COLLEGE OF INTENSIVE CARE MEDICINE
OF AUSTRALIA AND NEW ZEALAND

REPORT OF THE
INTENSIVE CARE FIRST PART EXAMINATION

MARCH / MAY 2018

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 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:	56
Number of candidates scoring > 50% in the written:	28
Number of candidates scoring 45 – 50% in the written:	0
Number of candidates carrying a written score:	1
Total number invited to the oral section based on written marks:	29
Total number of candidates successful at the CICM First Part Exam:	28

SUCCESSFUL CANDIDATES

Dr Lillian Armellin
Dr William Body
Dr Cally Buchan
Dr Chee Yun Eunice Chan
Dr Kerina Denny
Dr Clinton Ellis
Dr Amr Elrakaiby
Dr Brigitte Hollander
Dr Matthew James
Dr Patrick Joyce
Dr Sophie Kerr
Dr Qizhan Sherman Lee
Dr Victor Liew
Dr Yvette Low
Dr Eanna Lowney
Dr Lipi Mishra
Dr Jose Pereira
Dr Michael Pittard
Dr Justin Rheese
Dr Robert Short-Burchell
Dr Jessica Sommer
Dr Amelia Street
Dr Raghavendra Subbarayappa
Dr Simon Tan
Dr Joshua Thia
Dr Kate Wagner
Dr Cara Whitley
Dr Avadhut Zagade

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. Describe the carriage of oxygen in the blood, including total oxygen delivery per minute.

32% of candidates passed this question.

Better answers divided oxygen carriage into that bound to haemoglobin and that carried in the dissolved form. A reasonable amount of detail on the haemoglobin structure and its binding of oxygen was expected, including an explanation of co-operative binding and the oxygen carrying capacity of haemoglobin. Better answers mentioned Henry's law in the description of dissolved oxygen, along with an estimation of the amount of oxygen that is normally in the dissolved form.

It was expected that answers include the equation for oxygen delivery, a brief description of the components of that equation and the normal value, which a large number of candidates omitted.

2. Compare and contrast the pharmacology of adrenaline and milrinone.

45% of candidates passed this question.

This question was best answered using a table. Better answers included: the mechanisms of action, the pharmacokinetics and pharmacodynamics, indications for use and adverse effects. To complete the answer, the two drugs should have been **compared** and **contrasted.** There are many areas which could be contrasted e.g. different indications, different mechanisms of action, different half-lives and duration of action, different metabolism and different pharmacodynamic effects, in particular the effects on the cardiovascular system and the pulmonary circulation. Similarities should also have been highlighted.

3. **Define dead space and its components (30% of marks). Explain how these may be measured (35% of marks) and describe the physiological impact of increased dead space (35% of marks).**

59% of candidates passed this question.

Some candidates failed to provide a correct definition of dead space. An outline of anatomical, alveolar and physiological dead space was expected. The Bohr equation was commonly incorrect, and many did not comment on how to measure the components of the Bohr equation. Fowler's method was generally well described though some plotted the axes incorrectly.

The impact of increased dead space was not often well explained. Very few people stated the major impact of increased dead space is reduced minute ventilation and how this would affect CO_2.

4. **Describe the renal handling of sodium.**

46% of candidates passed this question.

A description of filtration and reabsorption, including amounts was required. Better answers described sodium handling in a logical sequence as it progressed through the nephron including the percentages reabsorbed in each segment. In addition to the amounts reabsorbed, the mechanisms of transport across the tubular luminal and basolateral membranes into interstitial space should have been described.

5. **Compare and contrast the pharmacokinetics and pharmacodynamics of IV fentanyl and IV remifentanil (60% of marks). Discuss the concept of context sensitive half-time using these drugs as examples (40% of marks).**

66% of candidates passed this question.

Well-constructed answers were presented in a table to compare pharmacokinetics and pharmacodynamics with a separate paragraph to discuss the concept of context sensitive half-time. Important pharmacokinetic points included: the differences in lipid solubility, ionised fractions and onset, and differences in metabolism. Marks were awarded for a definition of context-sensitive half-time. A discussion of these two drugs' context-sensitive half-times should have included the differences in re-distribution into other compartments and rates of elimination.

6. **Define a buffer (25% of marks). Describe how acid and base shifts in the blood are buffered (75% of marks).**

45% of candidates passed this question.

Few candidates defined a buffer making it difficult to award 25% of the marks for this question. The three main buffers in blood should have been described: bicarbonate system, haemoglobin and proteins. The pKa, the buffering mechanism and the capacity of the system should have been described. The Henderson Hasselbach equation was sometimes incorrect. Marks were only awarded for buffers in blood and unfortunately some candidates described non-blood buffers.

7. Outline the blood supply to the gastrointestinal system (arteries and veins).

7% of candidates passed this question.

An outline of the blood supply from the oesophagus down to the anus was expected. Very few candidates knew the branches of the main 3 arteries and which portion of the gastrointestinal system they supplied. Concepts related to control of blood flow and autoregulation of blood flow were not asked and therefore marks were not awarded for this information.

8. Outline the principle of co-oximetry (40% of marks), describe what a co-oximeter is able to measure (30% of marks), and compare its limitations to those of a pulse oximeter (30% of marks).

32% of candidates passed this question.

Most candidates confused co-oximetry with other methods of measuring oxygenation of blood. Whilst there were a number of excellent descriptions of pulse oximetry, these attracted no marks for the first two sections. Structuring the answer based on the three parts asked, would have improved answers ensuring all aspects of the question were addressed.

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

32% of candidates passed this question.

Many candidates provided a broad overview of functions of the placenta but lacked detail. Placental blood flow has maternal and foetal components, though most only considered the maternal circulation to the placenta and didn't mention the foetal vessels. Many were not specific as to what blood vessels were described.

Many stated that uterine blood flow is not autoregulated, however went on to describe myogenic and neuro-humoral mechanisms of autoregulation.

10. Outline the advantages (15% of marks) and disadvantages (85% of marks) of the clinical use of suxamethonium.

46% of candidates passed this question.

This commonly used drug should be very well-known. The question asked for an outline, hence long explanations of various aspects of pharmacology (e.g. pseudocholinesterase deficiency) were unnecessary.

Headings should have included: advantages (e.g. rapid onset, rapid offset, short acting, IV or IM administration, not end organ dependent for metabolism, premixed, safe in pregnancy and neonates). The disadvantages section should have included the following headings: pharmaceutical, adverse drug reactions (including several potentially fatal ones), numerous contraindications, unpleasant side-effects and potential problems with repeat dosing.

11. Describe the regulation of the coronary circulation.

46% of candidates passed this question.

Some answers suffered from listing things rather than describing things as the question required.

Better answers included a description of metabolic, physical and neuro-humoral factors and the relative importance of each.

Many described detailed anatomy which was not necessary.

12. Briefly describe the cardiac events that occur during ventricular diastole.

29% of candidates passed this question.

Many answers lacked structure and contained insufficient information. Better answers defined diastole and described the mechanical events in the 4 phases of diastole. A common error was the ECG events in diastole. The electrical events and coronary blood flow should have been mentioned.

13. Explain the difference between viscosity and density (10% of marks). Describe the effects of changes in viscosity and density on the flow of gases and liquids (90% of marks).

46% of candidates passed this question.

Whilst most candidates defined density correctly, there was a lot of uncertainty regarding viscosity. Most candidates recognised that flow may be laminar, turbulent or transitional. Most accurately recounted Reynolds number and applied this correctly. Additionally, the Poiseuille equation was correctly stated by most candidates and correctly related to laminar flow. Few candidates recalled the equation describing turbulent flow.

14. Classify anticholinesterase drugs according to chemical interaction with an example of each (30% of marks). Outline the pharmacodynamic effects of anticholinesterase drugs and their clinical indications (70% of marks).

32% of candidates passed this question.

Many candidates who scored poorly confused anticholinesterase drugs with anticholinergic drugs. Some described pharmacokinetics when it was not asked. Similarly, treatment of organophosphate poisoning and/or cholinergic crisis was not asked for in the question.

15. Describe the physiological regulation of intracranial pressure.

45% of candidates passed this question.

A definition and a normal value were expected. A description of the Monro-Kellie doctrine was expected. Better answers divided into the various components of the cranium with the answer focussing on cerebral blood volume and CSF volume as the brain tissue as no capacity to change its volume.

16. Compare and contrast the pharmacology of furosemide (frusemide) and acetazolamide.

30% of candidates passed this question.

The use of a table assisted with both clarity and the ability to compare the two drugs. Writing separate essays about each makes it difficult to score well. It was expected that candidates would follow a standard pharmacology format and discuss pharmaceutics, pharmacokinetics, pharmacodynamics and adverse drug reactions. Both of these drugs are 'Level A' in the syllabus and a suitable level of detail was expected.

It was expected candidates would discuss in detail the mechanism of action, electrolyte and acid-base effects. Pharmacokinetic values were poorly answered. Qualitative terms such as 'moderate, good and some' are vague and should be avoided. Only correct numerical values (or ranges) attracted full marks.

17. Define the osmolality and tonicity of an intravenous fluid (20% of marks). Compare and contrast the pharmacology of intravenous Normal Saline 0.9% and 5% Dextrose (80% of marks).

29% of candidates passed this question.

Most candidates gave an adequate definition of osmolality and tonicity. A single concise sentence for each attracted full marks. Some candidates drew diagrams & equations, which added few marks. Some candidates confused osmolarity (mOsm/L) and osmolality (mOsm/kg).

Tonicity was best defined as the number of 'effective' osmols (those that cannot cross the cell membrane) in a solution relative to plasma. The use of a table greatly facilitated the comparison of 0.9% saline and 5% dextrose solutions. Values for composition, osmolarity and osmolality were poorly done. Some manufacturers state calculated values and some approximate values on the bags – both were accepted.

No candidate correctly pointed out the fluids respectively have 9g NaCl and 50g dextrose per litre.

18. Compare and contrast non-invasive oscillometric and invasive arterial blood pressure monitoring.

52% of candidates passed this question.

There were some good answers, though invasive BP measurement was better answered than oscillometry. Many candidates provided extensive detail in one area i.e. the workings of a Wheatstone bridge, to the detriment of a balanced answer.

Few seemed to have a structure consisting of "equipment, method, sources of error, advantages, disadvantages" or similar and missed providing important information as a result. Several described auscultatory non-invasive blood pressure measurement, rather than oscillometry, which although related in principle is a different process.

19. Explain the mechanisms by which normal body temperature is maintained and regulated.

52% of candidates passed this question.

The best answers were systematic, using a sensor, integrator, effector approach, while also mentioning physiological variations i.e. diurnal, with ovulatory cycle etc.

Few candidates raised the concept of central and peripheral compartments. The differentiation of the concepts of set point, interthreshold range and thermoneutral zone was often confused.

20. Outline the structure (20% of marks) and function (80% of marks) of the hypothalamus.

21% of candidates passed this question.

Most candidates understood the endocrine functions of the hypothalamus, and to some degree its interactions with the pituitary. Fewer candidates mentioned the importance of the hypothalamus as an integrator for the autonomic nervous system, or its roles in arousal/emotions.

Many candidates had only a vague idea of the structure of the hypothalamus, while the best candidates were able to relate function to structure quite accurately.

MULTIPLE CHOICE QUESTIONS – PAPERS 1 AND 2

96% of candidates passed overall:

Paper 1	95% pass rate
Paper 2	95% pass rate

ORAL SECTION

DAY 1

VIVA 1

This viva will assess your knowledge of haematological physiology & pharmacology.

Outline the different blood groups and explain why they are different.

80% of candidates passed this question.

VIVA 2

This viva will examine pacemaker cells and antiarrhythmic drugs.

Explain the ionic currents responsible for spontaneous electrical activity of sinus node pacemaker cells.

85% of candidates passed this question.

VIVA 3

This viva will examine respiratory changes in pregnancy.

The figure below depicts the expected changes in oxygen saturation when individuals are pre-oxygenated prior to intubation.

Explain why pregnant patients desaturate so quickly.

(Image removed from report.)

85% of candidates passed this question.

VIVA 4

This viva will examine pain pathways and analgesic pharmacology.

Define pain and describe how pain is detected in response to a peripheral noxious stimulus.

70% of candidates passed this question.

VIVA 5

This viva will explore your knowledge of the following areas:

The pharmacology of common anticoagulants and the physics of arterial lines.

What is the mechanism of action of un-fractionated heparin?

100% of candidates passed this question.

VIVA 6

This viva is about “High Flow” Oxygen Therapy.

Describe each labelled component in the diagram and their role.

(Image removed from report.)

100% of candidates passed this question.

VIVA 7

This viva is about insulin and glomerular filtration.

What are the effects of insulin?

90% of candidates passed this question.

VIVA 8

This viva relates to the physiology and pharmacology of vomiting.

Define vomiting.

Describe the inputs to the vomiting centre.

95% of candidates passed this question.

DAY 2

VIVA 1

This viva will assess your knowledge of renal physiology.

Describe the physiological processes which cause oliguria in response to acute hypovolaemia?

100% of candidates passed this question.

VIVA 2

This viva will test your knowledge of alveolar ventilation and metabolism.

In relation to respiration, describe the central chemoreceptors, and explain their role in the control of ventilation.

78% of candidates passed this question.

VIVA 3

This viva will examine nerve action potentials and neuromuscular blockade.

Describe the graph shown below.

(Image removed from report.)

100% of candidates passed this question.

VIVA 4

This viva will examine your understanding of lung volumes and capacities.

Why does the lung not “collapse” at the end of expiration?

100% of candidates passed this question.

VIVA 5

This viva will explore your knowledge of the following areas:

Renal clearance and aspects of the ECG.

What is meant by the term clearance when applied to the kidney?

What are the units?

100% of candidates passed this question.

VIVA 6

This viva will explore your understanding of antibiotics and antiarrhythmics.

Which classes of antibiotics are effective against Gram positive organisms?

100% of candidates passed this question.

VIVA 7

This viva is about cardiovascular physiology and blood.

Describe the important features of a left ventricular pressure-volume loop.

100% of candidates passed this question.

VIVA 8

This viva will examine adreno-receptors, second messengers and calcium.

Classify adreno-receptors and their secondary messenger systems.

89% 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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