

Past FE questions (with examiners comments)

A 29 year old woman is brought in to the Emergency Department by a friend after being found in an agitated state. The woman is reluctant to be assessed and declines to give a history. The only available blood test is an arterial blood gas and electrolytes on room air.

		Reference range
pH	7.31	(7.35-7.45)
PCO ₂	30 mmHg	(35-45)
PO ₂	104 mmHg	(75-100)
HCO ₃	18.5 mmol/L	(22-33)
BE	-4.8	(-3.0-+3.0)
Saturation	99%	(95-98%)
FIO ₂	0.21	
Na ⁺	141 mmol/L	(135-145)
K ⁺	8.4 mmol/L	(3.2-4.5)
Ca ²⁺	1.21 mmol/L	(1.15-1.35)
Cl ⁻	113 mmol/L	(100-110)

- (a) Describe the blood test results. (50%)
(b) List the differential diagnosis. (50%)

The overall pass rate for this question was 55 / 83 (66.3%).

Examiners felt that this was a good question but were aware that, given the number of calculations that can be made from a combined gas / electrolyte result, that it was a big ask in the available time. It was expected that an answer would note the normal anion gap metabolic acidosis, the respiratory alkalosis, hyperkalaemia and normal Aa gradient. The differential diagnosis list could then include the causes of each of these. Failures were due to arriving at the wrong summary / diagnosis and then trotting out the usual MUDPILES causes for an increased anion gap.

A 14 year old female presents to the emergency department via ambulance with agitation and drowsiness. An arterial blood gas is taken.

Describe and interpret the patient's results. (100%)

		Reference range
FIO ₂	0.21	
pH	6.89	(7.35-7.45)
pCO ₂	72 mmHg	(35-45)
pO ₂	60 mmHg	(80-110)
HCO ₃ ⁻	10 mmol/L	(23-32)
Base Excess	- 20.5	(-2 / +2)
Sodium	136 mmol/L	(135-145)
Potassium	4.0 mmol/L	(3.5-5.5)
Chloride	90 mmol/L	(90-115)
Urea	16 mmol/L	(3.5-8.0)
Creatinine	0.14 mmol/L	(0.06-0.12)

The overall pass rate for this question was 39 / 44 (88.6%).

Examiners expected that candidates would provide a comprehensive description that included comment on the respiratory acidosis, metabolic acidosis, elevated anion gap and calculation of the A-a gradient. It was expected that clinically relevant (for a 14yo girl) unifying differential diagnoses would be provided rather than separate diagnoses for the respiratory acidosis or metabolic acidosis alone. A pass could be gained by a sound description and interpretation but better answers formulated a clinically relevant differential diagnosis which confirmed understanding of the concepts involved.

A 74 year old man is brought to your emergency department after three days of persistent vomiting.

His observations are:

HR 110 /min
BP 135/70 mmHg supine
Temperature 37°C

Arterial blood gas and serum biochemical results are shown.

Describe and interpret his investigations. (100%)

		Reference Range
FiO ₂	0.5	
pH	7.62	(7.35-7.45)
pCO ₂	28.5 mmHg	(35-45)
pO ₂	234 mmHg	(80-95)
Bicarbonate	30.0 mmol/L	(22-28)
Base excess	8.3	(-3 - +3)
O2 saturation	99.8 %	(> 95)
Lactate	1.1 mmol/L	(< 1.3)
Na ⁺	131 mmol/L	(134-146)
K ⁺	2.0 mmol/L	(3.4-5)
Cl ⁻	90 mmol/L	(98-106)
Glucose	12.7 mmol/L	(3.5-5.5)

The overall pass rate for this question was 65/81 (80.2%).

The examiners felt that this was an excellent question yielding a wide spread of marks. Good answers showed a structured approach to ABG/electrolyte interpretation, made appropriate secondary calculations and recognised the complex nature of this abnormality with its possible differential diagnoses. Poor responses failed to recognise the metabolic and respiratory alkaloses, the raised A-a gradient (and its possible significance) and did not suggest a reasonable differential.

A 45 year old woman with a past history of depression presents to your emergency department with 2 weeks of nausea, weakness and lethargy. There has been no vomiting or diarrhoea.

Describe and interpret her results (100%)

Serum biochemistry and arterial blood gas

		Reference Range
FiO ₂	0.21	
pH	7.60	7.35-7.45
pCO ₂	41 mmHg	35-45
pO ₂	80 mmHg	80-95
Bicarbonate	40 mmol/L	22-28
Base excess	16	-3 - +3
O ₂ saturation	96 %	> 95
Na ⁺	119 mmol/L	134-146
K ⁺	2.1 mmol/L	3.0 – 4.5
Cl ⁻	67 mmol/L	98-106
Urea	6 mmol/L	3-8
Creatinine	85 µmol/L	45-90
Glucose	6.4 mmol/L	3.5-5.5

The overall pass rate for this question was 45/70 (64.3%)

Pass criteria

Candidates needed to adequately describe 4 features

Metabolic acidosis

Primary respiratory acidosis (not just lack of compensation)

Renal impairment

High sugar

Adequately interpret the above description with at least the following 2 points

Likely DKA (for metabolic component)

Hypoventilation (for respiratory component)

All 6 were required to pass the question

An 84 year old man is brought to your emergency department following a high speed car accident. He has signs of multiple left rib fractures.

Two hours after arriving in the emergency department he becomes more breathless and distressed.

Arterial blood gases are performed
His observations are:

GCS 14
HR 75 /min
BP 100/60 mmHg
RR 24 /min

Describe and interpret his results (100%)

Arterial blood gases

		Reference Range
pH	7.14	(7.35-7.45)
pCO ₂	60 mmHg	(35-45)
pO ₂	114	
HCO ₃ ⁻	17 mmol/L	(21-28)
Lactate	1.4 mmol/L	(< 2.0)
FiO ₂ 50 %		
Na ⁺	139 mmol/L	(135-145)
K ⁺	4.8 mmol/L	(3.2-4.3)
Cl ⁻	116 mmol/L	(99-109)
Glucose	11.3 mmol/L	(3.0-6.0)

The overall pass rate for this question was 50/82 (61%)

Pass Criteria

Uncompensated respiratory acidosis;

Non-anion gap metabolic acidosis;

Increased A – a gradient;

Clinical correlation: mainly A-a gradient, with fractured ribs, possible flail segment, pulmonary contusion, haemopneumothorax, depressant drugs, occult tension pneumothorax

Features of unsuccessful answers

Poor organisation of information, random or incorrect calculations, poor clinical correlation, listing generic causes of NAGMA, failure to mention causes of V/Q mismatch, extremely brief incomplete answers

A 3 month old girl is brought to your emergency department after three days of diarrhoea and vomiting. She appears very unwell and lethargic, with sunken eyes, a sunken fontanelle and dry mucous membranes.

Describe and interpret her blood test results (100%)

Her serum biochemical results are as follows

		Reference Range
Venous Blood Gas		
FiO ₂	50 %	
pH	7.12 mmHg	(7.35-7.45)
pCO ₂	12 mmHg	(40-52)
pO ₂	103 mmHg	
O ₂ Saturation	98 %	
Base Excess	-25.0 mmol/L	(-3 - +3)
Bicarbonate	4 mmol/L	(24-32)
Lactate	3.6 mmol/L	(0.5-2.0)

Electrolytes

Sodium	155 mmol/L	(135-145)
Potassium	3.0 mmol/L	(3.5-4.8)
Chloride	136 mmol/L	(95-110)
Urea	15.4 mmol/L	(3-8)
Creatinine	45 µmol/L	(50-120)
Glucose	6.1 mmol/L	(3.0-6.0)

The overall pass rate for this question was 30/81 (37.1%)

Pass Criteria

- Severe acidaemia
- Mixed metabolic acidosis, with features of normal AG / hyperchloraemic acidosis (predominant) and slightly raised AG
- Appropriate respiratory compensation
- Hyponatraemia & hypokalaemia with adequate interpretation
- Consistent with severe dehydration / hypovolaemia / GI loss of bicarbonate and hypoperfusion

Features of Unsuccessful Answers

- Failure to appreciate predominant non-anion gap metabolic acidosis
- Description of abnormal parameters not followed by adequate interpretation
- Failure to recognize that blood was venous (not arterial), and therefore parameters such as A-a gradient is unreliable
- Inability to integrate the various information when interpreting
- Answers included management, which is not required