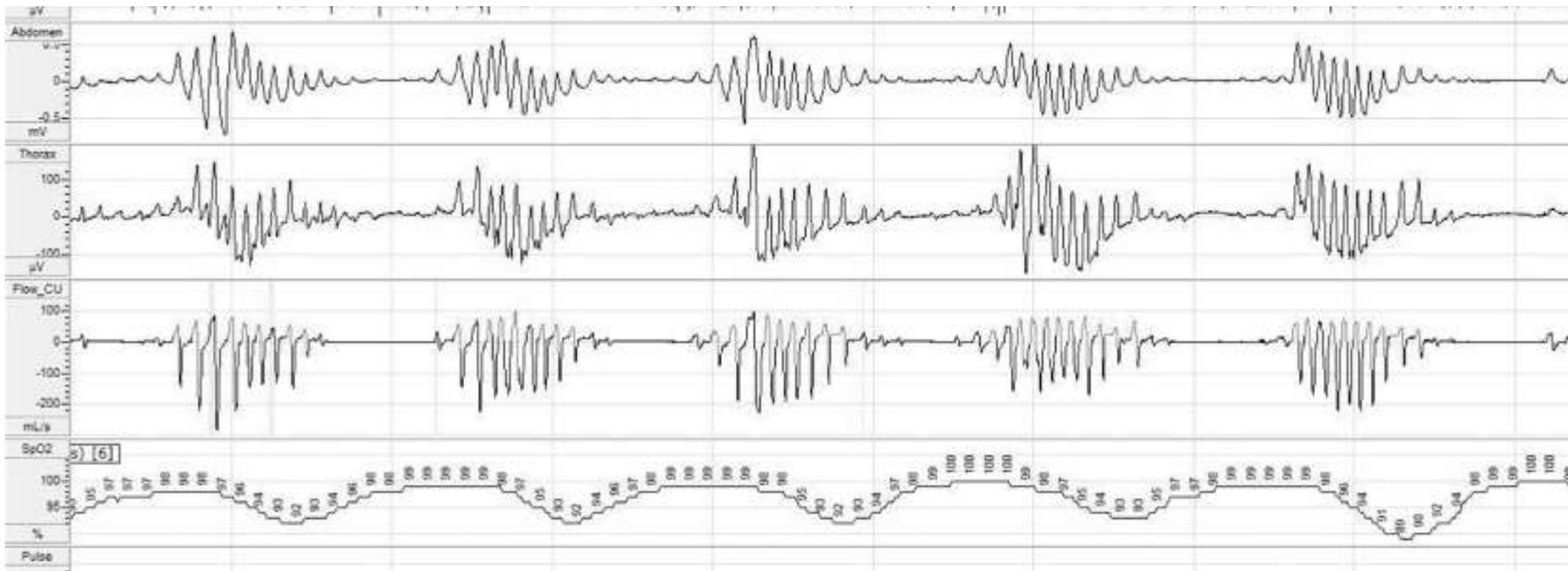
Q5

Cheyne-Stokes breathing can be associated with of which of the following:

- A - Diabetic ketoacidosis
- B - Congestive heart failure
- C - Pulmonary hypertension
- D - Respiratory failure

Q5

Cheyne-Stokes breathing



Q5

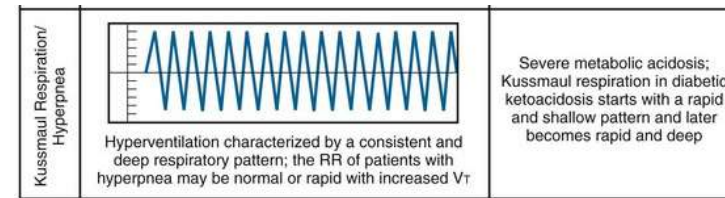
Cheyne-Stokes breathing can be associated with of which of the following:

~~A - Diabetic ketoacidosis~~

B - Congestive heart failure

~~C - Pulmonary hypertension~~

~~D - Respiratory failure~~



– Prolonged circulation time, reduced buffering

– *Non-specific*

– *Non-specific*

Q6

Which statement best describes the relationship between the pH of blood and its oxygen carrying capacity at a given P_{O_2} ?

- A - The oxygen carrying capacity of blood at pH 7.4 is greater than at pH 7.0
- B - The oxygen carrying capacity of blood at pH 7.0 is greater than at pH 7.4
- C - The oxygen carrying capacity of blood at pH 7.0 and at pH 7.4 are equal
- D - pH affects only the position of the oxyhaemoglobin dissociation curve, not the oxygen content of blood

- ↗ CO₂
- ↘ pH
- curve

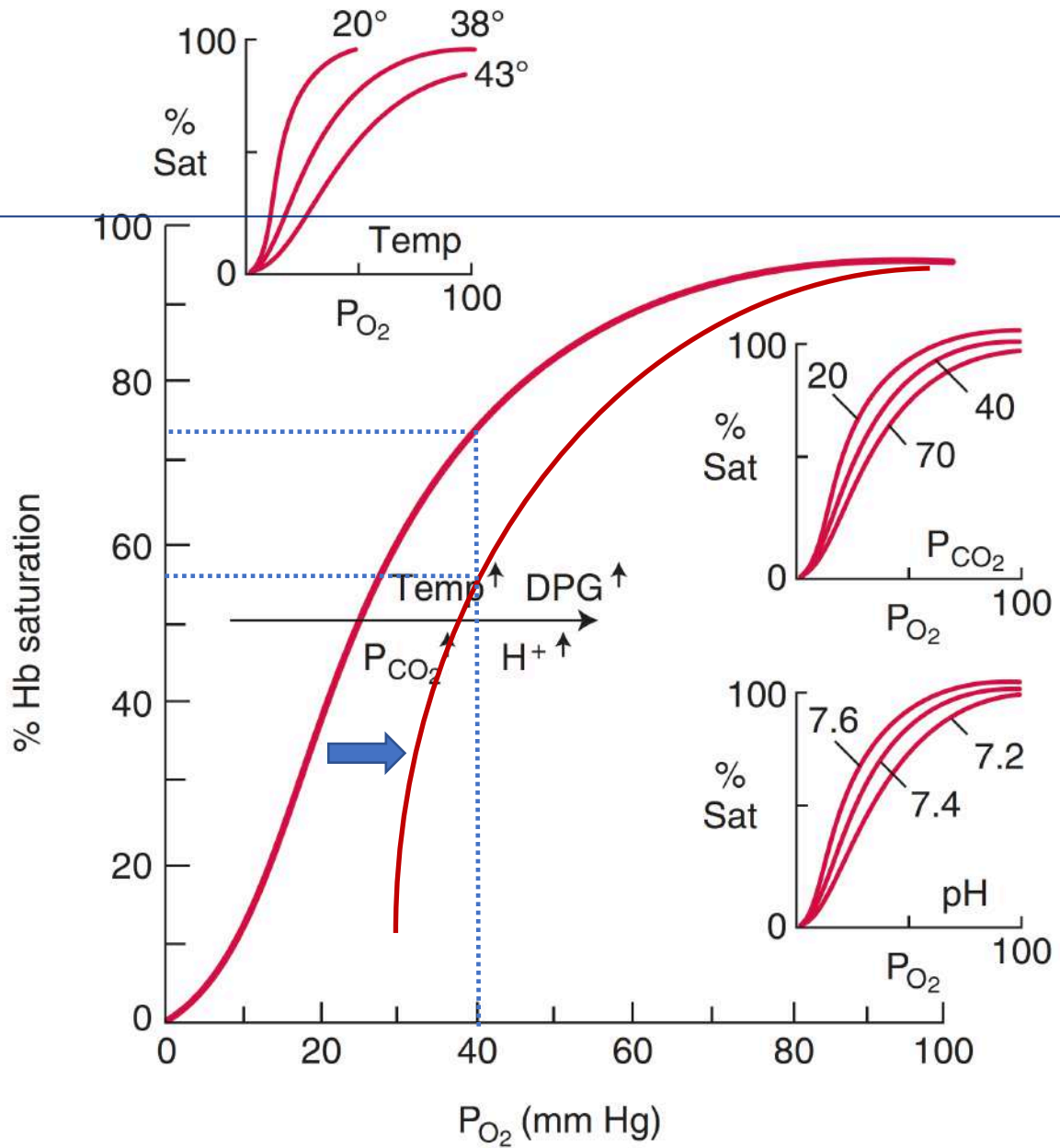


Figure 6-3. Rightward shift of the O₂ dissociation curve by increase of H⁺, PCO₂, temperature, and 2,3-diphosphoglycerate (DPG).

Q6

Which statement best describes the relationship between the pH of blood and its oxygen carrying capacity at a given P_{O_2} ?

- A - The oxygen carrying capacity of blood at pH 7.4 is greater than at pH 7.0
- ~~B - The oxygen carrying capacity of blood at pH 7.0 is greater than at pH 7.4~~
- ~~C - The oxygen carrying capacity of blood at pH 7.0 and at pH 7.4 are equal~~
- ~~D - pH affects only the position of the oxyhaemoglobin dissociation curve, not the oxygen content of blood~~