

"List" = 1-3 words

"State" = short statement/ phrase/ clause

**UNIVERSITY HOSPITAL, GEELONG
FELLOWSHIP WRITTEN EXAMINATION**

WEEK 4– TRIAL SHORT ANSWER QUESTIONS Suggested answers
PLEASE LET TOM KNOW OF ANY ERRORS/ OTHER OPTIONS FOR ANSWERS
Please do not simply change this document - it is not the master copy !

Question 1 (18 marks) 9 minutes

A 35 year old patient presents to your department with feelings that she may commit suicide.
The patient absconds shortly after being triaged, prior to medical assessment.

- a. List five (5) steps that you would take in an attempt to return the patient to your department. (5 marks)
- **Security to check outside hospital**
 - **Ring patient on mobile phone**
 - **Ring NOK**
 - **Ring police**
 - **Ring patient on home phone if no answer on mobile after reasonable time**
 - **Ring MHT- may have a case manager**
 - **Ring LMO**

You are tasked to review this incident and suggest changes to try to prevent similar future occurrences.

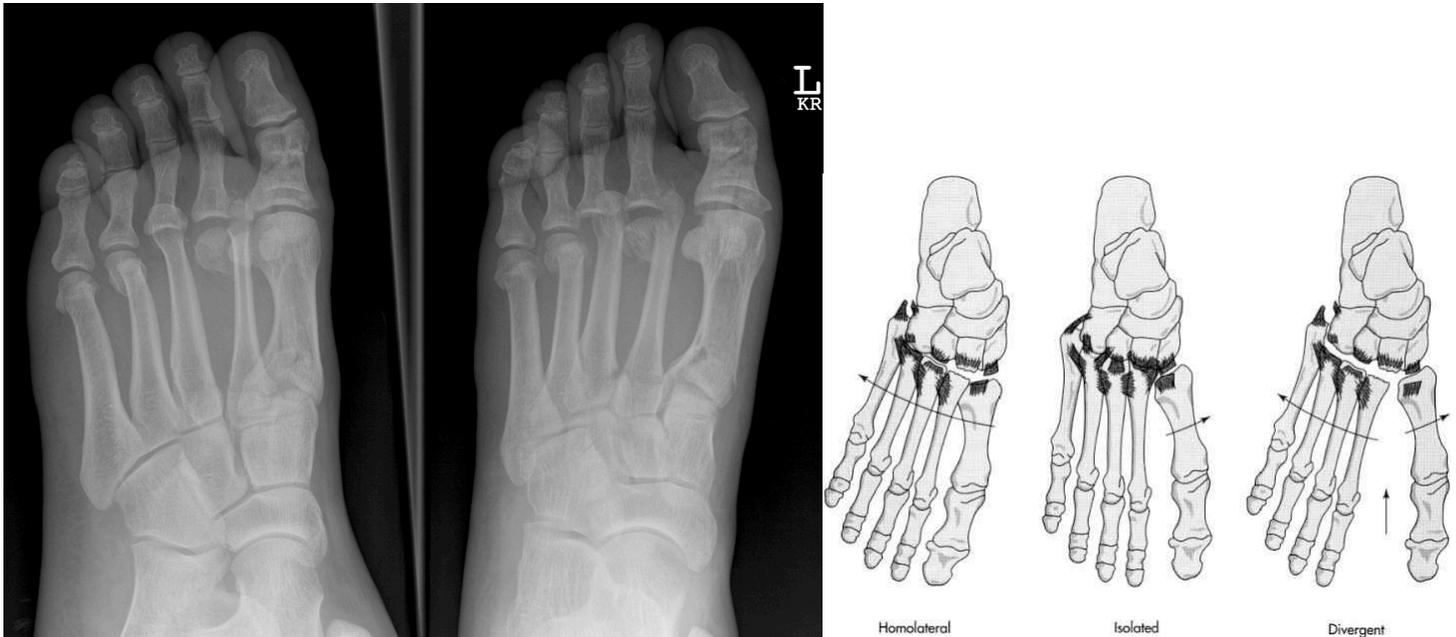
- b. List five (5) recommendations that you may make to prevent similar future occurrences. (5 marks)
- **Secure placement of suicidal patients- location**
 - **Assign security to high risk patient**
 - **Constant visual observation**
 - **High triage category to potentially suicidal/ flight risk**
 - **Mobilise Mental health service more rapidly**
 - **Early WR interventions/medication to ↓ anxiety**
 - **Triage education re MH-specific emergencies**

Your Director also asks you to investigate a high "did not wait" rate.

- c. List four (4) factors that are associated with patients who "did not wait". (4 marks)
- **Long wt times**
 - **Waiting room overcrowding**
 - **Lower socioeconomic background**
 - **Young adults**
 - **Pt with young children**
 - **Triage 4 or 5**
 - **Attendance after hours**
 - **Lack of PHI**
 - **Perceived lack of concern by ED staff**
 - **Symptom improvement**
- d. List four (4) methods to reduce your "did not wait" rate. (4 marks)
- **Shorter ED waiting times**
 - **Accurate triage allocation**
 - **Methods to reduce wt time**
 - **Attention to WR patients**
 - **ensure frequent pt reassurance/ regular communication**
 - **adequate staff to attend to WR needs**
 - **comfort needs**
 - **Education re the triage process**
 - **RV Dept design- F/T areas**
 - **Early senior medical input at triage**
 - **Early medical intervention @ triage- provide symptom care**

Question 2 (12 marks) 6 minutes

A 40 year old male has sustained a crush injury to his foot at work.



- a. State six (6) abnormal findings shown in this xray. (6 marks)
- **Isolateral LisFranc # base 1st MT, medial displacement**
 - **# neck 2nd MT- 100% off ended with shortening (unable to give cms)**
 - **Dislocated 3rd MTP jt**
 - **# 4th MT neck probable 100% off ended**
 - **# 5th MT, transverse impacted**
 - **# 1st proximal phalanx- comminuted neck/head**

He has received no pre hospital analgesia and has no IV access on arrival.

- b. List four (4) steps in your approach to his analgesia. Include any doses and routes. (4 marks)
- **Elevate**
 - **Immobilise**
 - **I/N fentanyl or IM ketamine or N₂O₂ (must have non IV analgesia prior to IV to pass)**
 - **IV morphine or ketamine**
 - **Ankle block- . bupivacaine 0.25% max dose 2mg/kg**
 - **(oral NSAID/oxycodone/paracetamol)**

- c. Other than pain, list two (2) potential complications in the first 72 hours. (2 marks)
- **Compartment syndrome**
 - **Infection- open wound**
 - **Neurovascular compromise**
 - **Ischaemic digit**
 - **Neuropraxia**

Question 3 (12 marks) 6 minutes

A 35 year old female presents with sudden onset of difficulty with breathing. A photograph is taken soon after arrival is shown below.



- a. List three (3) different medications that you would use for her condition in the first 30 minutes. State the route and dose for each medication. (6 marks)
NB: 3 “different” medications are requested, so for once it cannot be simply adrenaline/ adrenaline /adrenaline

Drug (3 marks)	Route (1.5 marks)	Dose (1.5 marks)
Adrenaline	Neb IM IV	5mg 0.3 mg 10 mcg aliquots then infusion
Steroid (dexa or HC)	IV	Hydrocortisone 100- 250 mg IV
Antihistamine H1	IM	loratadine PO 10mg

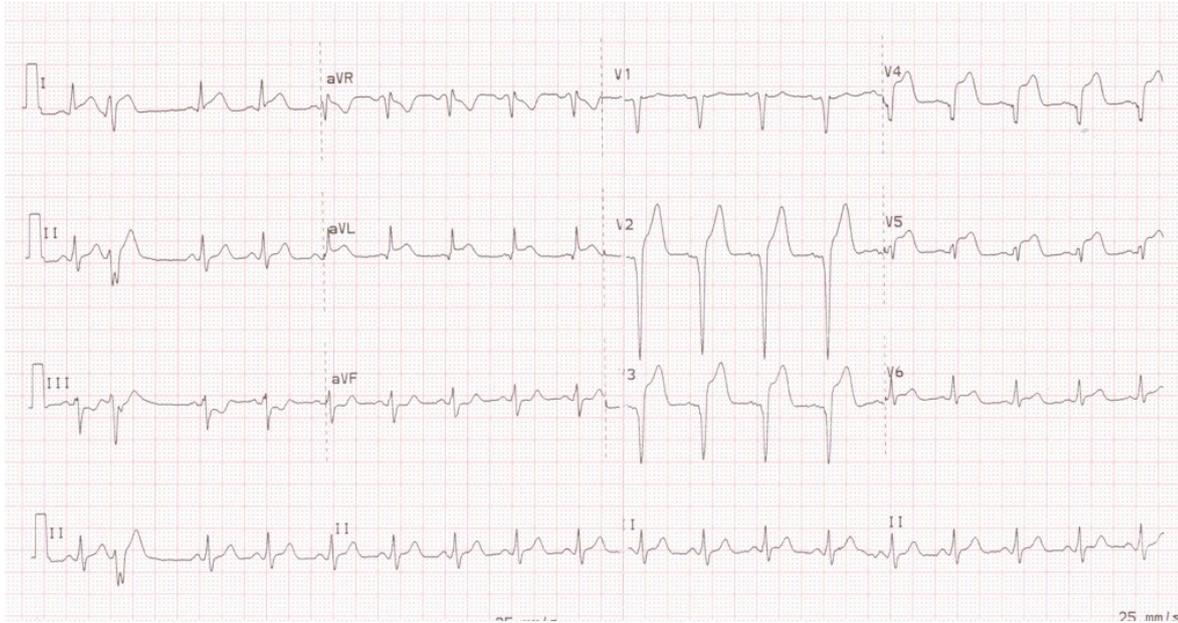
The patient responds poorly to your above medications and has marked stridor.

- b. Other than drugs used to facilitate rapid sequence induction list three (3) further, different medications that may be utilised in this setting. State the route and dose for each medication. (6 marks)

Drug (3 marks)	Route (1.5 marks)	Dose (1.5 marks)
Antihistamine H2- Ranitidine	IV	50mg
Salbutamol	Neb	5-20mg
Glucagon (if patient taking BB blocker)	IV	1-5 mg

Question 4 (12 marks) 6 minutes

A 25 year old man presents to the ED complaining of chest pain for 48 hours.



- a. State four (4) abnormalities shown in this ECG. (4 marks)
- **STE 4-5 mm V2-V4, 2mm V, 0.5 mm V6 1mm V1, 2mm aVI**
 - **STD 1mm III, aVF**
 - **ST 110**
 - **T waves peaked V2-3**
- b. List four (4) possible different pathological aetiologies for these ECG findings. (4 marks)
- **anterolateral STEMI in assoc with IHD**
 - **Vasospasm a/w methamphetamines**
 - **Takasubo cardiomyopathy**
 - **TAD with dissection down carotid**
 - **Myocarditis**
- c. List four (4) non-cardiac causes of elevated high sensitivity troponins. (4 marks)
- NB: "non- cardiac" so not myocarditis etc*
- **Renal impairment**
 - **Severe sepsis**
 - **Large PE**
 - **Stroke**
 - **COPD exacerbation**
 - **GI bleeding**
 - **TTP**

Question 5 (12 marks) 6 minutes

A 68 year old female presents to ED with an acutely painful right leg.

- a. List five (5) examination features that would support the diagnosis of an ischaemic leg. (5 marks)
- **Paraesthesia**
 - **Pallor**
 - **Paralysis**
 - **Pulseless**
 - **Evidence of pre-existing vascular disease eg. wasting, hair loss, atrophy, ulceration**
 - **Compartment syndrome**
 - **AF**
- b. List four (4) key investigations that you would order if you suspected an ischaemic leg. (4 marks)
- **Vasc US**
 - **Limb Angiography**
 - **CT angiography limb**
 - **ECG**
 - **Clotting**
 - **Lactate**
 - **CK**
 - **Renal Fx**
 - **CXR**
 - **ECHO**

A proximal femoral artery thrombosis is confirmed.

- c. State three (3) specific treatments options that may be utilised to treat this condition. (3 marks)
- **Thrombolysis**
 - **Surgical embolectomy**
 - **Radiological embolectomy**

Question 6 (9 marks) 6 minutes

A 14 year old female presents to your emergency department via ambulance with agitation and drowsiness.

FIO₂	0.21	
pH	6.89	(7.35- 7.45)
pCO₂	72 mmHg	(35- 45)
pO₂	60 mmHg	(80- 110)
HCO₃	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)

a. Provide three (3) calculations to help you to interpret these results. (3 marks)

Derived value 1: Anion gap $AG (mEq/L) = \{[Na] (mmol/L) + [K] (mmol/L)\} - \{[HCO_3] mmol/L + [Cl] (mmol/L)\} = 36$ (HAGMA)

Derived value 2: Δ gap $= \frac{(AG - 12)}{(24 - [HCO_3-])} = 1.7$ (pure HAGMA)

Derived value 3: A-a gradient $PAO_2 = (FIO_2) (P_{atm} - 47 mm Hg) - (P_aCO_2) / 0.8 = 0$ (therefore no V/Q mismatch)

b. State the primary acid/ base disturbance. (2 marks)

- **Primary Life threatening high anion gap metabolic acidosis**
- **Primary respiratory acidosis**

c. List four (4) differential diagnoses for her presentation (each must be a different pathological mechanisms). (4 marks)

- **CNS infection**
- **Overwhelming lactic acidosis- shock/ hypoxia**
- **OD- Salicylate, Iron, Isoniazid (Methanol, cyanide, Ethylene glycol)**
- **DKA with cerebral oedema**
- **Hypoglycaemia complicated by seizures**

Delta ratio

This Delta Ratio is sometimes useful in the assessment of metabolic acidosis. As this concept is related to the anion gap (AG) and buffering, it will be discussed here before a discussion of metabolic acidosis. The Delta Ratio is defined as:

Delta ratio = (Increase in Anion Gap / Decrease in bicarbonate)

Others⁵ have used the *delta gap* (defined as rise in AG minus the fall in bicarbonate), but this uses the same information as the delta ratio and has does not offer any advantage over it.

How is this useful?

In order to understand this, consider the following:

If one molecule of metabolic acid (HA) is added to the ECF and dissociates, the one H⁺ released will react with one molecule of HCO₃⁻ to produce CO₂ and H₂O. This is the process of buffering. The net effect will be an increase in unmeasured anions by the one acid anion A⁻ (ie anion gap increases by one) and a decrease in the bicarbonate by one. Now, if all the acid dissociated in the ECF and all the buffering was by bicarbonate, then the increase in the AG should be equal to the decrease in bicarbonate so the ratio between these two changes (which we call the delta ratio) should be equal to one. The delta ratio quantifies the relationship between the changes in these two quantities.

Example

If the AG was say 26 mmols/l (an increase of 14 from the average value of 12), it might be expected that the HCO₃⁻ would fall by the same amount from its usual value (ie 24 minus 14 = 10mmols/l). If the actual HCO₃⁻ value was different from this it would be indirect evidence of the presence of certain other acid-base disorders (see Guidelines below).

Problem

A problem though: the above assumptions about all buffering occurring in the ECF and being totally by bicarbonate are not correct. Fifty to sixty percent of the buffering for a metabolic acidosis occurs intracellularly. This amount of H⁺ from the metabolic acid (HA) does not react with extracellular HCO₃⁻ so the extracellular [HCO₃⁻] will not fall as far as originally predicted. The acid anion (ie A⁻) however is charged and tends to stay extracellularly so the increase in the anion gap in the plasma will tend to be as much as predicted.

Overall, this significant intracellular buffering with extracellular retention of the unmeasured acid anion will cause the value of the delta ratio to be greater than one in a high AG metabolic acidosis.

Caution

Inaccuracies can occur for several reasons, for example:

- Calculation requires measurement of 4 electrolytes, each with a measurement error
- Changes are assessed against 'standard' normal values for both anion gap and bicarbonate concentration.

Sometimes these errors combine to produce quite an incorrect value for the ratio. As an example, patients with hypoalbuminaemia have a lower 'normal' value for anion gap so using the standard value of 12 to compare against must lead to an error. Do not overinterpret your result and look for supportive evidence especially if the diagnosis is unexpected.

Guidelines for Use of the Delta Ratio

Some general guidelines for use of the delta ratio when assessing metabolic acid-base disorders in provided in the table below.

Overall Advice: **Be very wary of over-interpretation** - Always check for other evidence to support the diagnosis as an unexpected value without any other evidence should always be treated with great caution.

Delta Ratio	Assessment Guideline
< 0.4	Hyperchloraemic normal anion gap acidosis
0.4 - 0.8	Consider combined high AG & normal AG acidosis BUT note that the ratio is often <1 in acidosis associated with renal failure
1 to 2	Usual for uncomplicated high-AG acidosis Lactic acidosis: average value 1.6 DKA more likely to have a ratio closer to 1 due to urine ketone loss (esp if patient not dehydrated)
> 2	Suggests a pre-existing elevated HCO ₃ level so consider: <ul style="list-style-type: none"> • a concurrent metabolic alkalosis, or • a pre-existing compensated respiratory acidosis

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Week 4 – SHORT ANSWER QUESTION- EXAMPLE ANSWERS

Warning

Be very wary of over-interpretation - Always check for other evidence to support the diagnosis as an unexpected value without any other evidence should always be treated with great caution.

A high ratio

A high delta ratio can occur in the situation where the patient had quite an elevated bicarbonate value at the onset of the metabolic acidosis. Such an elevated level could be due to a pre-existing metabolic alkalosis, or to compensation for a pre-existing respiratory acidosis (ie compensated chronic respiratory acidosis). With onset of a metabolic acidosis, using the 'standard' value of 24 mmol/l as the reference value for comparison when determining the 'decrease in bicarbonate' will result in an odd result.

A low ratio

A low ratio occurs with [hyperchloraemic \(or normal anion gap\) acidosis](#). The reason here is that the acid involved is effectively hydrochloric acid (HCl) and the rise in plasma [chloride] is accounted for in the calculation of anion gap (ie chloride is a 'measured anion'). The result is that the 'rise in anion gap' (the numerator in the delta ration calculation) does not occur but the 'decrease in bicarbonate' (the denominator) does rise in numerical value. The net of of both these changes then is to cause a marked drop in delta ratio, commonly to < 0.4

Lactic acidosis

In [lactic acidosis](#), the average value of the delta ratio in patients has been found to be is 1.6 due to intracellular buffering with extracellular retention of the anion. As a general rule, in uncomplicated lactic acidosis, the rise in the AG should always exceed the fall in bicarbonate level.

Diabetic ketoacidosis

The situation with a pure [diabetic ketoacidosis](#) is a special case as the urinary loss of ketones decreases the anion gap and this returns the delta ratio downwards towards one. A further complication is that these patients are often fluid resuscitated with 'normal saline' solution which results in an increase in plasma chloride and a decrease in anion gap and development of a 'hyperchloraemic normal anion gap acidosis' superimposed on the ketoacidosis. The result is a further drop in the delta ratio.

Question 7 (12 marks) 6 minutes

A 72 year old male presents after his first ever, self- terminated seizure.

A slice from his CT Brain with intravenous contrast is shown below.



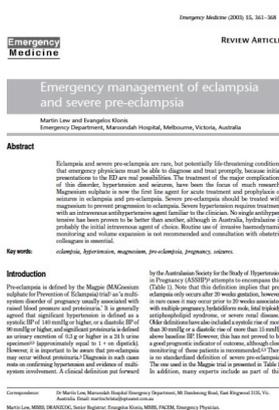
- a. State six (6) abnormalities shown in this scan. (6 marks)
- **4.5 x 3.5 cm ring enhancing lesion L frontal lobe adj to ML**
 - **Surrounding oedema**
 - **M/L shift**
 - **Sulcal effacement**
 - **L Lateral ventricular effacement**
- b. List four (4) differential diagnoses for these findings. (4 marks)
- **1° cerebral malignancy eg GBM**
 - **2° met from skin, GIT, etc (remember NOT breast)**
 - **Abscess- Staph**
 - **Fungal- cryptococcus**
 - **Parasitic infection e.g. toxoplasmosis**
- c. List two (2) medications that you would commence in the emergency department for this patient.(2 marks)
- **Dexamethasone**
 - **Antiepileptic- Phenytoin or lamotrigine**

Question 8 (12 marks) 6 minutes

A 35 year old female who is 36 weeks pregnant presents to ED.

- a. List six (6) clinical features that would support the diagnosis of pre-eclampsia. (6 marks)
- **BP > 140/90 On 2 occasions 4/24 apart or > 160/110**
 - **Headache**
 - **Confusion**
 - **Abdominal pain**
 - **General oedema**
 - **Hyperreflexia/ clonus**
 - **Proteinuria**
 - **Intra uterine growth retardation**
- b. List six (6) potential blood result findings in a patient with severe pre-eclampsia. (6 marks)
- **↑ Se Uric acid**
 - **↓ Platelets**
 - **↑ AST & ALT**
 - **↑ creatinine**
 - **↑ INR**
 - **Haemolysis on blood films**

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This resource is produced for the use of University Hospital, Geelong Emergency staff for preparation for the Emergency Medicine Fellowship written exam. All care has been taken to ensure accurate and up to date content. Please contact me with any suggestions, concerns or questions.

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Question 9 (19 marks) 9 minutes

An 11 month old male presents with likely bronchiolitis.

- a. State six (6) criteria that would lead you to seek admission to hospital. (6 marks)
 - **Oxygen required sats < 92% MANDATORY**
 - **> moderate dehydration/ < 60% intake MANDATORY**
 - **WOB MANDATORY**
 - **Underlying resp disease**
 - **Associated high risk comorbidity**
 - **Prior rapid deterioration/ ICU for same**
 - **Social supports**
 - **Diagnosis not clear**

- b. What is the role of a chest Xray in a patient with suspected bronchiolitis? State three (3) points in your answer. (3 marks)
 - **Rarely necessary**
 - **Only in severe to exclude complication of PTX**
 - **To differentiate from CCF, pneumonia or FB**
 - **Common findings hyperinflation, infiltrates, peribronchial cuffing**
 - **Atelectasis**
 - **Often results in ↑ Ab use**
 - **Confirm NGT position**
 - **Hypoxia despite oxygen**
 - **Clinical deterioration despite appropriate Mx**

- c. Assuming the patient is to be admitted and that you have referred to the Paediatric team, list three (3) management steps that you may commence in the emergency department. Provide one (1) justification for each step. (6 marks)

	Management (3 marks)	Justification (3 marks)
1.	Oxygen- HFNP	Oxygen indicated if SpO2 < 93% Reduce WOB Humidified oxygen reduces drying out of airways Facilitates drinking
2.	NGT/ IV fluids	Replace losses/ maintain hydration Deflates stomach enabling better mechanics of ventilation
3.	Salbutamol	Strong FHx asthma/ eczema Nearly 1 If critical

The next day, you are advised that the patient is diagnosed with confirmed meningococcal sepsis.

- d. List three (3) different groups of people who should be offered contact prophylaxis.
 - **Close contacts/ household of index case**
 - **Classroom contacts < 1/52**
 - **Health providers involved in airway support if not wearing mask PEP**

- e. In a case of Meningococcaemia, at what stage is notification to the public health department required?
 - **As soon as suspected**

Possible additional question: What chemoprophylaxis should be given to (doses not required):

- f. A child aged 5.
 - **rifampicin o or ceftriaxone IM (Cipro CI < 12)**
- g. A patient taking the oral contraceptive pill.
 - **Cipro or ceftriaxone**
- h. A pregnant patient.
 - **Ceftriaxone**