

Candidate number _____

Northern Sydney Hospitals/NSW HETI Network 2

FELLOWSHIP EXAMINATION PRACTICE PAPER

2016.1

MODEL ANSWERS

QUESTION 1 (25 marks) – DOUBLE QUESTION

A 42 year old man is brought by ambulance after completing a long distance bicycle race. Since the race his wife reports he has been acting strangely and fainted twice. She was told by his fellow cyclists that he had drunk plenty of water and had not fallen off his bike.

His vital signs are:

Temp: 39.5 degrees (per rectal)

HR: 122 regular

BP: 100/45

GCS: 14

- i. List 5 potential causes for this man's symptoms and signs (5 marks)

- **Heat stroke/heat related illness (bold mandatory)**
- **Hyponatraemia**
- **Hypoglycaemia**
- Sympathomimetic syndrome and/or stimulants
- Serotonin syndrome
- Anticholinergic syndrome
- Neuroleptic malignant syndrome
- Seizure
- Sepsis
- Encephalitis

ii. List 5 investigations that you think are the most important and their rationale (10 marks)

INVESTIGATION	RATIONALE

- **BSL** **hypo/hyperglycaemia (bold mandatory)**
- Na hyponatraemia
- K hyperkalaemia (due to AKI)
- VBG metabolic acidosis
- Lactate shock
- CK rhabdomyolysis
- U/Cr AKI /dehydration
- LFT ischaemic hepatitis
- Lipase pancreatitis
- UA myoglobinuria

iii. The patient’s temperature rises to 41 degrees (per rectal). Outline 4 actions in your initial management (4 marks)

- Passive Cooling (fan and mist, ice packs, wet towels, cooling blankets etc)
- Active Cooling (Cooled IVF, IDC – cold water irrigation)
- IV rehydration crystalloid
- Rectal/core temperature
- Supportive care
- Chlorpromazine/Diazepam if shivering
- IV antibiotics if sepsis suspected

iv. Despite resuscitative efforts the patient's temperature rises to 42 degrees and he has a generalised seizure. Outline 6 treatment priorities now. Provide doses and end points where appropriate (6 marks)

- Seizure control – benzodiazepine titrated
- Airway support – sensible drugs and doses for RSI
- Active cooling, aim core temp <38.5
- Rectal/Peritoneal lavage, CPB etc if no response
- Seek and treat hyponatraemia
- Aggressive IVF (aim UO >1-2ml/kg/hr) if rhabdomyolysis
- Diuresis and urine alkalinisation if above fails

QUESTION 2 (11 marks)

A 51 year old lady presented having been seen in your ED 3 days ago after an MVA. A senior registrar reviewed her and a full trauma assessment was performed. No major injuries were found. She complained of foot pain prior to discharge and an x-ray was performed. The discharge letter states no fracture, and she was advised to treat this as a sprain. She represents with ongoing pain and is now unable to weight bear.

AN XRAY OF THE FOOT IS SHOWN IN THE PROPS BOOKLET, PAGE 3

- i. Describe the main abnormality in this x-ray and the likely diagnosis (2 marks)

- Widening of the space between 1st and 2nd MT
- Lis Franc injury

- ii. List 3 fractures which can occur in association with this injury (3 marks)

- # Base of 2nd MT (most common)
- # Cuboid
- # Medial Cuneiform
- less common but probably ok – navicular #

iii. The patient is angry about the missed injury and states she is going to make a complaint. Briefly outline how you would address this complaint (6 marks)

- Answer should show logical thought process to stepwise management of complaint including acknowledgement, investigation, documentation, quality cycle and communication with patient. Example as below.
- Senior and consistent staff member dealing with incident
- Identify error – ensure no harm and treat issues
- Acknowledge error and complaint – open disclosure, apologize without accepting liability and explain initial process of investigation and plan to get back to her
- Investigate case fully –review notes, xray, discuss with staff involved
- Document error – IMMS, incident notification, escalate if serious error (probably not required in this case)
- Quality – ensure goes through Q and A cycle, M and M, address individual vs system errors. Implement education / system changes e.g. prompt review of rad reports in this case
- Meet again with patient ideally within 72 hrs and answer complaint addressing how repeat issue prevented.

QUESTION 3 (16 marks)

A 26 yr man presents with a 3 day history of sharp central chest pain suggestive of pericarditis. His observations are stable apart from a temp of 38C.

THE ECG IS SHOWN IN THE PROPS BOOKLET, PAGE 4

i. List the ECG abnormalities (3 marks)

- Sinus tachycardia
- Concave STE inf and V4-6
- PR depression inf & V4-6
- Reciprocal ST depression & PR elevation V1 & aVR

ii. What ECG features would make a diagnosis of benign early repolarisation more likely? (2 marks)

- ST elevation limited to the precordial leads
- Absence of PR depression
- Prominent T waves
- Changes do not evolve over time

iii. List 5 causes of pericarditis (5 marks)

- uraemia
- viral infection (all causes of myocarditis)
- bacterial infection
- radiation
- malignancy (metastatic: lung>breast>leukaemia and lymphoma>melanoma)
- vasculitis
- autoimmune (SLE, RA, scleroderma, sarcoid...)
- TB

iv. List 3 investigations used to detect a pericardial effusion in this setting – include a brief description of the positive finding for each investigation (6 marks)

- ECG – low voltage QRS complexes
- CXR – globular shaped heart
- ECHO – fluid seen as a black stripe

QUESTION 4 (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 delivery (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 (accept < 10 min)

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 5 (21 marks)

A concerned first-time mother has brought her 2-week-old baby to the ED because the baby is jaundiced.

- i. What is the name of the pathological condition caused by neonatal jaundice? (1 mark)

- Kernicterus - chronic bilirubin encephalopathy

- ii. If left untreated, what are 2 sequelae of this condition? (2 marks)

- Acute: seizures, coma
- Chronic: cerebral palsy, developmental delay, death

- iii. List 2 benign causes of neonatal jaundice (2 marks)

- Normal physiological jaundice due to ?immature hepatocytes
- Breast milk jaundice – Can last up to a couple of weeks, tends to be settling by week 3

- iv. List 4 pathological causes of neonatal jaundice (4 marks)

- Sepsis (onset anytime)
- Haemolysis: Rhesus, ABO (onset usually in 1st 24h)
- Liver trouble e.g. hepatitis, congenital abnormality e.g. biliary atresia, metabolic e.g. alpha-1 antitrypsin deficiency
- Bowel obstruction
- Hypothyroidism
- Other e.g. breakdown of blood from cephalhaematoma

v. What 5 historical features will guide your assessment of this child? (5 marks)

- Prematurity
- Time of onset
- Duration of symptoms > 3/52
- Obstructive symptoms – pale stools, dark urine, vomiting
- Duration of symptoms > 3/52
- Signs of lethargy eg poor suck
- Formula feed?
- Symptoms of sepsis ?fever

vi. How can a serum bilirubin assist your assessment? (2 marks)

- The higher the total bilirubin level, the greater the risk. Interpretation depends on prematurity (term babies handle higher levels)
- Conjugated versus unconjugated bilirubin. Conjugated is bad because it indicates an obstructive cause.

vii. List 5 other investigations you might consider (5 marks)

- Sepsis – FBC, CRP, blood and urine culture, LP
- Hemolysis - FBC & film again, group & hold, haptoglobins, LDH, Coombs test, G6PD
- Tests for liver function/obstruction – LFT, US
- TFT
- Other – serum ammonia, pyruvate, lactate

QUESTION 6 (15 marks)

A 65 year old woman presents to ED with lower back pain and normal observations. She has a history of type 2 diabetes but is otherwise well. There is no history of trauma.

i) List 6 historical features which may suggest serious pathology (6 marks)

- Bladder or bowel symptoms
- Weakness
- Sensory changes
- Fever
- Known Malignancy
- Weight Loss
- IVDU
- Thoracic back pain
- Night pain – increased likelihood of malignancy
- Steroid use
- History of Osteoporosis
- Recent invasive procedure to back – eg steroid injection / LP
- History of Spinal stenosis

ii) After taking your history you are concerned about possible cauda equina syndrome. List 4 examination findings which would support your diagnosis (4 marks)

- Urinary Retention
- Saddle Anaesthesia
- Loss of perianal sensation
- Loss of anal tone
- Leg Weakness
- Diminished reflexes
- Sensory Changes in the legs

iii) List the most important immediate investigation and the most important treatment if this condition is confirmed (2 marks)

- Investigation: urgent MRI
- Treatment: urgent surgical decompression (Neurosurg consultation probably acceptable)

iv) List the most common cause, and 2 other causes for cauda equina syndrome (3 marks)

- Large central disc prolapse / rupture
- Malignancy – tumour pressing on cord
- Spinal infection
- Epidural Haematoma
- Trauma
- Spinal stenosis

QUESTION 7 (15 marks)

A 62 year old male is brought to ED by ambulance after falling 4 metres from a ladder, sustaining a head injury. Primary survey is unremarkable apart from a significant head injury. There is an obvious swelling to the left side of his face and it is difficult to open his left eye.

Observations are:

HR 100

BP 100/60

SaO₂ 99% RA

RR 16

GCS 6

i. You elect to undertake an RSI to secure his airway prior to imaging. Complete the table below:

a) List 2 possible sedative drugs and doses you could use to facilitate RSI (4 marks)

- Suggest ketamine and thiopentone most appropriate answer
- Propofol inappropriate as more likely to cause hypotension
- Other answers could be accepted if rationalised

b) List one potential positive and one potential negative aspect of each drug's pharmacodynamics in this patient (4 marks)

Drug	Ketamine	Thiopentone
Dose	Suggest lower end of dose spectrum as drowsy – probably 1mg/kg	3-5mg/kg, suggest lower end
Positive pharmacodynamics specific to head injured patient	Maintains BP which is important in head injury. As even one episode of hypotension associated with worse outcome	Cerebroprotective function Anticonvulsant

Negative pharmacodynamics specific to head injured patient	Some statement re previous concern about possible increased ICP with ketamine. Although good candidates would state that more recent evidence would suggest probably safe (reflecting current common use in retrieval medicine especially)	Significant chance of hypotension especially if inappropriate large dose used May need to use vasopressor post induction eg metaraminol

- ii. List 4 positive findings from the 2 axial CT images (4 marks)

2 AXIAL IMAGES OF A CT BRAIN ARE SHOWN IN THE PROPS BOOKLET, PAGE 5 & 6

- Large right sided parieto-occipital subdural haematoma
- Significant midline shift with effacement of ventricles
- Left zygomatic fracture, nasal bone fractures, fractures through walls of left maxillary sinus
- Left facial swelling and proptosis, difficult to appreciate from single image but significant retrobulbar haemorrhage

- iii. Neurosurgery review the patient and are keen to take the patient to theatre urgently. A lateral canthotomy is also suggested. List 3 signs in an unconscious patient that would suggest a need for urgent lateral canthotomy (3 marks)

- Raised intra ocular pressure >40mmHg in unconscious patient with retrobulbar haemorrhage (normal pressure is 10-21)
- RAPD
- Dilated pupil in absence of central cause and CT suggesting retrobulbar haematoma
- Normal indications of decreased acuity, significant pain and ophthalmoplegia – not appropriate answers for this question as patient has low GCS

QUESTION 8 (15 marks)

You have agreed to be the expedition doctor for a trek to the Everest base camp. (altitude 5300m)

i. Outline the proposed pathophysiology of:

Acute Mountain Sickness (AMS)/High Altitude Cerebral Oedema (2 marks)

- Vasogenic cerebral oedema. Hypoxia appears to cause cerebral vasodilatation, leading to increased cerebral blood volume and blood flow.
- Leaky BBB – due to loss of autoregulation and increased permeability.

High Altitude Pulmonary Oedema (2 marks)

- Non cardiogenic, hydrostatic oedema.
- Widespread but uneven pulmonary vasoconstriction. Heterogeneity of the response causes diversion of flow to the less constricted areas with subsequent capillary leakage.

ii. List 2 risk factors for the development of High Altitude Pulmonary Oedema at any given altitude (2 marks)

- Rapid ascent
- Genetic predisposition
- Any pre-existing pulmonary hypertension (e.g. previous VTE/PE, cardiac shunts – e.g. ASD)
- Exertion
- Cold
- Use of sleeping medication
- Excessive salt ingestion

iii. List 5 clinical features of AMS (5 marks)

- Headache – worse with bending over or valsalva
- Anorexia, nausea, sometimes vomiting
- Lassitude, weakness, irritability
- Retinal haemorrhages
- Fluid retention - peripheral/facial oedema

iv. For severe High Altitude Pulmonary Oedema, list 4 treatment options (4 marks)

- Immediate descent
- Oxygen
- Minimise exertion
- Nifedipine
- Portable hyperbaric compression chamber
- CPAP/EPAP mask

QUESTION 9 (18 marks)

You are on duty in a small urban district hospital. You attend to an 8 year-old boy who was rescued from the bottom of a saltwater backyard pool, unconscious. He was resuscitated by pre-hospital personnel and presents with the following vital signs:

HR 72 bpm, regular

BP 90/60 mmHg

RR 24 bpm

SaO₂ 100 % on high flow oxygen

i. Outline 5 key features in your examination of this child (5 marks)

- Temperature
- Signs of lung injury/aspiration from immersion
- Signs of perfusion/haemodynamics
- Neurological deficit
- Evidence of C spine injury

ii. List 5 factors which determine this child's prognosis (5 marks)

- Immersion time
- Water temperature
- Presence of CPR and effectiveness
- Response to resus/ROSC prehospital
- Neurological state/GCS prehospital
- Comorbidities
- Intercurrent traumatic injuries

- iii. The child’s GCS improves to 14. Despite high flow “non-rebreather” mask oxygen, he shows signs of respiratory distress from aspiration pneumonitis. Complete the table outlining 3 escalating modalities that could be used to improve his oxygenation. Describe initial settings and sizes as appropriate (6 marks)

Treatment/modality	Settings
High Flow humidified nasal prong O2	FiO2 variable using blender – start 0.21 & titrate up. Increasing CPAP type effect with increasing flow rate. 8 year old estimate 30kg – usual “formula” is 2L/kg/min flow but max is 60L/min. Start at 6L/min & titrate up
NIV	mask CPAP or BiPAP high FiO2 (>0.6 or more??), 10/5 or similar
Invasive	6mm cuffed ETT, 5-7ml/kg TV

- Bag-mask oxygen with PEEP valve

- iv. List 4 potential disadvantages of the use of non-invasive mask ventilation (CPAP or BiPAP) for this child in the aero-medical retrieval context (4 marks)

- huge O2 supply required (may not be feasible)
- limited evidence for effectiveness in non-cardiogenic pulm oedema or aspiration syndromes
- may delay “proper’ treatment
- mask potentially claustrophobic/uncomfortable in an already scary aero-med environment
- air insufflation → increase risk of emesis

QUESTION 10 (24 marks) – DOUBLE QUESTION

Ambulance officers are bringing a 5-month old baby to your ED, in cardiac arrest. You have a few minutes to prepare your drugs and equipment.

- i. Complete the table below (10 marks)

	Formula/calculation	Answer
Estimated weight	2x birth weight	6-8kg
ETT size		3.5 uncuffed / 3.0 cuffed
DC shock joules	4 J/kg	25-30J
Adrenaline dose	10mcg/kg or 0.1ml/kg 1:10,000	0.0 mg or 0.7 mL
10% glucose dose	5ml/kg	35ml

- ii. Complete the table below identifying the recommended compression:ventilation ratio for each (3 marks)

Group	Ratio
Neonatal	3:1 = from birth to "a few hours" post-partum
Paediatric	15:2 = from "a few hours post partum" to approx 8 years old or?? Puberty
Adult	30:2 = beyond 8 years old/??puberty

iii. Briefly explain the rationale for different compression ratios in these populations (2 marks)

- Younger population more likely to have asphyxia cause of arrest so increased emphasis on ventilation (A/B) versus compressions (C)

iv. Briefly explain why the ratio recommended for lay provider BLS is constant across age groups (1 mark)

- Simply an attempt to reduce confusion & increase bystander CPR attempts

v. The child regains spontaneous circulation but is agitated and requires a rapid sequence induction. Please list the drugs you will choose, including doses (6 marks)

Drug	Dose/kg	Dose

- Sedation
 - thiopentone need low dose eg 1mg/kg
 - propofol similar eg 1mg/kg
 - ketamine 1-2mg/kg
 - can probably use other alternatives too

- Paralysis
 - sux then 1.5mg/kg is pretty standard
 - roc then should give similar or slightly less

vi. Increasingly cuffed endotracheal tubes are used in paediatric intubations. Briefly explain why, historically, uncuffed tubes were preferred (2 marks)

- Narrowest part of paed airway subglottic. Older paed ETTs had small volume, high pressure cuffs made of poorly tolerated materials leading to tracheal injury & subsequent subglottic stenosis. Newer devices have larger volume, lower pressure cuffs

QUESTION 11 (17 marks)

A 75 year old man has been resuscitated following an out-of-hospital cardiac arrest. He has been taken to a small regional Emergency Department. He was intubated at scene. His past history is unknown but paramedics have brought a bag of his normal medications: frusemide, aldactone, digoxin and warfarin.

THE PATIENT'S ECG IS SHOWN IN THE PROPS BOOKLET, PAGE 7

i. What are the 3 main findings in this ECG? (3 marks)

- Inferior STEMI
- Complete heart block
- Widespread anterolateral ST depression

ii. List 3 potential causes of the dysrhythmia in this patient (3 marks)

- Ischaemia/STEMI
- Electrolyte abnormality – especially K
- Digoxin toxicity

- iii. A retrieval team has been dispatched by helicopter with an estimated flight time of 2 hours. For the safe transfer of this patient, list the minimum monitoring modalities required (5 marks)

- Pulse oximetry
- Capnography
- Ventilation failure/disconnect alarm
- ECG/cardiac monitoring
- Invasive BP

- iv. Complete the following table, listing 3 common issues with the helicopter transport environment and their potential effects on patient assessment/management (6 marks)

Issue	Effects
Altitude	Decrease partial pressure → hypoxaemia (effect on patient & staff/crew), gas expansion (may worsen e.g. PTx, intracranial air)
Noise	Can't auscultate, unable to hear equipment alarms, can't communicate with patient
Movement/Vibration	Motion sick doctor, patient emesis, clinical signs obscured (e.g. pulses, pneumothorax), monitor (e.g. sats, NIBP) dysfunction, loose equipment items become missiles

Temperature

Ambient light

QUESTION 12 (14 marks)

A 36 year old woman presents with a very sudden onset severe headache 5 hours ago. It is suspicious for subarachnoid haemorrhage (SAH).

(i) Apart from headache, list 4 other clinical features that may be present in SAH (4 marks)

- Onset during strenuous exercise
- Neck pain
- Neck stiffness
- Photophobia
- Transient or prolonged decrease in consciousness
- Seizures
- Nausea/vomiting
- Focal neurological signs

(ii) Complete the table providing estimates where indicated (3 marks)

Situation	Estimate
Prevalence of confirmed SAH in a patient with a classic history of “thunderclap” headache	25% (20-30)
Sensitivity of new generation CT scanning in detecting SAH in this setting	About 98% (90-99)
Incidence of “traumatic tap” when performing a lumbar puncture (LP)	15-20%

(iii) The CT scan of this patient is reported as normal and a decision made to perform a lumbar puncture to look for xanthochromia. Name the two red cell breakdown products that can cause yellow discolouration of CSF (2 marks)

- Bilirubin
- Oxy-haemoglobin

(iv) List 5 criteria that indicate that a CT scan should be carried out prior to lumbar puncture (5 marks)

- Signs of RICP – papilloedema, bradycardia/hypertension
- GCS < 14 (this number variable)
- Immunosuppression
- Focal neuro deficit
- New onset seizures
- History of CNS disease (mass lesion, AVM etc)
- Older age
- Suspected SAH

QUESTION 13 (15 marks)

A 72 year old male is brought to ED by family with pain and swelling in his left calf for the last 24 hours. He has a history of myelodysplasia and denies trauma. On examination the calf is swollen and tender.

i. List 4 possible causes of his calf pain (4 marks)

- DVT
- Cellulitis/infection
- Ruptured bakers cyst
- Muscle tear/tendon rupture
- Ischaemia/embolism
- Venous insufficiency

In the ED, the patient continues to complain of pain despite opiate analgesia. His leg is increasingly swollen and now is erythematous with palpable crepitus. Vital signs are as follows:

GCS 15

Temp 37.8C

HR 120

BP 66/40

Sats 96% RA

ii. List your immediate management priorities in this patient. Include drugs, doses and end points where appropriate (5 marks)

- Move to monitored/resus area
- IV access/Fluid resuscitation (sensible approach)
- Empiric antibiotic treatment for nec fasc
 - Meropenem 1g IV q8h
 - Vancomycin (dependent on renal function) but usually 1g to 1.5g IV initially
 - +/- clindamycin 600mg IV q8h
- Analgesia (sensible)
- Monitor fluid balance
- Urgent surgical consultation

iii. List 3 risk factors for this condition. (3 marks)

- Immunosuppression from any cause including; diabetes, malignancy, alcoholism, IV drug use, chronic diseases such as HIV, organ transplant or any immunosuppressive therapy
- Trauma
- Surgery

- iv. The patient's hypotension remains refractory to fluid treatment and you decide to start vasoactive therapy. Give an example of a suitable medication for this patient with typical dosing/concentrations and treatment end points (3 marks)

- Noradrenaline either 4mg or 6mg in 100mls 5% dextrose – start at anywhere from 1 to 5 mls/hr and titrate to MAP 65-70, end organ perfusion – UO >0.5mls/kg/hr,
- Adrenaline either 4mg or 6mg in 100mls 5% dextrose – start at 1 to 5 mls/hr and titrate to MAP >65, end organ perfusion. Can be used peripherally if no CVC.
- Metaraminol – 10mg in 20mls saline, boluses of 0.5 to 1mg peripherally to increase SBP as temporary measure only

QUESTION 14 (12 marks)

A 5 month old boy brought in by his parents appears breathless and is “off his feeds.” Your provisional impression is bronchiolitis.

- i. Name three common organisms which cause this illness (3 marks)

- RSV, human metapneumovirus, parainfluenza virus, influenza virus, adenovirus, enteroviruses, rhinovirus

- ii. List 4 clinical features which would indicate a severe episode warranting admission (4 marks)

- Increased irritability or lethargy
- Marked increase in respiratory rate
- Marked chest wall retraction
- O₂ sats < 90% on room air
- Poor feeding
- Apnoeic episodes (or history of same from home)

- iii. Complete the following table describing the rationale for each investigation in a child with bronchiolitis (3 marks)

Investigation	Indication/Rationale
Chest Xray	In general not indicated Indicated if there are focal findings (suggesting consolidation) or diagnostic uncertainty (e.g. kid with murmur → ? CCF)
Nasopharyngeal aspirate	Varies b/w hospitals Some guidelines state “should not be done” Many centres use for cohorting/infection control
Blood gas	Not usually indicated Can be performed in deteriorating child though need for ICU etc remains a predominantly clinical decision

iv. This illness is contagious. List 2 ways to reduce transmission in hospital (2 marks)

- Barrier nursing: wear gloves and gown. Face shield if resp droplets likely to contaminate face
- Frequent hand decontamination with gel – wash with soap 1st if soiled
- Isolate patient in the ED and ward
- Wipe equipment & environment with suitable disinfectants

QUESTION 15 (15 marks)

A 27 year old man climbed over an electricity sub-station fence and sustained an electrical injury while grabbing a metal pole with his right hand. He arrives 30 minutes later complaining of tingling in his right arm and a numb left foot.

A CLINICAL PHOTOGRAPH IS SHOWN IN THE PROPS BOOKLET, PAGE 8

- i. Describe the wound seen on the foot (1 mark)

- Deep, full thickness burn to plantar aspect forefoot
- Depressed central area with surrounding eschar
- Sensible answer

- ii. Complete the table outlining factors that determine the severity of an electrical injury (8 marks)

Category	Explanation
Voltage	High voltage defined as > 1000V (some say 600V)
Current	0.5-2mAmp –tingling 1-4mAmp – pain threshold 6-22mAmp – tetanic contraction, unable to let go 18-30mAmp – respiratory arrest > 70mAmp – VF > 2000mAmp – asystole
Resistance	Wet skin much better conductor than dry → increase likelihood of injury resistance increases – nerves/vessels -> muscles -> bone

Type of current	<p>Low voltage AC more likely to → VF</p> <p>High voltage AC, and DC</p> <p>-more likely to cause muscle contractions that throw person away from source</p> <p>-more likely to cause asystole</p>

- iii. For each of the three categories below, what specific injuries or problems may occur in the patient described in the stem? For each, describe the pathophysiological process (6 marks)

	Injury	Pathophysiology
Cardiac	Variety of dysrhythmias	<p>High voltage injury likely (substation)</p> <p>Evidence of trans thoracic current</p>
Nervous system	Peripheral nerve injury/parasthesia/paralysis	Current down arm and leg
Limb soft tissue	<p>Cutaneous burns</p> <p>Vascular injury</p>	<p>Current from hand-foot</p> <p>Vasospasm/thrombosis/ischaemia</p> <p>Heating of tissue</p>

QUESTION 16 (19 marks)

An 80yr female presents via ambulance from her GP to your ED. She has a 24 hour history of vomiting, followed by syncope this morning. She had a second syncope at her GPs office and was noted to be bradycardic on ambulance arrival.

Observations on arrival to ED are:

GCS 15 HR 76 BP 85/30 RR 18 SaO₂ 96% RA

She describes no chest pain, has had a recent course of antibiotics for a chest infection and has started on a “new drug for my memory”.

THE PATIENT’S AMBULANCE RHYTHM STRIP AND ARRIVAL ECG ARE SHOWN IN THE PROPS BOOKLET, PAGE 9 & 10

- i. List 3 relevant findings from the 12 lead ECG (3 marks)

- Sinus rhythm
- PR prolongation
- QT prolongation
- No ischaemic changes

- ii. List 3 causes of the ECG abnormalities in this patient (3 marks)

- Electrolytes
- Drugs (must provide a relevant example) eg cholinergic agents, macrolide, psychotropic agents
- Myocardial ischaemia

iii. List your management priorities (4 marks)

- Seek and treat cause – medications, AMI, electrolytes
- Address hypotension – fluids, inotropes
- Continuous monitoring
- Cardiology consult/admission
- Apply pacing pads and consider temporary/chemical pacing if further bradycardia

She becomes bradycardic to 35 again, and her BP drops to 75/30 with a rhythm matching the initial ambulance ECG strip.

iv. What is her likely diagnosis? (1 mark)

- Complete heart block

v. You decide to initiate transcutaneous pacing for her transfer to ICU. Outline your approach (5 marks)

- Inform and consent
- Analgesia/sedation as required – sensible options
- Technique-
 - AP pads
 - Set rate (60-80)
 - Start pacing and slowly increase mA until pacing rate captured on monitor
 - Ensure mechanical capture
 - If pacing not captured, consider increasing current or re-siting electrodes

QUESTION 17 (16 marks)

A 40-year-old female who is Day 3 post-partum has been brought in following increasing confusion and agitation at home. In the ambulance she had a generalised tonic-clonic seizure which stopped with 5mg IMI midazolam.

When you arrive she is being nursed on a bed in the Resuscitation Room.

On examination:

Airway: snoring / partly obstructed

RR 40, O2 saturations 95%

HR 130, BP 180/100

Decreased LOC – drowsy, post-ictal, GCS 9

- i. Apart from eclampsia, list the causes of seizure you would consider in this patient (4 marks)

- **Cerebral venous sinus thrombosis**
- **Meningoencephalitis** e.g. post-epidural
- Primary epilepsy
- Hypoxia e.g. due to pulmonary embolus
- TTP
- Plus at least one not directly related to pregnancy / delivery: e.g., hypoglycaemia, toxic ingestion, structural intracranial e.g. bleed, ICH/SAH

ii. List 3 risk factors for pre-eclampsia/eclampsia (3 marks)

- Nulliparity
- Family history of preeclampsia, previous preeclampsia and eclampsia
- Poor outcome of previous pregnancy, including intrauterine growth retardation, abruptio placentae, or fetal death
- Multifetal gestations, hydatid mole, fetal hydrops, primigravida
- Teen pregnancy
- Primigravida
- Patient older than 35 years
- Lower socioeconomic status

iii. What examination features would increase your level of suspicion that this seizure is eclamptic in origin? (3 marks)

- Hypertension
- Peripheral oedema
- Hyper-reflexia → Clonus

- iv. Outline your initial management in each category below. Include drugs/dose/route (where appropriate) that you would administer (6 marks)

Category	Management
General management & resuscitation	<ul style="list-style-type: none"> • Form a team and assign roles • Address ABCs esp airway: simple adjuncts initially eg suction, NPA and lie on side <ul style="list-style-type: none"> ○ Breathing: high flow O2 and nasal CO2 monitor ○ Circulation: IV/IO access and send bloods / bedside BSL • Stop the fit Midazolam IV/IO/IM 5mg – other drugs – see below • Seek and treat a cause from the list above, esp eclampsia • Get help: <ul style="list-style-type: none"> ○ Obstetrics, renal / neurology, ICU
Pharmacotherapy of eclampsia/pre-eclampsia	<ul style="list-style-type: none"> • Midazolam 5mg IV/IO/IMI • Magnesium sulphate: officially 4G IV over 30 mins, but it comes in 10mmol amps. Closest is 20mmol (=5G). Safe enough to give over 20 mins provided you dilute it and watch the BP. Followed by IV infusion • Hydralazine: 5mg IV over 10 mins, can repeat

QUESTION 18 (16 marks)

A 25 year old man presents 6 hours after a SCUBA dive with possible decompression sickness (DCS).

- i. List 6 questions specific to diving you should ask in your history (6 marks)

- Dive profile (ideally from log book or computer)
 - depth, times, ascent rates, surface intervals, safety/decompression stops
- Dives in excess of tables?
- Multiple dives in one day?
- Altitude/flight since dive
- Any problems during descent/ascent
 - problems equalising? Equipment issues? Incidents?
- Delay to symptom onset after leaving water
- Previous dive experience
- Previous dive-related illness

- ii. Complete the table listing 3 symptoms or signs of DCS in each category (6 marks)

Category	Symptom/Sign
Neurological	Weakness, headache, paralysis, dizziness, visual disturbance, ataxia, altered LOC, parasthesias
Other	SOB, rash, itching, joint aches, chest pain

iii. Complete the table contrasting DCS and Arterial Gas Embolism (AGE) (4 marks)

	DCS	AGE
Pathophysiology	Nitrogen bubbles forming in tissues (pressure effects), in vessels (flow effects) & activation of inflammatory cascade	Barotrauma; rapid expansion/tear of pulmonary tissue – direct entry of bubbles into arterial circulation
Time of onset	Gradual onset of neuro, MSK and/or skin symptoms often within 30-60 min of surfacing – nearly all within 24 hours	Usually occur on ascent or immediately upon surfacing

QUESTION 19 (21 marks) – DOUBLE QUESTION

A 70 year old man presents with ischaemic-sounding chest pain on a background of longstanding, poorly controlled hypertension. His 12-hour troponin is normal.

THE PATIENT'S ECG IS SHOWN IN THE PROPS BOOKLET, PAGE 11

i. List 4 abnormalities in this ECG (4 marks)

- Markedly increased LV voltages: huge precordial R and S waves that overlap with the adjacent leads
- LVH
- LV strain pattern with ST depression and T-wave inversions in I, aVL and V5-6
- ST elevation in V1-3
- Prominent U waves in V1-3
- Left axis deviation

ii. List 5 causes of ST segment elevation other than myocardial ischaemia (5 marks)

- Pericarditis
- Benign early repolarization
- Left bundle branch block
- Left ventricular hypertrophy
- Ventricular aneurysm
- Brugada syndrome
- Ventricular paced rhythm
- Raised intracranial pressure

iii. The patient is noted to have a systolic heart murmur. List 6 differential diagnoses of a systolic murmur (6 marks)

- Aortic stenosis
- Mitral valve prolapse
- Mitral regurgitation
- Pulmonary stenosis
- Tricuspid regurgitation
- VSD
- ASD
- HOCM

iv. You suspect this patient has aortic stenosis. What are the physical signs that suggest severe aortic stenosis? (4 marks)

- Slow rising pulse
- S4
- Paradoxical splitting of the second heart sound
- Aortic thrill
- Length and harshness of murmur
- LVH – displaced apex beat
- LVF – a late sign

v. Your registrar wants to commence a nitrate infusion for this man's angina. Outline your concerns about this plan (2 marks)

- In severe AS, vasodilators are (relatively) contraindicated – cardiac output is preload dependent (filling the thickened, stiff ventricle)

QUESTION 20 (14 marks)

A 42-year-old man is brought to your ED by ambulance with acute confusion. His health has been deteriorating for three months, with tiredness & 10kg weight loss despite an enormous appetite. He is on no medications.

Observations on arrival are:

HR 140 BP 180/100 RR 40 SaO₂ 100% GCS 13 Temp 38.5 BSL 10

i. List the most likely diagnosis (1 mark)

- Thyroid storm

ii. List 4 differential diagnoses (4 marks)

- Heat related illness
- Intracranial SOL/haemorrhage
- Sepsis – meningoenephalitis, other
- Toxidrome – sympathomimetic, anticholinergic
- Withdrawal syndromes – ethanol, benzodiazepines

iii. List 4 problems that may precipitate the most likely diagnosis (4 marks)

- Sepsis
- Acute MI
- DKA
- Trauma
- IV iodinated contrast
- Unrecognised or poorly treated hyperthyroidism
- Ingestion thyroid hormone
- Withdrawal of thyroid medication

iv. List 5 treatment priorities in ED (5 marks)

- Some knowledge/description of anti thyroid medications essential
- Supportive care – ABC
- Sedation – benzodiazepines
- Seek and treat precipitant
- Block peripheral effects – IV B Blocker (Propranolol, esmolol)
- Decrease synthesis – PTU, carbimazole
- Prevent release of hormone – iodine (after synthetic pathway blocked)
- Corticosteroids
- Consult endocrinology

QUESTION 21 (11 marks)

Ambulance officers bring a 68 year old man with severe back pain to your ED. He is shocked (BP 80/50mm Hg). Your trainee has performed a bedside ultrasound and obtained this image.

A CLINICAL IMAGE IS SHOWN IN THE PROPS BOOKLET, PAGE 12

i. Describe the image. (2 marks)

- Abdominal aortic aneurysm (AAA) approx 8cm (essential)
- Likely to be a bleed into the wall as well (clotted blood appears bright on US)

ii. List the most likely diagnosis and one differential diagnosis. (2 marks)

- **Ruptured AAA is most likely in this patient**
- DDx includes all other causes of shock and back pain (eg pyelonephritis with sepsis) with a coincidental, and as yet unruptured, AAA.

The on-call vascular surgical registrar has asked you to continue to resuscitate the patient and get an urgent CT while he organises theatres.

iii. What is the role of CT scanning in this setting? (2 marks)

- This depends on the institution & the established practice of the vascular team.
- In centres where emergency AAA repairs are done by endo-vascular approach a CT scan is essential for planning/sizing of stent (even if some patients die in CT).
- In centres where open laparotomy is the only approach, a CT scan is essentially contraindicated as it delays OT. In this latter setting this should be explained to the vascular registrar +/- his/her boss

iv. List the key steps in your ongoing resuscitation and preparation for theatres (5 marks)

- Prepare for OT: urgent cross match/ platelets/ FFP. (These will be required in OT.) (essential)
- In the meantime, permissive hypotension: keep BP high enough just to perfuse the brain eg 90mm Hg. (essential)
- Analgesia: eg small aliquots of IV morphine (essential)
- Explanation to patient & family

QUESTION 22 (13 marks)

You are the retrieval doctor at a pre-hospital scene where there has been a single-occupant rollover MVA. The driver has been trapped for 2 hours by extensive compression of both legs by dashboard and steering column intrusion. He has chest and head injuries (GCS 7)

- i. What are the potential pathophysiological consequences of rapid release of this patient's legs? (2 marks)

-
- Washout of "trash" blood – cold, acidotic, myoglobin-&-potassium-laden
 - Sudden acidosis & K spike – risk malignant dysrhythmias

- ii. What therapies could you use to mitigate these pathophysiological consequences? (3 marks)

-
- IV access
 - Fluid (saline) pre-load
 - IV bicarbonate
 - Calcium at hand
 - Ideally intubate – with decreased LOC and chest injuries will not be able to mount adequate ventilatory response to sudden acid load

On arrival at the nearby trauma centre, concerns are raised about the possibility of a bilateral lower leg compartment syndrome.

- iii. Outline a technique for measuring compartment pressures (4 marks)

There are a few acceptable answers

- Stryker needle – proprietary device with special needle with side ports – attaches to a pressure measuring component in the Stryker kit
- "Normal" large bore needle or cannula attached to standard IV line and transduced as one would an arterial or CVP line (zero it etc)
- With either device → prep skin, insert needle into muscle body of concern. Use of local anaesthetic is tricky as infiltration of a volume of LA could further increase compartment pressure

- Regardless of finding (in mmHg) a high clinical suspicion should nonetheless prompt urgent consideration of fasciotomy

iv. What pressure threshold would confirm suspicions of compartment syndrome?
(1 mark)

-
- A typical threshold is around > 35 mmHg

v. The patient's creatine kinase is 7000 IU/L. The renal registrar wants you to start a mannitol infusion to reduce renal injury from tubular deposition. List 3 disadvantages or adverse effects of mannitol in this context (3 marks)

-
-
-
- lack of proven efficacy in preventing renal injury or need for dialysis (beyond that provided by aggressive volume → increased UO)
 - causing big fluid shifts and contributing to hypovolaemia/hypotension are potentially bad ideas in a polytrauma patient
 - potential haemoconcentration/increased viscosity
 - effects on ICP (??advantageous in this patient)
 - allergy/anaphylaxis

QUESTION 23 (13 marks)

A 24 year old woman with a history of asthma presents with dyspnoea, dizziness and pleuritic chest pain for 24 hours. She appears tired, her pulse is 135bpm, and has mottled peripheries. A CXR is performed in the resuscitation room.

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

i. List 3 positive and 2 negative findings on the CXR (5 marks)

Positive

Negative

- Positive
 - **Right PTX**
 - **Significant tension with massive mediastinal shift**
 - Flattened right hemidiaphragm
 - Small amount right pleural fluid
 - Deep sulcus

- Negative
 - No subcutaneous emphysema
 - No medical intervention, lines, drains etc
 - Trachea midline
 - No focal consolidation

ii. List 4 immediate management steps (4 marks)

- **Immediate chest decompression**, (fatal error if not mentioned)
 - needle thoracocentesis (ensure resolution), ICC if rapid, finger thoracostomy then 3 sided occlusive dressing
- Ensure improvement of clinical state and vital signs
- Non invasive monitoring
- Formal ICC with underwater seal
- Oxygen
- Asthma management (nebs, IV therapy)

iii. List 4 complications of definitive treatment of this problem (4 marks)

- Misplacement of ICC
- Solid organ injury
- Infection/empyema
- Haemorrhage
- Tube malfunction/blockage/kinking

QUESTION 24 (15 marks)

You are at a peripheral hospital with no paediatric or neonatal 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. You have been asked to care for the baby after birth.

- i. List 5 of the most important factors that the mother or baby may have that will increase the risks of the infant needing resuscitation (5 marks)

The following is a standard list

Maternal Risk Factorsⁱ

- Prolonged rupture of membranes (> 18 hours)
- Bleeding in second or third trimester
- Pregnancy-induced hypertension
- Chronic hypertension
- Substance abuse
- Drug therapy (e.g. lithium, magnesium, adrenergic blocking agents, narcotics)
- Diabetes mellitus
- Chronic illness (e.g. anaemia, cyanotic congenital heart disease)
- Maternal pyrexia
- Maternal infection
- Chorioamnionitis
- Heavy sedation
- Previous fetal or neonatal death
- No antenatal care

Fetal Risk Factors

- Multiple gestation (e.g. twins, triplets, etc.)
- Preterm gestation (especially <35 weeks)
- Post-term gestation (>41 weeks)
- Large for dates
- Fetal growth restriction
- Alloimmune haemolytic disease (e.g. anti-D, anti-Kell, or other antibody known to cause haemolytic disease of the fetus and newborn, especially if fetal anaemia or hydrops fetalis is present)
- Polyhydramnios, oligohydramnios
- Reduced fetal movement before onset of labour
- Congenital abnormalities which may affect breathing, cardiovascular function or other aspects of perinatal transition
- Intrauterine infection
- Hydrops fetalis

Intrapartum Risk Factors

- Non-reassuring fetal heart rate patterns on CTG
- Abnormal presentation
- Prolapsed cord
- Prolonged labour (or prolonged second stage of labour)
- Precipitate labour
- Antepartum haemorrhage (abruption, placenta praevia, vasa praevia)
- Meconium in the amniotic fluid
- Narcotic administration to mother within 4 hours of delivery
- Forceps delivery
- Vacuum-assisted (Ventouse) delivery
- Maternal general anaesthesia

ii. List 3 ways you can estimate the gestational age of the infant (3 marks)

- Ask mother about LMP
- Measure Fundal Height (at umbi = 20 weeks, at xiphsternum 36 weeks, halfway between 27 weeks)
- Perform ultrasound measure- femur length or bpd or head circumference. Often ultrasound machines will correlate length with age

iii. On delivery, the baby is limp, with poor respiratory effort and a HR of 90/min. List 5 of your immediate actions to resuscitate the baby (5 marks)

- Dry, stimulate and place in a warmed resuscitation environment
- Open the airway, place head in neutral position
- Gentle suctioning to remove secretions
- If breathing remains inadequate, give 5 breaths via neonatal bag-valve mask
- Reassess breathing and HR. Ventilate at 30 breaths/min until regular breathing is established.
- If HR falls below 60, commence chest compressions

iv. If this is a term infant should you resuscitate with air or a higher concentration of oxygen? Provide reasons for your answer (2 marks)

- Air
- While insufficient oxygenation can impair organ function or cause permanent injury, there is increasing evidence that even brief exposure to excessive oxygenation can be harmful to the newborn during and after resuscitation

QUESTION 25 (19 marks)

i. Complete the table comparing lightning vs high voltage injury (10 marks)

Factor	Lightning	High Voltage AC
Current duration	Brief/instantaneous (1-3ms)	1-2 sec, may be prolonged/tetanic
Current characteristics	DC	AC
Energy level	> 1 million V > 20000 A	>600 V < 1000 A
Cardiac arrest initial rhythm	Asystole	Asystole/VF
Tissue damage	Superficial, minor	Deeper tissues involved

ii. There are several different types of lightning strike. List 2 types and briefly describe them (4 marks)

Type of strike	Description

- Direct -Victim struck directly
- Side flash - Nearby object struck & current traverses the air to hit victim or multiple victims
- Contact strike - Lightning hits an object the person is holding – current is transmitted to ground via the victim (e.g. indoor telephone)
- Ground current - Lightning hits the ground and is transferred through the ground to nearby victim. Current will enter a foot closer to the strike and exit through the more distant foot (“step voltage”)

iii. Describe 2 clinical features which are considered pathognomonic for lightning strike (2 marks)

- Keraunoparalysis - Lightning induced (usually lower) limb paralysis with vascular spasm, flaccidity and loss of sensation. Impalpable peripheral pulses with mottled, blue limb. Usually self-limiting
- Lichtenberg flowers - Feathery cutaneous burns

iv. List 3 other clinical features seen in lightning strike (3 marks)

- Asystolic cardiac arrest due to massive depolarisation. May recover if secondary hypoxic arrest prevented
- Neurological deficits: temporary extremity paralysis, loss of consciousness, confusion, amnesia. Usually transient. Occasional delayed and progressive disorders eg parkinsonism, seizures, cerebellar ataxia.
- Cataracts, delayed
- Tympanic membrane rupture
- Posterior shoulder dislocations

QUESTION 26 (14 marks)

A 67 year old male with a urethral catheter in situ for 2 months, awaiting TURP, presents with a blocked IDC which has been changed. Routine pathology tests were performed.

Na 137	(135-145)	Bilirubin 5	(3-20)
K 4.3	(3.5-5.2)	Prot 68	(60-80)
Cl 104	(95-110)	Alb 38	(32-46)
Bic 22	(22-32)	ALP 585	(30-110)
Urea 5.2	(3-8)	GGT 47	(9-36)
Creat 67	(45-90)	ALT 13	(<55)
eGFR 94	(>60)	AST 39	(12-36)

- i. List 2 possible causes for the pathology abnormality (2 marks)

- Paget's disease
- Bone malignancy/metastases

- ii. List 3 further pathology tests you would perform and provide reasoning (6 marks)

Test	Clinical reasoning
FBC	Anaemia, concern re malignancy
Calcium	Bone disease/malignancy suspected
Prostate specific antigen	Prostatic malignancy possible

iii. List 5 malignancies that metastasize to bone (5 marks)

- Breast
- Prostate
- Lung
- Thyroid
- Kidney

iv. What type of bony metastases occurs in prostatic malignancy? (1 mark)

- Sclerotic

QUESTION 27 (19 marks)

A 67 year old woman has presented having found her blood pressure to be 205/130 on her home BP machine.

- i. Define hypertensive emergency (2 marks)

- An acute elevation of blood pressure (typically to >180/120mmHg) associated with end-organ damage – specifically acute effects on brain, heart, aorta, kidneys and/or eyes

- ii. An image of the patient's retina is shown. Name two abnormalities seen (2 marks)

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

- Flame (splinter) haemorrhages
- Cotton wool spots
- Papilloedema (blurred optic disc margins)

- iii. List and justify 3 blood tests you might order in this patient (6 marks)

Blood Test	Justification
FBC	Microangiopathic RBC abnormalities/haemolysis
EUC	Renal injury (end-organ) – Ur/Cr +/- Na/K abnormalities
Troponin	Cardiac injury

BNP?

Heart failure/APO

- iv. Acute lowering of BP in profoundly hypertensive patients is indicated in a number of specific settings. Complete the table including two medications for each condition listed (doses not required). Identify the therapeutic goal and the blood pressure target (12 marks)

Diagnosis	Preferred agents (2 marks each)	Goal/Target (2 marks each)
Aortic dissection	Esmolol infusion Nitroprusside infusion (after B-blocker) Labetolol	SBP 100-120 Reduction of shear forces
Myocardial ischaemia	GTN infusion (+/- topical/sublingual) B-blockade (e.g. metoprolol) CaCh blockers	Decrease BP 20-25% Reduction of ischaemia
Intracerebral haemorrhage	Labetalol Hydralazine Clonidine	Target BP 160/90 or lower Limit expansion of haematoma