



One Minute Revision Guides

**Arterial Blood Gases**

# Arterial Blood Gases

When you see an arterial blood gas you should just think “marks in the bag”. These are commonly found, easy to write questions that test knowledge.

ABG's are shown as follows. I've listed some normal range values below.

<b>pH</b>	7.35-7.45
<b>P<sub>a</sub> O<sub>2</sub></b>	>10.5
<b>P<sub>a</sub> CO<sub>2</sub></b>	4.7-6
<b>HCO<sub>3</sub><sup>2-</sup></b>	20-28
<b>Base excess</b>	+/- 2

There are 3 key steps to interpreting a blood gas in your exams:

## Step 1

- Does the result show ACIDOSIS/ ALKALOSIS or a NORMAL PH

If the pH is low i.e. <7.35 the patient is acidotic. Many FY1 doctors seem to “struggle with the lower number meaning more acidity” but I have tried to convince several that yes, this is true and no, I'm not making it up.

So pH<7.35 = Acidotic  
7.35-7.45= Normal pH  
>7.45= Alkalotic

## Step 2

- Are the lungs doing something as a *result* of a “breathing” problem or *in response* to another problem [for “breathing” think airway/lung substance/ nerves /muscles/ central drive to breathe]

So, what's happened to the CO<sub>2</sub>? If it's gone UP↑ then it implies that gas exchange through the lungs is impaired. This most commonly happens because the lungs are under ventilated for any one of a number of reasons (e.g. hypoventilation secondary to drugs (opiates) or neuromuscular failure Guillan Barre Syndrome) etc.

For example: CO<sub>2</sub> is 9.6. That's high: the lungs must not be ventilating effectively.

Think airway/lung substance/ nerves /muscles/ central drive to breathe/ respiratory rate/ tidal volume.

### Examples of under ventilation causing a respiratory acidosis

Bronchospasm – eg, acute asthma

Reduced respiratory rate e.g. opiate toxicity

Chronic obstructive airways (reduced effective lung volumes and therefore tidal volume)

Muscular weakness: e.g. paralysis in GBS muscular dystrophy etc.

If the CO<sub>2</sub> has gone down this implies that the lungs are working more efficiently. This is because in general you will produce a reasonably constant amount of CO<sub>2</sub> for the purposes of considering questions in an exam.

So.... things which increase your respiratory rate (e.g. panic attack and hyperventilation) will cause a primary respiratory alkalosis. If this is occurring in response to a metabolic acidosis then this is a *compensatory* change.

## Step 3

- What's happened to the HCO<sub>3</sub><sup>2-</sup> ?

In a metabolic acidosis caused by any severe infection/ physiological stress/ acute renal failure the amount of acid produced (e.g. lactate) by stressed organs will increase. As a result of this the buffering system in the blood will compensate leading to a net fall in your HCO<sub>3</sub>. This means in metabolic acidosis you tend to see the HCO<sub>3</sub> go down.

The key fact to remember is that the kidneys regulate your HCO<sub>3</sub> but cannot do it in the space of a few hours. It takes days-weeks for them to regulate pH via changing HCO<sub>3</sub> levels.

However an illness resulting in the production of rapid acid accumulation (e.g. ketosis in diabetic ketoacidosis) will lead to a rapid fall in the HCO<sub>3</sub> as it tries to compensate.

***The "base excess" simply refers to how much extra base [alkali] you have in your body and how much "acid" would be required to return your pH to normal. A negative base excess( e.g. -10) occurs in acidosis, a positive base excess (e.g.+10) in alkalosis***

So....

Changes in HCO<sub>3</sub>, when its elevated, usually relates to a chronic acidosis: most commonly because of chronic obstructive pulmonary disease  
HCO<sub>3</sub> can fall quickly but cannot rise quickly

BLOOD ACIDS INCLUDE:

Lactate (produced during hypoxic stress)  
Ketones (diabetic ketoacidosis, ethanol)  
Urate (renal failure)

## Examples

DKA→Metabolic acidosis (ketone production)→compensatory increase in respiratory rate aiming to normalise pH→CO<sub>2</sub> falls.

*If the CO<sub>2</sub> falls sufficiently to normalise the PH then it's a **compensated** metabolic acidosis  
If it doesn't normalise the pH then it's a **partially compensated** metabolic acidosis*

Examples

pH 7.23, P<sub>a</sub> CO<sub>2</sub> 1.4, HCO<sub>3</sub><sup>2-</sup> 11.2 = **partially compensated** metabolic acidosis(DKA)  
pH 7.44, P<sub>a</sub> CO<sub>2</sub> 8.4, HCO<sub>3</sub><sup>2-</sup> 36 = **compensated** respiratory acidosis (e.g. COPD)