(A)

A 58 year old man with a history of alcohol abuse was found unresponsive at his home and lying on the ground with coffee ground vomit around him.
He is brought to your Emergency Department by an Ambulance in an altered conscious state. He was then sedated for agitation and subsequently intubated for protection of his airway. (14 marks) - 9 min

His obs are as follows:
  - HR: 100
  - BP: 145/80
  - Temp: 34
  - Sats: 98% on RA
  - GCS - E- 3, V - 1, M 3

1 - List 6 possible causes for his condition (6 Marks)

i.   Acute Alcohol intoxication

ii.   Acute intoxication with recreational substances

iii. Head trauma

iv.   Hepatic Encephalopathy

v.   Alcoholic Withdrawal

vi.   Hypoglycaemia

vii. Post-ictal

viii. Meningoencephalitis

2 - Your registrar comes to you with his blood results (given below)

ABG		Blood	
pH	7.03	Sodium : 149 mmol/L (135-145)	
pCO2	23	Potassium : 5.0 mmol/L (3.5-5.2)	
pO2	141	Chloride : 114 mmol/L (95-110)	
Sats	98.3	Bicarbonate : 14 mmol/L (22-32)	
Na+	149	Urea : 17.3 mmol/L (3.0-8.4)	
Cl-	112	Creatinine : 261 umol/L (60-110)	
K+	4.9	GFR(mL/min) : 22 (> 60)	
Lac	21	Serum Lactate: 8	
Glu	4		
Bic	6		
BE	-23.2	Serum Osmolality: 319 mosmol/Kg (275-300)	

2 - Describe the acid base status (include 3 calculations) and provide relevant 5 differential diagnosis . (8 marks)

i. Metabolic Acidosis, Anion Gap = Na - (Cl + Bic) = 149 – (112+6) = 31 = HAGMA (Normal – 12)

ii. Δ Gap = Δ AG/Δ Bic = 31-12/24-6 = 19/18 = 1.05 = Pure HAGMA (<0.4- NAGMA, 0.4-0.8 - NAGMA/HAGMA, 0.8-2 - pure HAGMA, >2 - mixed)

iii. Osmolar Gap = Measured – Calculated = <10 (normally)

• Calculated Osmolarity = 2Na + Gluc + Urea = 2*149+4+17 = 319

• 319 – 319 = 0 (normally –14 to +10)

iv. Toxic alcohol poisoning – most likely Ehylene Glycol due to the lactate gap

v. Alcoholic keto–acidosis

vi. Acute renal failure secondary to rhabdomylosis

vii. Salicylate poisoning

viii. Starvation keto–acidosis

ix. Sepsis causing Lactic acidosis

Key Points:
 - Do not be mislead by normal osmolar gap
 - Think more of toxic alcohol in high lactate
 - Measure Serum Lactate in everyone

Explanation for some of the points in the answer.

1 - The term "**Lactate Gap**"

   - "**Lactate Gap**" - The difference between the blood gas lactate and measured serum Lactate. Blood Gas has a false positive high lactate since the analyser misreads **"Glycolate"** for **"Lactate",** whereas the lab measures the true serum Lactate, hence the "**Lactate Gap**"

2 - The fact that we think the answer is ethylene glycol poisoning but blood results do not show a "**High Osmolar Gap**", as we would expect with a toxic alcohol poisoning.

   - After Ethylene glycol ingestion, for about 1-2 hours patient will display signs of acute alcohol intoxication, and in that time frame, the patient will have a high Osmolar Gap due top presence of "alcohol", but as Ethylene Glycol is metabolised to its toxic metabolites, the Osmolar Gap normalises and & HAGMA develops

3 - We need to elaborate on the importance of collateral history and early consultation with Toxicologist

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However another question could be -

(B)
You are in-charge of a rural Emergency Department working on a Friday evening. At 6pm a 58 year old patient is admitted to ED in an altered conscious state after a suspected intentional overdose of antifreeze.
(15 Marks - 12 min)

His obs & blood results are given below

- HR: 100
- BP: 145/80
- Temp: 34
- Sats: 98% on RA
- GCS - E- 3, V - 1, M 3

ABG		Blood	
pH	7.03		
pCO2	23	Sodium : 149 mmol/L (135-145)	
pO2	141	Potassium : 5.0 mmol/L (3.5-5.2)	
Sats	98.3	Chloride : 114 mmol/L (95-110)	
Na+	149	Bicarbonate : 14 mmol/L (22-32)	
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K+	4.9	Creatinine : 261 umol/L (60-110)	
Lac	21	GFR(mL/min) : 22 (> 60)	
Glu	4	Serum Lactate: 8	
Bic	6		
BE	-23.2	Serum Osmolality: 319 mosmol/Kg (275-300)	

1 - Describe the acid base status (include 3 calculations) (3 Marks)
  i. Metabolic Acidosis, Anion Gap = Na - (Cl + Bic) = 149 – (112+6) =

      31 = HAGMA (Normal – 12)

ii. Δ Gap = Δ AG/Δ Bic = 31-12/24-6 = 19/18 = 1.05 = Pure HAGMA (<0.4- NAGMA, 0.4-0.8 - NAGMA/HAGMA, 0.8-2 - pure HAGMA, >2 - mixed)

iii. Osmolar Gap = Measured – Calculated = <10 (normally)

- Calculated Osmolarity = 2Na + Gluc + Urea = 2*149+4+17 = 319
  - 319 – 319 = 0 (normally –14 to +10)

2 - Outline the initial and ongoing management of this patient, assuming that the patient is in already in Resus with normal physiological monitoring attached. (12 Marks)

i. 2 large for IV access

ii. Bloods sent for VBG, FBE, UEC, LFT, CMP, Serum Osmolarity, Serum Alcohol

iii. Urine for Oxalate crystals

iv. Intubate patient

v. Commence Ethanol via NG tube, 3 x 40ml shots of vodka (70kg)

vi. Maintenance with 40ml shot hourly

vii. Correct Electrolytes

viii. Insert CVC and Arterial line

ix. Discuss with Toxicologist

x. Pyridoxine 100mg IV Q6H

xi. Thiamine IV 100mg Q6H

xii. Discuss with ARV and request for a bed in an ICU which can accomodate CVVHF

xiii. Notify NOK

xiv. Sodium Bicarbonate 50-100mmol IV

Further explanations are needed for the given answers:

- Ethanol is the treatment of choice in Australia as the drug Fomepizole is not available

- Alcoholic dehydrogenase has affinity towards Ethanol, and when given in a toxic overdose, it metabolises Ethanol, rather than Ethylene glycol, thus preventing the toxic metabolites

- Oral Bioavailability of alcohol ~ 80%, Onset of action within 30 min, & peaks at about ~45 min

- Not all department have IV ethanol available, specially during after-hours. But Vodka is available very easily even in the most remote towns.

- In ethylene glycol toxicity, pyridoxine and thiamine increase the metabolism of glycolic and glyoxylic acid to the less toxic metabolites glycine and alpha-hydroxy-beta-ketoadipate. Hence they can be commenced early.