COLLEGE OF INTENSIVE CARE MEDICINE
OF AUSTRALIA AND NEW ZEALAND

SECOND PART PAEDIATRIC EXAMINATION

WRITTEN EXAM REPORT

AUGUST 2020

This report is prepared to provide candidates, tutors and their Supervisors of Training with information about the way in which the examiners assessed the performance of candidates in the Examination. Candidates should discuss the report with their tutors so that they may prepare appropriately for future examinations.

The written section of the examination was held in Auckland, Brisbane, Melbourne, and Sydney. The examination included two 2.5 hour written papers, each composed of 15 ten-minute short answer questions. The pass mark for the written section is derived by the Angoff method and for this sitting was set at 49.8%. The oral component comprises of 8 interactive vivas and two clinical hot cases. Due to COVID, the oral component for this sitting was postponed to May 2021.

The tables below provide an overall summary, as well as information regarding performance in the individual sections. A comparison with the previous five examinations is also provided.

STATISTICAL REPORT

Overall pass rates	**2020**	**2019**	**2018**	**2017**	**2016**	**2015**
Total number presenting (written + carry + OTS)	8	11	12	12	11	13
Total number invited to the oral section	4	4	10	7	6	9
Total number successful at orals	N/A*	4	10	7	6	8
	N/A*	100%	100%	100%	100%	89%
Overall pass rate	N/A*	4/11	10/12	7/12	6/11	2/4
	N/A*	**36%**	**83%**	**58%**	**55%**	**62%**

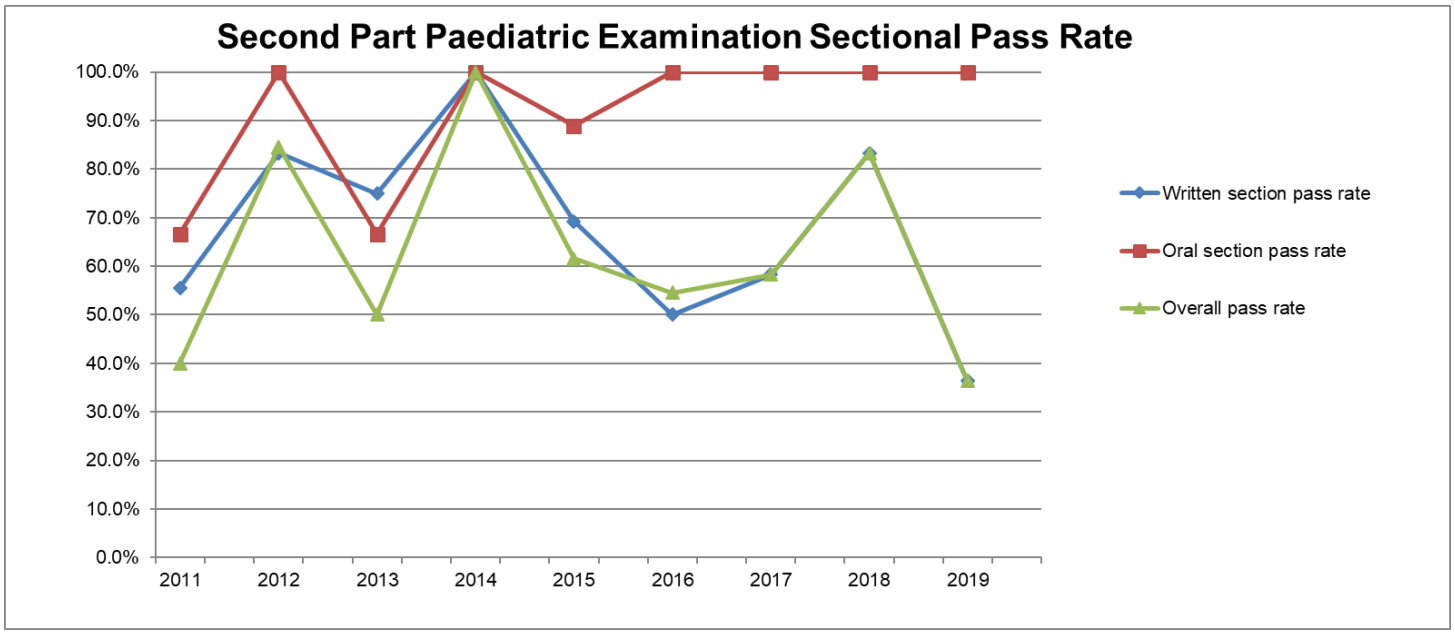
**Oral component postponed due to COVID.*

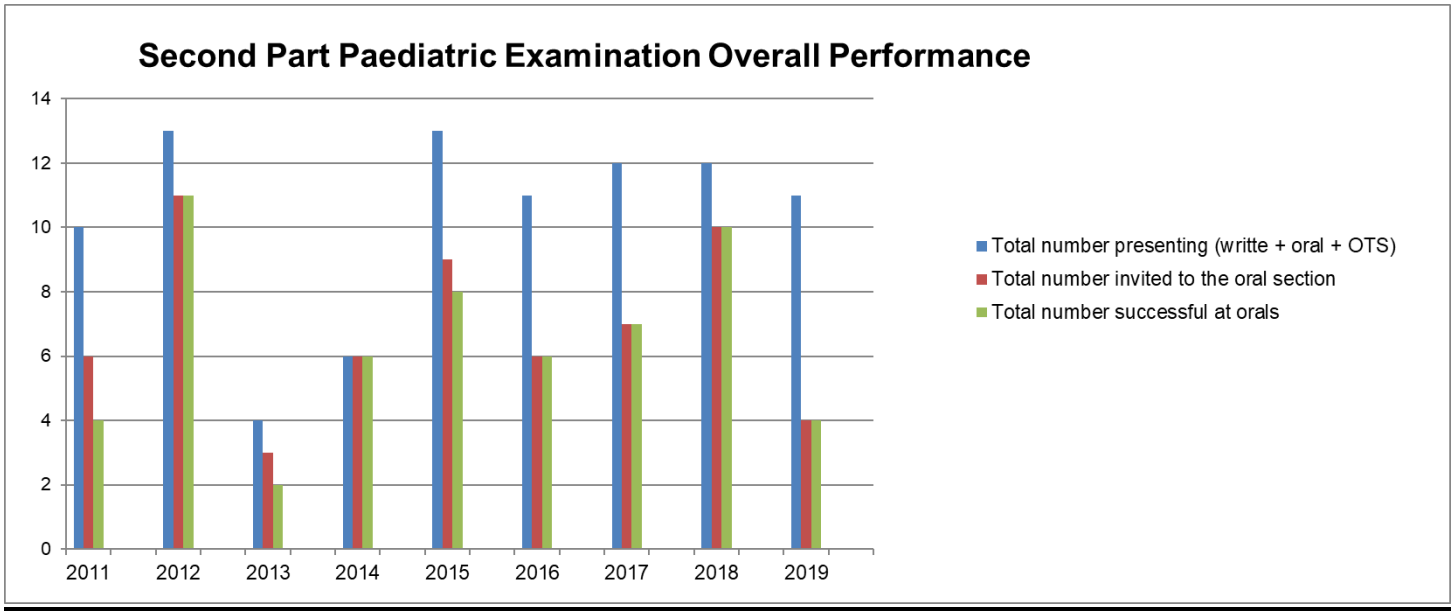
Clinical Pass Rates	2020		2019		2018		2017		2016		2015	
	Pass rate	Highest individual mark	Pass rate	Highest individual mark	Pass rate	Highest individual mark	Pass rate	Highest individual mark	Pass rate	Highest individual mark	Pass rate	Highest individual mark
Hot Case 1	N/A*		75%	78%	50%	73%	71%	75%	100%	80%	78%	80%
Hot Case 2			50%	70%	70%	78%	86%	76%	100%	95%	56%	85%
Total number successful in the Hot Case section	N/A*		3/4		6/10		6/7		6/6		8/9	
Overall Hot Case pass rate	N/A*		75%		60%		86%		100%		89%	

Vivas Pass Rates	2020		2019		2018		2017		2016		2015	
	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
Viva 1	N/A*		25%	54%	70%	75%	100%	70%	67%	80%	44%	60%
Viva 2			50%	60%	70%	85%	86%	78%	100%	85%	44%	70%
Viva 3			75%	70%	60%	83%	86%	85%	0%	49%	33%	85%
Viva 4			100%	88%	80%	59%	86%	78%	67%	90%	67%	83%
Viva 5			75%	69%	80%	73%	43%	76%	100%	88%	67%	80%
Radiology Viva			100%	65%	100%	90%	100%	70%	100%	83%	89%	80%
Communication Viva			25%	58%	70%	75%	86%	85%	83%	80%	89%	95%
Procedure Viva			75%	88%	80%	83%	57%	90%	83%	95%	100%	95%
Total number successful in the Viva section	N/A*		4/4		10/10		6/7		6/6		8/9	
Overall Viva pass rate	N/A*		100%		100%		86%		100%		89%	

**Oral component postponed due to COVID.*

Overall Performance*





**Oral component for 2020 sitting postponed due to COVID. Data will be updated upon completion.*

EXAMINERS' COMMENTS

Written Paper

More than 50% of candidates scored less than 5 out of 10 marks in twelve of the thirty short answer questions. Topics covered by questions where more than 70% of candidates scored less than 5/10 related to clinical trial design, acid-base disorders, status epilepticus, post-coarctectomy hypertension, bronchopleural fistula, neutropaenic colitis and burns.

The most common reasons for candidates to fail questions were:

- Insufficient knowledge of the topic
- Insufficient detail or incomplete answer
- Failure to answer the question asked
- Answer not at consultant level

Once again, candidates are reminded that it is crucially important to write legibly; examiners need to be able to read written answers.

Candidates are reminded to read the questions carefully and thoroughly, and to include in their answer only information that is relevant to the question. The allocation of marks in multipart questions is shown to allow candidates to organise their answers appropriately. The glossary of terms is provided to help candidates to understand the type of information and structure required in the answer. These terms are used in the questions to convey the level of detail required in each answer; it is very important that candidates understand their meaning.

WRITTEN EXAMINATION REPORT

Instructions to Candidates

a) Write your answers in the blue books 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 you 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.

Notes

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

Images from the SAQ papers are not shown in this report.

Question 1

An 8-month-old infant with Trisomy 21 is admitted to PICU following complete repair of a complete atrioventricular septal defect (AVSD).

Outline the clinical manifestations of the early (first 24 hours) complications specific to repair of this lesion and their management.

Maximum Score	7.30
Percentage scoring ≥5/10	63%

Examiners' comments:

This question explicitly aimed to examine candidates' knowledge of the potential complications following this specific surgery in this patient. Good answers covered pulmonary reactivity, pulmonary hypertension, likely rhythm or conduction problems and individual residual lesions, with a clear description of the presentation and management of these. Candidates who gave general answers (unspecified low cardiac output syndrome or complications of CPB) scored poorly.

Reference(s):

Critical Heart Disease in Infants and Children, 3rd Ed. Ross M. Ungerleider & Kristen Nelson et al 2019 Ch 25, pp 605-606.

Question 2

With respect to neuroprotective intensive care measures in the management of paediatric acute severe traumatic brain injury, outline:

a) Baseline neuroprotective intensive care where the Intracranial Pressure (ICP) is normal. (60% marks)

b) Tier 1 and Tier 2 responses to a rising ICP. (40% marks)

You may assume that intubation, ventilation, appropriate vascular access, and routine PICU monitoring have all been initiated, the brain CT scan has not shown a surgically remediable lesion, cervical spine precautions are being utilised and a functioning ICP monitor is in place.

Maximum Score	7.25
Percentage scoring ≥5/10	63%

Examiners' comments:

This question required good working knowledge of the most recent consensus guidelines for management of paediatric traumatic brain injury, and candidates who did well were able to reproduce the essence and intent of those guidelines. Candidates who scored poorly were unable to properly articulate the difference between baseline, tier 1 and tier 2 therapies, or missed out significant aspects of these.

Reference(s):

Kochanek PM, Tasker RC, Bell BJ et al. Management of Pediatric Severe Traumatic Brain Injury: 2019 Consensus and Guidelines-Based Algorithm for First and Second Tier Therapies. Pediatr Crit Care Med 2019; 20:269–279.

Question 3

Concerning influenza infection in PICU:

a) List six complications of influenza infection that can cause critical illness in children. (30% marks)

b) List four potential causes of acute rhabdomyolysis in a critically unwell child with severe influenza infection. (20% marks)

c) List five ECG abnormalities you might expect to see in a patient with severe hyperkalaemia. (25% marks)

d) Outline the indications and rationale for oseltamivir (Tamiflu) in critically ill children with suspected influenza infection. (25% marks)

Maximum Score	7.50
Percentage scoring ≥5/10	88%

Examiners' comments:

Although this question covered a lot of ground, there were simple marks to be had for relatively short lists. Perhaps the most basic part of the question was done poorly; a surprising number of candidates were unable to list the ECG changes in severe hyperkalaemia. Few candidates conveyed a convincing understanding of the approach to oseltamivir use.

Reference(s):

Louie et al. Neuraminidase inhibitors for critically ill children with influenza. Pediatrics 2013; 132(6) e1539-e1545.

Question 4

a) Define bias in clinical research. (10% marks)

b) In table form, list different types of bias, briefly describe each one and suggest a mitigation strategy. (90% marks)

Maximum Score	4.00
Percentage scoring ≥5/10	0%

Examiners' comments:

An understanding of bias is important not just for trial design, but also for interpretation of the literature; consequently, it is part of the expected competencies for training in intensive care medicine. Many candidates could not provide a basic definition of bias. Multiple types of bias are described in the literature; a description of and approach to mitigating several of these was expected; however, candidates fell well short of this.

Reference(s):

Higgins JPT, Altman DG, Gøtzsche PC, Jüni P, Moher D, Oxman AD, et al. The Cochrane Collaboration's tool for assessing risk of bias in randomised trials. BMJ. 2011;343:d5928.
Sevransky, Jonathan E. MD, MHS; Checkley, William MD, PhD; Martin, Greg S. MD, MSc, FCCM Critical care trial design and interpretation: A primer, Critical Care Medicine: September 2010 - Volume 38 - Issue 9 - p 1882-1889

Question 5

A 14-month-old male with no comorbidities was extubated yesterday 10 days following laryngotracheoplasty. His stay has been complicated by an episode of ventilator-associated pneumonia that required prolonged and high-dose sedation. He is currently afebrile, with normal gas exchange, breathing air and has a clear chest X-ray.

He has been quite agitated and irritable overnight and has received multiple intravenous boluses of fentanyl and midazolam and regular oral chloral hydrate.

His current medications include fentanyl 6 mcg/kg/hour, midazolam 180 mcg/kg/hour (3 mcg/kg/minute), clonidine 0.5 mcg/kg/hour, chloral hydrate 20 mg/kg 6 hourly prn.

Outline your approach to his sedative weaning.

Maximum Score	7.50
Percentage scoring $\geq$5/10	88%

Examiners' comments:

This question was generally well answered. Most candidates outlined a weaning strategy that involved: assessment of pain, delirium and withdrawal; an approach to drugs by category; breakthrough recommendations; and non-pharmacologic strategies.

Reference(s):

Pediatric Critical Care, 5th Ed. Fuhrman & Zimmerman 2017, Ch 134 Sedation and analgesia, p1858-; Ch135 Tolerance, withdrawal and dependency p1862-.

Rogers' Textbook of Pediatric Intensive Care, 5th Ed. Rogers & Nicholls et al 2016. Ch 14, p 157-.

Question 6

6.1

An 8-year-old child presents with tachypnoea and a one week history of diarrhoea.

The following arterial blood gas is obtained:

Parameter	Patient Value	Normal Range
pH	7.11*	7.35 – 7.45
$PaCO_2$	16 mmHg (2.13 kPa)*	35 – 45 (4.70 – 6.00)
PaO_2	98 mmHg (13.1 kPa)	80 – 105 (10.7 – 14.0)
O_2 saturation	99%	96 – 100
Sodium	137 mmol/L	135 – 145
Potassium	2.5 mmol/L*	3.5 – 4.5
Chloride	118 mmol/L*	97 – 106
HCO_3	5 mmol/L*	25 – 27
Lactate	1.9 mmol/L	< 2.0

Base excess	-22 mmol*	-2 to +2

a) Describe the acid base abnormality and justify your answer. (10% marks)

6.2

A 16-year-old patient presents with abdominal pain and an increased respiratory rate.

The following arterial blood gas is obtained:

Parameter	Patient Value	Normal Range
pH	7.45	7.35 – 7.45
$PaCO_2$	22 mmHg (2.93 kPa)*	35 – 45 (4.70 – 6.00)
PaO_2	104 mmHg (13.9 kPa)	80 – 105 (10.7 – 14.0)
O_2 saturation	98%	96 – 100
Sodium	140 mmol/L	135 – 145
Potassium	4.1 mmol/L	3.5 – 4.5
Chloride	100 mmol/L	97 – 106
HCO_3	15 mmol/L*	25 – 27
Lactate	4.1 mmol/L*	< 2.0
Base excess	-9 mmol/L*	-2 to +2

a) Describe the acid base abnormality and justify your answer. (30% marks)

b) Give <u>one</u> potential cause. (10% marks)

6.3

A 10-year-old child with chronic heart failure presents with signs of a lower respiratory tract infection.

The following arterial blood gas is obtained:

Parameter	Patient Value	Normal Range
pH	7.29*	7.35 – 7.45
$PaCO_2$	55 mmHg (7.33 kPa)*	35 – 45 (4.70 – 6.00)
PaO_2	102 mmHg (13.6 kPa)	80 – 105 (10.7 – 14.0)
O_2 saturation	98%	96 – 100
Sodium	154 mmol/L*	135 – 145
Potassium	4.1 mmol/L	3.5 – 4.5
Chloride	100 mmol/L	97 – 106
HCO_3	23 mmol/L*	25 – 27
Lactate	8 mmol/L*	< 2
Base excess	-3 mmol/L*	-2 to +2

a) Describe the acid base abnormality and justify your answer. (40% marks)

b) What is the likely cause? (10% marks)

Maximum Score	5.55
Percentage scoring <u>≥</u>5/10	25%

Examiners' comments:

The great majority of marks here were for interpretation of the arterial blood gas results, requiring more than simple naming of the acid-base status. Candidates were also expected to calculate and comment on the anion gap and the degree of compensation based on formulae to calculate expected $PaCO_2$ and

HCO_3. Many candidates did not demonstrate a systematic approach and were unable to produce a nuanced and detailed description of the increasingly complex acid base disorders.

Reference(s):

http://www.anaesthesiamcq.com/AcidBaseBook/ab9_2.php

Question 7

a) List the complications of epidural anaesthesia that may be seen in PICU. (30% marks)

b) In table form, compare and contrast high epidural block and systemic local anaesthetic toxicity with respect to the following two features:

   i. Signs and symptoms

   ii. Management (70% marks)

Maximum Score	6.56
Percentage scoring ≥5/10	88%

Examiners' comments:

Most candidates knew this subject matter sufficiently, and several managed to score well answering from first principles. All candidates had some knowledge of specific management of local anaesthetic toxicity.

Reference(s):

El-Boghdadly K et al. Local anesthetic systemic toxicity: current perspectives. Local Reg Anesth. 2018;11:35-44.

Question 8

a) Outline the pathophysiology underlying the development of ventilator-induced lung injury (VILI). (40% marks)

b) Outline the pathophysiological basis of respiratory management in ARDS aimed at preventing VILI. (60% marks)

Maximum Score	8.12
Percentage scoring ≥5/10	75%

Examiners' comments:

There were some very good answers here, which gave a comprehensive account of injury mechanisms and had a systematic approach to management, with clear pathophysiological rationale. In the first part, candidates were expected to address barotrauma, volutrauma and atelectrauma, as well as damage caused by oxygen and inflammation. The management part of the question required a description of the pathophysiological aims of ventilator management – why limit tidal volume?, why best PEEP? etc. - and non-ventilator management (proning, sedation etc).

Reference(s):

Beitler JR, Malhotra A, Thompson BT. Ventilator-induced Lung Injury. Clin Chest Med. 2016;37(4):633-646.

Question 9

The parents of a 14-month-old child with a progressive neurodegenerative disorder have taken to social media to express their frustration at what they call the 'lack of care' they are receiving from your PICU.

a) Outline the early warning signs of developing conflict between parents and medical teams. (40% marks)

b) Outline how you will prevent this conflict from occurring or escalating. (60% marks)

Maximum Score	7.00
Percentage scoring ≥5/10	50%

Examiners' comments:

Some candidates did well as they were clearly able to describe warning signs in the first part of the question, even if their language did not match descriptions in the literature (avoidance and controlling behaviours, micromanagement, entrenched viewpoints, etc), suggesting experience and perspective. The second part of the question could be more readily answered describing sensible strategies for patient and family-centred care, appropriate and consistent communication, and multi-disciplinary support in chronic and complex ICU patients.

Reference(s):

Linney et al. Achieving consensus advice for paediatricians: on prevention, recognition and management of conflict in paediatric practice. Arch Dis Child. May 2019:104;413-416.

Barclay. Recognizing and managing conflict between patients, parents and health professionals. Pediatrics and Child Health. Jul 2016 26:7;314-315.

Question 10

a) Briefly outline the synthesis, composition and physiological roles of pulmonary surfactant. (40% marks)

b) Discuss the rationale and evidence for the use of exogenous surfactant in PICU. Do not include its use in neonatal respiratory distress syndrome/surfactant deficiency disorder/hyaline membrane disease. (60% marks)

Maximum Score	6.50
Percentage scoring ≥5/10	38%

Examiners' comments:

A basic knowledge of surfactant's production by type II alveolar cells, phospholipid:protein constitution and roles in host defence and alteration of surface tension was expected. Although infrequently used in PICU, decreased secretion and inactivation of surfactant in acute lung disease has lead to investigation of surfactant administration in meconium aspiration, bronchiolitis, ARDS and ALI. Some candidates had knowledge of the most recent relevant clinical trials.

Reference(s):

Pediatric calfactant in acute respiratory distress syndrome trial. Wilson et al. Pediatric Critical Care Medicine: 2013;14(7):657-665.

CALIPSO: A Randomized Controlled Trial of Calfactant for Acute Lung Injury in Pediatric Stem Cell and Oncology Patients. Biology of Blood and Marrow Transplantation. 2018;24(12):2479-2486.

Question 11

Intravenous salbutamol, aminophylline and magnesium are second-line therapies to treat acute severe/life-threatening asthma.

a) In table format, for each of these three agents, list:

   i. Mechanism(s) of action

   ii. Evidence supporting the drug's efficacy in this setting

   iii. Adverse effects (90% marks)

b) Based on this information, rank these agents in order of your current preference for use. (10% marks)

Maximum Score	7.50
Percentage scoring ≥5/10	100%

Examiners' comments:

This was a straightforward question that was generally well answered.

Reference(s):

Nievas IFF et al. Management of Status Asthmaticus in Critically Ill Children. In: Mastropietro C., Valentine K. (eds) Pediatric Critical Care: current controversies. Springer, Cham. 2019: pp63-81.

Mahemuti G et al. Efficacy and side effects of intravenous theophylline in acute asthma: a systematic review and meta-analysis. Drug design, development and therapy 2018;12:99.

Ohn M et al. Magnesium should be given to all children presenting to hospital with acute severe asthma. Paediatric respiratory reviews 2014;15(4):319-321.

Question 12

A previously well, fully immunised 6-year-old boy arrives in the Emergency Department with generalised tonic-clonic seizures. He has a history of mild developmental delay and a 3-day history of fever, cough, abdominal pain and nausea.

A dose of intravenous midazolam was administered by the paramedics with no effect. A repeat dose of midazolam is given on arrival in the Emergency Department with no effect on seizure termination.

a) Define refractory status epilepticus. (10% marks)

b) Which drug would you administer next? Justify your answer with supporting evidence. (50% marks)

c) In table form, compare midazolam with thiopentone for coma induction using the following headings: seizure control; duration to seizure control; complications. (40% marks)

Maximum Score	6.75
Percentage scoring ≥5/10	25%

Examiners' comments:

For the most part, this question was poorly answered, given the importance and prevalence of the topic. Although a few candidates were able to cite some clinical trial evidence to support their drug selection, many were not and scored poorly.

Reference(s):

Lyttle et al. Levetiracetam versus phenytoin for second-line treatment of paediatric convulsive status epilepticus (EcLiPSE): a multi centre, open-label, randomised trial. Lancet 2019; 393: 2125-34.

Dalziel et al. Levetiracetum versus phenytoin for second line treatment of CSE in children (CONSEPT Study): an open-label, muticentre, randomised controlled trial. Lancet 2019; 393: 2135-45.

Burman et al. A Comparison of Parenteral Phenobarbital vs. Parenteral Phenytoin as Second-Line Management for Pediatric Convulsive Status Epilepticus in a Resource-Limited Setting. Front Neurol. 2019; 10: 506.

Question 13

A 3-day-old, 3.8 kg baby with hyperammonaemia is referred to your PICU from a level 3 NICU 100 km away (90 minutes road trip). You are asked to provide advice and to send a transport team to retrieve the baby.

The referring neonatal registrar describes the baby as tachypnoeic and lethargic, although still breastfeeding. The most recent ammonia level, taken 30 minutes before the call, was 500 µmol/L (reference range < 50 µmol/L).

In order to get the patient to your unit and initiate renal replacement therapy as quickly as possible, outline:

a) The advice that you will give to the referring doctor. (45% marks)

b) The principles that will guide this transport and transport team. (30% marks)

c) The steps that you will take at your hospital prior to the patient's arrival. (25% marks)

Maximum Score	6.00
Percentage scoring ≥5/10	88%

Examiners' comments:

This question required candidates to think about management of a metabolic emergency complicated by the logistics and practicalities of transport. Answers were expected to cover ascertainment and appropriate use of expertise and resources at the referring hospital; initial resuscitation, workup and treatment; how to expedite transport; and appropriate preparation and liaison to initiate CRRT on arrival. Most candidates did well and clearly understood the subject matter, but answers often lacked the comprehensive approach required to score highly.

Reference(s):

Savy N et al. Acute pediatric hyperammonemia: current diagnosis and management strategies. Hepat Med. 2018;10:105-115.

Summar ML, Mew NA. Inborn Errors of Metabolism with Hyperammonemia: Urea Cycle Defects and Related Disorders. Pediatr Clin North Am. 2018 Apr;65(2):231-246.

Question 14

A 2-year-old male is reviewed on your ward round. He was admitted yesterday following repair of an isolated juxtaductal coarctation via thoracotomy. He is settled (your unit pain assessment tool is consistent with minimal discomfort), endotracheally intubated and spontaneously breathing, and has been fasted for extubation.

Ventilation:	CPAP/Pressure Support 10/5 cmH_2O
Heart rate:	100 beats/minute
Blood pressure:	(right radial arterial line) 130/60 mmHg
Drug infusions:	sodium nitroprusside 3 mcg/kg/minute; morphine 20 mcg/kg/hour

Outline the pathophysiology and your management of this hypertension.

Maximum Score	5.75
Percentage scoring ≥5/10	25%

Examiners' comments:

Responses to this question were generally poor and superficial, with few candidates able to articulate the reasons for hypertension in this group. Answers were expected to cover both general causes (pain, fluid overload) and specific problems (residual arch obstruction, adrenergic and renin-mediated).

Reference(s):

Critical Heart Disease in Infants and Children, 3rd Ed Ross M. Ungerleider & Kristen Nelson et al 2019 Ch 27.

Question 15

a) List the three main features of thrombotic microangiopathies. (10% marks)

b) In table form, compare:

- Congenital thrombotic thrombocytopenia (cTTP)
- Acquired thrombotic thrombocytopenia (aTTP) and
- Shiga toxin-producing Escherichia coli haemolytic uraemic syndrome (STEC-HUS)

With regard to the following five features:

i. Aetiology

ii. Typical age at presentation

iii. Diagnostic laboratory tests

iv. Major clinical features

v. Specific therapies (90% marks)

Maximum Score	8.00
Percentage scoring ≥5/10	75%

Examiners' comments:

Candidates generally demonstrated a good understanding of the clinical manifestations and management of these diseases. Poor answers lacked sufficient detail to distinguish the entities and were unclear about specific diagnostic tests.

Reference(s):

Joly BS. Understanding thrombotic microangiopathies in children. Intensive Care Med. 2018;44(9):1536-1538.

Question 16

A 12-month-old male infant has had a 15-minute tonic-clonic seizure on the ward while fasting for anaesthesia for a brain MRI to investigate developmental delay. He has not had seizures before. The bedside blood glucose level test was unrecordably low, and was repeated with the same result. The medical emergency team administered 5 ml/kg of 10% glucose via intraosseus (IO) needle. The seizure ceased after IO midazolam and he required intubation and ventilation for apnoea.

A blood sample collected when an intravenous cannula was sited yielded the following results:

Parameter	Patient Value	Normal Range
pH	7.08*	7.31 – 7.41
pCO_2	46 mmHg (6.1 kPa)	41 – 51 (5.5 - 6.8)
Base excess	-12*	-2 to +2
Bicarbonate	12 mmol/L*	23 – 29
Lactate	7.4 mmol/L*	0.5 – 2.2
Glucose	2.1 mmol/L*	3.0 – 5.5
Ketones	2.2 mmol/L*	< 0.6

He has been admitted to PICU and airway, breathing and circulation are now stable.

a) What are the relevant causes of hypoglycaemia in this child? Provide supporting features and investigations for each cause. (70% marks)

b) Outline PICU management goals for the next 8 hours. (30% marks)

Maximum Score	6.25
Percentage scoring $\geq$5/10	50%

Examiners' comments:

To score highly, candidates needed to address all aspects of part a) of the question in their answer; however, some candidates omitted to provide supporting features for each potential cause of hypoglycaemia, concentrating instead on investigation. Some answers were quite superficial, with an inadequate or unfocussed approach to differential diagnosis and investigation. Answers were expected to cover ketotic hypoglycaemia, possible metabolic and endocrine disorders, liver disease and sepsis.

Reference(s):

Textbook of Pediatric Intensive Care, 5th Ed Mark C. Rogers & David G Nicholls et al 2016 Ch 106 p 1761

Question 17

A previously well 18-month-old boy has sustained 45% superficial and deep thickness scald burns to face, neck, anterior upper limbs, hands, anterior trunk and upper lower limbs.

He is three days into his ICU admission, having been intubated, ventilated and stabilised. A series of burn debridement and skin grafting procedures are planned over the next four weeks.

Outline the important management considerations over the next month.

Maximum Score	5.75
Percentage scoring ≥5/10	63%

Examiners' comments:

Candidates were directed to address important management considerations over the next month. To score highly, answers needed to be wide-ranging and holistic. Most candidates described an approach to airway and respiratory support, vascular access and analgesia; however, few went on to discuss nutrition and metabolism, sepsis surveillance, mobilization, maintenance of strength and range of motion, various family supports etc. There was a tendency to focus on acute management, despite the directive in the question.

Reference(s):

Duran C, R.L. Sheridan. Current Concepts in the Medical Management of the Pediatric Burn Patient, Current Trauma Rep (2016) 2:202-209.

Question 18

a) List five effects of critical illness on the gut. (20% marks)

b) List five causes of diarrhoea in the critically ill child. (20% marks)

c) Discuss your approach to new-onset diarrhoea with high gastric residual volumes in a 3-year-old patient who has been intubated and ventilated for five days with acute respiratory failure secondary to viral pneumonia. (60% marks)

Maximum Score	5.85
Percentage scoring ≥5/10	50%

Examiners' comments:

Many candidates struggled with part c) of the question, with some candidates focusing on the residual gastric volumes and not addressing the diarrhea. Candidates were expected to describe an approach that included seeking a cause for the new symptoms, fluid and electrolyte management, and investigation of current and potential alternative feeding routes, regimens, and types.

Reference(s):

Pathophysiology of the Gut and the Microbiome in the Host Response. PCCM 2017;18:S46–S49

Diarrhoea in the critically ill. Curr Opin Crit Care 2015, 21:142–153

Guidelines for the Provision and Assessment of Nutrition Support Therapy in the Pediatric Critically Ill Patient: Society of Critical Care Medicine and American Society for Parenteral and Enteral Nutrition. PCCM. July 2017 • Volume 18 • Number 7

Question 19

A previously well 8-month-old infant was admitted to your unit overnight with presumed septic shock on a background of loose frequent stools for 48 hours.

Resuscitation involved 30% high-flow nasal prong oxygen, 30 ml/kg of 0.9% saline and broad spectrum antibiotics.

The infant is now haemodynamically stable on weaning noradrenaline (0.025 mcg/kg/minute) and passing 0.5 ml/kg/hour urine. There is some ongoing diarrhoea.

This morning's arterial blood gas is shown below:

Parameter	Patient Value	Normal Range
pH	7.21*	7.35 – 7.45
$PaCO_2$	23 mmHg (3.06 kPa)*	36 – 44 (4.60 – 6.40)
PaO_2	85 mmHg (11.3 kPa)	80 – 100 (11.0 – 14.4)
HCO_3^-	8.8*	22.0 – 32.0
Base excess	-23.9 mmol/L*	-2.0 to +2.0
O_2 saturation	93.5%	90.0 – 95.0
Sodium	144 mmol/L	133 – 146
Potassium	2.8 mmol/L*	3.5 – 5.3
Chloride	126 mmol/L*	95 – 108
Lactate	3.0 mmol/L*	< 2.0
Glucose	5.5 mmol/L	3.6 – 5.5

Urine electrolytes:

Parameter	Patient Value
pH	6.00
Urine Chloride	57 mmol/L
Urine Sodium	61 mmol/L
Urine Potassium	38.2 mmol/L
Urine HCO_3^-	< 2 mmol/L

a) Describe this infant's metabolic derangement and suggest the likely cause. (30% marks)

b) Discuss the use of bicarbonate infusions in PICU. (70% marks)

Maximum Score	4.75
Percentage scoring $\geq$5/10	0%

Examiners' comments:

Candidates were expected to use all of the presented information to comment on the acid-base status, including the anion gap, respiratory compensation and the urinary anion gap. This was poorly done, and candidates lost relatively easy marks as a consequence. Responses to the second part of the question were also disappointing; candidates often producing an indiscriminate list of scenarios in which bicarbonate is used. Context was expected, with acknowledgment of the potential detrimental effects and the limited evidence to support bicarbonate use in most situations.

Reference(s):

Jaber S, et al. Sodium bicarbonate therapy for patients with severe metabolic acidaemia in the intensive care unit (BICAR-ICU): a multicentre, open-label, randomised controlled, phase 3 trial. Lancet. 2018 Jul 7;392(10141):31-40.

Question 20

a) Define the term 'clinical guideline'. (10% marks)

b) Define the term 'clinical pathway'. (10% marks)

c) List four characteristics of a patient diagnosis or condition that make it suitable for integration into a clinical pathway. (40% marks)

d) Outline the steps you would take to design and implement a clinical pathway in your unit. (40% marks)

Maximum Score	8.25
Percentage scoring ≥5/10	63%

Examiners' comments:

Most candidates did well on this question. Those who did not were unclear about the differences between a pathway and a guideline, or did not have a comprehensive approach to implementation. Several candidates misinterpreted part c) and gave a list of examples of conditions, rather than characteristics of conditions, that would be suitable for a clinical pathway.

Reference(s):

Bjurling-Sjoberb P. Struggling for a feasible tool - the process of implementing a clinical pathway in intensive care: a grounded theory study. BMC Health Services Research 2018; 18: 831.

Rotter T, Kinsman L, James EL, Machotta A, Gothe H, Willis J, Snow P, Kugler J. Clinical pathways: effects on professional practice, patient outcomes, length of stay and hospital costs. Cochrane Database of Systematic Reviews 2010, Issue 3. Art. No.: CD006632.

Rakes L et al. Development and implementation of a standardized pathway in the Pediatric Intensive Care Unit for children with severe traumatic brain injuries. BMJ Open Quality 2016;5:u213581.w5431.

Question 21

With respect to Kawasaki disease:

a) List six risk factors for the development of cardiac involvement. (15% marks)

b) Outline the acute cardiac manifestations. (40% marks)

c) Outline the management of acute cardiac manifestations. (45% marks)

Maximum Score	6.15
Percentage scoring ≥5/10	50%

Examiners' comments:

Some candidates had limited knowledge of this topic. Few were able to describe cardiac manifestations beyond coronary artery dilatation. Parts b) & c) specifically asked about acute cardiac manifestations, and answers should have also contained reference to depressed cardiac function, pericarditis, mitral regurgitation, Kawasaki Disease Shock Syndrome etc.

Reference(s):

McCrindle BW et al. Diagnosis, Treatment, and Long-Term Management of Kawasaki Disease: A Scientific Statement for Health Professionals From the American Heart Association. Circulation 2017; 135:e927.

Question 22

Prone positioning is a recommended adjuvant therapy for the management of hypoxic respiratory failure.

a) Outline the mechanisms for improved oxygenation with prone positioning. (40% marks)

b) Discuss the evidence for prone positioning in hypoxic respiratory failure. (40% marks)

c) List the contraindications to prone positioning. (20% marks)

Maximum Score	6.75
Percentage scoring ≥5/10	63%

Examiners' comments:

Candidates were expected to outline the effects of proning on regional mechanics, recruitment, VQ matching, etc. This part of the question was superficially done by most. Knowledge of the major outcomes of the 2 clinical trials referenced below was expected.

Reference(s):

Rogers' Textbook of Pediatric Intensive Care 5th Ed. Ch 49: Adjuvant therapies in ALI and ARDS.

Guerin C et al. Prone positioning in severe acute respiratory distress syndrome. NEJM 2013;368(23):2159-68.

Curley MA et al. Effect of prone positioning on clinical outcomes in children with acute lung injury: A randomized controlled trial. JAMA 2005;294:229-37.

Question 23

A six-week-old boy is admitted with bacterial pneumonia (Streptococcus pneumoniae) and cardiac failure. He has been diagnosed with coarctation of the aorta and a large VSD in another centre and been treated with diuretics and fluid restriction prior to transfer to your unit.

He is oliguric, with a creatinine of 150 µmol/L (reference range 0 – 60 µmol/L).

a) List likely causes of renal failure in this patient. (30% marks)

b) Outline your management plan for this baby including stabilisation, investigations, medications and timing of surgery. (70% marks)

Maximum Score	6.00
Percentage scoring ≥5/10	88%

Examiners' comments:

This was a relatively straightforward question, with marks available for a simple list of causes of kidney injury in this scenario. The second part of the question required the candidate to demonstrate an ability to prioritise management of the acute infection, acute kidney injury and cardiac lesion. Candidates were expected to recognize the need for early surgical repair, but to ensure adequate resuscitation and treatment to minimize morbidity associated with surgery in this infant.

Question 24

a) List six common underlying diseases or processes causing a bronchopleural fistula (BPF) in children. (30% marks)

b) Outline your approach to investigation, diagnosis and management of children with BPF. (70% marks)

Maximum Score	4.75
Percentage scoring ≥5/10	0%

Examiners' comments:

Simple marks were lost for not providing an adequate list of the causes of bronchopleural fistula. In the second part of the question most candidates provided very limited and conservative answers with respect to diagnosis and management. Few candidates described interventional approaches to persistent air leak

Reference(s):

Increased incidence of bronchopulmonary fistulas complicating pediatric pneumonia. McKee AJ et al. Pediatr Pulmonol. 2011 Jul;46(7):717-21.

Hathorn C et al. Bronchial balloon occlusions in children with complex pulmonary air leaks. Arch Dis Child. 2013;98(2):136-40.

Sakata KK. Persistent air leak – review. Respir Med 2018 ;137:213-218.

Question 25

With respect to an adaptive trial design testing the safety and efficacy of novel therapeutic agents in ICU patients with COVID-19:

a) Explain what is meant by an adaptive trial. (30% marks)

b) Explain why this design is being considered. (10% marks)

c) Outline the advantages and disadvantages. (60% marks)

Maximum Score	4.33
Percentage scoring ≥5/10	0%

Examiners' comments:

The quality of answer provided was poor, given the topical nature of the question and the fact that it has also been asked in a very recent exam. Very few candidates had any grasp of the subject matter, including the core concepts of interim analyses and trial modifications.

Reference(s):

van Werkhoven et al. Adaptive designs in clinical trials in critically ill patients: principles, advantages and pitfalls. Intensive Care Med 45, 678–682 (2019).

https://intensivecarenetwork.com/adaptive-trial-design/

Question 26

An 11-year-old, previously well boy is transferred to PICU following intubation and ventilation at a regional centre for depressed conscious state.

He has a 5-week history of vomiting (up to 10 times per day) and polydipsia, and a 2-day history of increasing drowsiness and abnormal movements. He presented to a regional centre with a Glasgow Coma Scale of 5.

His initial venous blood gas is shown below:

Parameter	Patient Value	Normal Range
pH	7.53*	7.35 – 7.45
$PaCO_2$	28 mmHg (3.7 kPa)*	35 – 45 (4.7 – 6.0)
HCO_3	24 mmol/L	18 – 24
Base excess	6 mmol/L*	-2 to +2
Lactate	6.1 mmol/L*	< 2.0
Sodium	118 mmol/L*	134 – 154
Potassium	2.0 mmol/L*	3.5 – 4.5
Chloride	70 mmol/L*	90 – 110
Glucose	7.9 mmol/L*	3.0 – 6.0

a) List the potential causes of severe hyponatraemia in this boy. (30% marks)

b) What are the clinical sequelae of severe hyponatraemia? (10% marks)

c) Outline your initial investigation and management. (40% marks)

d) Outline the major complication of serum sodium correction. (20% marks)

Maximum score	7.75
Percentage scoring ≥5/10	75%

Examiners' comments:

This was a straightforward clinical question that most candidates answered well. Most were able to outline a management approach, with those conveying good knowledge of osmotic demyelination syndrome scoring most highly.

Question 27

During a pandemic there may be overwhelming demand for intensive care.

Outline the principles involved in decision-making about the ethical allocation of critical care resources when demand exceeds capacity during a global pandemic.

Maximum Score	6.25
Percentage scoring ≥5/10	13%

Examiners' comments:

A response outlining the basis for ethical decision making and how this would affect traige, unit function and resource allocation was expected. Responses limited to the "nature of ethics" without real world examples of critical care did not score as well. Some responses demonstrated an appreciation of recent published guidelines reflecting a wider appreciation of the complexities of current practice.

Reference(s):

Warrillow S et al. ANZICS Guiding principles for complex decision making during Pandemic COVID-19 Crit Care Resusc 2020; 22 (2): 98-102.

Jansen M et al. Ethical considerations for paediatrics during the COVID-19 pandemic: A discussion paper from the Australian Paediatric Clinical Ethics Collaboration. J Paediatr Child Health, 56: 847-851.

Emanuel E et al. Fair Allocation of Scarce Medical Resources in the Time of Covid-19. N Engl J Med 2020; 382:2049-2055.

Question 28

(Images removed from report.)

A 3-month-old, 5 kg baby girl with trisomy 21 and an unrepaired primum atrial septal defect is scheduled for an elective anorectoplasty for an imperforate anus. The general surgical registrar has requested a postoperative PICU bed for one night. The surgery is due to be performed next week. You are asked to review the booking.

The child was reviewed in cardiology clinic two weeks ago. Current medications are oral frusemide 3 mg twice a day and spironolactone 6.25 mg twice a day.

The echo report from that visit reads:

"Dilated RA, bidirectional flow across large ostium primum ASD. Moderate right AV valve regurgitation. The LV appears small relative to the RV, with flattened septal motion and normal LV function. The RV is dilated and hypertrophied with normal function. There is evidence of pulmonary hypertension. The left lower pulmonary veins are small."

A plain AP (Figure 28.1) and lateral chest X-ray (Figure 28.2) is shown on pages 9 and 10 respectively.

a) List the main features on the AP and lateral chest X-ray. (20% marks)

b) Outline the implications of this echo report for the procedure and the postoperative course in the PICU. (40% marks)

c) How will you manage the overall situation? (40% marks)

Maximum Score	6.25
Percentage scoring ≥5/10	38%

Examiners' comments:

Simple marks were lost by incomplete description of CXR features. Most candidates recognized that this was a high-risk anaesthetic, but most responses were limited in their description of the potential problems. The third part of the question asked candidates about management of the overall situation, rather than just the patient, and good answers incorporated exploration of whether the surgery was necessary, involvement of appropriate teams for discussion, communication of risks and ensuring appropriate allocation of resources.

Reference(s):

Critical Heart Disease in Infants and Children, 3rd Edition, Chapter71: Pulmonary Hypertension.

A Practice of Anesthesia for Infants and Children, Sixth Edition. Chapter 23: Anesthesia for noncardiac surgery in children with congenital heart disease.

Question 29

Discuss the pathogenesis, differential diagnosis and management of neutropenic colitis (typhlitis).

Maximum Score	5.00
Percentage scoring ≥5/10	13%

Examiners' comments:

Answers generally demonstrated limited understanding of an important problem. The pathogenesis aspect of the question was particularly poorly answered. The section on management could be answered with less specific knowledge and was better handled, although some candidates failed to mention some very basic aspects, such as gut rest.

Reference(s):

Roger's Textbook of Pediatric Intensive Care, 5th Edition. Ch 101, pp1669-70; Ch 115, pp1876-77.

F.G. Rodrigues, G. Dasilva, S.D Wexner. Neutropenic enterocolitis, World Journal of Gastroenterology 2017 January 7; 23(1): 42-47.

Question 30

A 6-year-old boy is referred to your PICU three hours after having sustained 25% burns when a propellant was thrown onto an open fire.

He is in the Emergency Department of a small country hospital staffed by GPs (including a GP-anaesthetist) 160 km away.

The burns are over the face, upper chest and lower arms, and are estimated to affect ~25% body surface area.

The boy is conscious and alert. There is no drooling, stridor nor hoarseness. There are blisters on the face with mild facial swelling and a small amount of blackening around the nares without obvious singeing of the nasal hairs. There are no blisters or erythema seen in the mouth.

a) Discuss the factors you will consider when advising the referring doctor regarding airway management. (60% marks)

b) Discuss the factors you will consider when recommending the optimal mode of transport. (40% marks)

Maximum Score	5.50
Percentage scoring ≥5/10	13%

Examiners' comments:

Many candidates wrote about general burns management (fluid resuscitation formulae, etc), rather than what the question asked - airway management of a burns patient in a small facility several hours away. Candidates were expected to recognize advantages and disadvantages of intubation in this scenario and discuss these in the context of local resources and capabilities, likelihood of progression of swelling, and the impact of intubation on subsequent management and transport. Many answers to the second part of the question were inadequately brief; candidates were asked to discuss the factors they would consider, not to simply list them.