COLLEGE OF INTENSIVE CARE MEDICINE
OF AUSTRALIA AND NEW ZEALAND

REPORT OF THE
INTENSIVE CARE FIRST PART EXAMINATION

AUGUST / OCTOBER 2020

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 our guide as to what was expected.

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

2020.1

Total number of candidates presenting for the written examination:	75
Number of candidates scoring > 50% in the written:	45
Number of candidates scoring 45 – 50% in the written:	1
Number of candidates carrying a written score:	0
Total number invited to the oral section based on written marks:	46
Total number of candidates successful at the CICM First Part Exam:	45

2020.2

Total number of candidates presenting for the written examination:	68
Number of candidates scoring > 50% in the written:	34
Number of candidates scoring 45 – 50% in the written:	7
Number of candidates carrying a written score:	0
Total number invited to the oral section based on written marks:	41
Total number of candidates successful at the CICM First Part Exam:	39

SUCCESSFUL CANDIDATES

Dr Mahmoud Adbdallah
Dr Mohammad Abu Yosef
Dr Thomas Barr
Dr James Basha
Dr Cristina Beltran Orihuela
Dr Marie Blaney
Dr William Bonavia
Dr Jason Bromage
Dr Bronwyn Brown
Dr Lindsay Campbell
Dr Hugh Carter
Dr Amy Chapman
Dr Hannah Coleman
Dr Benjamin Jay Cunanan
Dr Fabien Dade
Dr Udeshika Daluwatta
Dr Maryse Daniel
Dr Netra Dawadi
Dr Abhinesh Dhital
Dr James Doherty
Dr Stephanie D'Souza
Dr Kelly Eitzen
Dr Sherif Elbadrawy
Dr Tess Evans
Dr Xizhe Fang
Dr Deepak Ghimiray
Dr Jane Guan
Dr Jonathan Gunther
Dr Monica Gunturu
Dr Yuxiaoyan Zoe Guo
Dr Jaimie Henry
Dr Samantha Ho
Dr Rachael Hocking
Dr Haitham Jassim
Dr Nathan Jeffery
Dr Sunil John
Dr Caroline Kuruvilla
Dr Simon Landes
Dr Huey Ying Lim
Dr Yu-hsuan Dave Liu
Dr Rachel Martin
Dr Yassir Matloob
Dr Daniel Joseph McAuliffe
Dr Goran Mitric
Dr David Mogg
Dr Fraser Moss
Dr Mohammed Mostafa
Dr Thomas Murchie
Dr Janeni Nadarajah
Dr Thomas Niccol
Dr Robert Nicholson
Dr Susanne Nicholson
Dr Mairi Northcott
Dr Jonathan O'Leary
Dr Hyo Jung Ivy Park
Dr Alison Parsell
Dr Adam Pasfield
Dr Jessemine Pitt
Dr Joseph Preston
Dr Megan Price
Dr Patrick Purcell
Dr Joseph Rea
Dr Laura Renger
Dr Sophie Roome
Dr Scott Santinon
Dr Benjamin Seymour
Dr Jeremy Sharman
Dr Bhavneet Singh
Dr Melinda Sirmais
Dr Ryan Slack
Dr James Soares
Dr Georgia Sparks
Dr Marina Xi Yuan Tan
Dr Piers Turner
Dr Ruan Vlok
Dr Alice Walsh
Dr Scott Warming
Dr Benjamin White
Dr Christopher Wilder
Dr Nicholas Wilson
Dr Benedict Wong
Dr Alexander Wood
Dr Karolina Koko Wozniak
Dr Alexandr Zubarev

WRITTEN SECTION

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.

Questions from previous examinations are occasionally 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 – for example cardiovascular and respiratory physiology. Candidates are strongly encouraged to read widely to gain a high level of understanding. Candidates are reminded to ensure writing is legible.

SHORT ANSWER QUESTIONS – PAPERS 1 AND 2

1. Describe and compare the action potentials from cardiac ventricular muscle cells and the sino-atrial node.

72% of candidates passed this question.

This question details an aspect of cardiac physiology which is well described in multiple texts. Comprehensive answers included both a detailed description of each action potential and a comparison highlighting and explaining any pertinent differences. The question lends itself to well-drawn, appropriately labelled diagrams and further explanations expressed in a tabular form. Better answers included a comparison table with points of comparison such as the relevant RMP, threshold value, overshoot value, duration, conduction velocity, automaticity, ion movements for each phase (including the direction of movement) providing a useful structure to the table. Incorrect numbering of the phases (0 – 4) and incorrect values for essential information (such as resting membrane potential) detracted from some responses.

2. Define functional residual capacity (10% marks). Outline the functions (70% marks) of the functional residual capacity and the factors affecting it (20% marks).

79% of candidates passed this question.

This question was in two parts with the percentage of marks allocated an indication of the relevant time or detail expected per part. The second part of the question also contained two distinct headings which should have been used in the answer. As an outline question, dot points with a brief explanation of each point were expected. Most candidates drew diagrams, few of which added value. For a diagram to add value it should be accurate, have labelled axes, a scale with numerical values and units. As a general rule, diagrams should also be explained and help to illustrate or relate to a written point.

For factors affecting FRC, to score full marks, it should be clearly stated if the factor causes an increase or decrease in FRC. This topic is well covered in the recommended respiratory texts.

3. Describe the pharmacology of hydrocortisone.

69% of candidates passed this question.

Hydrocortisone is a level 1 drug in the syllabus. Most answers were well structured, many used key headings. In general, detailed information specific to hydrocortisone was lacking. Answers that focused on the mechanism of action, pharmacodynamic effects and pharmacokinetics effects which were detailed and accurate scored well. It was expected that significant detail be included in the sections with relevance to clinical practice for example, the mechanism of action and pharmacodynamic effects including the side effect profile. An indication/appreciation of the timelines of such was also represented in the marking template.

4. Outline the role of the liver in the metabolism of fat (⅓ marks), carbohydrate (⅓ marks) and proteins (⅓ marks).

54% of candidates passed this question.

This question relates to basic hepatic physiology and is well described in the recommended texts. The mark allocation and division of time was indicated in the question. Better answers used the categorisation in the question as an answer structure. Many candidates gave a good description of beta oxidation, the formation of Acetyl Co A and ketone synthesis. A description of the synthesis of cholesterol, phospholipids, lipoproteins and fatty acid synthesis from proteins and carbohydrates mainly using glycogen, glucose and lactate also received marks. Candidates seem to have a better understanding of fat and glucose metabolism than protein metabolism. Higher scoring candidates appreciated the anabolic and catabolic processes of each component.

5. Describe the anatomy (70% marks) and effects (30% marks) of the sympathetic nervous system.

51% of candidates passed this question.

Most candidates had a suitable structure to their answers, those without a clear organisation of thought tended to gain fewer marks. In many cases incorrect information or limited detail, particularly around the anatomical organisation prevented higher marks.

6. Classify the oral hypoglycaemic drugs (20% marks); include their mechanism of action (40% marks) and their most significant side effects (40% marks).

37% of candidates passed this question.

High scoring answers most often started with a strong and logical structure and focused on the requested categories of information. Many candidates gave good answers across the wide range of drugs. Several candidates could have scored more highly by giving more correct information on biguanides and sulphonylureas.

7. Compare and contrast external ventricular drains and intraparenchymal fibreoptic pressure monitors.

22% of candidates passed this question.

This question is ideally suited to a tabular format, where candidates are expected to highlight the significant similarities and differences as well as why a certain monitor may be chosen in preference to another rather than compile two lists written next to each other. To score well in this question, a statement of what could be measured (ICP: global vs local), a description of the measurement principles, along with other measurement related information like calibration and sources of error was required. Also sought was information regarding anatomical placement (e.g., lateral ventricle for EVD) and method of placement.

Furthermore, a comparison with each other (e.g., higher infection/bleeding risk with EVD, greater risk of trauma due to size and insertion, expertise to insert, cost, therapeutic benefit, risk of blocking) was required for completion. Candidates who structured these elements into advantages and disadvantages were generally able to elucidate this information and score better.

8. Describe the cough reflex.

62% of candidates passed this question.

Overall, this question was reasonably well answered. Those that performed well had suitably detailed knowledge and structured their responses which generally included a definition and purpose of the reflex as well as the identification and a description of the afferent, integrator/controller, and efferent limbs of the reflex. This structure allowed a logical platform for the elucidation of the detail required in the answer, including types of stimulus, receptors, nerves (for both limbs of the reflex) and the muscles used in the phasic response to be clearly articulated.

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

40% of candidates passed this question.

This topic is well covered in the recommended physiology textbooks. Many answers unfortunately simply listed the various components without providing sufficient detail; outline questions require some context around the key points as opposed to just a list.

Most candidates had a good estimate for the basal energy requirements of a resting adult. Good candidates were able to outline the g/kg daily protein requirements and the distribution of remaining energy intake between carbohydrates and lipids and included how this may change during periods of stress. They also stated the energy derived per gram of each of those food groups. Few candidates mentioned the need to include essential amino acids. Similarly, with fat intake, few candidates mentioned the need for essential fatty acids. A definition of “vitamin” would have received credit. Most candidates were able to classify vitamins as water soluble or fat soluble. Most candidates mentioned trace elements (with an abbreviated list) and mentioned bone minerals. A daily intake requirement for Na and K was expected, though not for bone minerals or trace elements.

10. Describe the pharmacology of suxamethonium.

63% of candidates passed this question.

This was a level 1 pharmacology question, and it represents core knowledge. The mechanism of action of suxamethonium and the interactions at the neuromuscular junction as well as pharmaceutics were areas that often required further detail. Few candidates mentioned the effects of suxamethonium on the autonomic nervous system. Another common omission related to the factors that reduce plasma cholinesterase activity beyond genetic deficiency (such as liver disease, renal failure, thyrotoxicosis). Pleasingly, there was generally a good understanding of role, dosing, side effect profile, pharmacokinetics and of special situations and limitations of use pertinent to this drug.

11. Describe the changes in the circulatory system that occur during exercise.

22% of candidates passed this question.

This is an applied physiology question. Better answers categorised the changes in some manner and included a measure of the degree of change as applicable (e.g., what increases, what decreases and what may stay the same). The question was to describe the changes so that the detail behind the mechanisms enabling these changes to occur was expected (e.g., neurohumoral, local factors). Marks were also awarded for any regional variation that occurs.

12. Describe the physiology (50% marks) and pharmacology (50% marks) of albumin.

19% of candidates passed this question.

The question required an equal treatment of the physiology and pharmacology of albumin. The physiology discussion needed to include synthesis, factors affecting synthesis, distribution in the body (including the proportion divided between the plasma and interstitial space), functions, breakdown, and elimination half-life. Discussion of the pharmacology should have included available preparations (4% and 20% Albumin) and pharmaceutics, distribution, elimination (both the protein and crystalloid components), mechanism of action to expand the plasma compartment, longevity in the plasma compartment, indications, and adverse effects. Oedema, circulatory overload, immunological reactions, and relative contraindication in brain injury were important to mention. There was some confusion regarding the infectious risks of albumin. An outline of the manufacturing process from donated plasma and pasteurisation was expected.

13. Describe the anatomical (20% marks) and physiological (80% marks) features of the pulmonary circulation.

25% of candidates passed this question.

The examiners consider that an understanding of the pulmonary circulation is core area of the syllabus. In general, the anatomy section was better answered than the physiological features. As well as a description of the gross anatomy of the pulmonary circulation tracking it from the pulmonary valve to the left atrium, some mention of the microscopic anatomy was required (e.g., that the pulmonary arteries are thin walled with little smooth muscle).

For the second part of the question, a breadth of knowledge was required. Candidates were expected to address the following physiological features of the pulmonary circulation: volume, pressure, resistance, regulation and regional distribution and function. Marks were apportioned

to each section, so it was important to write something on each section. Focussing on one section in detail (e.g., a very detailed description of West's Zones) usually came at the expense of missing one or more of the other sections, most commonly the functions of the pulmonary circulation. Indeed, candidates that scored well provided information on each section and for the functions of the pulmonary circulation mentioned more than gas exchange.

14. Describe the anatomy of the larynx.

40% of candidates passed this question.

For this question, candidates were expected to address the location of the larynx, its relations, the cartilages (single and paired), ligaments, muscles (intrinsic and extrinsic), innervation (sensory and muscular) and blood supply (including venous drainage). Marks were apportioned to each section, so whilst some detail was required, breadth of knowledge was also important. Most candidates had a grasp of the gross anatomy, the main relations and at least the innervation provided by the recurrent laryngeal nerve. However, an understanding of the functional anatomy of the cartilages was not always apparent. It should be noted that not every single muscle needed to be named (especially for the extrinsic muscles), but an understanding of the major muscle groups should have been included.

15. Compare and contrast the pharmacology of dobutamine and levosimendan.

41% of candidates passed this question.

The objective of this question was that candidates relay a detailed knowledge of both drugs with respect to their individual pharmacology highlighting the important clinical aspects of each drug (e.g., mechanism of action, metabolism, duration of effect). Then an integration of this knowledge was in the contrast section where the better candidates highlighted features of the drug that would influence when or why one may use it with respect to the second agent. Tabular answers of the pharmacology of each drug without any integration or comparison scored less well. A detailed knowledge of both agents was expected to score well.

16. Describe the formation of gastric acid (50% marks) and the regulation of gastric acid secretion (50% marks).

26% of candidates passed this question.

The is question was divided into two sections offering equal marks. The first section required a description of the generation and transport of both H^+ and Cl^- into the stomach lumen by the parietal cell. The contributions of basolateral and luminal ion channels, the role of carbonic anhydrase and accurate description of the net flux was expected for full marks. The second section required comments on the roles of neural and endocrine regulation. Increased acid secretion via acetylcholine (via muscarinic M3), histamine (via H2) and gastrin were expected as was reduced secretion via secretin and somatostatin. Better responses were able to combine and integrate these into cephalic, gastric, and intestinal phases. The nature and function of other gastric secretions and the role of pharmacologic agents was not asked for and therefore not awarded any marks.

17. Describe the pharmacology of inhaled nitric oxide (NO).

24% of candidates passed this question.

Nitric Oxide (NO) is an inorganic colourless and odourless gas presented in cylinders containing 100/800 ppm of NO and nitrogen. Many candidates mentioned oxygen instead of nitrogen. The exposure of NO to oxygen is minimized to reduce formation of nitrogen dioxide and free radicals. Hence it is administered in inspiratory limb close to the endotracheal tube. Many candidates did not mention the contraindications/caution for NO use. Candidates generally did well in mentioning the impact on improving V/Q mismatch by promoting vasodilatation only in the ventilated alveoli and reducing RV afterload. Many candidates did not mention the extra cardio-respiratory effects. The expected adverse effects of NO were nitrogen dioxide related pulmonary toxicity, methemoglobinemia and rebound pulmonary hypertension on abrupt cessation. Pharmacokinetics of NO carried a significant proportion of marks. It was expected that the answers would involve mention of location of delivery of NO in inspiratory limb and reason behind it, the high lipid solubility and diffusion, the dose (5-20ppm), very short half-life of < 5 seconds and combination with oxyhemoglobin to produce methaemoglobin and nitrate. The main metabolite is nitrate which is excreted in urine.

18. Define afterload (10% marks) and describe the physiological factors that may affect afterload on the left ventricle (90% marks).

53% of candidates passed this question.

Afterload can be defined as factors resisting ventricular ejection and contributing to myocardial wall stress during systole. Most answers utilised the law of Laplace to expand upon factors affecting ventricular wall tension. Systemic vascular resistance was commonly mentioned, but less frequently defined. Aortic and left ventricular outflow tract impedance were commonly referred to. Effects of preload and neurohumoral stimuli were less well outlined. Description of factors affecting right ventricular afterload and depictions of left ventricular pressure volume loops earned no extra marks unless directly referenced to the question.

19. Explain how the kidney handles an acid load.

51% of candidates passed this question.

This question required candidates to understand the renal response to an acid load. It was expected that candidates would answer with regard to recycling of bicarbonate in the proximal tubule, excretion of titratable acid via the phosphate buffer system and generation of ammonium and its role in acid secretion. Many candidates had a good understanding of the bicarbonate system but used this to explain the secretion of new acid.

20. Describe the pharmacology of intravenous sodium nitroprusside.

49% of candidates passed this question.

This was a straightforward pharmacology question relating to a relatively common and archetypal intensive care medication. The structure of the question was well handled by most of the candidates; easily falling into the classic pharmaceutics, pharmacokinetic and pharmacodynamics framework. Many candidates had a superficial knowledge of the presentation and formulation of the drug, aside from its light sensitivity. Better answers detailed the drug according to the above-mentioned framework but also accurately highlighted specific

points relevant to the ICU practise such as the metabolic handling of sodium nitroprusside and relating this to the consequences of the various metabolic products.

MULTIPLE CHOICE QUESTIONS – PAPERS 1 AND 2

84% of candidates passed overall.

ORAL SECTION

DAY 1

VIVA 1

This viva will explore your knowledge of anti-arrhythmic agents and the electrocardiogram.

Briefly describe the phases of an action potential of the SA nodal / pacemaker cell.

(Image removed from report.)

86% of candidates passed this question.

VIVA 2

This viva will explore your knowledge of respiratory physiology.

What are the major differences between the systemic and pulmonary circulation?

76% of candidates passed this question.

VIVA 3

This viva will explore your knowledge of renal physiology and pharmacology.

Describe the factors that determine the rate of movement of a solute across a semi-permeable membrane.

57% of candidates passed this question.

VIVA 4

This viva will explore your knowledge of the thyroid physiology and beta-blockers.

What is the fate of dietary iodine?

67% of candidates passed this question.

VIVA 5

This viva will explore your knowledge of platelets and antiplatelet drugs.

Can you outline how platelets are produced?

90% of candidates passed this question.

VIVA 6

This viva will explore your knowledge of acid-base physiology.

Please interpret this arterial blood gas:

pH	7.30
pO_2	400 mmHg (53.3 kPa)
pCO_2	30 mmHg (4 kPa)
HCO^{3-}	14 mmol/L
BE	- 8 mmol/L
Na^{2+}	140 mmol/L
K^{+}	4 mmol/L
Cl^{-}	120 mmol/L

90% of candidates passed this question.

VIVA 7

This viva will explore your knowledge of physiology and pharmacology in the elderly.

Consider the respiratory system:

Why does efficiency of gas exchange diminish with aging?

62% of candidates passed this question.

VIVA 8

This viva will explore your knowledge of bacteria and antibiotics.

What type of bacteria are demonstrated in the above gram stain?

How can bacteria be classified?

(Image removed from report.)

95% of candidates passed this question.

DAY 2

VIVA 1

This viva will explore your knowledge of the physiology of coronary blood flow.

How is coronary blood flow regulated?

(Image removed from report.)

90% of candidates passed this question.

VIVA 2

This viva will explore your knowledge of respiratory physiology.

Can you outline the factors that affect respiratory rate?

70% of candidates passed this question.

VIVA 3

This viva will explore your knowledge of measurement and regulation of body water.

Describe the normal water content of a 70 kg adult male and how this water is distributed.

85% of candidates passed this question.

VIVA 4

This viva will explore your knowledge of the body's response to a noxious stimulus.

What would happen if you have a sudden sharp cut to your hand?

80% of candidates passed this question.

VIVA 5

This viva will explore your knowledge of coagulation.

According to the cell-based model, what happens during the initiation phase of coagulation?

85% of candidates passed this question.

VIVA 6

This viva will explore your knowledge of respiratory physiology and measurement.

What is the oxygen content of blood and how is it transported?

90% of candidates passed this question.

VIVA 7

This viva will explore your knowledge of the central nervous system circulation and receptors.

What is normal cerebral blood flow?

100% of candidates passed this question.

VIVA 8

This viva will explore your knowledge of midazolam and the actions of benzodiazepines.

What is midazolam? What are some of the effects of midazolam?

80% of candidates passed this question.

DAY 3

VIVA 1

This viva will explore your knowledge of the anatomy of the cardiac ventricles and pharmacology of beta-blockers.

Can you describe the structure of the left ventricle?

91% of candidates passed this question.

VIVA 2

This viva will explore your knowledge of oxygen and respiratory physiology.

Can you describe the oxygen cascade?

100% of candidates passed this question.

VIVA 3

This viva will explore your knowledge of renal physiology and pharmacology.

Describe the factors that determine the rate of movement of a solute across a semi-permeable membrane.

65% of candidates passed this question.

VIVA 4

This viva will explore your knowledge of cranial nerves anatomy and the physiology of brain stem reflexes.

Please describe the pupillary light reflex.

74% of candidates passed this question.

VIVA 5

This viva will explore your knowledge of central venous pressure.

Can you describe the cardiac events that give rise to the labelled fluctuations in right atrial pressure?

(Image removed from report.)

91% of candidates passed this question.

VIVA 6

This viva will explore your knowledge of acid-base physiology and albumin.

Describe the Henderson Hassebalch Equation.

91% of candidates passed this question.

VIVA 7

This viva will explore your knowledge of smooth muscle and G proteins.

What types of smooth muscle are there?

61% of candidates passed this question.

VIVA 8

This viva will explore your knowledge of liver physiology and biliary metabolism.

What are the functions of the liver?

87% of candidates passed this question.

DAY 4

VIVA 1

The viva will explore your knowledge of the body's response to blood loss.

Describe the physiological sensing and response following the loss of 1 litre of blood over 10 minutes in an adult male.

100% of candidates passed this question.

VIVA 2

This viva will explore your knowledge of respiratory physiology.

What is compliance?

77% of candidates passed this question.

VIVA 3

This viva will explore your knowledge of renal anatomy and physiology.

Describe the anatomy of Bowman's capsule.

100% of candidates passed this question.

VIVA 4

This viva will explore your knowledge of GABA (Gamma Amino Butyric Acid) signalling.

Can you outline the pharmaceutics of propofol?

82% of candidates passed this question.

VIVA 5

This viva will explore your knowledge of coagulation.

Please describe the classical intrinsic pathway.

95% of candidates passed this question.

VIVA 6

This viva will explore your knowledge of opioids and their pharmacology.

What classifications of opioid receptors do you know?

36% of candidates passed this question.

VIVA 7

This viva will explore your knowledge of placental and foetal physiology.

What is the uterine blood flow at term? What percentage goes to the placenta?

100% of candidates passed this question.

VIVA 8

This viva will explore your knowledge of the pharmacology of aminoglycoside antibiotics.

How does gentamicin work against bacteria?

82% 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 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; however, the pass rate was excellent once candidates achieved a sufficient mark to attend the vivas.

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.

A/Prof Roslyn Purcell
Chair
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Dr Andrew Semark
Deputy Chair
CICM First Part Examination Committee

January 2020