COLLEGE OF INTENSIVE CARE MEDICINE
OF AUSTRALIA AND NEW ZEALAND

SECOND PART EXAMINATION

EXAM REPORT

MARCH / MAY 2019

This report is prepared to provide candidates, tutors and Supervisors of Training with information regarding the assessment of candidates' performance in the CICM Second Part Examination. Answers provided are not necessarily model answers but a guide as to what was expected and for use as an educational resource. Trainees should discuss the report with their tutors so that they may prepare appropriately for future examinations. Trainees should not rely solely on writing practice answers to previous exam questions for exam preparation, and first establish a strong knowledge base from learning at the bedside and studying relevant texts, journals and on-line sources.

The exam comprises a written section and an oral section. The written exam consists of two 2.5hr papers of 15 short answer questions each. The pass mark for the written section is derived by the Angoff method and for this sitting was set at 52%. The oral exam consists of eight interactive vivas and two separate clinical "hot cases".

The tables below provide an overall statistical analysis as well as information regarding performance in the individual sections. A comparison with data from the five previous exams is provided.

In all sections of the exam the candidate has to demonstrate performance consistent with that of a junior consultant, i.e. demonstrate he/she has the ability for safe, effective, independent practice as an Intensivist. Candidates who are not at this level are encouraged to defer their attempt at the exam.

Overall Performance	May 2019	October 2018	May 2018	October 2017	May 2017	October 2016
Presenting for written (Including OTS)	44	67	49	49	40	49
Carrying a pass from a previous attempt	13	7	11	8	9	14
OTS Exempt	0	0	0	0	0	0
Total number presenting (written + carry + OTS)	57	74	60	57	49	63
Invited to orals (>52% in written section)	20	47	28	39	24	34
Total number invited to oral section	33	54	38	47	33	48

Analysis of Performance in Individual Sections	May 2019	October 2018	May 2018	October 2017	May 2017	October 2016
Successful in the written section	20/44 45%	47/67 70%	28/49 57%	39/49 80%	24/40 60%	34/49 69%
Successful in the Hot Case section	24/33 73%	33/54 61%	23/38 61%	33/47 70%	15/33 45%	33/48 69%
Successful in both Hot Cases	11/33 33%	19/54 35%	11/38 29%	18/47 38%	11/33 33%	24/48 50%
Successful in the Viva section	26/33 79%	36/54 67%	31/38 82%	36/47 77%	24/33 73%	38/48 79%

Sectional Pass Rates	May 2019		October 2018		May 2018		October 2017		May 2017		October 2016	
	Pass rate	Highest individual mark	Pass rate	Highest individual mark	Pass rate	Highest individual mark	Pass rate	Highest individual mark	Pass rate	Highest individual mark	Pass rate	Highest individual mark
Hot Case 1	64%	88%	57%	85%	58%	85%	60%	100%	42%	90%	65%	93%
Hot Case 2	55%	80%	65%	90%	58%	90%	62%	98%	55%	95%	65%	90%
Viva 1	73%	80%	56%	75%	76%	95%	64%	90%	73%	85%	65%	88%
Viva 2	61%	85%	46%	95%	87%	100%	30%	68%	73%	90%	67%	85%
Viva 3	76%	77%	74%	85%	87%	100%	51%	83%	55%	71%	77%	95%
Viva 4	61%	93%	63%	95%	71%	98%	62%	83%	73%	93%	46%	90%
Viva 5	48%	83%	70%	83%	50%	80%	79%	100%	70%	77%	44%	95%
Procedure Viva	85%	90%	81%	95%	53%	90%	45%	78%	73%	90%	79%	100%
Radiology Viva	36%	67%	30%	77%	76%	97%	66%	95%	73%	94%	100%	92%
Communication Viva	67%	88%	50%	90%	53%	84%	91%	100%	52%	95%	60%	95%

Oral Section Pass Rates	May 2019	October 2018	May 2018	October 2017	May 2017	October 2016
Candidates who scored >52% in written section and passed the overall exam	17/44 **39%**	35/47 **75%**	22/28 **79%**	30/39 **77%**	17/24 **71%**	25/34 **74%**
All candidates invited to oral section and passed the overall exam (written + carry + OTS)	26/33 **79%**	39/54 **72%**	30/38 **79%**	37/47 **79%**	21/33 **64%**	39/48 **81%**
Overall Pass Rate	26/57 **46%**	39/74 **53%**	30/60 **50%**	37/57 **65%**	21/49 **43%**	39/63 **62%**

EXAMINERS' COMMENTS

Written Paper

The pass rate for the written section was the lowest for several years. Questions dealing with clinical trial design, upper limb venous thrombosis, ventilator associated pneumonia, and massive transfusion protocols were particularly poorly answered. A common theme from the examiner comments is that candidates did not read the stem carefully and so lost marks. **Specific practice on carefully reading the stem before attempting the answer is strongly recommended for candidates preparing for the written section**.

As in previous exams, candidates who failed questions did so for one or more of the following reasons:

- Insufficient knowledge of the topic in question
- Insufficient detail and/or depth of the answer
- Poorly structured answer
- Inadequate reference to supportive evidence where relevant
- Failure to answer the question as asked
- Omission of all or part of the question

Candidates that failed questions most often gave insufficiently detailed answers that were not at the level expected of a junior consultant. Candidates often gave generic "proforma" answers that did not deal with the specific issues in the question.

Candidates are advised to read the questions carefully and thoroughly and ensure they answer the question as asked and address all parts of each question. **Candidates are reminded to make sure their writing is legible and to avoid using non-standard abbreviations**. Candidates are also reminded that professional conduct is assessed throughout the exam process and that inappropriate comments written on the answer paper are not acceptable.

Candidates who failed the written section scored an average of 47% compared with those candidates who passed, whose average score was 57%.

SECOND PART WRITTEN EXAMINATION

(A) Write your answers in the blue book provided

(B) Start each answer on a **new page** and indicate the **question number**. It is not necessary to rewrite the question in your answer book

(C) You should aim to answer each question in **ten** minutes

(D) The questions are worth **equal** marks

(E) Record your **candidate number** and each **question number** on the cover of each book and hand in all books

GLOSSARY OF TERMS

Critically evaluate:	Evaluate the evidence available to support the hypothesis
Outline:	Provide a summary of the important points
List:	Provide a list
Compare and contrast:	Provide a description of similarities and differences (E.g. Table form)
Management:	Generic term that implies overall plan. Where appropriate, may include diagnosis as well as treatment
Discuss:	Explain the underlying key principles. Where appropriate, this may include controversies and/or pros and cons

NOTE

Where laboratory values are provided, abnormal values are marked with an asterisk (*****).

Please note that in this report all images from the SAQs have been removed.

Question 1

You are attending a rapid response call (RRC) for a 60-year-old male who is hypotensive following coronary angiography and angioplasty.

a) What is your differential diagnosis for the hypotension? (20% marks)

b) List the findings from the history, examination and investigations that would help determine the cause of the hypotension. (30% marks)

c) Outline your management priorities. (50% marks)

ANSWER TEMPLATE

Diagnoses
Pericardial collection with tamponade

Stent occlusion
Coronary dissection or rupture
Evolving MI
Anaphylaxis
Effects of sedation and respiratory depression
Blood loss from cannulation site or retroperitoneal haematoma (femoral access)
Pulmonary oedema
Arrhythmias including heart block

History
-known allergies
-indication for procedure
-procedure performed, anatomical site of access, ease of procedure, coronary anatomy and disease, stents deployed
-medications given (anticoagulants, antiplatelets, vasodilators, inotropes or vasoconstrictors, sedatives, hypnotics etc)
-current symptoms (chest or abdo pain, SOB, dizziness etc)

Examination
-signs of cardiogenic shock (cold, clammy, diaphoretic, altering mentation, pulmonary oedema etc)
-signs of tamponade (soft HS / Elevated JVP and distended neck veins / pulsus paradoxus)
-Assess access sites especially groin and look for signs of local or retroperitoneal bleeding
-signs of anaphylaxis e.g. wheeze, flushing etc.
Blood pressure, heart rate and rhythm, respiratory rate, signs of respiratory distress, heart sounds

Investigations
ECG and echo mandatory
-ECG: new or ongoing ST elevation may indicate thrombus, stent occlusion or coronary dissection. Inferior MI may lead to 2/3rd degree heart block, and ongoing ischaemia may result in ventricular arrhythmias.
-Echocardiography looking or pericardial effusion/tamponade, which may be the result of coronary artery perforation, or cardiac perforation. Also looking for regional wall motion abnormalities or new VSD, cardiac function etc.
-Bloods including blood gas and troponin; drop in Hb, elevated lactate, significant hypoventilation etc
Chest x-ray if signs of respiratory distress

Management priorities
Should focus on stabilisation of ABC and correction of reversible causes.
Haemorrhage should be excluded as quickly as possible, as should a contrast or other drug reaction.
Judicious fluid challenge and use of inotropic agents/vasopressors to achieve a safe blood pressure.
The need for urgent return to the Cath Lab or proceeding to the operating theatre should be decided on as soon as possible. In the absence of local haemorrhage or another clear precipitant, and after the deployment of stents, return to the Cath Lab is almost mandated to exclude stent occlusion/dissection
The need for intubation should be very carefully assessed, as the procedure carries
significant risk in the setting of severe hypovolemia or cardiac tamponade. Oxygen should be given, and judicious use of CPAP may help with pulmonary oedema although this may worsen RV dysfunction/tamponade physiology etc
Temporary pacing (transvenous or percutaneous) as indicated. Anti-arrhythmics such as amiodarone should be given as required.

Examiners Comments:

Often unstructured general resuscitation answers without reference to the specific clinical scenario. The crucial possibilities of reinfarction and cardiac tamponade were missed by many candidates as

were the potential need for specific therapies. Unfortunately, some candidates spent a lot of time writing on very general aspects.

Maximum Score	8.1
Percentage Passed	54.5%

Question 2

List the typical findings in the following investigation-disease pairs:

a) The nerve conduction findings in Guillain-Barre syndrome. (20% marks)

b) The cerebral spinal fluid findings in Listeria meningitis. (20% marks)

c) MRI features in posterior reversible encephalopathy syndrome (PRES). (20% marks)

d) Full blood count and blood film in Vitamin B12 deficiency. (20% marks)

e) Plain cervical spine X-ray in ankylosing spondylitis. (20% marks)

ANSWER TEMPLATE

a) The nerve conduction findings in Guillain-Barre syndrome
- May be normal
- With pure demyelination-Slowed nerve conduction velocities, (temporal dispersion of waveforms, conduction block, prolonged or absent F waves).
- If axonopathy-reduced amplitude

b) The cerebral spinal fluid findings in Listeria meningitis
- Increased WCC with lymphocytosis
- Elevated protein
- Reduced glucose
- Gram positive rods on microscopy

c) MRI features in posterior reversible encephalopathy syndrome (PRES)
- T1: hypointense in affected regions
- T2: hyperintense in affected regions
- DWI: usually normal
- ADC: signal increased in affected regions due to increased diffusion
- SWI: may show microhaemorrhages in up to 50%

d) Full blood count and blood film in Vitamin B12 deficiency
- Anaemia
- Macrocytosis
- Leucopenia/thrombocytopenia
- Low reticulocyte count
- Hypersegmented neutrophils

e) Plain cervical spine x-ray in ankylosing spondylitis
- Squaring vertebral bodies
- Ankylosis facet joints
- “Bamboo spine”

Examiners Comments:

Generally poor knowledge in this area with many factual errors in some candidates' answers.

Maximum Score	6.8
Percentage Passed	31.8%

Question 3

3.1

A 69-year-old female with a past history of multiple bowel surgeries and severe rheumatoid arthritis presents to the ICU with hypotension. The following results are obtained:

Parameter	**Patient Value**	**Adult Normal Range**
FiO_2	0.30	
pH	7.36	7.35 – 7.45
pO_2	79.7 mmHg (10.6 kPa)	
pCO_2	22.0 mmHg (2.9 kPa)*	35.0 – 45.0 (4.6 – 6.0)
SpO_2	96.1%	
Bicarbonate	12.0 mmol/L*	22.0 – 26.0
Base Excess	-12.0 mmol/L*	-2.0 – +2.0
Lactate	3.9 mmol/L*	0.5 – 1.6
Sodium	133 mmol/L*	135 – 145
Potassium	5.3 mmol/L*	3.5 – 5.0
Chloride	109 mmol/L*	95 – 105
Glucose	4.1 mmol/L	3.5 – 6.0

a) Describe the acid base abnormality. (10% marks)

b) Give <u>three</u> potential causes for this patient's hypotension consistent with these results. Provide a rationale for each cause. (30% marks)

3.2

An 84-year-old male with a recent diagnosis of myeloma and osteoarthritis is admitted to ICU following a three-day history of constipation followed by diarrhoea.

Parameter	Patient Value	Adult Normal Range
FiO_2	0.21	
pH	7.22*	7.35 – 7.45
pO_2	98 mmHg (13 kPa)	
pCO_2	10.0 mmHg (1.3 kPa)*	35.0 – 45.0 (4.6 – 6.0)
SpO_2	99.6%	
Bicarbonate	4.0 mmol/L*	22.0 – 26.0
Base Excess	-22.0 mmol/L*	-2.0 – +2.0
Lactate	1.4 mmol/L	0.5 – 1.6
Sodium	133 mmol/L*	135 – 145
Potassium	5.7 mmol/L*	3.5 – 5.0
Chloride	113 mmol/L*	95 – 105
Glucose	4.4 mmol/L	3.5 – 6.0

a) Describe the acid base abnormality. (10% marks)

b) Give a physiological rationale for the acid base abnormalities in this patient. (20% marks)

3.3

A 44-year-old female, who is a type II diabetic, has been fasting for elective morning surgery. She is currently on oral anti-diabetic drugs.

On admission to the day surgery unit, she describes feeling nauseous with diffuse abdominal pain. The following results are obtained:

Parameter	**Patient Value**	**Adult Normal Range**
FiO_2	0.21	
pH	7.28*	7.35 – 7.45
pO_2	102 mmHg (13.6 kPa)	
pCO_2	40.0 mmHg (5.3 kPa)	35.0 – 45.0 (4.6 – 6.0)
SpO_2	97%	
Bicarbonate	18.0 mmol/L*	22.0 – 26.0
Base Excess	-8.0 mmol/L*	-2.0 – +2.0
Sodium	141 mmol/L	135 – 145
Potassium	3.6 mmol/L	3.5 – 5.0
Chloride	103 mmol/L	95 – 105
Glucose	6.0 mmol/L	3.5 – 6.0
Ketones	5 mg/L*	< 1

a) Comment on the acid base status. (10% marks)

b) List three potential causes of the elevated ketone level in this patient. (20% marks

ANSWER TEMPLATE

3.1

a) Describe the acid base abnormality: (10% marks)

Normal anion gap metabolic acidosis and respiratory alkalosis

b) Give <u>three</u> potential causes for this patient's hypotension consistent with this ABG. Provide a rationale for each cause. (30% marks)

1. Addisonian crisis. Hypotension, normal anion gap acidosis, high potassium and low sodium all fit. Patient likely to be on long term steroid treatment for rheumatoid making her vulnerable to this condition. *(Note: if this was secondary adrenal insufficiency the potassium would not normally be raised;)*
2. Hypovolemia from fistula – Na consistent, and history of bowel surgery suggestive. Again, would expect a non-anion gap acidosis.
3. Hypovolemia from diarrhoea: patients history makes her vulnerable to infective causes especially. NAGMA fits.

Coexistent respiratory alkalosis likely to be secondary to hyperventilation from pain/distress *(any other plausible explanation acceptable – note candidates not required to comment on this)*

3.2

a) **Describe the acid base abnormality. (10% marks)**
   High anion gap metabolic acidosis, respiratory alkalosis, delta ratio of 0.2 suggesting associated normal anion gap metabolic acidosis.

b) **Give a physiological rationale for the acid base abnormalities in this patient (20% marks)**
   HAGMA without elevated lactate in this scenario may be renal failure (multiple possible causes) or starvation ketosis
   Coexisting NAGMA from diarrhoea
   Respiratory alkalosis from hyperventilation secondary to pain/distress

Only one rationale per abnormality required.

3.3

a) **Comment on the acid base status. (10% Mark)**
   High AG metabolic acidosis
   Secondary respiratory acidosis

b) **List three potential causes of the elevated ketone level in this patient? (20% mark)**
   1. SGLT2 Inhibitor
   2. Starvation
   3. Alcohol

(Note to examiners – diabetic ketoacidosis not accepted unless described as adverse effect of the SGLT2 inhibitor.)

Examiners Comments:

Some candidates paid insufficient attention to the clinical information in the stem, leading to generic responses and inappropriate prioritisation of information. Some failed to list potential causes of hypotension consistent with the ABG and lost potentially easy marks as a result of not slowing down and reading the question.

Maximum Score	9.5
Percentage Passed	90.9%

Question 4

Outline the clinical features, diagnostic tests and initial drug treatment of cytomegalovirus (CMV) infection in an immunosuppressed patient.

ANSWER TEMPLATE

Clinical features (4 marks)
CMV infection can range from asymptomatic viraemia to CMV syndrome and tissue invasive disease.

CMV syndrome is defined as the presence of detectable viral replication in blood accompanied by attributable symptoms and signs: fever, malaise, arthralgia, leukopenia, thrombocytopenia.

Tissue-invasive CMV disease has clinical symptoms and signs of end-organ disease:
GI – diarrhoea, fever, abdominal pain, bloody stool
Hepatic – LFT abnormalities
Neurological – Encephalitis, GBS
Pneumonitis
Retinitis

Can reactivate in critical illness.

Diagnosis (4 marks)
Serology IgM and IgG – can indicate past infection
PCR CMV DNA – blood / CSF/BAL – copies per ml / standard units / ml
Biopsy if tissue invasive disease with typical histology cellular and nuclear enlargement, inclusion bodies
Viral cultures in past – slow, high cost, long turnaround

Treatment (2 marks)
Stop/reduce immunosuppressive drugs if possible
Ganciclovir
Valganciclovir
Foscarnet (IV), Cidofovir (IV)
Consider IVIG or CMV IG

Examiners Comments:

Overall poor knowledge of this topic. Many candidates gave a list of clinical syndromes associated with CMV without detail of the clinical features as required by the stem. Many of the diagnostic tests discussed were generic tests of potentially affected end organ function, rather than tests that would secure the specific diagnosis. The stem asked specifically for drug treatment. Some candidates gave details of supportive therapy and resuscitation that were not necessary.

Maximum Score	7.6
Percentage Passed	36.4%

Question 5

a) Define a chylothorax. (10% marks)

b) Outline how you would diagnose it and the principles of management. (90% marks)

ANSWER TEMPLATE

a) **Definition** – A chylothorax is an accumulation of chyle (lymphatic fluid of intestinal origin) in the pleural space. It is caused by a disruption or obstruction of the thoracic duct or its tributaries - resulting in leakage of chyle into the pleural space. (*1 mark-any reasonable definition)*

b) **Diagnosis** *(4 marks-this degree of detail not required)*
The diagnosis of chylothorax is considered when a pleural effusion occurs in an appropriate clinical context. (*1 mark)* The aetiology of a chylothorax includes malignancy, iatrogenic injury – thoracic or neck surgery especially oesophagectomy, trauma – blunt/penetrating or forceful

emesis, associated with infection – tuberculosis – or with disease states – sarcoidosis or amyloidosis.

The gold standard for the diagnosis of a chylothorax is detection of the chylomicron content of pleural fluid. (*2 marks*) Chylomicrons are large lipid globules that belong in chyle – to find them in pleural fluid is always abnormal. This can be done by electrophoresis or by the less reliable method of fat staining.

Other features of a pleural effusion that suggest the diagnosis of chylothorax are a milky colour, high protein and LDH content and high triglyceride content. These signs are not as reliable as the gold standard and may miss the diagnosis especially in fasting patients. *(1 mark)*

A 'fat challenge' - looking for the presence of milky pleural exudate after consuming fat, and CT with lymphangiography are fewer practical ways of diagnosing chylothorax in the ICU.

Management *(5 marks-reasonable outline, this degree of detail not required)*

1) Conservative management – the aim of all conservative management is to decrease chyle formation and allow the lymphatic defect to close (*1 mark)*
- A 'low fat' diet, or at least one with predominantly medium chain triglycerides (*0.5 mark)*
- Rare - a somatostatin or octreotide infusion or thoracic duct embolization *(0.5 mark)*
- Use of TPN

2) Treatment of the underlying condition – for example, sarcoidosis or lymphoma *(1 mark)*

3) Surgical management – should be considered for all large chylothoraces, especially those associated with malnutrition or immunosuppression *(1 mark)*
- ligation of the thoracic duct *(0.5 mark)*
- pleurodesis *(0.5 mark)*
- pleurovenous/pleuroperitoneal shunting - less frequently

Maximum Score	7.7
Percentage Passed	52.3%

Question 6

6.1

A 17-year-old female, a recent migrant from Southeast Asia, was admitted with an 8-day history of fever, rigors, headache and neck stiffness. On admission her temperature was 40°C, and Glasgow Coma Scale 15 with photophobia and marked neck stiffness. The chest radiograph was normal, and thick and thin films demonstrated no evidence of malaria.

An analysis of her cerebrospinal fluid (CSF) showed the following results:

Parameter	**Patient Value**	**Adult Normal Range**
Opening pressure	40 cm*	15 – 25
Glucose	0.8 mmol/L*	3.3 – 6.1
Protein	0.62 g/L*	0.1 – 0.5
Red Cell count	5 cells/high power field	0 – 5
White Cell Count	320 cells/high power field*	0 – 5
Neutrophils	70%	
Lymphocytes	30%	
Gram stain	Nil bacteria seen	

a) List five likely infective organisms. (25% marks)

After a week of treatment with Ceftriaxone, her cultures were negative, and her clinical state remained static. A repeat CSF examination on day 4 showed the following results:

Parameter	**Patient Value**	**Adult Normal Range**
Opening pressure	41 cm*	15 – 25
Glucose	0.2 mmol/L*	3.3 – 6.1
Protein	1.5 g/L*	0.1 – 0.5
Red Cell count	0 cells/high power field	0 – 5
White Cell Count	560 cells/high power field*	0 – 5
Neutrophils	50%	
Lymphocytes	50%	
Gram stain	Nil bacteria seen	

b) List five other CSF tests that would help determine the underlying diagnosis. (20% marks)

6.2

A 27-year-old male with a prolonged ICU stay following a subarachnoid haemorrhage has a CSF specimen taken from his external ventricular drain (EVD).

The CSF gram stain result is shown below:

Parameter	**Patient Value**	**Adult Normal Range**
Red Blood Cells	1946 x 10^6/L*	0 – 5
Polymorphs	198 x 10^6/L*	0 – 5
Mononuclear cells	74 x 10^6/L*	0 – 5
Gram stain:	Scant gram-positive cocci.	

a) What is your assessment of the CSF result and provide a reason? (10% marks)

b) List two likely organisms commonly reported on the Gram stain in this setting. (10% marks)

c) List two therapies you may consider based on this report. (10% marks)

6.3

A previously well, 19-year-old female presents with fever, headache, photophobia and neck stiffness.

a) List three clinical features that would indicate the need for a brain CT scan prior to lumbar puncture in this patient. (25% marks)

ANSWER TEMPLATE

6.1

a) List five likely infective organisms. 25% marks
Streptococcus pneumoniae,
Neisseria meningitides,

Haemophilus influenzae
Listeria
Mycobacteria

b) List <u>five</u> other CSF tests that would help determine the underlying diagnosis. 20% marks
AFB and PCR for Tuberculous meningitis
Antigen/PCR for Cryptococcus
Antigen testing for syphilis
Fungal cultures
Cytology/flow cytometry

6.2

a) What is your assessment of the CSF result and provide a reason? 10% marks
Ventriculitis: due to raised WCC:RCC ratio and a positive gram stain

b) List two likely organisms commonly reported on the Gram stain in this setting. 10% marks
Staphylococcus epidermidis
Staphylococcus aureus

c) List 2 therapies you may consider based on this report. 10% marks
Removal of EVD / replacement
Vancomycin

6.3

a)
Papilloedema
Immunocompromised state
Altered level of consciousness
Focal neurology (? Space occupying lesion)
History of CNS disease (mass lesion, stoke, local infection)
New onset seizures

Maximum Score	8.2
Percentage Passed	86.4%

Question 7

Discuss the role of frusemide in patients in the ICU. Include in your answer potential indications, proposed benefits, adverse effects and a summary statement of the available evidence.

ANSWER TEMPLATE

Potential indications
1. Use as a diuretic for fluid overload
-Acute treatment of Fluid overload/LVF for first line therapy.
Primary respiratory failure i.e. ARDS, inc non-cardiogenic pulmonary oedema. TACO,

Secondary to other organ failures e.g. CCF (peripheral and pulmonary oedema), CRF (peripheral and pulmonary oedema), CLD (oedema or ascites)
+/-
-Chronic/maintenance therapy for CCF, CRF, CLD,

Use in high altitude sickness. HACE. HAPE.

2. Use as a diuretic as a forced diuresis
In pathologies such as rhabdomyolysis, barbiturate poisoning.

3. Electrolyte manipulation
Use in hypercalcaemia (with fluid as a forced diuresis)
Use in urgent hyperkalaemia control as adjunct with salbutamol for compartment shift
Use in hypernatremia 2' to water intoxication.
E.g., TURP syndrome, psychogenic polydipsia, SIADH (with or without fluid restriction)

4. As one of First line therapies in chronic hypertension control. OR acute hypertensive emergencies.

5. Paediatric bronchopulmonary dysplasia management

Proposed Benefits

- Reduction of preload and afterload in CCF and RHF- Venodilation and diuresis causing reduction in RAP and PCWP
- Changes renal failure from oliguric to non-oliguric and this may reduce duration of AKI (controversial- limited or poor evidence for this)
- May reduce need for renal replacement therapy in terms of fluid balance requirements however shown no benefits in RCTs
- First line treatment of volume overload and electrolyte homeostasis
- Frusemide is a Loop diuretic which Increases Tubular flow but there seems to be no clinical benefit for this only theoretical.

Adverse effects –

- Worsening renal function -particularly if diuretic therapy is not accompanied by adequate hydration.
- Increased electrolyte abnormalities- hypokalaemia, hypomagnesaemia, Hypernatraemia
- Metabolic alkalosis
- Hearing loss, vertigo and nystagmus in toxic doses
- Sulpha cross reactivity but this is very rare
- Worsening of gout as reduction of clearance of uric acid

Drug interactions
Additive with aminoglycosides for ototoxicity
Reduction in lithium renal clearance given increased Li toxicity risk

The Evidence
DOSE trial (2011) bolus high dose frusemide (2.5x daily dose) reduced mortality in decompensated heart failure patients over low dose or infusion.

Cochrane review 2013- no clear benefit for any AKI sparing strategies including frusemide.

Cochrane review 2015- no benefit from routine use of frusemide in transfusions to avoid TACO.

A recent meta-analysis published 2018 by Bove et al that concluded that there was no difference in mortality or length of hospital stay in patients given frusemide boluses in established renal failure which is consistent with others, but there was a survival benefit in the subgroup receiving Frusemide as a

preventative measure. The conclusion was that there is no evidence at present to unequivocally support the use of Frusemide in acute kidney injury in the intensive care unit in unselected patients.

A number of other meta-analysis have consistently found higher urine output, decreased use of RRT and duration of RRT but no improvement in outcome.

SPARK study (2017) confirmed the above findings but also noted that there was an increased rate of electrolyte abnormalities with frusemide.

The European society of Intensive care consensus statement 2017 advised against the use of Loop diuretics in unselected patients with AKI due to lack of evidence for benefit in use and increased risk of adverse effects.

In summary, from the evidence available – the use of frusemide is not without adverse effects but may reduce the use of RRT in some patients. At present there is insufficient evidence to unequivocally support its use in unselected patients with established renal failure in ICU. However, in this setting, it may be beneficial in some patients in preventing the use of RRT and in those patients with fluid overload

Examiners Comments:

This question was generally poorly answered. A number of candidates lacked knowledge about proposed benefits of frusemide use and adverse effects. Rather than a summary statement of the evidence, many candidates chose to describe their own practice, not answering the question asked.

Maximum Score	6.3
Percentage Passed	22.7%

Question 8

a) List four predisposing conditions and four precipitating factors which may lead to the occurrence of dynamic left ventricular outflow tract obstruction in critically ill patients. (40% marks)

b) What specific cardiovascular clinical signs on physical examination may be present in a patient with left ventricular dynamic outflow obstruction? (20%marks)

c) What are the principles of medical treatment in a patient with shock secondary to dynamic outflow obstruction? (40% marks)

ANSWER TEMPLATE

a) Predisposing conditions
Hypertrophic cardiomyopathy
Left ventricular hypertrophy (e.g. Hx of hypertension or aortic stenosis)
Post AVR or TAVI for aortic stenosis
Post MVR

Precipitating factors
Hypovolaemia
Vasodilatation e.g. anaesthesia, sepsis, nitrates, liver failure
Tachycardia/arrhythmias
Inotropic agents

b) Ejection systolic murmur lower left sternal edge which may vary in intensity over time as the gradient changes
An associated MR murmur is common
Signs of low CO syndrome i.e. hypotension, oliguria, lactic acidosis, end organ hypoperfusion
LVF signs

c) Fluid loading
–increase preload
Vasocontrictors (preferably without b effect i.e. phenylephrine / vasopressin) increase afterload without increasing heart rate
Negative inotrope / chronotrope e.g. b blockade
–control heart rate
–manage arrhythmias
Treat underlying conditions

Examiners Comments:

This was generally answered well. Candidates who did poorly didn't know how to manage patients with outflow tract obstruction and recommended dangerous therapies including inotropic therapy and vasodilator agents.

Maximum Score	9.2
Percentage Passed	65.9%

Question 9

9.1

A 24-year-old male is admitted to the ICU following a spontaneous intracranial haemorrhage. He is noted to have labile blood pressure that is difficult to control, and a persistent tachycardia in spite of high dose sedatives. Further investigation reveals raised plasma and urinary catecholamine levels.

a) List four potential causes of the above findings in this patient. (25% marks)

9.2

A 69-year-old male with a history of previous pneumonectomy for lung carcinoma, is admitted with confusion. There are no focal neurological signs on clinical examination. Neck stiffness is not present. Contrast CT brain scan is normal. His initial plasma biochemistry is shown below:

Parameter	**Patient Value**	**Adult Normal Range**
Na^+	148 mmol/L*	134 – 145
K^+	3.7 mmol/L	3.5 – 5.0
Cl^-	109 mmol/L*	97 – 107
HCO_3^-	33 mmol/L	24 – 34
Albumin	15 g/L*	35 – 40
Urea	12.8 mmol/L*	3.1 – 8.1
Creatinine	36 µmol/L*	60 – 100
Total calcium	2.59 mmol/L*	2.20 – 2.55
Phosphate	0.86 mmol/L	0.78 – 1.05

a) What is the most likely cause of the confusion in this patent, based on the above information? Justify your response. (10% marks)

b) List four therapies for the cause stated in a). (20% marks)

9.3

A 55-year-old male with a history of significant alcohol intake presents with a 2-week history of lethargy. He takes no regular medications and has no other medical disorders. Clinically, he appears malnourished and euvolaemic. Investigations reveal the following:

Parameter	**Patient Value**	**Adult Normal Range**
Blood Results:		
Na^+	115 mmol/L*	134 – 143
K^+	3.7 mmol/L	3.5 – 5.0
Cl^-	80 mmol/L*	97 – 107
HCO_3^-	22 mmol/L*	24 – 34
Urea	3.0 mmol/L*	3.1 – 8.1
Creatinine	46 µmol/L*	50 – 90
Glucose	4.1 mmol/L*	4.4 – 6.8
Osmolality	241 mmol/kg*	271 – 289
Urine Results:		
Na^+	10 mmol/L	10 – 20
Osmolality	53 mmol/kg	40 – 1200

a) What is the most likely cause of the hyponatraemia? (15% marks)

9.4

A 76-year-old female presents with seizures. She takes no regular medications. On examination she weighs 60 kg, has no evidence of cardiac failure or liver disease, and appears euvolaemic. Her results in the Emergency Department reveal the following:

Parameter	**Patient Value**	**Adult Normal Range**
Blood Results:		
Na^+	110 mmol/L*	134 – 143
K^+	3.8 mmol/L	3.5 – 5.0
Cl^-	81 mmol/L*	97 – 107
HCO_3^-	24 mmol/L	24 – 34
Urea	5.7 mmol/L	3.1 – 8.1
Creatinine	36 mmol/L*	50 – 90
Osmolality	237 mmol/kg*	274 – 289
Urine Results:		
Na^+	23 mmol/L*	10 – 20
Osmolality	488 mmol/kg	40 – 1200

a) What is the likely cause of the hyponatraemia? (10% marks)

b) Approximately how many mmol of NaCl would need to be given to raise her serum sodium to 120 mmol/L? Show your calculations. (20% marks)

ANSWER TEMPLATE

9.1

a) Causes:

- Phaeochromocytoma
- Physical stress - critical illness, hypoxia, hypercapnia, hypoglycaemia
- Use of catecholamines, amphetamine use
- Prior h/o tricyclic/MAOI use

9.2

a) Hypercalcemia (When corrected for albumin the true calcium is higher).

b) Calciuresis (saline +/- frusemide)

- Bisphosphonates
- Calcitonin
- Corticosteroids
- NSAIDS
- Mithramycin

9.3

a) Water intoxication/Beer potomania

9.4

a) SIADH

b) (An answer between 300 - 360 mmol was acceptable).
(Sodium deficit = TBW x (desired Na - Actual Na)
= 0.5/0.6 x 60 x (120-110)
= 30/36 x 10
= 300/360

Maximum Score	9.7
Percentage Passed	81.8%

Question 10

In relation to diffuse cerebral oedema; discuss the pathophysiology, and the clinical and CT manifestations.

ANSWER TEMPLATE

(30%- 30%- 40% marks)

Cerebral oedema is often classified based on 3 different mechanisms by which oedema results:

Cytotoxic oedema: failure of ionic pumps to maintain cellular homeostasis, accumulation of water and swelling of cells. Blood brain barrier (BBB) is intact. Metabolic derangements and ischaemia most common causes. E.g. CVA, post cardiac arrest, encephalopathy e.g. due to hepatic impairment.

Vasogenic oedema: breakdown of endothelial junctions of the BBB allowing intravascular proteins and fluid into extracellular space. Due to trauma, tumours, inflammation (e.g. infection), late stage of ischaemic insults, high altitude sickness. Mechanism relates to hydrostatic pressure in arterial HT, tumour released endothelial destructive factors (e.g. vascular endothelial growth factor - secretion reduced by Dexamethasone).

Osmotic oedema: Dilution of plasma leading to shift of water down the osmolarity gradient to the brain. E.g. Excess H2O intake, SIADH, dialysis, rapid decrease in blood glucose when treated for a hyperosmolar hyperglycaemic state.

Cytotoxic and vasogenic oedema often coexist e.g. in setting of infarction or trauma.

Clinical manifestations
May be similar to and superimposed on manifestations of the underlying cause
Related mostly to elevated ICP or mass effect
Reduced consciousness
Headache
Photophobia
Agitation, delirium early
Hypertension, bradycardia (Cushing's response)
Pupillary dilatation and decreased light reflex
Papilledema
(Lateralising signs may be present with unilateral uncal/cerebellar herniation)

CT manifestations
Loss of sulci
Loss of grey-white differentiation
Basal cistern/lateral ventricle effacement
Uncal herniation
Herniation of cerebellar tonsils into foramen magnum.

Maximum Score	8.0
Percentage Passed	75.0%

Question 11

a) What is a Standardised Mortality Ratio (SMR) and how is it calculated? (20% marks)

b) The SMR in your ICU has increased from 0.95 to 1.05 in the past 12 months. Outline the possible causes. (80% marks)

ANSWER TEMPLATE

a) Overview of SMR (20% marks)

SMR is one of the quality indicators that reflect the performance of an ICU.
Definition of SMR = ratio of observed deaths in the study group to expected deaths in the general population based on APACHE or other severity of illness
SMR values of 1 indicate expected performance, whereas values below 1 and above 1 indicate respectively better and worse performances than expected.

b) Causes for increase (80% marks)
Lower than expected predicted mortality

Errors in predicted/expected mortality due to gaps in data, changes in case-mix etc
Change in data collection systems or personnel – e.g., change in the way the expected mortality is estimated
Lead-time bias (pre-ICU care) – patients transferred from other facilities may have become more stable after receiving appropriate management at the original hospital.
Increases in observed mortality
Based on hospital mortality, not ICU mortality – therefore, influenced by pre-ICU and post ICU care in the hospital
Change in case-mix, so changes in case mix may account for increase in SMR and increased other hospital admissions
One-off events such as mass disasters, epidemics etc
Variations in practice, changes in clinical protocols either in the hospital or in the ICU
Changes in personnel – e.g., new intensivist, new surgeon etc
Changes in staffing levels and training
New services introduced such as ECMO etc.

Examiner's Comments:

The candidates rarely considered the denominator. Often wrote "admitted sicker patients" without considering these likely to also have higher predicted mortality. Rarely any structure.

Maximum Score	7.2
Percentage Passed	50.0%

Question 12

12.1

The following data refer to a 65-year-old male admitted to ICU with septic shock on a background of active rheumatoid arthritis.

Parameter	**Patient Value**	**Adult Normal Range**
Haemoglobin	86 g/L*	125 – 180
Serum ferritin	298 µg/L	15 – 300
Serum iron	7 µmol/L*	9 – 27
Total Iron Binding Capacity (TIBC)	52 µmol/L	47 – 70
Transferrin Saturation (Iron / TIBC x 100)	28%	16 – 40
Erythropoietin level	15 U/L	4 – 28
C-reactive protein (CRP)	321 mg/L*	< 8

a) What abnormality is demonstrated in this patient? Give your reasoning. (20% marks)

b) What is the pathogenesis of these changes? (20% marks)

c) What are the principles of management? (10% marks)

12.2

The following data refer to a 48-year-old female admitted electively to ICU following extensive pelvic surgery for invasive endometrial carcinoma. The patient has remained in ICU for 22 days because of complications including acute kidney injury.

Parameter	Patient Value	Adult Normal Range
Haemoglobin	66 g/L*	125 – 180
Serum ferritin	14 µg/L*	15 – 300
Serum iron	3 µmol/L*	9 – 27
Total Iron Binding Capacity (TIBC)	86 µmol/L*	47 – 70
Transferrin Saturation (Iron / TIBC x 100)	9%*	16 – 40
Erythropoietin level	41 U/L*	4 – 28
C-reactive protein (CRP)	60 mg/L*	< 8

a) What abnormality is demonstrated in this patient? Give your reasoning. (20% marks)

b) Give <u>two</u> potential causative factors in this patient. (10% marks)

c) Briefly outline the available treatment options to correct the demonstrated abnormality including any disadvantages / risks. (20% marks)

ANSWER TEMPLATE

12.1

a) Anaemia of Inflammation demonstrated by:
- · decreased haemoglobin
- · decreased iron
- · normal to high ferritin
- · suppressed erythropoietin
- · elevated CRP.

b) Inflammation -> cytokines (IL6) -> increased hepcidin -> decreased iron release from bone marrow, decreased iron release from macrophages, decreased absorption of iron -> suppressed erythopoeisis

c) Control inflammation, no value to iron replacement, no value to the use of erythropoietin.

12.2

a)
Iron deficiency anaemia as evidenced by:
- · decreased haemoglobin
- · decreased iron
- · decreased ferritin
- · increased erythropoietin
- · increased TIBC.

b)
Blood loss
Pre-existing dietary deficiency

c)
IV iron replacement – no demonstrated benefit and risks of adverse effects (infection risk-IRONMAN)
Oral iron replacement?

Erythropoeitin – expensive and no demonstrated benefit
Blood transfusion – risks of transfusion including immunosuppression?
No treatment – may have reduced oxygen carrying capacity for some time until correction of Hb

Maximum Score	8.2
Percentage Passed	63.6%

Question 13

a) What are the principles behind empiric antimicrobial management in a patient with confirmed ventilator-associated pneumonia (VAP)? (70% marks)

b) What are the theoretical advantages and disadvantages of using nebulised antibiotics for management of VAP? (30% marks)

ANSWER TEMPLATE

a) Principles – 30%
General
- Early treatment
- Optimal cultures – Sputum, BAL, mini-BAL, blood – depending on local policy

Microorganism
- Likely organisms – previous cultures, antibiotic exposure, comorbidities and local flora
- At 14 days will need to cover MRSA, *Pseudomonas* and other resistant gram negatives

Antibiotics
- Adequate dose and frequency to achieve adequate tissue levels
- Consideration of organ function and extracorporeal effects
    - AKI, augmented clearance, CRRT
- Mention of two antibiotics
    - Gram positive – Vancomycin, linezolid etc
    - Gram negative – Piperacillin-tazobactam, cefepime, meropenem
        - Consider two agents for antipseudomonal cover
- Deescalation
- Short course or long course

b) Nebulised – 40%
Advantages
- Increased local concentrations in lung parenchyma
- Reduced system toxicity from high dose intravenous antibiotics
- Concentrations above resistance emergence threshold and so may reduce resistant strain selection

Disadvantages
- Limited evidence primarily based on observational studies
- Limited pharmacopeia – primarily polymixins and aminoglycosides
    - Colistin and tobramycin most studied
- Antibiotics with concentration-dependent and post antibiotic effect better suited to intermittent regime than drugs requiring continuous concentration above MIC
- Dosing unclear
- Specialised nebuliser – ultrasonic or vibrating mesh
- Ventilator dysfunction – filter obstruction
- Possible mucosal toxicity and bronchospasm and bronchorrhoea

Examiners Comments:

Tendency not to read the question, so to write about definition, diagnosis or risk of VAP rather than principles of management in confirmed disease. Nebulised antibiotics poorly understood. Frequently no antibiotic choice given. No organisms other than basic classification. Few mentioned "resistant" organisms.

Maximum Score	6.3
Percentage Passed	13.6%

Question 14

A 37-year-old male has been admitted to your ICU following an explosion in his garage. He has suffered a mixture of partial and deep burns estimated at 35% total body surface area, and he has been intubated in the Emergency Department. After one hour of resuscitation in your unit he remains hypotensive with a blood pressure of 80/50 mmHg.

List the potential causes and outline how you would diagnose and manage them.

ANSWER TEMPLATE

1. Spurious
    a. Damped or poorly functioning, zeroed, arterial line
    b. Inappropriate sized cuff
        i. Check line, cuff size
        ii. Measure second site, alternative modality

2. Hypovolemia
    a. Review volumes of administered fluids to date
    b. Confirm size and depth of burn
    c. Check calculations for fluid resuscitation are correct
    d. Rising haematocrit, ECHO findings
        i. Increase fluid resuscitation rate

3. Bleeding from occult/missed injury
    a. Review/repeat trauma imaging
        i. Blood product resuscitation, correction of coagulopathy
        ii. Operative/Interventional radiology interventions to treat cause

4. Sepsis
    a. Too early for burn sepsis – possible intraabdominal or thoracic blast injury
        i. Broad spectrum antibiotics and source control

5. Distributive
    a. High cervical spine injury
        i. Review imaging, vasopressors
    b. Anaphylaxis to drugs
        i. Review history, examine for rash/bronchospasm, adrenaline
    c. Cyanide toxicity
        i. Mixed venous oxygen, empirical antidote administration

6. Cardiogenic
    a. Takustubo, underlying cardiac disease, blast injury, myocardial toxins
        i. ECHO, ECG, Inotropic support

7. Obstructive
    a. Tension pneumothorax
        i. CXR, drainage
    b. Abdominal compartment syndrome
        i. Bladder pressure, escharotomies, laparotomy/laparostomy
    c. Tamponade
        i. Echo and pericardiocentesis

Examiners Comments:

Frequently poorly structured answer, with a list of causes of hypotension, then repeated with diagnosis and management. Worked better when candidates classified each category of shock, then described individual diagnosis and management within each category. Often the question had not been carefully read, and the time already spent in ED and ICU was ignored; then a simplistic EMST initial approach to trauma was given.

Maximum Score	7.5
Percentage Passed	59.1%

Question 15

(Images removed from report.)

Please note: The following ECG has been recorded at 25 mm/sec and gain setting of 10 mm/mV.

15.1

A 50-year-old diabetic female has been admitted to your unit with worsening gas exchange in the setting of precipitous hypotension and acute confusional state requiring initiation of mechanical ventilation and inotropic and vasopressor support. She is febrile with deranged liver and renal function. She has anaemia and profound thrombocytopenia, and a widespread rash (see Figure 15.1 below).

List four likely causes to account for these findings. (40% marks)

15.2

A 25-year-old female is admitted with a reduced level of consciousness and suffers a brief seizure in the Emergency Department.

Her ECG is shown on page 14 (ECG 15.2).

a) Describe the abnormalities. (20% marks)

b) What is the most likely diagnosis? What urgent treatment is required and what is the mechanism of action of the treatment? (30% marks)

c) Which drug would you avoid using to treat her convulsion and why? (10% marks)

ANSWER TEMPLATE

15.1

Differential diagnoses

- DIC secondary to sepsis
- TTP
- Catastrophic Antiphospholipid Syndrome (APL accepted)
- HITTS
- Warfarin induced skin necrosis
- Protein C deficiency-with sepsis

15.2

a)
Broad QRS complex, first degree heart block, prolonged QT, dominant R wave in AVR

b)
Sodium bicarbonate is used to treat a suspected TCA overdose. Alkalinization increases the binding of TCA to plasma proteins reducing the amount of free drug and reduces the amount of ionisation of the drug reducing its ability to pass through cell membranes. Also reduces extracellular K concentration, causing hyperpolarisation and reducing the Na channel blockage.

c)
Phenytoin (Class 1b) should be avoided that it would potentiate sodium channel blockade

Maximum Score	7.5
Percentage Passed	63.6%

Question 16

Outline the mechanism of action and list the indications, contraindications and complications of the TIPSS procedure (Transjugular intrahepatic portosystemic shunt).

ANSWER TEMPLATE

Mechanism of action:
Percutaneous formation of a tract between hepatic vein and intrahepatic segment of portal vein. Blood is shunted away from portal circulation to systemic circulation, thereby reducing portal pressure.

Indications: (20% Marks)
Uncontrolled variceal bleeding
Refractory ascites
Hepatic pleural effusion
Also consider in: bridge to transplant

- Budd Chiari (may need a DIPS- shunt from IVC to portal vein)
- HRS

Hepatic veno occlusive disease
Hepatic hydrothorax

Contraindications (1 mark/point to max 4 points) (30% marks)
Severe progressive liver failure with imminent death
Severe encephalopathy

Severe Right or congestive heart failure (increases preload)
Polycystic liver disease
Caution in: portal vein thrombosis
Pulmonary hypertension/tricuspid regurg
Hepatopulmonary syndrome
Active infection
Tumor in shunt pathway

Complications: (50% marks)
Peri-insertion:
Technical failure
Trauma to heart/liver
Bleeding haemoperitoneum
Bile leak
Stent Migration
Post insertion:
Encephalopathy
Stenosis/obstruction of shunt (uncommon with modern stents)
Portal or hepatic vein thrombosis

Acute liver ischamia
Infection: peritonitis, endotipsitis
Heart failure
Deterioration in hepatic function

Examiners Comments:

Candidates responses lacked specific details.

Maximum Score	8.2
Percentage Passed	65.9%

Question 17

A 47-year-old female patient is in your ICU having had a prolonged wean from mechanical ventilation following severe head and chest injuries sustained in a motor vehicle collision. She has a tracheostomy and has been breathing spontaneously, free from ventilatory support, on an FiO_2 of 0.3 via a tracheostomy mask for 24 hours.

Describe how you will assess whether the tracheostomy tube can be safely removed.

ANSWER TEMPLATE

Assessment will involve history, examination and targeted investigations and may involve a trial period with the tracheostomy “capped” or occluded (with the cuff deflated!) to ensure that it can be safely removed.

The tracheostomy can be safely removed if the patient:
- Has a patent upper airway
- Has a protected upper airway
- Can adequately clear her secretions
- No longer requires mechanical ventilation

Patent upper airway

- History
  - Upper airway trauma
  - Duration of translaryngeal intubation
  - Indication for tracheostomy (was it placed for upper airway obstruction)
  - Known grade of intubation or difficulty with intubation
- Examination
  - Facial or airway trauma or recent surgery
- Investigations (if indicated, not routine)
  - Direct or fibreoptic laryngoscopy
  - CT scans if available may offer some information

Protected upper airway

- History
  - Severity of brain injury
  - Focal brainstem injury
- Examination
  - Current neurological status
    - Level of consciousness
    - Lower cranial nerves including cough and gag reflex
- Investigations
  - Neurological imaging inc CT and MRI
  - Barium swallow or fibreoptic assessment for aspiration

Adequate clearance of secretions

- History
  - Injuries that may impair cough
    - Spinal cord injury
    - Multiple rib fractures with flail segment
    - Diaphragmatic injury
    - Severe lung trauma
    - Recurrent pneumonia or lung abscess
  - Co-morbidity
    - Lung disease e.g., bronchietcasis
    - Neuromuscular weakness
    - Sleep apnoea
- Examination
  - Respiratory
    - Frequency of suctioning
    - Nature and volume of secretions
    - Presence of flail segment
  - Neurological assessment
    - Peripheral neuromuscular function
    - Cough assessment (strength, ability to cough secretions past tube)
- Investigation
  - Ultrasound of diaphragm (if problem suspected)
  - Fibreoptic examination of vocal cord function

No requirement for mechanical ventilation

- History
  - Background and co-morbidities (OSA, smoking, lung or heart disease….)
  - Nature and extent of chest injury and other injuries
  - Requirement for any ongoing surgery
  - Pattern and duration of weaning from ventilation (24hours of spontaneous ventilation

would be a minimum for trache removal)

- Examination
  - Respiratory and cardiovascular examination
  - Tertiary survey
- Investigations
  - CXR
  - CT chest
  - ABG off ventilation
  - Spirometry

Notes

The answer template is not exhaustive, merely indicative and this level of detail in this template was not required. To pass the candidate needed to demonstrate awareness of the requirement for all of:

1. Patent upper airway
2. Ability to clear secretions with a mention of cuff deflation
3. Adequate level of consciousness
4. Adequacy of spontaneous ventilation

Examiners Comments:

Superficial approach. Lack of systematic approach to a common procedure done in ICU. Cuff deflation missed most often.

Maximum Score	8.6
Percentage Passed	50.0%

Question 18

18.1

A 76-year-old male with a background of emphysema is now Day 7 after an elective colectomy. His ICU stay was complicated by intra-abdominal sepsis and ongoing high-volume nasogastric aspirates. There is difficulty in weaning him from the ventilator. The following arterial blood gases are obtained:

Parameter	**Patient Value**	**Adult Normal Range**
FiO_2	0.35	
pH	7.58*	7.35 – 7.45
pO_2	82.0 mmHg (10.9 kPa)	
pCO_2	52.0 mmHg (6.9 kPa)*	35.0 – 45.0 (4.6 – 6.0)
SpO_2	94%	
Bicarbonate	47.0 mmol/L*	22.0 – 26.0
Base Excess	23.7 mmol/L*	-2.0 – +2.0

a) Describe the acid-base disturbance. (10% marks)

b) List three likely causes. (15%marks)

18.2

A 28-year-old female presented to the Emergency Department with general malaise. The following results are obtained from blood and urine respectively:

Parameter	Patient Value	Adult Normal Range
Blood Results:		
FiO_2	0.21	
pH	7.29*	7.35 – 7.45
pO_2	106 mmHg (14 kPa)	
pCO_2	26.0 mmHg (3.5 kPa)*	35.0 – 45.0 (4.6 – 6.0)
SpO_2	97%	
Bicarbonate	12.0 mmol/L*	22.0 – 26.0
Base Excess	-13.0 mmol/L*	-2.0 – +2.0
Sodium	137 mmol/L	135 – 145
Potassium	0.9 mmol/L*	3.5 – 5.0
Chloride	119 mmol/L*	95 – 105
Glucose	8.1 mmol/L*	3.5 – 6.0
Phosphate	0.3 mmol/L*	0.8 – 1.5
Urine Results:		
pH	7.50	
Sodium	36 mmol/L*	10 – 20
Potassium	37 mmol/L*	5 – 15
Chloride	22 mmol/L	20 – 40

a) Describe the acid base abnormality on the blood results. (10% marks)

b) Give <u>three</u> potential causes of these findings with a rationale for your answer. (15% marks)

18.3

What are the biochemical findings in methanol toxicity? Outline the specific management along with its physiological rationale. (50% marks)

ANSWER TEMPLATE

18.1

a) There is a primary metabolic alkalosis which is appropriately compensated.

b) Likely causes

1. Volume depletion due to high naso-gastric losses causing contraction alkalosis
2. Any cause of hyperaldosteronism (e.g., Glucocorticoids for emphysema, Barrter's syndrome, Cushing's disease etc)
3. Chloride loss in urine from diuretics; e.g. frusemide

18.2

a) There is a non-anion gap metabolic acidosis.

b) Likely causes

1. Type 1 or 2 Renal Tubular Acidosis (High urinary pH)

2. Salt wasting nephropathies (high urinary Na)
3. Diuretic use/abuse (High urinary Na and K, low K and Phos)
4. Conns (High urinary Na and K, low plasma K)

18.3

High anion gap metabolic acidosis, osmolar gap, elevated plasma methanol level.

Antidote therapy, often using ethanol or fomepizole, is directed towards delaying methanol metabolism until the methanol is eliminated from the patient's system either naturally or via dialysis. Like methanol, ethanol is metabolized by ADH, but the enzyme's affinity for ethanol is 10-20 times higher than it is for methanol. Fomepizole is also metabolized by ADH; however, its use is limited because of high cost and lack of availability

Dialysis: The toxic products of methanol and ethanol are formic acid and oxalic acid respectively. They are small molecules, are not protein bound and have low volume of distribution so are easily dialysable.

Folic acid – can accelerate the metabolism of formate via tetrahydrofolate.

Maximum Score	8.2
Percentage Passed	72.7%

Question 19

Outline the advantages and disadvantages of videolaryngoscopy as compared to direct laryngoscopy.

ANSWER TEMPLATE

Videolaryngoscopy (VL) utilizes video camera technology to visualize airway structures and facilitate endotracheal intubation. It could allow good exposure of the glottis without the need to align oral, pharyngeal and tracheal axes.

Advantages:

- Improve laryngeal view and glottic visualization
    a. Improve laryngeal view: allow assessment of larynx, facilitate procedures, e.g. NG Tube placement, ETT exchange
    b. reduce failed intubations
- VL requires the application of less force to the base of the tongue, therefore is less likely to induce local tissue injury.
- Allows less cervical spine movement for intubation compared with direct laryngoscopy
- Allows others to view the screen
    a. Allow assistant to help facilitate endotracheal intubations, e.g. enable real time cricoid force optimization, optimal external laryngeal manipulation to improve view
    b. Facilitate teaching and supervision of endotracheal intubation
- Can allow video recording to provide an official record of tracheal intubation
- Faster learning curve than direct laryngoscopy

Disadvantages:

- Possible difficulty in passing endotracheal tube despite improved glottic visualization especially with hyper angulated 'D' blade, termed "laryngoscopy paradox". Use of a bougie or stylet would be recommended. Hyper angulated blades may prolong easy intubations.
- Multiple devices exist with unique learning curves. Training is required

- Blood, secretions and vomitus in the airway as well as fogging can hamper use of VL
- Potential for false sense of security and lack of preparation for difficult airway. VLs are not the panacea for difficult airway management. All airway plans that utilize VL require a plan for technical failure.
- VL are more expensive. Additional maintenance and disinfection arrangement.
- Potential weakening in development and maintenance of direct laryngoscopy skill set

Maximum Score	6.9
Percentage Passed	27.3%

Question 20

a) List the risk factors, clinical features and relevant investigations for occlusive upper limb deep venous thrombosis (ULDVT) in critically ill patients. (50% marks)

b) Discuss the available management options. (50% marks)

ANSWER TEMPLATE

a)
Risk factors: (20% Marks)

1. Catheter Insertion
    a. Size /number of lumens increases risk
    b. Position – PICC > Central
    c. Malposition of catheter
    d. Difficulty in placement
    e. Irritant infusion – e.g. TPN, Chemotherapy
    f. Catheter infection
2. Systemic Conditions
    a. Malignancy
    b. Upper limb trauma
    c. Hypercoagulable state
    d. Previous thrombosis

Marking Guide: 8-10 correct 2 marks
5-7 correct 1 mark
<5 correct 0.5 mark

Clinical Features: (20% Marks)
1. May be asymptomatic
2. Symptoms: discomfort, pain, paraesthesia and weakness
3. Signs:
    a. limb swelling, oedema, venous collaterals
    b. Superior vena cava syndrome; oedema of face, neck and upper torso; dyspnoea; syncope; positive Pemberton's sign.

Investigations: (10% Marks)
Compression ultrasound is the diagnostic standard, with >95% sensitivity and specificity. (this detail not required)
Doppler and CT may be required to diagnosis intrathoracic/super vena cava (SVC) obstruction.

b)

Treatment: (50% Marks)

Treatments aim to alleviate the symptoms, prevent thrombin propagation and pulmonary embolism, and prevent post-thrombotic syndromes.

1. **Anti-coagulation:**
   - Initiate with unfractionated heparin infusion or **low molecular weight heparin** (preferred)
   - Followed by either low molecular weight heparin or oral anticoagulants for 3 to 6 months
2. **Thrombolysis:**
   - Limited evidence
   - Catheter-directed thrombolysis is upper limb has extensive swelling and functioned impairment
3. Mechanical catheter intervention:
   - Aspiration of the thrombus, fragmentation and thrombectomy should be considered in patients with persistent severe symptoms, despite anticoagulation or thrombolysis.
4. SVC filters:
   - Evidence is lacking
   - Prevention of pulmonary embolism in patients with ULDVT in whom anticoagulation is contraindicated or thrombus progression despite anticoagulants.
   - Significant complications including cardiac tamponade and aortic perforations reported.
5. **Catheter/device removal:**
   - No need for routine removal
   - Remove if infected
   - Factors to be considered include the ongoing need for the catheter and difficulty in venous access.

(Highlighted points in treatment section are required for a pass mark.)

Examiners Comments:

Topic was poorly understood, with little knowledge beyond superficial. It was suspected that that relates to poor exposure and experience of more advanced interventions (thrombolysis, possible radiology directed treatments). Little was mentioned around importance of lines in thrombosis and almost everyone who remembered wanted to pull the lines out without thought or consideration of the implications.

Maximum Score	5.4
Percentage Passed	6.8%

Question 21

With respect to transfusion protocols for massive haemorrhage; discuss the advantages and disadvantages of using a protocol guided by thromboelastography (TEG guided) compared to one that uses a fixed ratio of product replacement (e.g. FFP : platelets : packed cells = 1 : 1 : 1).

ANSWER TEMPLATE

Background

Heterogeneous nature of the critically bleeding trauma patient and the spectrum of trauma induced coagulopathy may mean fixed ratio protocol (FRP) is too simplistic to apply to all patients. Although a FRP may improve survival, the optimal ratio of packed cells to other blood components is unknown.
TEG-guided algorithms allow rapid identification and correction of patient-specific coagulation abnormalities. Trauma induced coagulopathy in the critically bleeding patient is complex and changes throughout time of resuscitation, therefore TEG allows repeated assessment and correction throughout resuscitation period.

TEG-guided MHP algorithms, as compared to FRP may limit unnecessary blood product transfusion and the associated complications (e.g. TRALI, volume overload) of giving high volumes of plasma and other products, while ensuring appropriate clotting factors are replaced as required (i.e. allows targeted intervention to replace coagulopathy with fewer side effects)

Advantages of TEG compared with FRP
Patient specific – therefore may limit unnecessary blood product transfusion and the associated complications (e.g. TRALI, transfusion reaction, volume overload, TACO, immunomodulation, allergy)

Patient specific – therefore ensures appropriate clotting factors are replaced when required (i.e. allows rapid targeted intervention to replace coagulopathy with fewer side effects)

Aids rapid identification of when there is an ongoing medical cause of bleeding (i.e. ongoing coagulopathy) versus purely surgical bleeding with the need to progress surgical intervention.

Detects fibrinolysis and hyperfibrinolysis which may be particularly relevant in the critically bleeding trauma patient.

TEGs have a higher sensitivity than standard laboratory tests to detect trauma induced coagulopathy and are faster than lab-based tests.

Even a 1:1:1 (plasma:platelets:packed cells) delivers dilute coagulation factors compared with whole blood; ideal ratio of blood products to packed cells in FRP remains debated.

Disadvantages of TEG compared with FRP
Machine (ROTEM or TEG) not available in all centres;

More expensive than standard laboratory coagulation testing

Ability to manage MHPs in multiple trauma patients simultaneously limited by number of machines available

Requires adequate volume of blood sample to run test and can't be performed on intraosseous sample; therefore, may not be able to be performed on critically unwell patient with difficult iv access.

May delay lab preparation (thawing) of blood products while awaiting result; compared with fixed ratio protocol where products immediately thawed and delivered. (i.e. FRP allows rapid delivery of blood products independent of test results)

Requires interpretation of values to guide blood product use.

Not valid to assess effects of platelet function, direct thrombin inhibitors, LMWH, warfarin

Evidence
Controversial; evidence exists to support TEG in identifying trauma induced coagulopathy, but limited RCT trials on role of TEG-guided MHP algorithms

STATA trial currently ongoing (FRP vs thromboelastometry guided MHP in trauma patients)

Single centre RCT reports reduced blood transfusion rates and improved-survival with TEG-guided MHP (Gonzalez 2016) (compared with MTP guided by conventional coagulation assays)

Systematic review (2014) – 55 observational studies on use of TEG to guide blood product use in trauma:

- Findings overall inconclusive
- Only one cohort in one study with penetrating trauma and packed cells>10 showed improved mortality with TEG-guided MHP

FRP:

- PROMMTT (2013): observational – higher ratios of plasma and platelets early → decreased mortality
- PROPPR (2015): RCT severe trauma – 1:1:1 vs 1:1:2 (plasma:plts:packed cells)
    - More haemostasis and less death due to exsanguination @ 24hr
    - No overall difference in mortality at 24 hrs or 30 days
    - better haemastasis & less death from exsanguination

Note: The level of detail in the evidence section was not expected.

Examiner Comments:

A very topical question that was generally answered in a very superficial way. Detailed reference to the weak evidence base was not required, but some recognition of this fact was expected. Better structure often ensured better marks.

Maximum Score	6.5
Percentage Passed	15.9%

Question 22

Outline the features and list the advantages and disadvantages of each of the following clinical trial designs:

a) Cluster randomised trial. (50% marks)

a) Non-inferiority trial. (50% marks)

ANSWER TEMPLATE

a)
Cluster randomised trial (10%)
Unit of randomisation is the cluster (e.g. one hospital or ICU) rather than individual patients.
Individual clusters may be matched / paired with similar clusters to increase power
Power increased more by increasing number of clusters rather than increased numbers of patients within clusters

Advantages (20%)
Ability to test interventions directed at systems rather than individuals (e.g. MET, SDD, education campaigns)
Where individual patients not consented may lead to recruitment of 'all' patients with the entry criteria –increased recruitment and external validity

Disadvantages (20%)
Larger numbers of patients required when compared to conventional individual patient RCT i.e. reduced statistical efficiency
Complex statistics: power calculation require knowledge or estimate of intercluster correlation coefficient
Chance of getting imbalance is greater depending on the characteristics of the cluster

b)
Non-inferiority trial (10%)
The null hypothesis in a noninferiority study states that the primary end point for the experimental treatment is worse than that for the positive control
treatment by a specified margin. Rejection of the null hypothesis supports a claim of noninferiority the control treatment

Advantages: (20%)
Allows investigation of a new therapy to be compared to an existing accepted therapy
Does not require a placebo group, where this may be unethical
Allows cheaper or less toxic therapies to the introduced in place of older therapies

Disadvantages: (20%)
Does not prove efficacy of tested therapy
Relies upon known / accepted benefit of control
Needs to be performed under similar conditions in which the active control has demonstrated benefit
No clear consensus on what margin of noninferiority should be accepted
Repeated noninferiority trial may lead to acceptance of inferior therapies 'biocreep'

Examiners Comments:

Significant knowledge gap. Disappointing, since several important trials have followed these designs.

Maximum Score	5.6
Percentage Passed	4.5%

Question 23

Outline the principles of, and strategies for management of a persisting broncho-pleural fistula (BPF) in a mechanically ventilated patient.

Include in your answer the advantages and disadvantages of each strategy.

ANSWER TEMPLATE

<u>Principles of Management:</u>
1. Drainage
   - Adequate drainage of the fistula with an intercostal catheter of adequate size to manage a large air leak.
   - May require multiple catheters, and ability to manage large flow rates.
   - Minimise suction.
2. Ventilatory management
   - Aim is to reduce mean airway pressure to reduce flow through fistula tract.
   - Low tidal volume and PEEP.
   - Low mandatory breath rate.
   - Permissive hypercapnoea.
   - Short inspiratory time.
   - Attempt to wean to spontaneous breathing mode from mandatory ventilation as soon as practicable and preferably from ventilatory support altogether.
3. General measures
   - Standard ICU supportive management
   - Broad spectrum antibiotic cover
   - Attention to nutritional requirements – patients usually catabolic.

Strategies for Managing Large Leaks:

1. Independent Lung Ventilation
    - Advantages: - May minimise leak in injured lung whilst preserving gas exchange with conventional parameters in normal lung.
    - Disadvantages: -requires some form of double lumen tube – difficult to place and secure.
    - May not be tolerated in hypoxic patients.
    - Requirement for two ventilators –either synchronous or asynchronous – technically demanding and complex.
2. High Frequency Ventilation
    - Advantages are that it may reduce peak air pressures and theoretically reduce air leak.
    - Disadvantages - not widely available. Recent evidence suggesting an increase in mortality for this ventilatory technique in ARDS patients.
3. Surgery
    - Advantages – Definitive management strategy. May be only option to seal leak.
    - Disadvantages – Patient may not be fit enough to tolerate.
4. Endobronchial Occlusion
    - Advantages – Widely available, can be definitive treatment.
    - Disadvantages – may be technically challenging, not feasible with multiple leaks.
5. Application of PEEP to intercostal catheter
    - Advantages – may decrease leak volume and maintain intra-thoracic PEEP.
    - Disadvantages – compromise drainage, risk of tension, not feasible with multiple tubes.
6. ECMO
    - Advantages – may be only option to treat hypoxia.
    - Disadvantages – not widely available, complex, little experience

Examiners Comments:

Answered well. Most candidates could have scored more if they had given greater breath to the strategies used, or greater depth to the strategies they discussed.

Maximum Score	8.0
Percentage Passed	90.9%

Question 24

24.1

List five causes of cardiogenic shock following myocardial infarction. (25% marks)

24.2

What clinical signs on physical examination would you expect in a non-ventilated patient with a right ventricular infarct? (25% marks)

24.3

A 54-year-old male presents with septic shock requiring vasopressor support and continuous renal replacement therapy for acute kidney injury (AKI).

His blood tests on presentation show:

Parameter	**Patient Value**	**Adult Normal Range**
FiO_2	0.4	
pH	7.15*	7.35 – 7.45
pO_2	146.0 mmHg (19.5 kPa)	
pCO_2	42.0 mmHg (5.6 kPa)	35.0 – 45.0 (4.6 – 6.0)
SpO_2	98%	
Bicarbonate	14.0 mmol/L*	22.0 – 26.0
Base Excess	-13.6 mmol/L*	-2.0 – +2.0
Lactate	1.4 mmol/L	0.5 – 1.6
Sodium	104 mmol/L*	135 – 145
Potassium	4.0 mmol/L	3.5 – 5.0
Chloride	73 mmol/L*	95 – 105
Glucose	4.1 mmol/L	3.5 – 6.0
Urea	35.6 mmol/L*	3.0 – 8.0
Creatinine	947 µmol/L*	45 – 90
Albumin	28 g/L*	35 – 50

a) With regards to his electrolytes, what is the concern about performing renal replacement therapy on this patient? (10% marks)

b) List <u>three</u> ways by which you could reduce this risk. (40% marks)

ANSWER TEMPLATE

24.1

Left or Right ventricular failure
Severe mitral regurgitation
Septal rupture
Cardiac tamponade/ventricular free wall rupture
Arrhythmia (brady or tachy)
Drug induced

24.2

Clinical signs would include the triad of hypotension, elevated JVP and clear lung fields
Pulsus paradox
Kussmaul's sign (elevation of JVP on inspiration)
Right sided gallop S3/4.

24.3

a)
Patient is hyponatraemic (duration unknown) -concern about rapid correction of Na causing osmotic demyelination syndrome (although uraemia may be protective) – should be aiming for 6-8 mmol/24

hrs which may be problematic if using standard bags (with normal Na levels) for CRRT as correction may occur more rapidly

b)

1. CRRT at **lower doses** than usual i.e. very low flow rate to try to minimise speed of electrolyte correction and for short intervals only
2. Add **sterile water to dialysis or replacement fluid** so that solution patient is being dialysed against has a lower sodium than standard solution (e.g. dilute to Na 117mmol/L or less – formulas exist to determine amount of sterile water to be added – candidates were not expected to know values/calculations)
3. Give the patient **additional free water/5% dextrose intravenously** while receiving CRRT (and remove this volume on circuit)

Examiners Comments:

Part a was answered well. Part b was answered poorly - candidates listed the signs of right ventricular failure, not of a right ventricular infarct. Part c - a lot of candidates focussed on the urea and potential disequilibrium syndrome rather than the far more concerning hypoatraemia and potential OSM.

Maximum Score	7.2
Percentage Passed	56.8%

Question 25

A 46-year-old female patient with class 3 (BMI > 40 kg/m^2) obesity has been admitted to your ICU with community-acquired pneumonia. She is sedated and ventilated with no other organ dysfunction. You are considering starting nutritional therapy.

a) Outline the metabolic derangements likely to be present in this patient. (20% marks)

b) How would you make an assessment of this patient's current nutritional status? (40% marks)

c) Outline your nutritional regimen in particular your optimal target protein and energy delivery. (40% marks)

ANSWER TEMPLATE

a) A number of metabolic derangements affect fuel utilization:

- Insulin resistance
- Impaired glucose tolerance,
- Increased fatty acid mobilization
- Hyperlipidemia
- Obese patients, compared to lean counterparts, may have accelerated protein degradation and depletion of lean body mass.
- "Metabolic X syndrome" may exist: insulin resistance, hyperinsulinemia, hyperglycaemia, coronary artery disease, hypertension, and hyperlipidemia.
- Obese patients are more likely to have a pre-existing pro inflammatory state.
- Obese patients have increased resting energy expenditure secondary to increased BMI, with central adipose tissue being more metabolically active than peripheral adipose tissue.

b) Assessment

- Assess patterns of weight change and nutrition intake prior to the admission

- Anthropometrics –actual body weight, ideal body weight, usual body weight, height, BMI, and waist circumference should be determined
- (Biomarkers of the metabolic syndrome; triglycerides, cholesterol, glucose serum albumin and pre-albumin)

c) Nutritional Regimen
• High protein (anabolic) hypocaloric feeding (reduced complications from overfeeding) should be provided to the obese critically ill patient regardless of whether the route of nutrition therapy is enteral or parenteral
• Most studies using this method give11-14kcal/kg/actualBWperday or 22-25kcal/kgIBW per day- equates to about 60-70% of calorie requirement determined by indirect calorimetry or predictive equation.
• Protein requirements should be met to maximise protein synthesis and preserve lean body mass (> 2.0g/kg IBW/d for class 1 and 2 obesity and > 2.5g/kg IBW/d for class 3). Note: TARGET trial suggested hypocaloric and eucaloric feeding have same effects on mortality when protein level constant

Maximum Score	7.5
Percentage Passed	59.1%

Question 26

The findings of your departmental mortality and morbidity meeting suggest that delirium is an increasing problem in the patient population in your ICU.

Describe how you would design a quality improvement (QI) project to minimise delirium in your unit, including in your answer a list of potential strategies and interventions.

ANSWER TEMPLATE

Elements of QI project are:
1. Identify local motivation, support and change champions and establish a multi-disciplinary team
2. Review evidence for strategies and interventions to minimise delirium

Environment:
- Excessive noise and insufficient light associated with delirium
- Ideal design allows patient exposure to daylight, space to facilitate early mobilisation, space for family and visitors to be involved in care. Access to outdoor spaces for long stay patients.
- Monitoring equipment quiet, audible alarms adjusted to accepted physiologic parameters.

Unit practices:
- Use of valid screening tool for delirium e.g. Confusion Assessment Method for the ICU (CAM-ICU)
- Sedation – minimise sedation, titrated to sedation target e.g. Richmond Agitation and Sedation Score. Avoidance of benzodiazepines.
- Early mobilisation – physical environment, equipment, allied health staff
- Cues for orientation – easy to read clocks, whiteboards or similar with day plan
- Day/ night maintenance - low lights and quiet overnight, promotion of sleep, minimising interventions at night, grouping cares
- Staff awareness and education – identification of high-risk patients, routine monitoring for delirium, seek staff input to quality initiative
- Family involvement in care

3. Prioritise interventions and implement with staff education and training as needed
4. Evaluate outcomes
    - Ongoing monitoring and data collection

- Benchmarking with previous results and other comparable units

An acceptable answer addressed a breadth of initiatives including departmental design, processes and individual patient care. Details of treatment and management of delirium not relevant to the question.

Maximum Score	7.5
Percentage Passed	79.5%

Question 27

a) List five neurological signs associated with a lateral medullary infarction. (25% marks)

b) List four neurological signs of a third cranial nerve palsy. What clinical feature of the palsy would distinguish between an intracranial mass lesion or diabetic neuropathy as the cause? (20% marks)

c) List five neurological deficits associated with a bulbar palsy, along with the corresponding cranial nerves which are affected. (25% marks)

d) List six causes of dilated unreactive pupils not due to a primary intracranial lesion. (30% marks)

ANSWER TEMPLATE

a)
Loss of contralateral pain and temperature in the trunk, and ipsilateral pain and temperature loss in the face.
Difficulty in walking or sitting upright
Nystagmus
Limb ataxia/hypotonia
Horner's syndrome
Bulbar muscle weakness

b)
Ptosis (complete or partial).
The affected eye deviates downwards and outwards (divergent strabismus).
Intorsion (internal rotation of eye)

The pupil MAY be dilated and fixed to light but may be normal.
A mass lesion results in pupillary non-reactivity, in diabetes the pupil is spared.

c)
Absent gag reflex (IX, X nerve lesions)
Absent elevation of soft palate (IX, X, nerve lesions)
Nasal speech (soft palate movement absent)
Jaw jerk normal or absent (V lesion)
Tongue weak and wasted and possibly fasciculating (XII lesion)
Drooling saliva and difficulty swallowing (IX, X, XII lesions)

d)
Drugs systemic: e.g. Barabiturate ,adrenaline, atropine, methanol (only one drug marked)
Drugs topical – anticholinergics. Sympathomimetics (only one drug marked)
Guillain Barre

Trauma
Prosthetic eye/lenses
Envenomation (tetrodoxin, pufferfish)
Chronic blindness
Total spinal
Hepatic encephalopathy
(any answer not on the list that the examiner considers plausible or can verify to attract a mark)

Maximum Score	8.1
Percentage Passed	36.4%

Question 28

With respect to phaeochromocytoma:

a) What is the usual mode of clinical presentation? (30% marks)

b) What biochemical tests and imaging can be performed to make the diagnosis? (20% marks)

c) Outline the key features of preoperative preparation and postoperative management. (50% marks)

ANSWER TEMPLATE

a) What is the usual mode of clinical presentation
Symptomatic patient. Classic triad of symptoms consists of episodic headache, sweating, and tachycardia. Sustained or paroxysmal hypertension and less commonly visual blurring, papilledema, weight loss, polyuria, polydipsia and cardiomyopathy.
Incidental adrenal mass
Family history in patients with familial disease.

b) What biochemical tests and imaging can be performed to make the diagnosis
24-hour urinary excretion of catecholamines and total metanephrines.
Plasma fractionated catecholamines (dopamine, norepinephrine, and epinephrine) and fractionated metanephrines (metanephrine and normetanephrine)
CT or MRI of abdomen and pelvis
Scintigraphy and PET scanning

c) Outline the key features of preoperative preparation and postoperative management
Combined alpha and beta-adrenergic blockade
Calcium channel blockers
Metyrosine which inhibits catecholamine synthesis
Post-operative management in ICU
Hypertensive crises or arrhythmias common complications
Patients who have bilateral adrenalectomies will require steroid cover

Maximum Score	6.3
Percentage Passed	47.7%

Question 29

With respect to the management of a multi-trauma patient requiring mechanical ventilation; describe the injuries that require specific positioning or immobilisation of the patient and the strategies used in this context. Include in your answer how these strategies impact upon the care of the patient.

ANSWER TEMPLATE

Patients with "unstable" injuries may be at risk of secondary injury if passive or active movements are not limited.

Brain- Traumatic Brain Injury:

- Head up (venous drainage)
- May be at odds with spinal precautions
- Priority given to greatest identified injury
- Can nurse flat in bed, with entire bed angled head up
- Avoid venous obstruction if TBI (collar and jugular CVC)

C-Spine injury

- Collar (which type not esp evidence based- Philadelphia/Aspen/hard collar)
- Particular attention to head hold in movement including airway manipulation
- Lie flat (but can tilt bed if head elevation dictated by underlying TBI)
- Log roll acceptable but recommended to use 4 people
- Can side lie with wedge to minimise pressure injury
- Should aim to remove collar as early as possible, and many trauma hospitals institute a Radiological clearance protocol using CT or MRI.
- If injury is identified then collar should not be removed until definitive treatment is defined (fixation/hard collar/conservative mx)
- Prolonged collar placement may lead to pressure injuries
- C-spine collar may make airway access more difficult

Thoraco-lumbar spine injury

- Lie flat (no bending) or side lie with a wedge.
- Log roll (4 person).
- Radiologic clearance protocols used commonly.

Pelvic fractures

- Haemodynamic instability may be related to pelvic injury
- Mechanically unstable pelvic fractures may be worsened by rolling/side lie/ sitting
- Pelvic binders may be required if haemodynamically unstable
- Additional fixation once injury identified- or removed if not.

Long bone fractures

- No universal position restrictions
- In event of clinical suspicion long bones should be immobilised to prevent embolic and haemorrhagic complications and pain

Other points

Competing injuries- precautions should relate to the most serious identified injury - e.g. a cleared spine may mean a patient can be sat up, but not in the setting of a co-existing mechanically unstable pelvis.

Likewise:

- Management of ICP in TBI takes precedence over use of cervical collars.
- Chest injuries/hypoxia takes precedence over spinal precautions

- Intubation and securing the airway takes precedence over cervical collars/head holds

Urgency exists in identifying injuries at the earliest possible time (secondary and tertiary survey) in order to remove or increase position restrictions for the individual patient.

Emphasis should be on own practice, no single "right way" but sensible risk/benefit-based approach including clinical and radiologic findings to guide practice.

Examiners Comments:

Poor discussion on competing priorities and how to manage this. Many answers lacked detail and/or did not really address all aspects of the question and were at junior registrar level. Some answers included injuries/complications/strategies not related to positioning or immobilisation.

Maximum Score	9.0
Percentage Passed	84.1%

Question 30

(Images removed from report.)

Please note: The following ECG has been recorded at 25 mm/sec and gain setting of 10 mm/mV.

30.1

A 60-year-old female who has presented to the Emergency Department with breathlessness is referred to you. Her ECG is shown on page 11 (ECG 30.1).

a) Describe the important features of this ECG. (40% marks)

b) List the likely differential diagnoses in this patient. (20% marks)

30.2

A 36-year-old female with history of alcohol abuse presents with nausea, vomiting and palpitations. Her ECG is shown on page 12 (ECG 30.2).

a) What is the major abnormality in this ECG? (20% marks)

b) List three differential diagnoses for the ECG abnormality. (20% marks)

ANSWER TEMPLATE

30.1

a) Describe the important features of this ECG (40% marks)
Sinus tachycardia
Right axis deviation
Peaked P waves
Upright R in avR
R wave in V1,
poor R wave progression (RVH)

b) List the likley differential diagnoses in this patient. (20% marks)
Massive Pulmonary Embolus
Pulmonary arterial hypertension
(various aetiologies, including underlying connective tissue disorders, porto-pulmonary hypertension, primary pulmonary hypertension)
Conditions causing cor pulmonale
(including COPD, Interstitial lung disease, OSA/obesity hypoventilation syndrome)

30.2

a) What is the major abnormality in this ECG (20% marks)
Prolonged QT

b) List 3 differential diagnoses for the ECG abnormality (20% marks – 5% marks each)

- Electrolyte abnormality
  - Hypokalaemia
  - Hypocalcaemia
  - Hypomagnesaemia
- Drugs (many)
  - E.g. Amitriptyline, amiodarone, erythromycin, droperidol, haloperidol, risperidone,
- Thyroid – hypo/hyper
- Myocardial – heart failure, ischaemia, myocarditis
- Congenital

Maximum Score	9.5
Percentage Passed	86.4%

EXAMINERS' COMMENTS

Hot Cases

The Hot Cases run for twenty minutes with an additional two minutes at the start of each case for the candidate to be given both a verbal and a written introduction to the case in question. This is to give candidates more opportunity to take in the relevant information and to plan a focussed approach to examination of the patient.

The following comments are a guide to the expected standard for performance in the Hot Cases:

- Candidates should demonstrate professional behaviour, treating the patient with consideration and respect.
- Candidates should address and answer the question asked of them in the introduction to the Hot Case.
- Candidates should interpret and synthesise information as opposed to just describing the clinical findings.
- Candidates need to seek information relevant to the clinical case in question.
- Candidates should be able to provide a sensible differential diagnosis and appropriate management plan. A definitive diagnosis is not always expected and, in some cases, may yet to be determined.
- Candidates should not rely on a template answer or key phrases but answer questions in the context of the clinical case in question.

- Candidates must be able to describe, with justification, their own practice for specific management issues.

Candidates who performed well in the Hot Cases, as in previous exams, were able to demonstrate the following:

- A professional approach showing respect and consideration for the patient.
- Competent, efficient and structured examination technique and also able to appropriately adapt the examination to suit the clinical case in question.
- Seeking of information relevant to the case.
- Appropriate interpretation and synthesis of their findings.
- Presentation of their conclusions in a concise and systematic fashion, addressing the issue in question.
- Listing of a differential diagnosis that is relevant to the clinical case in question.
- Appropriate interpretation of relevant investigations.
- Discussion of management issues in a mature fashion, displaying confident and competent decision-making.
- An appreciation of the complexities and key issues of the case.
- Overall performance at the expected level (Junior Consultant).

Candidates who did not perform at the acceptable standard did so for reasons including the following:

- Missing or misinterpreting key clinical signs on examination.
- Failure to perform a focussed examination relevant to the case in question.
- Incomplete or poor technique for examination of a system.
- Poor synthesis of findings with limited differential diagnosis, sometimes compounded by missed key clinical signs on examination.
- Poor interpretation of imaging and data.
- Failure to grasp the key issues relevant to the case in question and a lack of insight into the problems.
- Inability to construct an appropriate management plan for the case in question.
- Hesitancy and/or uncertainty in stating a management plan.
- The need for significant prompting during the discussion with knowledge gaps.
- Limited time for discussion as a consequence of taking too long to present the clinical findings or to interpret basic data.
- Inability to convey the impression that he/she could safely take charge of the unit.

It is apparent that some candidates are very nervous, and this affects their exam performance. Candidates badly affected by nerves may benefit from sessions with a performance psychologist, drama coach, public speaking coach or similar.

Candidates are advised that they should not sit the Second Part Examination until they can confidently examine patients, present the relevant clinical findings, synthesise all the information and discuss management issues at the appropriate level, **i.e. demonstrate that they are capable of safe, effective, independent practice at the level of a Junior Consultant.** Candidates should practise Hot Cases from the commencement of their exam preparation. To this end, candidates are encouraged to do the following in their daily clinical practice as preparation for the Hot Cases:

- Seek the opportunity to take charge of the unit and be responsible for management decisions.
- Practise examination of individual systems.
- Treat every case to be assessed at work as a Hot Case, i.e. pose a relevant question (e.g. ‘Why is this patient not progressing?’ ‘What is the cause of the new fever?’ ‘Is this patient ready for extubation?’), perform a focussed exam and then present your findings to a colleague.

Vivas

The overall pass rate for the vivas was 79%, compared with 45% for the written paper and 73% for the Hot Cases. Two out of the eight vivas had a pass rate under 50%. The radiology viva had a particularly low pass rate. Candidates who failed a viva mostly did so because of knowledge gaps, poorly structured answers and inability to give the rationale for their responses. As in the discussion for the Hot Cases, candidates should not rely solely on generic statements, key phrases and template answers, and, instead, tailor their responses to the specifics of the question and be able to justify and expand their response. Candidates are encouraged to practise viva technique and to discuss patient management, including the rationale for their decisions, with senior colleagues. As with the Hot Cases, candidates who are very nervous or have a poor technique may benefit from training with a performance coach.

SECOND PART ORAL EXAMINATION

CLINICALS "HOT CASES"

Prince Charles Hospital

- A 36-year-old female on day 28 of her ICU admission. She had presented with pneumococcal pneumonia and multi organ failure, and had been weaned from ECMO two days before. She had developed a fever overnight and candidates were asked to assess her for potential sources. A Chest x-ray and arterial blood gas sample was provided in the reading time. Areas of discussion included sources of fever, management of a persistent air leak from a thoracostomy tube, and issues related to ICU acquired weakness.

- A 74-year-old female on day 6 of her ICU admission. She had presented with an out of hospital cardiac arrest. Candidates were asked to comment on current state and prognosis. Areas of discussion included prognostication, causes of fever and management of haematuria.

- A 70-year-old male on day 3 of his ICU admission. He had been admitted with septic shock after an umbilical hernia repair. Relevant background included obesity, diabetes and aortic valve replacement. Candidates were asked to examine him for sources of post-operative fever. Areas of discussion included differential diagnosis of fever, exclusion of endocarditis, and empirical antimicrobial treatment.

- A 46-year-old male on day 14 of his ICU admission. He had been admitted following a repair of a type A aortic dissection. Candidates were asked to assess his suitability for ward discharge. Areas of discussion included interpretation of Chest x-ray and CT imaging, management of delirium and a discussion around discharge.

- A 38-year-old female on day 1 of her ICU admission. She had been admitted with an altered conscious state with a background history of anxiety and depression. Candidates were asked to provide a differential diagnosis. Candidates were expected to perform a competent neurological examination, provide an organised differential diagnosis based on their findings, discuss the relevant investigations including elevated liver function tests, and comment on the role of steroid treatment in alcoholic hepatitis.

Princess Alexandra Hospital

- A 69-year-old female on day 44 of her ICU admission. She had presented with an ASIA-A spinal injury following a surfing accident complicated by cardiac arrest. Candidates were asked to assess her for complications of her injury and to comment on what further complications she

was at risk of. Areas of discussion included management of paralysis, ventilator dependence, infection, thrombosis and mood.

- A 66-year-old male on day 42 of his ICU admission. He had been admitted after an out of hospital cardiac arrest. The candidates were asked to comment on prognosis and ongoing management priorities. Areas of discussion included management of quadraparesis, potential complications, and interpretation of imaging.

- A 73-year-old male on day 9 of his ICU admission. He had been admitted with progressive weakness and difficulty in swallowing on a background of a recent diagnosis of myasthenia gravis. Candidates were asked to assess him with emphasis on his neurological status and to provide a plan for his ventilatory management.

- A 66-year-old female on day 5 of her ICU admission. She had been admitted following an out of hospital cardiac arrest thought to be secondary to a primary arrhythmia. Candidates were asked to examine her with a view to determining her neurological prognosis and other complications post cardiac arrest. Discussion point included the findings on physical examination, prognosis and management.

- A 48-year-old male on day 2 of his ICU admission. Presented to hospital with abdominal pain and sepsis on a background of Burkitt's Lymphoma. Candidates were asked to determine the likely source of the sepsis and to formulate a management plan. Discussion points included empiric antibiotic therapy, interpretation of the chest x-ray and the cardiac ECHO findings.

- A 39-year-old male on day 13 of his ICU admission. He had presented acutely unwell with sepsis immediately after a dialysis treatment. He had a background of diabetes and renal failure. Candidates were asked to give a differential diagnosis for the source of his sepsis.

- A 58-year-old male on day 13 of his ICU admission. He had presented with a PEA arrest following a period of entrapment between two cars. Candidates were asked to assess him and plan for further management. Areas for discussion included the management of his fever, jaundice, acute kidney injury and further assessment of his leg injury.

- A 47-year-old male on day 3 of his ICU admission. He had been admitted following aortic surgery and had a background of hypertension and obesity. Candidates were asked to formulate a plan for management with a focus on liberation from mechanical ventilation. Areas for discussion included a weaning plan, and management of fevers, acute kidney injury and feeding.

Royal Brisbane & Women's Hospital

- A 40-year-old male on day 7 of his ICU admission. Admitted with 40% burns to face and limbs. Candidates were asked to identify ongoing issues and provide a management plan. Discussion points included interpretation of arterial blood gases and causes of hypotension.

- A 64-year-old male on day 3 of his ICU admission. Admitted with 40% burns to face, circumferentially to the chest and both arms. He had a background of atrial fibrillation on apixaban therapy. Candidates were asked to formulate a management plan for the next 48 hours. Issues included causes of shock and management of anticoagulation.

- An 81-year-old male on day 5 of his ICU admission. He had been admitted following an emergency call from the ward with Type 2 respiratory failure. Candidates were asked to assess

his suitability for extubation. Areas of discussion included predictors of weaning and complications of tracheostomy.

- A 77-year-old male on day 9 of his ICU admission. Admitted after an NSTEMI followed by an acute abdomen requiring laparotomy. Candidates were asked to discuss the barriers to weaning and extubation. Areas of discussion included diagnosis of ischaemic bowel.

- A 63-year-old male on day 8 of his ICU admission. He had suffered a PEA arrest following a craniotomy for resection of a meningioma. Candidates were asked to comment on his neurological prognosis. Areas of discussion included the findings of a hemiparesis, interpretation of the CT scan, and prognostication.

- A 63-year-old female on day 3 of her ICU admission. Presented with an out of hospital cardiac arrest secondary to choking on food. Candidates were asked to assess the patient and describe what they would say to her family. Areas for discussion included the findings of myoclonus and bronchial breathing, family discussion and the role of organ donation.

- A 51-year-old female on day 10 of her ICU admission. She had presented with sepsis on a background of chemotherapy for acute myeloid leukaemia, and had remained unsedated since admission. Candidates were asked to find the cause of her delayed awakening. Areas of discussion included interpretation of chest x-ray and CT findings, as well as issues related to encephalopathy, jaundice and renal failure.

- A 43-year-old male on day 12 of his ICU admission. He had presented with a soft tissue infection 20 days ago. Candidates were asked to identify relevant issues and make a management plan for the next 24 hours. Areas of discussion included management of necrotising fasciitis.

The Wesley Hospital

- A 45-year-old male on day 20 of his ICU admission. Admitted following a pelvic extenteration for recurrent rectal cancer three weeks before. Complicated by a rupture from common iliac artery aneurysm. Candidates were asked to identify the immediate management priorities for the day. Areas for discussion included the urgent need for percutaneous nephrostomies.

- An 89-year-old male on day 6 of his ICU admission. He had presented with hypoxic respiratory failure following surgery for injuries sustained after a fall. Candidates were asked to discuss the cause and management of his respiratory failure.

- A 79-year-old female on day 10 of her ICU admission. She had been admitted following a redo aortic valve replacement complicated by intraoperative cardiovascular collapse. Candidates were asked to discuss their strategy to wean her from the ventilator.

- A 71-year-old male on day 2 of his ICU admission. Admitted following an emergency call from the ward for severe hypoxia following a VATS procedure. Candidates were asked to comment on his suitability for discharge to the ward.

VIVAS

Viva 1

You have been called to the gynaecology ward to review a 45-year-old female who is 48 hr post-laparotomy for large bowel obstruction, and is now tachypnoeic and hypotensive. She has a background of known ovarian malignancy for which she has received chemotherapy. At surgery she was found to have metastatic disease and has undergone a debulking procedure and bowel resection with formation of a de-functioning ileostomy.

Her vital signs are as follows:

- GCS 15
- Respiratory rate 35
- SpO_2 90% on 8l via Hudson Mask
- Few bibasal crepitations
- Heart rate 110
- BP 80/40
- Soft distended abdomen with pink functioning stoma

List your differential diagnoses for her presentation.

Maximum Score	8.0
Percentage Passed	73%

(This viva dealt with the diagnosis and management of pulmonary embolus.)

Viva 2

A 40-year-old previously well male is admitted to ICU for management of oliguric acute kidney injury accompanied by high fever with rigors, respiratory distress and headache. He has just returned from a brief tour of southeast Asia.

Give the most likely five differential diagnoses, and outline the features of the history and investigations that would help you distinguish between them.

Maximum Score	8.5
Percentage Passed	61%

(This viva dealt with the diagnosis and management of malaria.)

Viva 3

Twenty-four hours after a TOE to facilitate the treatment of chronic AF, a 60-year-old female presents to the emergency department with acute, severe chest pain.

Her observations are as follows:

- Heart rate 120 bpm, sinus
- Systolic blood pressure 80 mmHg, improving to 110 mmHg after 1 L bolus of IV crystalloid
- Respiratory rate 32/min
- O_2 saturation 92% on 6 L/min O_2 via Hudson mask

What is your differential diagnosis?

Maximum Score	7.8
Percentage Passed	76%

(This viva dealt with oesophageal perforation.)

Viva 4

You are the intensivist in charge of a 12-bed regional ICU.

A 50-year-old female presents to your hospital five months after heart transplant for dilated cardiomyopathy. She had been short of breath for several days. She has a temperature of 37.8 degrees. She is in atrial fibrillation with a ventricular rate of 125bpm, blood pressure is 80/50 mmHg. Oxygen saturations in air, on arrival, were 88%. Her GCS is 15. Her current medications include tacrolimus, mycophenolate and prednisone.

What are the two most important causes of this presentation to consider?

How would you distinguish between them?

Maximum Score	9.3
Percentage Passed	61%

(This viva dealt with the assessment of complications following heart transplantation.)

Viva 5

You are asked to urgently review a 25-yr-old male with isolated traumatic brain injury. He has had a percutaneous tracheostomy inserted within the last 30 minutes to facilitate weaning from mechanical ventilation. The bedside nurse is concerned about bleeding from the tracheostomy tube.

He has the following observations:

- SpO_2 88% on FiO_2 80% (increased from FiO_2 40%)
- SIMV+VC mode, tidal volume 400 ml, PEEP 5 cmH_2O, normal peak and plateau airway pressure
- Heart rate 120/ min and blood pressure 180/110 mmHg
- Patient is sedated and paralysed

Discuss your initial approach to the management of this patient.

Maximum Score	8.3
Percentage Passed	48%

(This viva dealt with complications of percutaneous tracheostomy.)

Viva 6 – Procedure Station

You are asked to see a 60-year-old male who has been trampled by a bull. He has a history of previous right sided pneumonia complicated by empyaema 10 years ago but is otherwise well.

CT shows a significant right sided haemopneumothorax, but nil other injuries. He currently has a respiratory rate of 30, Saturations 94% 15L NRBM, HR 100, BP 140/90.

What technique would you use to decompress this patient's chest and why?

Maximum Score	9.0
Percentage Passed	85%

(This viva dealt with the insertion and complications of thoracostomy tubes.)

Viva 7 – Radiology Station

Maximum Score	6.7
Percentage Passed	36%

(The radiology station consisted of two plain x-rays and four CT scans.)

Viva 8 – Communication Station

You are the Intensive Care Consultant caring for Aisha, an 18-year-old female with a background of cerebral palsy. She has recently transitioned from the paediatric to the adult hospital. She is cared for at home by her parent.

She was admitted to ICU yesterday with severe pneumonia, and was intubated and commenced on a noradrenaline infusion.

You decided on the ward round to insert a central line in the jugular vein. During insertion, your registrar has caused a pneumothorax. A chest drain is now required to treat the pneumothorax, although not urgently.

Previous discussions with her parent have identified that there should be no treatment limitations.

Informed consent was obtained for the central line.

You are about to meet her parent for the first time, to explain the pneumothorax and the need for a chest drain.

Maximum Score	8.8
Percentage Passed	67%