COLLEGE OF INTENSIVE CARE MEDICINE
OF AUSTRALIA AND NEW ZEALAND

REPORT OF THE FIRST PART EXAMINATION

August/October 2025

This report is prepared to provide candidates, educators and supervisors of training with information about the First Part examination. The report acts as a guide providing either a brief overview of a structure that would comprise a comprehensive answer or indicate common reasons why candidates were not successful in scoring higher in their answers. Unsuccessful candidates should read and then discuss the report with their supervisors to prepare for future exams.

The written component included two 2.5-hour papers, each comprising fifty multi-choice questions and ten short answer questions. The written paper using the angoff method to determine the pass mark. The MCQ pass mark was 65% and the SAQ pass mark was 47.81%. To progress to the oral exam a candidate needed to achieve equal to or above 62% MCQ AND equal to or above 46.04% SAQ. These values represent the angoff pass mark minus the standard error of the angoff method and for the written exam is considered a successful attempt by the First Part Examiner Court.

The oral component comprised eight ten-minute cross table oral VIVAs. The pass mark for this component of the examination was 59.2% determined by borderline regression. The candidates scoring above 55.5% (within one standard error) were also individually reviewed by the examiner court, all candidates falling within this error margin were deemed to have met a passing standard and are included in the number of candidates successful in this CICM First Part Exam.

OVERALL EXAM STATISTICS

Total number of candidates presenting for the written examination: 105

Number of candidates successful in the written component: 46

Number of candidates carrying a written pass: 10

Total number invited to the oral component: 56

Total number of candidates successful at the CICM First Part Exam: 47

WRITTEN SECTION

General Comments

This exam requires detailed knowledge and depth of understanding of the entire syllabus. Candidates should refer to the Glossary of Terms provided in the exam to determine the depth and breadth required to answer each question. The question determines the breadth of your answer and the detail required is that that could be reasonably achieved in 10minutes. Much care is taken in the specific wording and breakdown of each question to help guide candidates with the information expected. The ability to distill broad or complex concepts for some questions demonstrates a candidate's thorough knowledge of this topic and is a contributory reason why these questions are still included in the paper. Answers in point form are acceptable and encouraged, standard medical abbreviations that would be found in medical notes are also acceptable. All questions are scored equally; hence time should be apportioned accordingly, and we encourage you to attempt all questions.

Multiple Choice Questions

92% of candidates passed the multiple-choice component of the CICM First Part Examination.

Short Answer Questions

43.8 % of candidates passed the short answer component of the CICM First Part Examination.

Question 1

Describe how ligands binding to cell membrane receptors can cause a change within that cell. Illustrate your answer with a detailed example for each method.

25% of candidates passed this question

This question expected candidates to describe the four mechanisms of transmembrane signaling that are mediated by cell membrane receptors. These are:

- Ligand gated ion channels that open and close in response to ligand binding
- G protein coupled and G-protein mediated production of intracellular second messengers
- Ligand regulated transmembrane enzymes whose intracellular enzymatic activity is allosterically regulated by a ligand binding to extracellular protein binding sites.
- Transmembrane receptors that bind to and stimulate tyrosine kinase

For each mechanism, a detailed answer would describe the receptor structure, location, an example of a natural ligands and an overview of the signaling pathway and physiological effects. An example would be: Ligand gated ion channels are part of a membrane-spanning complex of protein subunits forming a channel through the membrane. Binding of a ligand causes a conformational change allowing passage of an ion(s) down its concentration gradient resulting in a change in the resting membrane potential, depolarization or repolarization. For example; nicotinic acetylcholine receptors are pentameric structures comprising 5 sub- units. They are located at the neuromuscular junction and bind acetylcholine to cause opening of Na channels causing membrane depolarisation.
Information on drug-receptor interactions such as agonism, antagonism, receptor affinity and intrinsic activity was not required.

Question 2

(a) Define dead space and its components (15% of marks).
(b) Describe the factors that affect each component (30% of marks).
(c) Outline the physiological impact of increased dead space (15% of marks).
(d) Describe methods of measurement of dead space (40% of marks).

34% of candidates passed this question.

The question structure and mark allocation is a useful guide to the level of detail required for each section.

a) The definition and components of dead space (apparatus, anatomical, alveolar and physiological) are relatively straightforward and were well answered.
b) A useful structure for this section involved a description of the factors that affect each of the components of dead space outlined in the first section. It was expected that each factor would be correlated to its effect e.g., an increase in conducting airway volume (such as in the supine position or with larger patient size) leads to increased anatomical dead space.
c) The major impact of increased dead space is a reduction in alveolar ventilation. Higher marks were gained by describing the consequences of this; changes in alveolar gas tension, compensatory changes in work of breathing and eventually respiratory failure once compensatory mechanisms are exhausted.
d) Techniques used to measure dead space are well described in both Nunn's and West's respiratory physiology textbooks. Anatomical dead space is measured using the Fowler's method (nitrogen washout) and the Bohr equation with Enghoff modifications measures physiological or total dead space. Alveolar dead space is then derived by subtracting anatomical from physiological dead space. A brief description of these concepts was expected.

Question 3

(a) Describe the action potential of the following:
(i) the sinoatrial node (35% of marks)
(ii) the cardiac ventricular muscle cells (35% of marks)
Include in your answer the phases and ionic events involved with each action potential.
(b) Explain the implications of the differences between these action potentials (30% of marks).

83% of candidates passed this question

a) Descriptions of the action potentials of the SA node and cardiac myocyte are well described in most physiology textbooks and were relatively well answered. Shape, duration and ionic events were covered in good detail in most answers.
b) An overview of the differences between the SA node and cardiac myocyte action potentials was required and then the implications of these differences. The differences expected to form a good answer included the absence of a true resting membrane potential in the SA node and differences in the duration of the action potentials, conduction velocities, action potential phases and refractory period.

Question 4

Outline the physiological effects of end stage renal dysfunction.
Changes associated with dialysis as a therapy are NOT required

28% of candidates passed this question.

This question required a structured approach to cover its breadth. An example of a structure that worked well considered the functions of the kidney (regulation of water, electrolytes and systemic blood pressure; acid-base balance; excretion of metabolic waste; endocrine functions) and then a description of the consequences of renal failure on each. Each physiological effect required a reasonably detailed discussion of the mechanism(s) by which it occurs and the consequences on the body. For example: stating in endocrine dysfunction that "renal failure leads to erythropoietin (EPO) deficiency and anaemia" would score less than stating that "reduced O2 consumption by failing nephrons => reduced hypoxic stimulation of EPO production by kidneys => reduced RBC production => anaemia.

Question 5

(a) Define pain (10% of marks).
(b) Describe how pain is detected and modulated in response to a peripheral noxious stimulus (90% of marks).

56% of candidates passed this question

a) The definition of pain is relatively straightforward and was well answered.
b) To assist in providing a comprehensive answer pain detection can be subdivided into the following;

- Peripheral nociception – including classification and role of sensitisation
- Transmission to spinal cord – including a description of fibre types and their characteristics
- Spinal cord synapse and modulation – this required only an outline of what goes on here as this is complex and not well understood. A brief description of the receptors and neurotransmitters involved at the spinal cord level and the role of first order and second order neurons and inhibitory interneurons.
- Transmission pathways from spinal cord to cortex – whilst spinothalamic was written by many the spinoreticular component of pain sensation and transmission was commonly missed.
- Descending modulation – a brief outline of the central origin and neurotransmitters involved.

Question 6

Outline the potential adverse consequences of blood product transfusion including the underlying mechanisms.

16% of candidates passed this question

This question required a structured approach to cover the breadth. A common structure in most of the recommended resources includes classification of adverse reactions into

- immune mediated
  - haemolytic vs non-haemolytic
  - immediate and delayed
- non-immune mediated.
  - acute reactions
  - delayed reactions

Not using a structured approach often resulted in the omission of whole sections. Other common omissions were in not briefly describing the mechanism of each reaction which was required to score well. Information on adverse effects related to storage lesions and massive transfusion also attracted marks.

Question 7

(a) Describe the functions of the placenta (80% of marks).
(b) Outline utero-placental blood flow and its determinants (20% of marks).

34% of candidates passed this question.

a) The synthetic, metabolic, immune and exchange functions of the placenta were generally well covered. Good answers addressed each of the synthetic, metabolic, exchange functions including and most importantly O2 and CO2 transport and the role of foetal Hb. Including a brief description on the exchange of electrolytes, glucose, nutrients, and waste products provided a comprehensive answer.

b) Utero -placental blood flow has a uterine component and a foetal component. An understanding that maternal arterial blood pressure is key was required and a brief discussion of the limited autoregulation and sparse sympathetic innervation. A reasonable range for the value of uteroplacental blood flow at term was allowed. Placental blood flow is largely regulated by metabolic products as the foetus grows and requires only a simple reference to this to gain these marks.

Question 8

Describe the anatomy relevant to performing a lumbar puncture.
Paediatric OR adult descriptions are acceptable. Descriptions of the procedure are NOT required. 29% of candidates passed this question.

This question requires candidates to demonstrate their understanding of the safety considerations in performing a lumbar puncture. High scoring answers discussed the surface and bony anatomy including the spinal cord termination, adjacent structures, safe entry sites to perform the procedure and the layers traversed to reach the subarachnoid space. Diagrams were not always useful in demonstrating this information and needed to be well labelled and accurate to score marks.

Question 9

Compare and contrast the following pharmacology of sodium nitroprusside and glyceryl trinitrate;

(a) mechanism of action (25% of marks)
(b) pharmacodynamics and toxicity (75% of marks).
Treatment of toxicity is NOT required.

21% of candidates passed this question.

The question structure provides a guide to the level of detail required for each section. High scoring answers discussed the similarities and key differences between the drugs which may influence the use of one over the other. Both drugs are commonly used level two drugs in the syllabus. A detailed knowledge of the mechanism of action, pharmacodynamic and adverse effects was expected and well covered in pharmacology textbooks. In general, given these are both primarily anti-hypertensive agents the cardiovascular pharmacodynamics carried more weight than other system effects.

Question 10

Describe the following pharmacology of meropenem:

(a) class and mechanism of action (25% of marks)
(b) spectrum of activity (20% of marks)
(c) indications for use (20% of marks)
(d) pharmacokinetic and dosing considerations in critically ill patients (35% of marks)

19% of candidates passed this question.

Meropenem is a commonly used drug in ICU and information required to do well in this question is directly applicable to everyday practice.

a) Mechanism of action was generally well answered and covered by candidates.
b) The spectrum of activity required a statement of its broad spectrum including some examples of this.
c) Indications for use were asking candidates to indicate the types of infections meropenem is preferred particularly as it is not usually the first antibiotic of choice, for example, hospital acquired infections, multi-microbial and necrotising infections, failure of first line therapy, melioidosis or any other reasonable example.
d) This section required an explanation of how critical illness changes the way meropenem is handled and hence the need to adjust dosage not necessarily just a list of the general pharmacokinetics of meropenem. A comprehensive answer included the increased dosage required in high cardiac output states as high GFR ie. burns, sepsis due to the renal handling, or the effect of renal impairment. The changes to the volume of distribution for meropenem are seen in critical illness and the relative lack of concern in hepatic failure and thus the limited need to dose reduce in these circumstances.

Question 11

Describe the control of breathing using the following headings:

(a) sensors (50% of marks)
b) controllers (40% of marks)
(c) effectors (10% of marks)

Include in your answer the location(s) and function(s) of each.

75% of candidates passed this question.

An ideal structure was represented in the breakdown of this question and gave an indication of the level of detail and time candidates should devote to describing the contribution of each to the control of breathing. This question was generally well answered. Good answers were able to integrate this sensor-controller- effector mechanism including the stimuli and effects.

a) Sensors included a detailed description of the central and peripheral chemoreceptors and their relative primary and secondary stimuli. Better answers included other sensors such as pulmonary, skeletal, and baroreceptors and briefly touched on their contribution.
b) This section required a brief description of the key areas that control breathing. These can be found in the medullary respiratory centre (CPG, VRG, DRG), the pons and the cortex. Their

functions and primary effects needed to be listed. The role of $PaCO_2$ (major determinant) and PaO_2 was also required.
c) Here only a brief description of the muscles that contribute to inspiration and expiration and the main nervous innervation would have constituted a good answer.

Question 12

(a) Define morbid obesity (5% of marks).
(b) Outline the cardiovascular changes associated with morbid obesity (95% of marks).

23% of candidates passed this question.

a) This definition is straightforward and accounted for small proportion of marks.
b) A good answer discussed the key changes in the right and left heart, pulmonary, systemic and coronary circulation and changes to the cardiac conduction pathways. The underlying mechanisms for these changes because of morbid obesity were expected.

Question 13

(a) What is lymph and what is its normal volume? (10% of marks).
(b) Outline the following with respect to lymph:
(i) composition (20% of marks)
(ii) circulation (45% of marks)
(iii) functions (25% of marks)

69% of candidates passed this question.

This topic is less commonly examined; however, it is well covered in the recommended physiology texts and was generally well done. The question breakdown provided a clear structure to approach this question and was mostly well utilised by candidates. Details that were commonly omitted included:

- the contribution of starling forces to the production of lymph
- differences between lymph and plasma
- the difference in protein and fat content depending on the areas drained

Question 14

Outline the physiology of the parasympathetic nervous system using the following headings:

(a) the anatomical origins and target organ(s) (45% of marks).
Responses of the organ(s) are NOT required.

(b) nerve fiber classification and characteristics (20% of marks)

(c) receptor types, locations and neurotransmitters (35% of marks

61% of candidates passed this question.

This question was best answered using the structure provided and ensuring the level of detail linked to the % of marks to be gained. It could be answered with the following simple information if presented with appropriate linking.

a) Craniosacral outflow.
CN III – eye,
CN VII – parotid gland
CN IX -submandibular glands,
CN X – cardiac, pulmonary and abdominal organs;
Sacral Outflow
S2-4 = pelvic and sex organs.

b) Preganglionic nerve fibres are long type B, partially myelinated and synapse on a ganglion close to the target organ. Post synaptic nerves are short type C unmyelinated.

c) Preganglionic NT is ACh onto N2 ACh receptor which is a ligand gated ion channel allowing for Na and K movement. Post ganglionic NT is ACh onto Muscarinic receptors which are G protein coupled.
- M1, M4 and M5 are in the CNS (Gq, Gi, Gq respectively)
- M2 – heart and lung (Gi – inhibition of AC and decreased cAMP)
- M3 stomach, gut and other organs (Gq – IP3/PLC).

Question 15

Explain the role of the liver with respect to the following:

(a) metabolic role in nutrition (30% of marks)

(b) other metabolic and excretory functions (30% of marks)

(c) storage and secretory functions (25% of marks)

(d) immune functions (15% of marks)

48% of candidates passed this question.

Again, the question breakdown provided a clear structure and expected level of detail for each section. Given the breadth of the question there was little time for candidates to give much more information other than a list of the roles under each category and a brief qualifying statement. This is all that was required to score well. High scoring answers included the following:

b) an outline of carbohydrates, protein and lipid metabolism in the liver, including descriptions of catabolic and metabolic processes for each.
c) an explanation of how the liver participates in drug biotransformation (phase 1+2 reactions and production of enzymes), lactate, ammonia, bilirubin and steroid hormone metabolism
d) role in nutrient and vitamin storage, blood storage and bile secretion.
e) role in phagocytosis, bacterial filtration in portal system and complement production.

Question 16

(a) Outline the structure of mitochondria (20% of marks).
(b) List the functions of mitochondria (20% of marks).
(c) Explain the role of mitochondria in the metabolism of carbohydrates (60% of marks).

74% of candidates passed this question.

a) Many answers included a diagram and description of an ovoid intracellular organelle with inner and outer membranes, an intermembrane space, an inner matrix, and cristae (or folds) on the inner membrane to increase surface area. High scoring answers described the significance of these structures.
b) This section requires a list of functions mentioning oxidative phosphorylation and any other functions. Descriptions were not expected.
c) A detailed description of both the citric acid cycle and oxidative phosphorylation was expected and the metabolic processes involved in ATP production. A number of candidates provided a step-wise chemical representation of the citric acid cycle and the various proton generation steps, this level of detail was not required to do well in this question.

Question 17

Describe the complement system using the following headings:
(a) components (30% of marks)
(b) activation pathways (10% of marks)
(c) role and functions (50% of marks)
(d) control and regulation (10% of marks)

54% of candidates passed this question.

a) The key components of the complement system are the C3 convertase, C5 convertase and membrane attack complex. These components are present as inactive precursors.
b) Broadly speaking the activation pathways include the classical (activated by immune complexes) and alternate (activated by microbial polysaccharides or pattern recognition receptors).
c) The main role of the complement system is to defend against bacterial infection. It is an important component of the innate immune system. The key functions are 9 opsonization and phagocytosis (via C3b), cell lysis, agglutination of microbes, chemotaxis (via C5a), modulation of B cell function, clearance of immune complexes and mast / basophil activation (via C3a, C4a and C5a).
d) Control is achieved via the short half-life of the activated factors and specific complement inactivators.

Question 18

a) Define the following: (10% of marks)

(i) heat

(ii) temperature

(iii) specific heat capacity

(b) Outline the principles underlying the different methods of temperature measurement using the following headings:

(i) electrical methods (60% of marks)

(ii) non-electrical methods (30% of marks)

Your answer should include examples of each method and their advantages and disadvantages of use.

40% of candidates passed this question.

a) For a measurement question the correct units for any definitions are required.

b) For this section candidates were expected to provide information on the following: Electrical thermometers

- resistance thermometers; thermistor and thermocouple
- infra-red thermometers.

Nonelectrical thermometers include

- liquid, dial and crystalline principles.

The expected information to score well included an outline of each of the underlying principles and how it is used to measure temperature, an example of a type of thermometer, and advantages and disadvantages of each method.

Question 19

Outline the following pharmacology of phenytoin:

(a) dosage (15% of marks)

(b) mechanism of action (15% of marks).

(c) adverse effects (30% of marks)

(d) pharmacological considerations relevant to safe and effective use (40% of marks)

21% of candidates passed this question.

The information asked for in this question is the information directly relating to its safe use in intensive care. Phenytoin is an exemplar drug for multiple essential pharmacological principles that apply to the safe prescription of drugs in critical illness. The best answers succinctly demonstrated understanding of these concepts within the structure provided. In general, in the first part exam including in this question, more serious, important or more common side effects or pharmacological considerations ie. Cardiac S/E or the contribution of zero vs first order pharmacokinetics to the narrow therapeutic window, would be weighted higher in the mark distribution within their subsections.

Question 20

Describe the following pharmacology of both unfractionated heparin and bivalirudin:

(a) indications for use (10% of marks)
(b) mechanism of action (30% of marks)
(c) monitoring and reversal (10% of marks)
(d) important pharmacokinetic differences and considerations when using in the intensive care unit (ICU) (30% of marks)
(e) adverse effects (20% of marks).

35% of candidates passed this question.

Given that heparin is the more commonly used drug and a level 1 drug, compared with bivalirudin which is level 2, a suggested way to answer this was to provide details on heparin for each subsection and then note the similarities and differences of bivalirudin.
The low pass rate for this question largely reflected a limited knowledge of heparin not just bivalirudin.

ORAL SECTION

83.9 % of candidates passed the oral component of the CICM First Part Examination.

VIVA 1

This viva will examine respiratory physiology.

Discuss how Positive End Expiratory Pressure (PEEP) may affect lung compliance in an intubated and ventilated patient? You may use the graph to help with your answer.
(Hysteresis Graph removed from report)

78.6 % of candidates passed this question.

VIVA 2

This viva will examine acid-base physiology and pharmacology.

Interpret these lab values using either the traditional or Stewart (physicochemical) approach to acid-base.

pH	**7.20**	**(7.35 - 7.45)**
pCO2	**39mmHg (5.2 kPa)**	**(35 - 45mmHg or 4.7-6.0 kPa)**
HCO3-	**15mmol/l**	**(22 - 26mmol/l)**
Lactate	**10mmol/l**	**(0 - 2mmol/l)**
BE	**-14 mmol/l**	**(-3 - +3mmol/l)**
Na	**126 mmol/l**	**(135 - 145mmol/l)**
K	**3 mmol/l**	**(3.7 - 4.7mmol/l)**
Cl	**82mmol/l**	**(101 – 110mmol/l)**
Cai	**1.5mmol/l**	**(1.15 – 1.30mmol/l)**
Mg	**1mmol/l**	**(0.7 – 1mmol/l)**
PO4	**1.5 mmol/L**	**(0.8 – 1.5 mmol/l)**
Albumin	**20g/L**	**(35 – 50 g/L)**

37.5 % of candidates passed this question.

VIVA 3

This viva will examine general pharmacology concepts.

Define volume of distribution.
Using the figure provided, how you would determine the initial Volume of distribution (Vd) following administration of 1500 mg IV of drug X.
(Drug plasma concentration vs time graph removed from report)

76.8 % of candidates passed this question.

VIVA 4

This viva will examine endocrine pharmacology and physiology

Explain the metabolic effects of insulin on the body.

71.4 % of candidates passed this question.

VIVA 5

This viva will examine cardiovascular physiology and pharmacology.

The systemic vascular resistance is suddenly increased. Describe the consequences of this on a healthy left ventricle. (Left ventricular pressure volume loop removed from report)

75 % of candidates passed this question.

VIVA 6

This viva will examine neuropharmacology.

Describe the desirable and undesirable pharmacological properties of ketamine when used to intubate frail elderly people in the ICU?

76.8 % of candidates passed this question.

VIVA 7

This viva will examine metabolism and nutrition.

Describe the metabolic and hormonal changes that occur during the following:

(a) prolonged starvation

(b) reintroduction of nutrition in a malnourished patient

57.1 % of candidates passed this question.

VIVA 8

This viva will examine immunology and haematology.

How does the body defend itself against pathogens?

85.7 % of candidates passed this question

SUMMARY OF THE EXAMINATION

The CICM First Part Examination ensures candidates possess a thorough understanding of the fundamental medical sciences that underpin intensive care practice. In recent years, significant work and investment from the Part 1 Examiner Court and the College of Intensive Care Medicine have been dedicated to standardising the Part 1 Exam in accordance with the Australian Medical Council's recommendations. These changes to the exam have been made in consultation with and under the supervision and guidance of ACER (Australian Council for Education Research), an independent, not for profit, education and assessment expert organisation. These initiatives aim to enhance reliability and ensure future validity of this assessment process. Additionally, these measures seek to increase transparency for exam candidates preparing to sit the exam. These initiatives include:

- ongoing revision and maintenance of a clear and concise syllabus. Version 5 (2026.2) demonstrates a streamlined integration of topics and more discrete phrasing to further define the breadth and depth of knowledge expected
- a standardised syllabus guide for candidates (T-17 Information for candidates) demonstrating consistency and transparency regarding the composition of each written and oral exam.
- the introduction of standardised marking rubrics for both written and oral questions.
- provision of sample answers to a past question representing different levels of marks.
- participation of the examiner cohort in the online education program to support trainees preparing
- the introduction of the angoff method to written papers.
- splitting of the VIVA exam across two days to ensure fairness across the candidate cohort and improved VIVA development and testing processes.
- the introduction of borderline regression to the oral exam.
- psychometric analysis of every exam component and all examiners to ensure consistency and fairness
- provision of information sessions and resources to improve transparency surrounding exam preparedness and marking.
- construction of questions that are more explicit with the depth and breadth of information required.
- improved feedback to candidates including provision of individual, mean, pass and highest marks.
- an exam report that reflects the knowledge required helping to benchmark for candidates the breadth of the answer and the detail required to provide answers that would achieve a comfortable but successful result.

We have observed that around 20-30% of candidates score less than 30% on the short answer questions. To improve your chances of success, we recommend allowing sufficient time for preparation, typically around 12 months, and ensuring detailed coverage of the entire syllabus. All questions are sourced from the syllabus, and the recommended texts are a guide to the level of information required. Some sections of the syllabus require more extensive research and the use of other textbooks. Candidates are expected to explain, describe, collate, and apply that knowledge across different circumstances relevant to intensive care practice. Candidates are strongly encouraged to trial written and oral questions and discuss their level of preparedness 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 of the exam and syllabus that are covered and information expected for each question but are not model answers and should be read as such.

On behalf of the College of Intensive Care Medicine and the First Part Examiners we wish you all the best as you prepare for and undertake this important step in your intensive care career.

Dr Naomi Pallas
Chair
CICM First Part Exam Committee

Dr Samuel Marment and A/Prof Patricia Hurune
Deputy Chairs
CICM First Part Exam Committee

October 2025