COLLEGE OF INTENSIVE CARE MEDICINE
OF AUSTRALIA AND NEW ZEALAND

REPORT OF THE
INTENSIVE CARE FIRST PART EXAMINATION

JULY / SEPTEMBER 2021

This report is prepared to provide candidates, tutors and their supervisors of training with information about the examination. The report does not constitute model answers but is a guide as to what was expected.

Unsuccessful candidates should read and then discuss the report with their tutors to prepare appropriately for future examinations.

The exam included two 2.5 hour written papers, each comprised of ten short answer questions and fifty multi-choice questions. Candidates were required to perform at a satisfactory level in the written before being eligible to present for the oral part of the exam. The oral was comprised of eight ten-minute viva stations.

OVERALL STATISTICS

Total number of candidates presenting for the written examination:	100
Number of candidates scoring > 50% in the written:	44
Number of candidates scoring 45 – 50% in the written:	12
Number of candidates carrying a written score:	1
Total number invited to the oral section based on written marks:	57
Total number of candidates successful at the CICM First Part Exam:	51

SUCCESSFUL CANDIDATES

Dr Tahiya	Amin		Dr Sean	Lannon
Dr Madhumati	Asundi		Dr John	Lee
Dr Parisha Kaur	Bisram		Dr Amy	McGowan
Dr Hugh	Brigden		Dr Ellen	McGuckin
Dr Andrew	Chesher		Dr James	Milosh
Dr James	Chu		Dr Rhalumi Daniel	Obute
Dr Oscar	Close		Dr Georgia	Peters
Dr Madeline	Coxwell Matthewman		Dr Alix	Pichon
Dr Justin	Dalby		Dr Ashleigh	Punch
Dr Mark	Elliman		Dr Samuel	Rudstein
Dr Philip	Emerson		Dr Matthew	Self
Dr Felicity	Few		Dr Abdelghafar	Sharara
Dr Luke	Fox		Dr Matthew	Shen
Dr Carl	Gao		Dr Isuru	Sirisinghe
Dr Simon	Gordon		Dr Lachlan	Stewart
Dr Hannah	Hall		Dr Li Theng Novia	Tan
Dr Elizabeth	Hallt		Dr Annie	Tan
Dr Owen	Hawksworth		Dr Rebecca	Tee
Dr Matthew	Holmes		Dr Trang	Tran
Dr Frederick	Hopkinson		Dr Shilpa	Veerappa
Dr Hector	Hughes		Dr Timothy	Wareing
Dr Hasini	Jayasinghe		Dr Choon Lim	Wong
Dr Sean	Keem		Dr Jennifer	Wright
Dr Tae Young	Kim		Dr Naveen	Yadav
Dr Yujin	Ko		Dr Wenyu	Zhang
Dr Mai-Ing	Koh			

EXAMINERS' COMMENTS

Candidates are reminded that all questions are scored equally, hence time should be apportioned accordingly. On occasion some questions were not attempted and this denies the candidate an opportunity to gain valuable marks. Candidates are encouraged to attempt all questions.

Candidates are expected to have a underline detailed knowledge and depth of understanding of "level I" topics. Candidates are strongly encouraged to read widely to gain a high level of understanding and are reminded to ensure writing is legible.

SHORT ANSWER QUESTIONS

1. Describe the regulation of body water.

28% of candidates passed this question.

This is a level 1 topic. An understanding as to how the body regulates water is crucial to the daily practice of critical care, this topic is well described in the major texts. This type of question lends itself to the basic template of sensor mechanisms, central processing and integration with effector limbs and feedback loops. However, high scoring answers require a quantification of responses and an introduction into how these processes are integrated and fine-tuned.

2. Describe the pharmacology of lidoocaine.

71% of candidates passed this question.

The answers for this question were generally of a good standard. Lidocaine is a core drug in intensive care practice and thus a high level of detail was expected. This question was best structured using a standard pharmacology template (pharmaceutics, pharmacokinetics and pharmacodynamics). A small number of answers omitted any pharmaceutic elements. Another common error was the use of vague and imprecise statements. For example, many answers stated that the maximum dose (without adrenaline) is 3 mg/kg, without specifying that this is subcutaneous.

The concept of the ratio of the dose required to produce cardiovascular collapse to that required to induce seizures (CC/CNS ratio) was often mentioned. However, in many cases this was conveyed simply as an abbreviated statement without any additional explanation leaving the examiner unsure as to whether the candidate understood the concept (and thus unable to award any additional marks). In addition, many candidates confused the order of this ratio (incorrectly referring to it as a CNS/CC ratio of 7). Lastly, few answers made specific mention of the narrow therapeutic index and the associated implications for use in the ICU.

3. Discuss the physiological determinants of cardiac output.

65% of candidates passed this question.

Although the pass rate for this question was reasonably high the examiners commented on a lack of detailed knowledge within most answers for such a core component of our daily practice. Several candidates failed to provide a normal value and only few provided anything other than 5l/min.

There was a general lack of detail, and at times, some confusion about the Frank Starling effect. Most candidates outlined the major determinants of stroke volume, although many were light on the determinants of each or incorporated incorrect facts. Several candidates did not mention HR as a determinant of CO.

4. Compare the pharmacology of fluconazole and amphotericin.

6% of candidates passed this question.

This question exposed an area of the syllabus neglected by the candidates. Answers were generally vague in detail with lots of incorrect facts and generally displayed a very limited knowledge. Antifungal agents are regularly used in critically ill patients either as treatment or prophylaxis. An understanding of the aspects of these drugs with respect to spectrum of activity, mechanism of action, specific PK and PD properties as well as potential side effects would have been the basis for this compare and contrast question. Examiners want to be convinced that the candidates understand the strengths and weaknesses of each drug and in which circumstances one agent might be used in preference to the other.

5. Write detailed notes on angiotensin, including its synthesis, role within the body and regulation.

24% of candidates passed this question.

This question provided headings for the answer template. Good answers integrated the required facts from the appropriate chapters of the major texts. Most answers lacked detail surrounding the factors that increase or decrease angiotensin activity. Few answers provided any detail as to all the mechanisms through which angiotensin exerts it effects. A lot of answers focussed singularly on the vascular effects of angiotensin. Overall, there was often a paucity of detail, with vague statements and incorrect facts.

6. Describe the functions of the placenta (80% marks). Outline the determinants of placental blood flow (20% marks).

49% of candidates passed this question.

There was a wide range of marks for this question with a few candidates scoring excellent marks. Those answers that scored well provided a comprehensive list of functions as well as an explanation as to the what, how and/or why of these functions. Poorer answers omitted some of the functions or failed to elaborate on them by providing only a limited list. The second component of the question was generally well outlined, most candidates provided some estimate of normal values at term and a simple elaboration regarding the factors that affect placental blood flow.

7. Outline how the measurement of the following can be used in the assessment of liver function (25% marks of each):
- **Albumin**
- **Prothrombin time**
- **Glucose**
- **Ammonia**

54% of candidates passed this question.

This was a new question and overall, most candidates provided some detail on each component as requested. Those answers that used a simple template for each section generally scored better than those who wrote in a paragraph style for each section. Areas expected to be covered included the following; a definition of the variable to provide context, a normal value and the range of influences that effect the variable both related to liver function and or extrinsic to the liver (attempting to introduce the concepts of sensitivity and specificity for each test). Stronger answers provided some context as to whether the variable was sensitive to acute or chronic changes in liver function and which synthetic/metabolic component of the liver the variable represented.

8. Describe the anatomy of the internal jugular vein including surface anatomy landmarks relevant to central venous line insertion.

38% of candidates passed this question.

The overall pass rate for this question was poor considering how relevant this area of anatomy is in our daily practice. Better scoring answers used a template including a general description, origin, course and relations, tributaries and as requested in this question, the surface anatomy. Many answers that scored poorly only provided the briefest detail, were vague in their descriptions and incorrect with respect to the facts presented or imprecise with respect to the terminology used.

9. Outline the classification and effects of beta-blocking drugs, including examples (50% marks). Compare and contrast the pharmacokinetics of metoprolol with esmolol (50% marks).

59% of candidates passed this question.

This was a two-part question with marks and thus timing of the answers given as a percentage. There are generally many ways to classify drugs within the same class. These are usually well described in the relevant recommended pharmacological texts. Receptor distribution throughout the body and the effect of the drug-receptor interaction are useful ways to organise systemic pharmacodynamic responses, as opposed to a list of organ systems with associated vague statements of interaction.

10. Describe the ventilation / perfusion (V/Q) relationships in the upright lung according to West's zones (40%). Explain the physiological mechanisms responsible for these relationships (60%).

47% of candidates passed this question.

This is a core aspect of respiratory physiology, and a detailed understanding of this topic is crucial to the daily practise of intensive care. As such the answers were expected to be detailed. Strong answers included precise descriptions of the zones of the lung as described by West and related these to the V/Q relationship in the upright lung. Generally, most candidates scored well in this section. Diagrams were of varying value. However, an impression from the examiners was that candidates spent too much time on this first section and ran out of time for a detailed answer in the second section. The answers to the second section seemed rushed and were often lacking in detail with many incorrect facts. This question highlights the importance of exam technique preparation in the lead up to the written paper.

11. Provide a detailed account of the side-effects of armiodarone.

17% of candidates passed this question.

The question asked for a detailed account of the side effects of amiodarone, hence those candidates that just provided a list or outline scored less well. It was expected that candidates provide some detail of the side effect. Answers that scored well prioritised those relevant to ICU clinical practice. Many provided disorganised outlines of the side effects and frequently the cardiovascular side effects were poorly explained. Many candidates omitted the important drug interactions of amiodarone use and few candidates related the side effect profile to the duration of treatment.

12. Explain the physiological factors that affect airway resistance.

31% of candidates passed this question.

It was expected candidates cover the breadth of the factors that affect airway resistance. Generally, as a concept the type of flow (laminar vs turbulent) was answered well by most candidates, however many failed to mention the other factors that affect airway resistance. Airway diameter as a primary determinant of airway resistance was commonly omitted. Better answers which covered the factors affecting airway diameter classified them broadly and included examples such as physical compression/external obstruction, broncho-motor tone and local cellular mechanisms. Some answers did not explain these factors in enough detail and often with incorrect facts.

13. Describe the factors that affect mixed venous oxygen saturation.

49% of candidates passed this question

Mixed venous oxygen saturation is used as a surrogate marker for the overall balance between oxygen delivery and oxygen consumption. A good answer stated this, described the importance of where it is measured and went on to describe the various factors that affect oxygen delivery and consumption. Descriptions of the factors that affect oxygen saturation of haemoglobin, partial pressure of oxygen in the blood and position of oxygen-haemoglobin dissociation curve were necessary to score well. Important omissions were factors that increased and decreased oxygen consumption. While many candidates were able to correctly write the equations for oxygen content and oxygen flux, they then failed to describe how the variables within these equations were related to mixed venous oxygen saturation.

14. Describe the production, action and regulation of thyroid hormones.

81% of candidates passed this question.

This question was divided in three sections to help candidates formulate an answer template, which for the most part was answered well. Most answers included a detailed description of the production and regulation of thyroid hormones, including the importance of negative feedback. A brief description of the action of thyroid hormones on intracellular receptors, and a system-based description of physiological effects, including CHO, protein and fat metabolism was expected.

15. Classify and describe the mechanisms of drug interactions with examples.

54% of candidates passed this question.

This question has been asked previously, the answer template expected some description rather than a list of drug interactions. Generally, examples were provided for each type of interaction. The examiners reported too many vague, factually incorrect descriptions of the mechanisms and in some cases a very limited classification.

16. Classify the anti-psychotic drugs (25% marks). Outline the pharmacology of haloperidol (75% marks).

28% of candidates passed this question.

Excellent answers were able to provide a classification of antipsychotics based on either typical/atypical or first/second generation categories, provide examples of each and identify key differences in mechanism and effects. They also distinguished between butyrophenones and phenothiazines within the typical antipsychotic group. Haloperidol was identified as a butyrophenone, with description of pharmaceutics, dose and route, as well as pharmacodynamics and pharmacokinetics. Key adverse effects were detailed, focusing on those specific to haloperidol, including a description of different types of extrapyramidal symptoms and QT prolongation/ torsades de pointes.

17. Explain the components of an ECG (electrocardiogram) monitor (70% marks). Outline the methods employed to reduce artefact (30% marks).

46% of candidates passed this question.

Excellent answers described the function of the ECG device and its components. Components include electrodes, which form leads (unipolar and bipolar), the amplifier and an output device. The process of amplification and filtering (e.g., high and low pass filters), as well as monitoring and diagnostic ECG modes were described. A comprehensive list of ways to reduce artefacts, including strategies to address both patient and equipment factors was generally provided.

18. Outline the neural pathways for the pupillary light, corneal, oculomotor and gag reflexes. The anatomical course of nerves is NOT required.

43% of candidates passed this question.

This is a fact-based question with little integration of knowledge required. Those candidates who synthesised their knowledge into a succinct and precise description of afferent and efferent pathways with a description of the various sensor and integrator components scored very high marks. A good working knowledge of all the cranial nerve reflex pathways are crucial to the practise of intensive care medicine. Marks were not awarded for any anatomical description related to these pathways.

19. Outline the process of fibrinolysis (40% marks). Write short notes on the indications, mechanism of action, pharmacokinetics and side effects of tranexamic acid (60% marks).

30% of candidates passed this question.

The relative allocation of marks and thus time to be spent on each component was delineated by the relative percentages in the question. The first part of the question required a step-by-step outline of the fibrinolytic pathway with mention of the regulatory processes. Tranexamic acid is an important drug in the practice of intensive care and the question provided the headings under which to answer the question. The detail surrounding the keys aspects of this drug with respect to its use in critical care were often vague and underappreciated.

20. Describe the physical principles of haemodialysis and haemofiltration, including the factors affecting clearance (80% marks). Outline the key components of renal replacement fluids (20% marks).

28% of candidates passed this question.

A brief description of the underlying mechanisms of dialysis and hemofiltration was required. Diffusion, the predominant mechanism in haemodialysis, involves movement of solute down the concentration gradient across the semipermeable membrane. This concentration gradient is generated and maintained by counter current movement of dialysate and blood. In hemofiltration the predominant mechanism is convection and solvent drag of the solute across the semipermeable membrane by application of transmembrane pressure. The filtrate is then replaced by replacement fluid. Small molecules are effectively removed by dialysis whereas hemofiltration can remove small and middle molecules. Various factors that impact clearance in haemodialysis and haemofiltration were expected separately. Constituents of replacement fluid should have included three broad headings of electrolytes, buffer and sterile water. Many answers lacked the details of how counter current mechanisms help, the difference in the two modalities in regard to clearance of molecules, how clearance is impacted by protein binding and volume distribution, sieving coefficient of the membrane and flow rates of blood and dialysate (or effluent) flow. The constituents of replacement fluid lacked details of various types of electrolytes, the common buffers and the strong ion difference.

MULTIPLE CHOICE QUESTIONS – PAPERS 1 AND 2

94% of candidates passed overall:
94% of candidates passed Paper 1.
88% of candidates passed Paper 2.

DAY 1

VIVA 1

This viva will assess your knowledge of renal physiology.

Please interpret the following blood gas:

Temperature	37.5°C		
pH	7.31	BE	-4 mEq/L
pCO_2	39 mmHg (5.2 kPa)	Na^+	136 mmol/L
pO_2	84 mmHg (11.2 kPa)	K^+	3.0 mmol/L
HCO_3	18 mmol/L	Cl^-	101 mmol/L
FiO_2	30%	Lactate	3.4 mmol/L

100% of candidates passed this question.

VIVA 2

This viva will assess your knowledge of glucose absorption and metabolism.

Describe the breakdown of carbohydrates and subsequent absorption in the gastrointestinal tract.

95% of candidates passed this question.

VIVA 3

This viva will assess your knowledge of coagulation.

What are the principles behind viscoelastic haemostatic assays like TEG and ROTEM?

(Image removed from report).

100% of candidates passed this question.

VIVA 4

This viva will assess your knowledge of sedative pharmacology.

Describe the pharmaceutics of propofol.

100% of candidates passed this question.

VIVA 5

This viva will assess your knowledge of endocrine physiology and pharmacology.

Outline the structure and secretions of the adrenal gland.

70% of candidates passed this question.

VIVA 6

This viva will assess your knowledge of respiratory mechanics.

Using the letters in Figure 1 below, what are the components of the work of breathing?

(Image removed from report).

100% of candidates passed this question.

VIVA 7

This viva will assess your knowledge of central venous pressure (CVP) and its measurement.

What are the cardiac events related to the roman numerals in the CVP trace below?

(Image removed from report).

95% of candidates passed this question.

VIVA 8

This viva will assess your knowledge on microbiology and antimicrobials.

The microscopic image (pink colour) above is from a septic patient. How are bacteria classified?

(Image removed from report).

95% of candidates passed this question.

DAY 2

VIVA 1

This viva will assess your knowledge on acid-base.

Define pH.

Describe how pH is measured by the blood gas machine?

89% of candidates passed this question.

VIVA 2

This viva will assess your knowledge on end-tidal CO_2 and pulmonary vasculature.

What are the factors that lead to increase in the difference between $PaCO_2$ and $PETCO_2$?

95% of candidates passed this question.

VIVA 3

This viva will assess your knowledge on thiopentone pharmacology.

Why does thiopentone have a rapid onset of action?

63% of candidates passed this question.

VIVA 4

This viva will assess your knowledge on GIT physiology. Outline the functions of the stomach.

How do proton pump inhibitors act?

100% of candidates passed this question.

VIVA 5

This viva will assess your knowledge on cardiovascular physiology.

Outline the structure of cardiac muscle and explain how it contracts.

56% of candidates passed this question.

VIVA 6

This viva will assess your knowledge on thermoregulation.

What is temperature and how can it be measured?

84% of candidates passed this question.

VIVA 7

This viva will assess your knowledge of hepatic function and lactate physiology.

Which letter on the diagram points to the functional unit of the liver?

(Image removed from report).

50% of candidates passed this question.

VIVA 8

This viva will assess your knowledge of the coagulation system.

This figure represents a thrombo-elastography tracing.

Describe what it shows and what is indicated by a, b, c, & d.

(Image removed from report).

89% of candidates passed this question.

DAY 3

VIVA 1

This viva will assess your knowledge of opioids.

What classification of opioid receptors do you know?

78% of candidates passed this question.

VIVA 2

This viva will assess your knowledge of cardiac anatomy and physiology.

Describe the anatomy and distribution of the left and right coronary arteries.

83% of candidates passed this question.

VIVA 3

This viva will assess your knowledge of pharmacology of antiepileptics and anti-depressants.

What are the mechanisms of actions of phenytoin?

61% of candidates passed this question.

VIVA 4

This viva will assess your knowledge of respiratory physiology.

Define the "closing capacity" of the lung and explain how it can be measured using the diagram below.

(Image removed from report).

100% of candidates passed this question.

VIVA 5

This viva will assess your knowledge of renal water handling.

Explain how the kidney concentrates urine.

44% of candidates passed this question.

VIVA 6

This viva will assess your knowledge of the cardiac action potential and anti-arrhythmic drugs.

This image shows the phases of the cardiac muscle action potential.

Describe the electrophysiological processes responsible for each phase.

(Image removed from report).

67% of candidates passed this question.

VIVA 7

This viva will assess your knowledge of the anatomy of the sensory and motor pathways.

Describe the pathway that a sensory impulse felt in the periphery takes to the cortex.

67% of candidates passed this question.

VIVA 8

This viva will assess your knowledge of haematology.

Describe the formation of red blood cells.

94% of candidates passed this question.

<u>**SUMMARY OF THE EXAMINATION**</u>

The CICM First Part Examination explores the knowledge of the basic sciences that form the basis of Intensive Care practice. A detailed syllabus has been developed and clearly sets out the Level of Understanding expected for each listed topic and drug. It is important that Candidates study the Syllabus in its entirety. All questions are sourced from the Syllabus and the recommended texts are a guide to study. Some sections will require more extensive research and the use of other textbooks.

Candidates are expected to attain a level of knowledge that goes beyond just the listing of pure facts but should be able to explain, describe, collate, and synthesize that knowledge across different scenarios as they apply to Intensive Care practice. Sufficient depth of understanding and a structured approach to topics continues to remain an area of weakness for many candidates.

Candidates must allow sufficient time to prepare (typically approximately 12 months to study). Candidates are strongly encouraged to discuss their level of preparedness and to trial written and oral questions, with their Supervisor of Training and other CICM Fellows, prior to undertaking the CICM First Part Examination. The examination reports are available as a guide to areas that are covered but do not provide model answers and should be read as such.

Dr Roslyn Purcell　　　　　　　　　　　　**Dr Andrew Semark**
Chair　　　　　　　　　　　　　　　　　　**Deputy Chair**
CICM First Part Examination Committee　　　**CICM First Part Examination Committee**

December 2021