COLLEGE OF INTENSIVE CARE MEDICINE
OF AUSTRALIA AND NEW ZEALAND

REPORT OF THE
INTENSIVE CARE FIRST PART EXAMINATION

SEPTEMBER / OCTOBER 2017

This report is prepared to provide candidates, tutors and their supervisors of training with information about the examination. Answers provided are not model answers but guides to what was expected. Candidates should discuss the report with their tutors so that they may prepare appropriately for future examinations.

The exam included two 2.5 hour written papers, each comprised of twelve short answer questions and twenty short fact 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:	63
Number of candidates scoring > 50% in the written:	42
Number of candidates scoring 45 – 50% in the written:	8
Number of candidates carrying a written score:	1
Total number invited to the oral section based on written marks:	51
Total number of candidates successful at the CICM First Part Exam:	46

SUCCESSFUL CANDIDATES

Dr Michael Adams
Dr Peter Allan
Dr Emma Bowcock
Dr Gregory Brogan
Dr Stephanie Bromage
Dr Vanessa Carnegie
Dr Lee Yen Ching
Dr Charlene Chua
Dr Daniel de Wit
Dr Priyanka Dhillon
Dr Marlene Dieker
Dr Shilpa Enjeti
Dr Emma Foster
Dr James Garrard
Dr Christopher Guy
Dr Graeme Heaney
Dr Irina Horvat
Dr Dat Huynh
Dr Yves Ineza
Dr Dimpel Jain
Dr Mathanhi Jegatheeswaran
Dr Namrata Jhummon-Mahadnac
Dr Hae Won Jo
Dr Craig Johnston
Dr Peta Jones
Dr Harsch Kothari
Dr Chi Ho Edwin Lau
Dr Hanmo Li
Dr Rachel Lister
Dr Ting Lyu
Dr Wan Wafira Fatma M Yusof
Dr Alice Magniac
Dr Saket Kumar Mandal
Dr Joyce Ng
Dr Trixy Ng
Dr Henrique Nicola
Dr Anshuman Raheja
Dr Brooke Riley
Dr Leon Rosebery
Dr Ravinesh Singh
Dr Jeremy Adam Smith
Dr Sarah-Jayne Stevenson
Dr Sharifah Ruqayyah Syed Mustaffa
Dr Jessica Thomson
Dr Sione Inoke Faivakimoana Tukia
Dr Timothy Webber

WRITTEN SECTION

EXAMINERS' COMMENTS

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

Questions from previous examinations may be repeated and candidates are encouraged to review prior papers and examination reports.

Candidates are expected to have a detailed knowledge and depth of understanding of "level I" topics such as cardiovascular and respiratory physiology. As a guide, the level of detail expected, goes beyond that often outlined in a general physiology textbook. Candidates are strongly encouraged to read widely to gain a high level of understanding. Some candidates scored full marks in questions illustrating that it is possible to do so. Candidates are reminded to ensure writing is legible.

SHORT ANSWER QUESTIONS – PAPERS 1 AND 2

1. Compare and contrast the pharmacology of ibuprofen and paracetamol.

65% of candidates passed this question.

This was a standard compare and contrast question of common analgesic pharmacology and it was generally well answered. The use of a table ensured all areas were covered including class, indications, pharmaceutics, mode of action, pharmacodynamics, pharmacokinetics and adverse effects. The uncertain nature (and possibilities) of the mechanism of action of paracetamol was alluded to in better responses.

Details of the comparative pharmacokinetics were often lacking. Answers should have included a comment on first-pass effect, the significance of the difference in protein binding and the details of metabolism, particularly paracetamol. Metabolism limited to "hepatic metabolism and renal excretion" gained no marks as better responses were more detailed and clearer about the differences between the two drugs. Knowledge of metabolism at therapeutic doses and the effect of overdose were expected. Better answers included potential interactions with other drugs (e.g. warfarin) and contraindications to the use of these drugs.

2. Outline the daily nutritional requirements, including electrolytes, for a normal 70 kg adult.

21% of candidates passed this question.

The provision of nutrition is a core skill in ICU. An understanding of its key elements enables prescription and modification. However, most answers lacked detailed information which is available in the standard texts. Better responses outlined the caloric requirements including each major element (water, carbohydrate, fat and protein) along with the caloric values and potential sources. Essential amino acids, fatty acids, fat and water-soluble vitamins were expected. A list of the requirements for major electrolytes and some of the trace elements were expected. Some candidates seemed to confuse calories, kilocalories and kilojoules.

Some answers did not provide the nutritional requirements, as asked, but instead discussed the fate of the nutrients; hence did not score marks. Candidates are reminded to read the question carefully.

3. Describe the factors that determine the filtered load of a substance at the renal glomerulus.

67% of candidates passed this question.

A good place to start was with the correct equation for a filtered load and a description of the components. Better answers described the components and how they differ and change over the glomerulus. Many candidates usefully based answers around the Starling forces.

A summary of factors including the role of plasma concentration, protein binding, molecular size and charge was required to pass. Many answers gave examples for the effects of size and charge and relate endocrine responses to specific alterations in arteriolar tone and how this affected filtration. A detailed discussion of cardiovascular and endocrine responses to hypovolaemia was not required.

Some candidates confused clearance with filtered load. Candidates are reminded to write legibly - especially where subscripts and Greek letters are used. Directional arrows (if used) should correlate with text.

4. Describe how interstitial fluid recirculates to the vascular system.

10% of candidates passed this question.

Candidates had a limited understanding of this area of the syllabus. It was expected that answers would describe important concepts including the anatomy of venous structures, valves and lymphatics, permeability and factors which influence permeability. A description of hydrostatic forces, other pressures involved, and the role of osmotic and electric forces were required.

5. Compare and contrast unfractionated heparin with low molecular weight heparin.

68% of candidates passed this question.

This question was generally well answered and lent itself well to a tabular format. Expected information included an approximation of the molecular weights / significance of the differences in size and therefore its mechanism of action.

Other pertinent areas to mention included pharmacokinetic differences and its use in renal failure, side effect profiles, monitoring, predictability of response and reversibility for the two agents.

6. Describe the effects of Ventilation/Perfusion (V/Q) inequality on the partial pressure of oxygen (PaO_2) in arterial blood.

48% of candidates passed this question.

Overall answers lacked sufficient detail on a core area of respiratory physiology. Answers expected included a description of V/Q ratios throughout the lungs and an explanation of how V/Q inequality lowers PaO_2.

7. Compare and contrast the sympathetic and parasympathetic nervous systems.

75% of candidates passed this question.

This question was generally well answered A table or diagram lent structure to the answer. More complete answers included details on the function, anatomy, a description of the pre- and post-ganglionic fibres, ganglia, receptors and neurotransmitters involved.

Whilst most commented on 'fight or flight' for the SNS and 'rest and digest' for the PNS, no candidate observed that the SNS is a diffuse physiological accelerator and that the PNS acts as a local brake. No candidate included the fact that the SNS supplies viscera and skin whilst the PNS only supplies the viscera. Many candidates failed to make reference to the fact that the postganglionic SNS receptor is G protein coupled and the PNS postganglionic receptor is G-coupled on muscarinic receptors but operates an ion channel when nicotinic.

Candidates may have scored higher if they had provided a little more detail in their answers.

8. Classify calcium channel antagonists and give <u>one</u> example of each class (30% of marks). Describe the pharmacology of Nimodipine including important drug interactions (70% of marks).

19% of candidates passed this question.

The classification was done well. Most candidates demonstrated that they had a structure for a "drug" question, but were often challenged to fill in the detail of that structure and failed to deliver enough content to secure a pass. Many candidates wrote a generic answer for calcium channel blockers instead of the specifics of nimodipine.

Frequently the pharmacokinetic data recounted was incorrect. Candidates failed to distinguish between absorption and bioavailability. The difference between oral and intravenous dosing was often omitted. Few answered the section on important drug interactions.

9. Briefly outline the formation, absorption, distribution, role and composition of cerebrospinal fluid.

44% of candidates passed this question.

The question spelt out very specific areas of CSF physiology to outline and the marks were evenly distributed among these areas. The candidates who did not pass this question usually did not provide enough detailed information.

Details of the production and absorption of CSF were commonly lacking. The majority of candidates correctly described the composition of CSF; indicating whether a particular variable was higher or lower than in plasma, scored less marks than more specific information.

10. Compare and contrast <u>two</u> methods of measuring cardiac output.

35% of candidates passed this question.

Good answers began with a definition of cardiac output. For each method, it was expected that candidates discuss the theoretical basis, equipment, advantages and disadvantages / sources of error and limitations. Additional marks were awarded when an attempt was made to compare and contrast the two methods (often helped by the use of a table).

11. Describe the pharmacology of propofol.

76% of candidates passed this question.

A structured approach proved a good basis to answer this question. It was expected candidates would outline the uses such as anaesthesia, more prolonged sedation or possible additional roles in patients with seizures or head injuries. Discussion of the presentation and pharmaceutics, including a comment on antibacterial preservatives or lack thereof was expected. The mechanism of action should have been described. It was expected candidates could provide an indication of the usual dose (and how it differs in the more unwell / elderly patient population). A maximal rate and possible toxicity was expected.

A discussion on the pharmacodynamics by major organ systems was expected and credit was given for additional comments about hyperlipidaemia, urine colour changes or metabolic alterations. It was expected that candidates would mention propofol infusion syndrome at some point in their answer with some mention of clinical features or pathophysiology.

The important aspects of its pharmacokinetics should have been mentioned (high protein binding, large volume of distribution, termination of effect by redistribution, hepatic metabolism, context sensitive half life). A mention of adverse effects would complete the answer.

12. Compare and contrast aspirin and clopidogrel.

68% of candidates passed this question.

Both of these commonly used agents are level A in the syllabus and thus a high level of detail was expected. Marks were awarded in the following areas - pharmaceutics, mechanism of action, pharmacokinetics (PK) and side effects. For the PK parameters a general description rather than exact values was sufficient (i.e. ‘high protein binding’ rather than ‘98% protein bound’). It was expected that candidates would mention the fact that clopidogrel is a pro-drug and the factors which influence its conversion to the active form. Additional marks were awarded for well-structured answers which attempted a comparison between the two drugs (helped by the use of a table).

13. Compare and contrast the pharmacology of intravenous fentanyl and morphine.

68% of candidates passed this question.

Good candidates produced a well-structured answer and highlighted the differences between the two drugs. It was important to include the dose, potency, time course of effect of both agents, and differences in pharmacokinetic and pharmacodynamic effects. Candidates should have specific knowledge of these important drugs. Many candidates failed to focus the question on intravenous fentanyl and intravenous morphine as asked. No marks were given for information about other routes of administration.

14. Explain the mechanisms responsible for the cell resting membrane potential (60% of marks) and describe the Gibbs Donnan effect (40% of marks).

35% of candidates passed this question.

A good answer included a definition of the resting membrane potential and a clear description of the factors that determine it. Explanation of these factors should have included a detailed description of the selective permeability of the membrane, electrochemical gradients and active transport mechanisms. Answers should demonstrate awareness of the Nernst equation and the Goldman-Hodgkin-Katz equation. These were often confused, sometimes with the Gibbs-Donnan effect. Descriptions of the Gibbs-Donnan effect generally lacked detail and understanding. The better answers included a definition and discussed in detail the influence of non-diffusible ions (intracellular proteins) on the distribution of diffusible ions.

15. List the properties of an ideal inotrope (50% of marks). How does adrenaline compare to these ideal properties (50% of marks)?

98% of candidates passed this question.

Many candidates scored very highly on this core topic. It was expected information be included on pharmaceutics, cost, availability and compatibilities. Relevant pharmacokinetics (onset/offset, titratability) and pharmacodynamics (including relevant receptors, nuances of haemodynamic effects e.g. effect on diastolic pressure and regional perfusion) should have been detailed. Adverse effects and safety profile (e.g. use in pregnancy, therapeutic index) should also have been included.

Good answers were structured and highlighted differences with specific facts and data.

16. Classify and describe adverse drug reactions with examples of each.

44% of candidates passed this question.

Candidates should have provided a definition of adverse drug reactions and then a classification. There are at least two widely accepted systems for classification, either was acceptable; though candidates often switched between both which led to a less structured answer. The WHO classification is comprehensive and logical, though both Rang and Dale and Goodman and Gilman also have sections on this topic.

Common errors were the citing of examples with the incorrect mechanism, describing only drug interactions rather than all adverse reactions and focussing the answer on the 4 hypersensitivity

reactions which could only score a low mark. Some candidates confused drug errors with adverse reactions.

17. Define and explain damping, resonance, critical damping and optimum damping.

25% of candidates passed this question.

Concise definitions were required with a clear explanation of the underlying physical principles. The response time of the system, degree of overshoot, effect on amplitude, noise and ability to faithfully reproduce frequencies relative to the natural resonant frequency were important considerations.

Many candidates interpreted the question as relating to arterial lines and a detailed discussion of the components and characteristics of an intra-arterial catheter and transducer system did not attract marks.

18. Draw and numerically label, on a spirogram, the lung volumes and capacities of a 30 kg child.

87% of candidates passed this question.

This core respiratory physiology topic was well answered by most candidates. Candidates generally were able to draw a spirogram. A common omission was inspiratory capacity.

19. Describe the physiology of a vasovagal syncope.

41% of candidates passed this question.

Generally, there was a lack of knowledge about this topic with many candidates confusing vasovagal syncope with a Valsalva or orthostatic hypotension. A “vasovagal” is from excessive autonomic reflex activity in contrast to orthostatic hypotension which is a failure of the autonomic reflex response.

A good place to start was with a description of vasovagal syncope, also known as neurocardiogenic syncope. It is benign, self-limiting and caused by an abnormal or exaggerated autonomic response to various stimuli (which should have been listed). The mechanism should have been described including the various receptors involved.

20. Outline the functions of the liver.

86% of candidates passed this question.

This is a very straightforward question testing breadth of knowledge rather than depth. It was well answered by the majority of candidates.

21. Describe and compare the action potentials from cardiac ventricular muscle and the sinoatrial node.

95% of candidates passed this question.

This topic was well understood and answered by most candidates. Some candidates had a good knowledge base but missed out on potential marks by failing to compare and contrast. A diagram outlining the various phases was a useful way to approach the question.

22. Define bioavailability. Outline the factors which affect it.

33% of candidates passed this question.
Many candidates did not specify that bioavailability describes the proportion/fraction of drug reaching the systemic circulation (to differentiate from the portal circulation). Some candidates considered only factors impacting absorption from the GI tract or stated that bioavailability related only to orally administered drugs. Candidates failed to provide an equation, or got equations or graphs wrong. Nearly all candidates failed to provide a comprehensive list of factors affecting bioavailability.

23. Outline the anatomy of the internal jugular vein relevant to central venous line cannulation (80% of marks). Include important anatomical variations (20% of marks).

14% of candidates passed this question.

Good answers were structured including origin, termination, tributaries, relationships, surface anatomy and common variations.

Factual inaccuracies were common and there was confusion about the relations of the internal jugular vein. Many candidates did not mention the changing relationship between the internal jugular and the carotid artery as they travel through the neck or the changes that result from repositioning for insertion. Many candidates also forgot to mention surface anatomy and a number talked about ultrasound and views used for insertion of central lines. Common omissions included the origin, tributaries, relationship with the correct cranial nerves and the fact that it is usually larger on the right. Almost nobody mentioned the relationship to the pleura.

24. What is functional residual capacity (30% of marks)? Describe <u>two</u> methods of measuring functional residual capacity (70% of marks).

59% of candidates passed this question.

Most candidates could state 2 methods of measuring FRC. Some candidates (especially for nitrogen wash out) failed to provide enough information e.g. statements such as "if the amount of nitrogen is measured then FRC can be derived" were insufficient to score many marks.

SHORT FACT QUESTIONS – PAPERS 1 AND 2

87% of candidates passed this section:

Cloze Questions	86% pass rate
Rank Questions	63% pass rate
Match Questions	89% pass rate

ORAL SECTION

DAY 1

VIVA 1

This viva will explore your understanding of the left ventricular pressure volume relationship.

Describe the cardiac cycle (ABCD).

(Image removed from report.)

75% of candidates passed this question.

VIVA 2

This viva will examine aspects of carbon dioxide physiology.

You will be asked to describe the relationship of the partial pressure of carbon dioxide (CO_2) (in either kPa or mmHg) and the CO_2 concentration.

(Image removed from report.)

80% of candidates passed this question.

VIVA 3

This viva will explore your knowledge of the following areas:

Neurophysiology and neuropharmacology.

What is normal cerebral blood flow?

Is it the same for gray and white matter?

70% of candidates passed this question.

VIVA 4

This viva is about intravenous fluids and buffers.

Using the diagram below explain how fluid is distributed throughout the body of a healthy 70 kg adult male.

(Image removed from report.)

100% of candidates passed this question.

VIVA 5

This viva will test your knowledge of respiratory physiology and the renal handling of sodium.

Describe the oxygen cascade – from the atmosphere to the tissues (in a normal healthy adult) using appropriate PO_2 values.

100% of candidates passed this question.

VIVA 6

This viva will explore classification of micro-organisms and antimicrobial pharmacology.

What types of micro-organisms are demonstrated on the Gram Stain?

(Image removed from report.)

85% of candidates passed this question.

VIVA 7

This viva will examine liver physiology and diuretics.

Describe the blood supply of the liver.

100% of candidates passed this question.

VIVA 8

This viva will test your knowledge of immunology and associated pharmacology.

What is innate immunity?

65% of candidates passed this question.

DAY 2

VIVA 1

This viva will test your knowledge of renal physiology and potassium.

Briefly outline the functions of the kidney.

90% of candidates passed this question.

VIVA 2

This viva is about the physiology and pharmacology of work of breathing.

Please explain the graph shown below.

(Image removed from report.)

90% of candidates passed this question.

VIVA 3

This viva will explore your knowledge of the following areas:

Arterial blood gases and oxygen measurement.

What is the difference between hypoxia and hypoxaemia?

90% of candidates passed this question.

VIVA 4

This viva is about cardiovascular physiology and calcium.

Define afterload and list the components.

95% of candidates passed this question.

VIVA 5

This viva will test your knowledge of the peripheral nervous system and the pharmacology of local anaesthetics.

Regarding the relations of the femoral nerve in the femoral triangle, identify the structures A to H.

(Image removed from report.)

80% of candidates passed this question.

VIVA 6

This viva will explore the physiology and pharmacology of coagulation and its laboratory assessment.

Describe the events after injury to a vessel wall that lead to formation of a haemostatic plug.

100% of candidates passed this question.

VIVA 7

This viva will explore pharmacokinetics and opioids.

Draw the concentration-time curve following an intravenous bolus of 100 ug fentanyl.

75% of candidates passed this question.

VIVA 8

This viva is on the physiology and pharmacology as it relates to blood volume and tonicity.

Outline the response to loss of 1 L of circulating blood in an adult.

80% of candidates passed this question.

DAY 3

VIVA 1

This viva is on the structure and function of the respiratory system and inhaled drug delivery.

What is this structure and what are the key components?

(Image removed from report.)

82% of candidates passed this question.

VIVA 2

This viva is on the role of oxygen in the body.

Describe the role of oxygen in the body.

45% of candidates passed this question.

VIVA 3

This viva is on cardiac electrical physiology and anti-arrhythmic drugs.

This is a normal trace obtained from the Lead II of the electrocardiogram.

Describe the features of this trace.

(Image removed from report.)

55% of candidates passed this question.

VIVA 4

This viva is on blood transfusion, CNS physiology and pharmacology.

What is the ABO blood system?

100% of candidates passed this question.

VIVA 5

This viva is on neuromuscular physiology and the pharmacology of neuromuscular blockade.

Describe the structure of the neuromuscular junction and the events that lead to an action potential in the muscle plasma membrane.

100% of candidates passed this question.

VIVA 6

This viva is on the endocrine functions of the kidney and renal pharmacology.

Describe the renin-angiotensin system.

100% of candidates passed this question.

VIVA 7

This viva is on right heart physiology.

Draw the right atrial pressure trace.

82% of candidates passed this question.

VIVA 8

This viva is on neurophysiology and pharmacology.

Describe the response of the nervous system to standing on a nail.

45% of candidates passed this question.

SUMMARY OF THE EXAMINATION

The CICM First Part Examination explores the knowledge of the basic sciences that form the basis to 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 follow 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 to also 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.

This is a challenging exam. 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.

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