

/ABG QUIZ

QUIZ

# 1. What is the acid-base disturbance in this patient?

1 point

Presenting complaint: pneumonia

## Measurement report

23/10/2016 14:21

Serial number: 9500  
Instrument ID: WQ9500  
Operator ID: DR.ABG  
Hospital Location: Hospital

-----  
Patient ID: 0382832  
Patient Name: Mrs. Olive  
Date of Birth: 27/09/1950  
Remark: on 2l/min via  
nasal cannula

F<sub>i</sub>O<sub>2</sub>: -  
Temperature: 37.0°C  
Blood type: Arterial

-----  
pH 7.480 [7.350 - 7.450]  
pCO<sub>2</sub> 4.23 [4.27 - 6.40]  
pO<sub>2</sub> 9.23 [11.07 - 14.40]

-----  
cHCO<sub>3</sub><sup>-</sup> 23.5 [22.0 - 26.0]  
BE 0.7 [-2.0 - +2.0]

-----  
Na<sup>+</sup> 134.1 [136.0 - 145.0]  
K<sup>+</sup> 2.87 [3.50 - 5.10]  
Ca<sup>2+</sup> 1.152 [1.150 - 1.330]  
Cl<sup>-</sup> 96.1 [98.0 - 107.0]

-----  
nCa<sup>2+</sup> 1.20

-----  
Hct 38.3% [36.0 - 53.0]

-----  
tHb 118.0g/L [115.0 - 178.0]  
COHb 1.1% [0.0 - 3.0]  
O<sub>2</sub>Hb 93.6% [97.0 - 98.0]  
MetHb 0.8% [0.0-1.5]  
SO<sub>2</sub> 95.4% [94.0-98.0]

-----  
Glu Sample error [3.5 - 5.3]  
Lac Sample error [0.6 - 2.5]

Uncompensated metabolic alkalosis

- Partially compensated respiratory alkalosis
- Mixed alkalosis
- Uncompensated respiratory alkalosis
- Compensated metabolic acidosis
- Mixed acidosis

2. What is the acid-base disturbance in this patient? (select two answers) 2 points

No PMHx given.

	$F_iO_2$ :	0.21 (Room air)
-----		
pH	7.339 (-)	[7.350 - 7.450]
pCO <sub>2</sub>	7.89 (+)	[4.27 - 6.40]
pO <sub>2</sub>	6.64 (--)	[11.07 - 14.40]
-----		
cHCO <sub>3</sub> <sup>-</sup>	35.8 (+)	[22.0 - 26.0]
-----		
Hct	59.7% (+)	[36.0 - 53.0]
-----		
COHb	3.5% (+)	[0.0 - 3.0]

- Compensated metabolic acidosis
- Compensated metabolic alkalosis
- Uncompensated metabolic acidosis
- Mixed alkalosis
- Uncompensated respiratory acidosis
- Compensated respiratory alkalosis
- Compensated respiratory acidosis
- Mixed acidosis

3. What is the respiratory state of the above patient?

1 point

- Type 2 Respiratory failure
- No respiratory failure
- Type 1 Respiratory failure

4. What is the acid-base disturbance in this patient?

1 point

PMHx: CKD; mild COPD. Presenting complaint: Acute-on-chronic kidney injury

Remark:		28% venturi
F <sub>i</sub> O <sub>2</sub> :		0.28
-----		
pH	7.356 (-)	[7.350 - 7.450]
pCO <sub>2</sub>	3.96 (-)	[4.27 - 6.40]
pO <sub>2</sub>	9.64 (-)	[11.07 - 14.40]
-----		
cHCO <sub>3</sub> <sup>-</sup>	16.4 (-)	[22.0 - 26.0]
-----		
Na <sup>+</sup>	138.0	[136.0 - 145.0]
K <sup>+</sup>	6.23 (++)	[3.50 - 5.10]
Ca <sup>2+</sup>	1.355 (+)	[1.150 - 1.330]
Cl <sup>-</sup>	101.9	[98.0 - 107.0]

- Compensated respiratory acidosis
- Compensated metabolic acidosis
- Compensated metabolic alkalosis
- Uncompensated metabolic acidosis
- Mixed alkalosis
- Mixed acidosis
- Uncompensated respiratory alkalosis

## 5. What is the acid-base disturbance in this patient?

1 point

PMHx: CKD; severe COPD.

Remark:	on 1l/min via nasal cannula	
F <sub>i</sub> O <sub>2</sub> :	-	
-----		
pH	7.128 (-)	[7.350 - 7.450]
pCO <sub>2</sub>	7.26 (+)	[4.27 - 6.40]
pO <sub>2</sub>	9.89 (-)	[11.07 - 14.40]
-----		
cHCO <sub>3</sub> <sup>-</sup>	21.7 (-)	[22.0 - 26.0]
-----		
Na <sup>+</sup>	135.8	[136.0 - 145.0]
K <sup>+</sup>	4.68 (+)	[3.50 - 5.10]
Ca <sup>2+</sup>	1.161	[1.150 - 1.330]
Cl <sup>-</sup>	101.3	[98.0 - 107.0]
-----		
Hct	33.1% (-)	[36.0 - 53.0]

- Mixed acidosis
- Uncompensated respiratory acidosis
- Uncompensated metabolic alkalosis
- Partially compensated respiratory acidosis
- Uncompensated respiratory alkalosis
- Uncompensated metabolic acidosis
- Mixed alkalosis
- Compensated metabolic alkalosis

## 6. What is the acid-base disturbance in this patient?

1 point

No PMHx given.

Remark:	on 15l/min via non-rebreathe mask	
F <sub>i</sub> O <sub>2</sub> :	-	
-----		
pH	7.041 (--)	[7.350 - 7.450]
pCO <sub>2</sub>	19.73 (++)	[4.27 - 6.40]
pO <sub>2</sub>	71.36 (++)	[11.07 - 14.40]
-----		
cHCO <sub>3</sub> <sup>-</sup>	39.2 (+)	[22.0 - 26.0]

- Partially compensated respiratory acidosis
- Partially compensated respiratory alkalosis
- Compensated respiratory acidosis
- Uncompensated respiratory alkalosis
- Uncompensated metabolic acidosis
- Uncompensated respiratory acidosis
- Partially compensated metabolic alkalosis
- Partially compensated metabolic acidosis

## 7. Which is the single most likely diagnosis?

1 point

A 26-year-old man has been short of breath for 12h and is feeling generally unwell. An arterial blood gas is taken (on room air): pH 7.51 (+); PaCO<sub>2</sub> 3.1kPa (-); PaO<sub>2</sub> 8.9kPa (-); cHCO<sub>3</sub><sup>-</sup> 23.1mmol/L (~).

- Severe vomiting
- Methanol overdose
- Pulmonary embolus
- Diabetic ketoacidosis
- Panic attack

**8. Which is the single most likely diagnosis?**

1 point

pO<sub>2</sub> 16.1kPa (+); pCO<sub>2</sub> 3.3kPa (-); pH 7.11 (-); HCO<sub>3</sub><sup>-</sup> 12mmol/L (-)

- Acute pulmonary embolism
- Chronic obstructive pulmonary disease
- Diabetic ketoacidosis
- Gastric outlet obstruction
- Hyperventilation
- Motor neuron disease
- Opiate toxicity
- Third trimester pregnancy

**9. Which is the single most likely diagnosis?**

1 point

pO<sub>2</sub> 7.7kPa (-); pCO<sub>2</sub> 3.7kPa (-); pH 7.51 (+); HCO<sub>3</sub><sup>-</sup> 18mmol/L (-)

- Acute pulmonary embolism
- Chronic obstructive pulmonary disease
- Diabetic ketoacidosis
- Gastric outlet obstruction
- Hyperventilation
- Motor neuron disease
- Opiate toxicity
- Third trimester pregnancy

## 10. Which is the single most likely diagnosis?

1 point

30-year-old female; pO<sub>2</sub> 9.6kPa (-); pCO<sub>2</sub> 9.4kPa (+); pH 7.4; HCO<sub>3</sub><sup>-</sup> 36mmol/L (+)

- Acute pulmonary embolism
- Chronic obstructive pulmonary disease
- Diabetic ketoacidosis
- Gastric outlet obstruction
- Hyperventilation
- Motor neuron disease
- Opiate toxicity
- Third trimester pregnancy

## 11. Which is the single most likely diagnosis?

1 point

A 24-year-old woman has felt generally unwell for the last 24h. An arterial blood gas sample is taken (on RA): pH 7.24 (-); PaCO<sub>2</sub> 2.3kPa (-); PaO<sub>2</sub> 11.7kPa; cHCO<sub>3</sub><sup>-</sup> 10mmol/L (-). Sodium 141mmol/L; potassium 4.3mmol/L; chloride 111mmol/L (+).

- Severe vomiting
- Diabetic ketoacidosis
- Renal tubular acidosis
- Burns
- Diarrhoea

## 12. Which is the single most likely diagnosis?

1 point

A 68-year-old woman is confused and cannot relate her full history. An arterial blood gas sample is taken (on RA): pH 7.26 (-); PaCO<sub>2</sub> 3.1kPa (-); PaO<sub>2</sub> 12.3kPa; HCO<sub>3</sub><sup>-</sup> 16mol/L (-). Sodium 137mmol/L; potassium 3.5mmol/L; chloride 109mmol/L (+).

- Diarrhoea
- Alcohol overdose
- Acute renal failure
- Severe vomiting
- Salicylate poisoning

/ABG QUIZ

Total points 13/13

**ANSWERS**

✓ 1. What is the acid-base disturbance in this patient?

Presenting complaint: pneumonia

**Measurement report**

23/10/2016 14:21

Serial number: 9500  
Instrument ID: WQ9500  
Operator ID: DR.ABG  
Hospital Location: Hospital

-----  
Patient ID: 0382832  
Patient Name: Mrs. Olive  
Date of Birth: 27/09/1950  
Remark: on 2l/min via nasal cannula

F<sub>i</sub>O<sub>2</sub>: -  
Temperature: 37.0°C  
Blood type: Arterial

-----  
pH 7.480 [7.350 - 7.450]  
pCO<sub>2</sub> 4.23 [4.27 - 6.40]  
pO<sub>2</sub> 9.23 [11.07 - 14.40]

-----  
cHCO<sub>3</sub><sup>-</sup> 23.5 [22.0 - 26.0]  
BE 0.7 [-2.0 - +2.0]

-----  
Na<sup>+</sup> 134.1 [136.0 - 145.0]  
K<sup>+</sup> 2.87 [3.50 - 5.10]  
Ca<sup>2+</sup> 1.152 [1.150 - 1.330]  
Cl<sup>-</sup> 96.1 [98.0 - 107.0]

-----  
nCa<sup>2+</sup> 1.20

-----  
Hct 38.3% [36.0 - 53.0]

-----  
tHb 118.0g/L [115.0 - 178.0]  
COHb 1.1% [0.0 - 3.0]  
O<sub>2</sub>Hb 93.6% [97.0 - 98.0]  
MetHb 0.8% [0.0-1.5]  
SO<sub>2</sub> 95.4% [94.0-98.0]

-----  
Glu Sample error [3.5 - 5.3]  
Lac Sample error [0.6 - 2.5]

Uncompensated respiratory alkalosis



- Mixed alkalosis
- Mixed acidosis
- Partially compensated respiratory alkalosis
- Compensated metabolic acidosis
- Uncompensated metabolic alkalosis

#### **Feedback**

*Correct!*

*Alkalosis: pH >7.45*

*Respiratory: deranged CO<sub>2</sub>*

*Uncompensated: No change in the HCO<sub>3</sub><sup>-</sup>*

*Probable cause: hyperventilation*

✓ 2. What is the acid-base disturbance in this patient? (select two answers)

2/2

No PMHx given.

$F_iO_2$ :		0.21 (Room air)
-----		
pH	7.339 (-)	[7.350 - 7.450]
pCO <sub>2</sub>	7.89 (+)	[4.27 - 6.40]
pO <sub>2</sub>	6.64 (--)	[11.07 - 14.40]
-----		
cHCO <sub>3</sub> <sup>-</sup>	35.8 (+)	[22.0 - 26.0]
-----		
Hct	59.7% (+)	[36.0 - 53.0]
-----		
COHb	3.5% (+)	[0.0 - 3.0]

- Uncompensated respiratory acidosis
- Compensated respiratory acidosis ✓
- Compensated respiratory alkalosis
- Compensated metabolic alkalosis ✓
- Mixed alkalosis
- Mixed acidosis
- Uncompensated metabolic acidosis
- Compensated metabolic acidosis

**Feedback**

*Correct!*

*Partially compensated: deranged pH; but both components are involved acting to oppose one another, therefore one is the primary cause of disruption, and one is a compensatory change*

*Respiratory/metabolic: Both components are involved, therefore the two correct answers could be either respiratory or metabolic.*

*Mixed is incorrect, as the two components are working against each other (high acidotic PaCO<sub>2</sub> and high alkalotic HCO<sub>3</sub><sup>-</sup>) to balance the pH.*

*Probable cause: differentiated on history*

✓ 3. What is the respiratory state of the above patient?

1/1

Type 2 Respiratory failure ✓

Type 1 Respiratory failure

No respiratory failure

**Feedback**

*Correct! Both increased pCO<sub>2</sub> and decreased pO<sub>2</sub>*

*NOTE: Increased Hct may be due to polycythemia of chronic lung disease.  
COHb may be slightly raised in smokers.*

✓ 4. What is the acid-base disturbance in this patient?

1/1

PMHx: CKD; mild COPD. Presenting complaint: Acute-on-chronic kidney injury

Remark:		28% venturi
F <sub>i</sub> O <sub>2</sub> :		0.28
-----		
pH	7.356 (-)	[7.350 - 7.450]
pCO <sub>2</sub>	3.96 (-)	[4.27 - 6.40]
pO <sub>2</sub>	9.64 (-)	[11.07 - 14.40]
-----		
cHCO <sub>3</sub> <sup>-</sup>	16.4 (-)	[22.0 - 26.0]
-----		
Na <sup>+</sup>	138.0	[136.0 - 145.0]
K <sup>+</sup>	6.23 (++)	[3.50 - 5.10]
Ca <sup>2+</sup>	1.355 (+)	[1.150 - 1.330]
Cl <sup>-</sup>	101.9	[98.0 - 107.0]

- Uncompensated respiratory alkalosis
- Compensated metabolic acidosis ✓
- Compensated respiratory acidosis
- Mixed acidosis
- Compensated metabolic alkalosis
- Mixed alkalosis
- Uncompensated metabolic acidosis

**Feedback**

*Correct!*

*Fully compensated: normal pH*

*Acidosis: Low alkalotic HCO<sub>3</sub><sup>-</sup>*

*Cause: A thorough history would be needed; however likely metabolic over respiratory given the PMHx of CKD and presenting complaint of acute-on-chronic kidney injury.*

✓ 5. What is the acid-base disturbance in this patient?

1/1

PMHx: CKD; severe COPD.

Remark:		on 1l/min via nasal cannula
F <sub>i</sub> O <sub>2</sub> :		-
-----		
pH	7.128 (-)	[7.350 - 7.450]
pCO <sub>2</sub>	7.26 (+)	[4.27 - 6.40]
pO <sub>2</sub>	9.89 (-)	[11.07 - 14.40]
-----		
cHCO <sub>3</sub> <sup>-</sup>	21.7 (-)	[22.0 - 26.0]
-----		
Na <sup>+</sup>	135.8	[136.0 - 145.0]
K <sup>+</sup>	4.68 (+)	[3.50 - 5.10]
Ca <sup>2+</sup>	1.161	[1.150 - 1.330]
Cl <sup>-</sup>	101.3	[98.0 - 107.0]
-----		
Hct	33.1% (-)	[36.0 - 53.0]

- Uncompensated respiratory acidosis
- Mixed alkalosis
- Compensated metabolic alkalosis
- Uncompensated respiratory alkalosis
- Partially compensated respiratory acidosis
- Uncompensated metabolic alkalosis
- Mixed acidosis ✓
- Uncompensated metabolic acidosis

**Feedback**

*Correct!*

*Mixed: Both components are involved and working together to disrupt the pH in the same direction. (Increased acidotic PaCO<sub>2</sub>, decreased alkalotic HCO<sub>3</sub><sup>-</sup>)*

*Acidosis: pH <7.35*

*NOTE: Electrolyte disturbance may be due to CKD.*

*Decreased Hct may be due to CKD (decreased erythropoietin)*

✓ 6. What is the acid-base disturbance in this patient?

1/1

No PMHx given.

Remark:	on 15l/min via non-rebreathe mask	
F <sub>i</sub> O <sub>2</sub> :	-	
-----		
pH	7.041 (--)	[7.350 - 7.450]
pCO <sub>2</sub>	19.73 (++)	[4.27 - 6.40]
pO <sub>2</sub>	71.36 (++)	[11.07 - 14.40]
-----		
cHCO <sub>3</sub> <sup>-</sup>	39.2 (+)	[22.0 - 26.0]

- Partially compensated metabolic acidosis
- Partially compensated respiratory alkalosis
- Compensated respiratory acidosis
- Uncompensated metabolic acidosis
- Partially compensated metabolic alkalosis
- Partially compensated respiratory acidosis ✓
- Uncompensated respiratory acidosis
- Uncompensated respiratory alkalosis

**Feedback**

*Correct!*

*Partially compensated: Both components are involved, working against each other to balance the pH, however the pH is still disrupted.*

*Acidosis: pH <7.35*

*Respiratory: Raised acidotic PaCO<sub>2</sub>, causing alkalemia, against raised alkalotic HCO<sub>3</sub><sup>-</sup>*

*Possible cause: Hx of COPD (possibly shown by the raised HCO<sub>3</sub><sup>-</sup>), and the 15l/min supplemental oxygen has led to a decrease in respiratory drive, leading to CO<sub>2</sub> retention.*

✓ 7. Which is the single most likely diagnosis?

1/1

A 26-year-old man has been short of breath for 12h and is feeling generally unwell. An arterial blood gas is taken (on room air): pH 7.51 (+); PaCO<sub>2</sub> 3.1kPa (-); PaO<sub>2</sub> 8.9kPa (-); cHCO<sub>3</sub><sup>-</sup> 23.1mmol/L (~).

Pulmonary embolus ✓

Diabetic ketoacidosis

Severe vomiting

Panic attack

Methanol overdose

**Feedback**

*Correct!*

*This man has become acutely breathless.*

*He is hypoxic and, as a reflex to this, is hyperventilating (as evidenced by the low PaCO<sub>2</sub>). As a result, he has developed an alkalosis.*

*Note: PEs may present in differently depending on extent of hypoperfusion and RR.*

*Diabetic ketoacidosis & Methanol overdose: These are both causes of a metabolic acidosis (with a raised anion gap).*

*Panic attack: This does cause acute alkalosis via hyperventilation (and therefore low PaCO<sub>2</sub> and a high pH), but tends to happen in the absence of hypoxia rather than as a response to it (as in pulmonary embolism).*

*Severe vomiting causes a metabolic alkalosis (i.e. a high pH with a high HCO<sub>3</sub><sup>-</sup>).*

✓ 8. Which is the single most likely diagnosis?

1/1

pO<sub>2</sub> 16.1kPa (+); pCO<sub>2</sub> 3.3kPa (-); pH 7.11 (-); HCO<sub>3</sub><sup>-</sup> 12mmol/L (-)

- Acute pulmonary embolism
- Chronic obstructive pulmonary disease
- Diabetic ketoacidosis ✓
- Gastric outlet obstruction
- Hyperventilation
- Motor neuron disease
- Opiate toxicity
- Third trimester pregnancy

**Feedback**

*Correct!*  
*DKA is a typical metabolic acidosis.*

✓ 9. Which is the single most likely diagnosis?

1/1

pO<sub>2</sub> 7.7kPa (-); pCO<sub>2</sub> 3.7kPa (-); pH 7.51 (+); HCO<sub>3</sub><sup>-</sup> 18mmol/L (-)

- Acute pulmonary embolism ✓
- Chronic obstructive pulmonary disease
- Diabetic ketoacidosis
- Gastric outlet obstruction
- Hyperventilation
- Motor neuron disease
- Opiate toxicity
- Third trimester pregnancy

**Feedback**

*Incorrect.*

*Hypoxaemia and hypocapnia are typical of acute PE*

✓ 10. Which is the single most likely diagnosis?

1/1

30-year-old female; pO<sub>2</sub> 9.6kPa (-); pCO<sub>2</sub> 9.4kPa (+); pH 7.4; HCO<sub>3</sub><sup>-</sup> 36mmol/L (+)

- Acute pulmonary embolism
- Chronic obstructive pulmonary disease
- Diabetic ketoacidosis
- Gastric outlet obstruction
- Hyperventilation
- Motor neuron disease ✓
- Opiate toxicity
- Third trimester pregnancy

**Feedback**

*Correct!*

*Compensated respiratory acidosis due to hypoventilation.*

*COPD unlikely in this age group.*

*Motor neuron disease is therefore the correct answer.*

*The normal gas exchange can be demonstrated by calculating the A-a gap.*

✓ 11. Which is the single most likely diagnosis?

1/1

A 24-year-old woman has felt generally unwell for the last 24h. An arterial blood gas sample is taken (on RA): pH 7.24 (-); PaCO<sub>2</sub> 2.3kPa (-); PaO<sub>2</sub> 11.7kPa; cHCO<sub>3</sub><sup>-</sup> 10mmol/L (-). Sodium 141mmol/L; potassium 4.3mmol/L; chloride 111mmol/L (+).

- Burns
- Severe vomiting
- Renal tubular acidosis
- Diarrhoea
- Diabetic ketoacidosis



**Feedback**

*Corret!*

*See extras page!*

*In cases like this that show a metabolic acidosis, it is important to work out the anion gap. It is easily done—just subtract the anions (Cl<sup>-</sup> and HCO<sub>3</sub><sup>-</sup>) from the cations (Na<sup>+</sup> and K<sup>+</sup>) to get a measure of the organic acids on board. If the anion gap is high, there are more organic acids on board and they are responsible for the acidosis (e.g. lactic acid, ketones, phosphates).*

 [Extras page](#)

✓ 12 .Which is the single most likely diagnosis?

1/1

A 68-year-old woman is confused and cannot relate her full history. An arterial blood gas sample is taken (on RA): pH 7.26 (-); PaCO<sub>2</sub> 3.1kPa (-); PaO<sub>2</sub> 12.3kPa; HCO<sub>3</sub><sup>-</sup> 16mol/L (-). Sodium 137mmol/L; potassium 3.5mmol/L; chloride 109mmol/L (+).

- Alcohol overdose
- Severe vomiting
- Diarrhoea
- Acute renal failure
- Salicylate poisoning



**Feedback**

*Incorrect.*

*See extras page!*

*This is metabolic acidosis, with a normal anion gap. Whilst it is organic acids that raise the gap, a normal gap in acidosis suggests a loss of HCO<sub>3</sub><sup>-</sup> or ingestion of H<sup>+</sup> ions.*

[↪ Extras page](#)