

Candidate number _____

BOOK THREE ANSWERS

QUESTION 19 (21 marks) – DOUBLE QUESTION

A 20 year old male is brought to your ED with confusion and hyperthermia following a marathon. You think he has exertion related heat stroke.

i. What are the management priorities in this situation (5 marks)

- Remove him from the race/exertion
- Cooling – shade, spray/fan, remove clothing, ice packs/baths
- Cautious hydration – PO if able IVF if not
- Check metabolic function – BSL + Na
- Seek & treat complications – e.g. rhabdo, seizure, ...
- Consider intubation if not improving (avoid sux)
- Consider possibility of other competitors having problems

ii. What investigations would you perform and why (4 marks)

- EUC – Low Na, High K, Impaired renal function
- CK – High risk muscle damage and rhabdo
- Coags/LFTs – Risk of DIC
- BSL – Metabolic derangement
- UA – Myoglobinuria
- ECG – Cardiac arrhythmias
- Ongoing core rectal temp

Heat illness affects some groups more than others and non-exertional heat stroke is more common during heat waves.

iii. Define heat wave (2 marks)

- BOM definition - three days or more of high maximum and minimum temperatures that is unusual for that location
- Acceptable definition should include concept of prolonged period of high temperature unusual for that location and/or that results in adverse health effects

iv. List 4 risk factors for classic non-exertional heat stroke (4 marks)

- Environmental – Prolonged extreme high temperatures/humidity
- Situational – Lack of acclimatization, poor Na and H2O intake
- Patient related – Extremes of age, poor health, malnourished, alcohol, mental health
- Meds – Psychotropics, serotonergics, anticholinergics, sympathomimetics
- Medical – Sepsis, dehydration, chronic neurological conditions

v. List three drugs/medications from different classes that increase the risk of heat stroke and explain the pharmacological reason(s) for the effect for each (6 marks)

Medication	Explanation

- Interference with sweating, caused by:
 - Anticholinergics, e.g. tricyclic antidepressants and benztropine
 - Beta-blockers

- Antihistamines
- Phenothiazines
- Vasoconstrictors
- Interference with thermoregulation, caused by:
 - Antipsychotics or Neuroleptics (e.g. risperidone, clozapine, olanzapine)
 - Serotonergic agonists
 - Stimulants (Amphetamine, cocaine)
 - Thyroxin
- Decreased thirst, caused by:
 - Butyrophenone e.g. haloperidol and droperidol,
 - Angiotensin-converting enzyme (ACE) inhibitors
- Dehydration or electrolyte imbalance, caused by:
 - Diuretics (especially loop diuretics)
 - Any drug causing diarrhoea or vomiting (colchicines, antibiotics, codeine)
 - Alcohol
- Reduced renal function, caused by:
 - NSAIDS
 - Sulphonamides
 - Indinavir
 - Cyclosporin
- Aggravation of heat illness by worsening hypotension, caused by:
 - Vasodilators e.g. nitrates (GTN) and calcium channel blockers
 - Anti-hypertensives
- Levels of drug affected by dehydration (possible toxicity for drugs with a narrow therapeutic index), caused by:
 - Digoxin
 - Lithium
 - Warfarin
 - Antiepileptics
 - Biguanides (e.g. Metformin)
 - Statins
- Altered state of alertness, caused by:
 - Any drugs which alter the state of alertness (e.g. alcohol, benzodiazepine, narcotics and many more)

QUESTION 20 (10 marks)

A 20 year old male presents with a 3 day history of lethargy and generalised malaise. He is confused and looks unwell. The following venous blood tests are obtained.

pH	7.08		
pCO ₂	20	mmHg	(35-45)
HCO ₃	16	mmol/L	(22-28)
BE	-22	mmol/L	(-3-3)
Lactate	9	mmol/L	(<2.2)
Glucose	44	mmol/L	(3.9-5.8)
K	2.7	mmol/L	(3.5-4.2)
Na	160	mmol/L	(135-145)
Cl	124	mmol/L	(95-110)
Creatinine	70	micromol/L	(60-110)
Urea	5.3	mmol/L	(3-8)

i. Interpret the above results, and show any relevant calculations (5 marks)

- Severe metabolic acidosis with adequate respiratory compensation
- High anion gap metabolic acidosis. Likely secondary to DKA given the high glucose
- Na is high – 160 and even higher when corrected – $160 + (44-10/3) = 171$. Likely secondary to water loss – glycosuria. Potassium is low – acidaemia usually drive K up, so corrected will be even lower.
- Delta AG/HCO₃ – 1
- Hyperosmolality – $(2 \times 160) + 44/18 + 5.3/2.8 = 324$

ii. Outline your immediate management priorities (5 marks)

- Move to resus – needs monitoring in view of hypokalaemia and hypernatraemia. Needs x2 IVC, may need central access if K drops when resuscitation starts
- Needs 1 litre NS immediately
- Start insulin infusion at rate of 0.1 unit per kg/hr. Aim to drop BSL 2-4 per hour
- K replacement – may need central line. 10mmol/hour
- Need to monitor K and Na – at risk of seizures with large drops of Na level

QUESTION 21 (14 marks)

A 3 year old boy is brought to ED by his mother with abdominal pain and vomiting. Mum is concerned that he may have ingested some of her iron tablets. She is sure that there are more than 10 tablets missing.

- i. List 3 details that will assist your risk stratification (3 marks)

- Number of tablets ingested (inspect bottle if necessary)
- Time of ingestion
- Weight child
- Amount of elemental iron in each tablet to calculate amount of Fe ingested per kg/body weight

- ii. Complete the following table (4 marks)

Elemental Iron dose	Clinical Effect
<20mg/kg	Usually asymptomatic
20-60mg/kg	Gastrointestinal symptoms (vomiting/diarrhea/haematemesis/melena) Large losses contribute to hypovolaemia
>60-120mg/kg	Systemic toxicity anticipated. Predominantly CVS and Metabolic/liver. CNS (Lethargy/hypotonia secondary to CVS/Metabolic). Severe metabolic/lactic acidosis. Coagulopathy/jaundice/hypoglycaemia/coma
>120mg/kg	Lethal

- iii. List 4 investigations with a rationale for each that you would perform to determine the severity of toxicity (4 marks)

- FBC Leucocytosis/Thrombocytopenia
- EUC Renal impairment/K derangements secondary to acidosis
- Blood glucose Hypoglycaemia/Hyperglycaemia
- Coags Bleeding diathesis
- Blood gas Metabolic/lactic acidosis/HAGMA
- Serum Fe Levels Peak at 4-6 hours. No clear correlation between levels and toxicity but > 90 micromol/l predictive systemic toxicity
- AXR Confirming ingestion/planning/monitoring decontamination

iv. List 3 options for decontamination in this child (3 marks)

- UGI Endoscopy Consider in large OD if WBI fails. May require multiple insertions
- WBI PEG solution 250-500mls/hr
- GI Lavage Requires ETT. Useful only within 90 mins ingestion

QUESTION 22 (12 marks)

A woman in late pregnancy is brought to you following a high speed MVA.

- i. List three changes in respiratory physiology that occur with pregnancy [3 marks]

- Tidal volume increases (30-40%)
- Total lung capacity decreases (5% due to diaphragm elevation)
- Respiratory rate and minute volume increases (30-40%)
- pCO₂ decreases giving respiratory alkalosis
- Expiratory reserve volume decreases

- ii. Complete the table regarding cardiotocographic (CTG) monitoring in trauma (4 marks)

Purpose of CTG monitoring	
Gestation (weeks) from which CTG monitoring is useful	
Recommended duration of CTG monitoring in trauma	
Three CTG findings suggesting foetal distress	

- Purpose – detect uterine contractions which might suggest abruption/uterine irritability, assess for foetal distress/hypoxia
- Gestation – greater than 22-24 weeks – no role prior to that
- Duration – 4-6 hours in minor trauma – 24 hours in severe trauma or if any abnormalities in first 4-6 hours
- 3 abnormalities – premature contractions, foetal tachycardia, foetal bradycardia, loss of beat-to-beat variability, late deceleration after contractions

iii. Describe the process of peri-mortem caesarean section [5 marks]

- Make a midline vertical incision from the xyphoid to the symphysis pubis
- Bluntly separate the rectus muscles down the midline with a finger
- Open the peritoneum – either bluntly by pulling with your hands or with scissors
- Make a small incision at the lower end of the uterus, above the reflection of the bladder
- Insert two fingers, and lift the wall of the uterus away from the foetus. Using scissors, cut the uterus to the fundus
- Remove the infant, clamp and cut the cord, proceed to neonatal resuscitation
- Remove the placenta manually

QUESTION 23 (14 marks)

An 89 year old woman is brought to your tertiary ED with sudden severe chest pain and collapse with transient loss of consciousness.

Vital signs BP 90/- mmHg
 HR 50 bpm
 GCS 12

i. List 4 potentially life threatening diagnoses (4 marks)

- AMI/STEMI
- Aortic dissection
- PE
- AAA rupture
- Cardiac arrhythmia
- ACS/non STEMI

ii. What are the three most useful diagnostic tests in this setting (3 marks)

- ECG
- Echo/POCUS
- CT aortogram +/- pulmonary angiogram

- iii. What is the major abnormality on this bedside sub-sternal ultrasound image and what is the likely clinical diagnosis (2 marks)

AN ULTRASOUND IS SHOWN IN THE PROPS BOOKLET, PAGE 12

- Large pericardial effusion
- Thoracic aortic dissection with pericardial effusion, impending tamponade

- iv. What two treatment approaches are available (2 marks)

- Operative: urgent cardiothoracic surgery to replace the ascending aorta. May need urgent pericardiocentesis if becomes haemodynamically unstable
- Non operative, palliative approach

- v. The family arrives with an Advance Care Directive stating the patient did not want any lifesaving surgery. Prescribe the PRN meds you would chart for the ward (3 marks)

- Analgesia: morphine 1-2 mg subcut Q3H or hydromorphone or fentanyl
- Sedative: midazolam 2.5 mg Q3H
- Anti-secretions: hyoscine 400mcg Q3h or glycopyrrolate
- Various combinations acceptable but need one from each group

QUESTION 24 (13 marks)

You are at a peripheral hospital with no maternity facilities when a 16 year old obese girl presents in the second stage of labour. Up until this presentation she was unaware that she was pregnant.

i. List 5 steps you would take to prepare for her deliver (5 marks)

- Any 5 of the below
- Resuscitation room, get help, staff with midwifery/obstetric experience, 2 teams mother and baby,
- Baby resuscitation equipment and staff, resuscitaire, heater, blankets, bag valve mask-on air, dose of adrenaline, correct sized airway, breathing equipment. Umbilical line
- Mother - monitoring, delivery pack, pain relief, iv access bloods, syntocinon for post-delivery, ultrasound to exclude multiple birth?

Within minutes of arrival the baby's head is delivered. However, on the next contraction you are unable to deliver the shoulders despite gentle axial traction.

ii. Name this condition and in what period of time should the baby be delivered to avoid serious foetal hypoxia (2 marks)

- Shoulder dystocia
- 5 minutes (<10)

iii. Describe 3 manoeuvres that may enable the safe delivery of the child (6 marks)

- Answer any 3 of the following
- MacRobert's manoeuvre - Lie mother flat 2 staff members flex and abduct the hips until the thighs are on the abdomen (opens up and straightens the birth canal)
- Suprapubic pressure; to adduct the foetus' shoulder and thus narrow the width and to rotate the shoulders into the oblique axis (assistant presses from the foetus back in a downward and lateral manner)
- Internal rotation; "vaginal access should be gained posteriorly, into the sacral hollow. The whole hand should be entered posteriorly to perform internal rotation or delivery of the posterior arm. The woman should be brought to the end of the bed, or the end of the bed should be removed, to make vaginal access easier. Delivery can then be facilitated by rotation into an oblique diameter or when possible by a full 180 degree rotation of the fetal trunk"
- Delivery of the posterior arm: "The fetal wrist should be grasped and the posterior arm should be gently withdrawn from the vagina in a straight line"
- Episiotomy - mainly to allow for getting the hand in
- Putting mother in "all fours" position (on hands and knees)
- Cleidotomy - division of symphysis pubis
- Zavanelli manoeuvre - pushing the head back in and doing a caesarean

QUESTION 25 (18 marks)

A 4 week old baby presents to your urban ED with a runny nose, mild cough and increased work of breathing over the past 2 days. The child had several episodes where her breathing became slower but this resolved with gentle stimulation. She has not fed for 8 hours.

Vital signs Temp 36.6 deg C
 HR 190 bpm
 CR 3 sec
 RR 70/min
 SaO2 93% RA

i. List 4 differential diagnoses (4 marks)

- Infective – pneumonia, bronchiolitis, UTI, meningitis
- Cardiac – duct dependent lesion, non-cyanotic congenital heart disease
- Surgical – malrotation, intussusception
- Neurological – seizures
- Trauma – ICH
- Endocrine – CAH
- Metabolic – IEM, hypoglycaemia

ii. Describe and interpret the CXR (4 marks)

A CHEST XRAY IS SHOWN IN THE PROPS BOOKLET, PAGE 13

- RUL collapse / consolidation, LUL consolidation, NG inserted – needs advancing
- Diagnosis – pneumonia or bronchiolitis with collapse

iii. Outline your management steps (4 marks)

- HFNP – L/kg should be given, ideally include FiO₂
- NG insertion further 2cm
- IV access – IO if fail
- Fluid bolus – 10-20mls/kg 0.9%NaCl
- IV Ab – appropriate with dosing – benpen / cephalosporin
- NETS call
- Prepare for intubation given apneas

iv. You prepare for intubation. Complete the following table (6 marks)

Weight	4kg
ETT size	
ETT insertion depth	
Blade type and size	
Induction agent and dose	
Paralytic agent and dose	
Ventilator settings (TV, RR, FiO ₂)	

- ETT size: 3.5, depth 9.5-10cm
- Blade: Millar / straight 0 or 1
- Induction agent: ketamine / fentanyl / morph
- Paralytic: sux 2mg/kg
- Atropine 20mcg /kg
- TV 6-8mls/kg, RR 40, FiO₂ titrated (or reasonable) to sats > 95%, <98%

QUESTION 26 (14 marks)

A 50 year old female presents with chronic lithium poisoning. Investigations reveal a lithium level of 3.1 mmol/L, and serum creatinine 180 micromol/L.

i. What is the volume of distribution of lithium (1 mark)

- 0.7 – 0.9 L/kg

ii. List 6 possible signs or symptoms of chronic lithium poisoning (6 marks)

- Tremor, hyperreflexia, agitation, muscle weakness, ataxia
- Stupor, rigidity, hypertonia, hypotension
- Coma, convulsions, myoclonus

iii. Outline the principles of management in this patient (5 marks)

Candidate number _____

- Manage coma and seizures as required
- Aim to restore renal function to normal with attention to water and sodium deficits
- IV fluid resuscitation/hydration with 0.9%NaCl
- Tox consult/admission
- Consider haemodialysis in setting of neuro symptoms, and Li level > 2.5

iv. List 2 major differences between ACUTE and CHRONIC lithium poisoning (2 marks)

- GI vs neuro
- Lethality
- Elimination ie sufficient hydration in normal renal function vs haemodialysis

QUESTION 27 (16 marks)

A 68 year old male sustains blunt trauma to his right eye from a golf ball.

- i. Describe three abnormalities in the image (3 marks)

A CLINICAL IMAGE IS SHOWN IN THE PROPS BOOKLET, PAGE 14

- Extensive subconjunctival haemorrhage
- Extensive chemosis
- Dilated pupil
- Proptosis
- Periorbital bruising

- ii. List 5 features on assessment that would suggest orbital compartment syndrome (5 marks)

- Proptosis
- Rock hard eyeball palpated with eyelid closed
- Visual acuity. Significantly decrease, rapidly dropping to light perception only
- Inability to open eye
- Severe eye pain
- Limited eye movements
- Raised IOP >40 mm Hg. Rock hard eye ball to palpation compared to the other side
- RAPD

iii. Describe the steps involved in a lateral canthotomy/cantholysis (8 marks)

- Need to have adequate LA and/or sedation. Inject 1-2 mL local anaesthetic into lateral canthus
- Perform the canthotomy - insert needle holder from lateral canthus towards bony orbit and compress this area to devascularise it.
- Remove needle holder and using scissors cut along the lateral canthus 1-2 cm to the bony orbit.
- Perform cantholysis: Grasp the lateral lower eyelid with toothed forceps. Pull the lower eyelid down to visualise the inferior canthal tendon and cut through this with scissors. If not visualised the tendon can be identified as a rigid band, like a guitar string, "strummed" by the forceps to help locate it.
- If IOP still high after this cut the superior canthal tendon too by lifting the upper eyelid and locating the tendon. Use scissors to cut.