COLLEGE OF INTENSIVE CARE MEDICINE
OF AUSTRALIA AND NEW ZEALAND

REPORT OF THE
INTENSIVE CARE PRIMARY EXAMINATION

MARCH / APRIL 2010

This report is prepared to provide candidates, tutors and their supervisors of training with information about the way in which the Examiners assessed the performance of candidates in 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 the future examinations.

The exam included two 2.5 hour written papers, each comprising 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 sit 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:	10
Number of candidates scoring >50% in the written:	4
Number of candidates scoring 45-50% in the written:	4
Total number invited to the Oral section based on written marks:	8
Total number of candidates successful at the CICM Primary:	6

Successful candidates:

Corynn	Goh
Philippe	Le Fevre
Alex	Rosenberg
Ravikiran	Sonawane
Sudeep	Thekkayil
Prithiviraj	Thyagarajan

WRITTEN SECTION

SAQ PAPER 1

1. Describe the cardiovascular changes that occur following the loss of 1000ml of blood in an adult.

A structured approach that included mentioning that 1000mls of blood was substantial – being approximately 20% of the blood volume of a 70 kg person was required for a good answer. Candidates were expected to also include changes in systolic and diastolic blood pressure, pulse pressure, heart rate, cardiac output and the neuronal (eg sympathetic nervous system response on the various circulations) and hormonal responses (eg rennin aldosterone, Anti-Diuretic Hormone, catecholamines, etc). Candidates were also expected to discuss differences in responses according to rate of blood loss. Flow diagram could have been used to illustrate some of these concepts.

Syllabus: C1e
References: Textbook of Medical Physiology, Guyton pg 278 – 282, Principles of Physiology for the Anaesthetist, Power & Kam pg 154

10 (100%) of candidates passed this question.

2. Describe the pharmacology of Phenytoin.

A structured approach was expected addressing both the mechanism of action and pharmacokinetics. Candidates were expected to outline relevant mechanisms of action (such as sodium channel blockade) and how they relate to its use as an anticonvulsant agent. Additional credit was given for discussing other potential mechanisms and other uses such as pain management and antiarrhythmic properties.

Phenytoin is illustrative of several key concepts in pharmacology and mention of these was expected. Failure to address these key concepts or provide sufficient detail was a common omission. Candidates were expected to discuss that phenytoin is highly protein bound, changes from first to zero order kinetics with escalating doses and is metabolised by the cytochrome p450 enzyme system. Some discussion of the significance of these points was expected and extra credit was awarded for more detailed explanations, comments on enzyme induction and examples of drug interactions that are well known and clinically relevant. Candidates were expected to comment on the mode of delivery and compare oral and intravenous dosing. It was expected that the need for a loading dose followed by maintenance dosing would be mentioned and extra credit was given for highlighting the potential hazards of rapid intravenous administration. Additional credit was given for mentioning the importance of a narrow therapeutic index and the need for clinical monitoring. Well organized answers such as those with an ordered list of subheadings were rewarded.

Syllabus: G2f, 2f
References: Goodman and Gilman's the Pharmacological Basis of Therapeutics, Chp 19

9 (90%) of candidates passed this question

3. Outline the major clotting factors and steps in the haemostasis pathway (70% marks). Outline the mechanism of action of thrombolytics (30% marks).

This question was also best answered using a structured response and illustrations. Discussion and/or diagrams of the process of formation of temporary platelet plug and conversion to a definitive haemostatic plug after injury to the vessel wall, showing the Intrinsic, Extrinsic and Common Pathways with note of essential co-factors (tissue thromboplastin, Ca^{++}) and fibrinolysis and clot resolution, inhibitors and controlers that prevent excessive coagulation. The latter would lead into outlining the mechanism of thrombolytics. It was expected candidates would mention such mechanisms as catalysing the formation of plasmin from plasmingoen, activation of endogenous plasminogen and direct conversion of plasminogen to plasmin.

Syllabus: J2. 1, J2. 2e
Reference: Pharmacology and Physiology in Anesthetic Practice, Stoelting pgs 510 - 511, Basic and Clinical Pharmacology, Katzung pg 380 - 383

8 (80%) of candidates passed this question

4. Describe the underlying principles involved in the measurement of end tidal CO_2 (by infrared analysis), including sources of error and interference.

Candidates were expected to at least mention and describe the following points – absorption at the infrared spectrum; Beer-Lambert Law and it's relevance to measurement of ETCO2; sources of error (effect of other gases, atmospheric pressure), sources of interference (gas sampling methods, heating), calibration, features of the sampling chamber that may cause error (glass construction, size), sampling rates, etc.

Answers provided by candidates lacked breadth and depth, indicated that there was generally a poor understanding of this topic. The usual mistake was to discuss the clinical reasons behind the reading not reflecting the PaCO2 rather than sources of error of the end tidal CO2. Candidates should review this topic from the references from which the answer was sought and texts included as recommended reading.

Syllabus: R2d, S2g

1 (10%) of candidates passed this question

5. Describe the production and metabolism of lactate.

Lactate is constantly produced from pyruvate via the enzyme lactate dehydrogenase (LDH). Lactate is produced during normal metabolism and in increased quantities during anaerobic metabolism. Candidates were expected to further describe this physiological processes.

A good answered required quantification of lactate production during normal aerobic metabolism, during anaeorobic metabolism, the pathways involved (Glucose to Pyruvate, Pyruvate to Citric Acid cycle in presence of Oxygen, Pyruvate + NADH to Lactate + NAD+ without Oxygen) associated ATP production, site of intracellular production, why red blood cells differ and lactate metabolism (eg oxidation to pyruvate by well-oxygenated muscle cells which is then directly used to fuel the citric acid cycle conversion to glucose via the Cori cycle in the liver through the process of gluconeogenesis). Good answers illustrated the loss of energy potential with the production of lactate and discussed the situations that would lead to an inbalance between production and metabolism of lactate.

Candidates who did poorly in this question did so due to a lack of depth and breadth for this topic. For example, even though the Cori Cycle was often mentioned, it was poorly described in relation to lactate metabolism.

Syllabus: K2g
References: Textbook of Medical Physiology, Guyton Chp 67

5 (50%) of candidates passed this question

6. List the physiological factors that increase respiratory rate. Include an explanation of the mechanism by which each achieves this increase.

Good candidates had a structured approach to this questions. Submitted question structures took the form of key headings (eg, PaCO2, PaO2, pH, etc) with an accompanying explanation, which included diagrams, which were often underutilised. Candidate answers that lacked any structure were more likely to have omissions and lacked sufficient depth and as a result scored fewer marks. For a good answers candidates where expected to list and explain (preferably by including diagrams) physiological factors such as PaCO2, PaO2, pH, Exercise, temperature, pregnancy and the associated receptors for each mechanism.

Syllabus: B1c 1
Reference: Nunn's Applied Respiratory Physiology, Lumb, 6th edition 60-68
Principles of Physiology for the Anaesthetist, Power & Kam, 1st edition 92-98

6 (60%) of candidates passed this question

7. Classify the commonly used inotropic agents and describe their mechanism of action.

This question required a classification based on chemical structure and class action. Sympathomimetics, phosphodiesterase inhibitors, calcium sensitizers and cardiac glycosides should have been mentioned. Additional detail was expected, subdividing Sympathomimetics into catecholamines (naturally occurring and synthetic), and non-catecholamines (direct and indirect acting). Further classification based on peripheral vasomotor action demonstrated greater understanding.

Better answers included diagrams illustrating the mechanism and point of action on the cardiac myocyte. Discussion of receptors, second messengers, and the role of calcium was essential.

The question was aimed at “commonly used” agents, although some marks were awarded for discussion of calcium, glucagon and other rarely used drugs. Insufficient detail regarding mechanisms of action was a common observation.

Syllabus: C2d 2
References: Pharmacology and Physiology in Anaesthetic Practice, Stoelting 4th Ed p293-320. Basic and Clinical Pharmacology Katzung 10th Ed p121-198.
Pharmacology Rang & Dale 6th Ed p168-187, 290-291

6 (60%) of candidates passed this question

8. Describe the role of the kidney in drug excretion and the factors affecting this (80% marks). Briefly outline how you would alter the dosing of a drug with high renal excretion in a patient with renal impairment (20% marks).

The preponderance of marks was allocated to a discussion of renal drug excretion and factors altering this function. Detail was expected including a definition of clearance, and the balance between filtration / secretion / reabsorption in the tubules. Specific mention of GFR, molecular weight of filterable compounds, protein binding, and charge effects determining filtration at the glomerular level was anticipated. Tubular transport mechanisms for secretion and reabsorption in the proximal and distal tubule should have been included in the discussion.

Candidates needed to cover factors which alter GFR, competition for transport proteins, changes in pH on drug elimination, and disease states in answering the question.

An understanding that drug dosing should be based on estimating creatinine clearance and plasma concentration monitoring was essential. Loading dose is usually unaltered. However, maintenance dose and dosing interval need to be adjusted owing to an increased half-life. Many candidates did not emphasise the need to increase dosing interval as well as reduce maintenance dose in renal impairment.

Syllabus: II2d, D12h
References: Goodman and Gilman's the Pharmacological Basis of Therapeutics p10-14. Foundations of Anaesthesia Basic and Clinical Science, Hemmings p107.
Basic and Clinical Pharmacology, Katzung p35, 48-49.

0 (0%) of candidates passed this question

9. Describe the mechanism of action of drugs commonly used to treat acute severe asthma.

Answers to this question needed to address drugs that target the pathophysiology of asthma: bronchospasm, inflammation (oedema and hypersecretion), and hyper-reactivity to inhaled stimuli. Not all drugs used to treat less severe forms of the disease are relevant in the critical care context.

A discussion of efficacy versus toxicity was included in better answers.

As a minimum, sympathomimetics, antimuscarinics, corticosteroids and methylxanthines should have been included. The role of inhaled Adrenaline as a B_2 -agonist mediating bronchodilatation and an alpha-agonist constricting the bronchial mucosa was relevant to the discussion. Ketamine and volatile anaesthetics could have been discussed as adjuncts to therapy in ventilated patients. More controversial therapies such as Magnesium and Heliox are less commonly prescribed, however marks were awarded for more comprehensive answers.

Syllabus B2a 2a
Reference: Goodman and Gilman's the Pharmacological Basis of Therapeutics 11th Ed p717-736

7 (70%) of candidates passed this question

10. Outline the mechanism of action of drugs commonly used to prevent stress ulceration in intensive care.

For a good answer candidates were expected to mention the following key broad points, being there are drugs that act by decreasing acid production in the stomach, drugs that act as mucosal protectors and drugs that reduce intra gastric acidity. Based upon that candidates would be expected to mention and outline the mechanism of action of H2 receptor antagonists, H+K/=ATPase (proton pump) inhibitors, sucralfate's mechanism of action and antacids. Candidates who structured their answer tended to provide more complete answers and score better. Candidates who failed did so because of a lack of sufficient knowledge of the mechanism of action of the drugs.

Syllabus: Q2, 2a. b,c
References: Basic and Clinical Pharmacology Katzung 10th Ed pg 1009.
Pharmacology Rang & Dale 6th Ed p 526-7, 255, 497, 587

6 (60%) of candidates passed this question

11. Describe a set of arterial blood gases in a pregnant woman at term and the reasons for these values.

For a good answer candidates were expected to describe the respiratory alkalosis and metabolic compensation associated with pregnancy. Candidates were expected to write a set of arterial blood gases showing a compensated respiratory alkalosis with a normal to slightly high $P0_2$. Values within +/- 5% of those expected, and found, in listed references would have scored candidates marks.

Candidates were then expected to mention that the PaO2 is high despite a 20% increase in oxygen consumption (relate that to increase in alveolar ventilation, decrease in PaCO2, and alveolar gas equation; PaCO2 is low due to tidal volume increase by 35%, Although anatomical dead space increases VD/VT in unchanged, despite CO2 production increased by increased basal metabolic rate; HCO3 decreases because of increased renal excretion of HCO3 due to inhibition of renal secretion of hydrogen ions and ammonium; base deficit reflects the renal loss of HCO3.

Some candidates described a low maternal $P0_2$, none commented on how the maternal P02 and $PC0_2$ enhance gas exchange to the foetus. While electrolyte values are often measured on arterial blood gas analysis they do not form part of an arterial blood gas and so comments on electrolytes gained no marks. The double Bohr and double Haldane effects were not required to answer this question. Once again, this question highlighted the importance of a structured approach to the answer, thus enhancing a candidates opportunity to cover all key areas and put their knowledge across.

Syllabus: O1, 2a
References: Nunn's Applied Respiratory Physiology, Lumb, 6th edition, Chp 14

2 (20%) of candidates passed this question

12. Outline the classification of viruses giving examples of each class (60% marks). Describe the mechanism of action of acyclovir and oseltamivir (40% marks).

Viruses are classified according to

a) genetic material
b) mode replication
c) structural proteins (capsids)
d) presence of an envelope

Thus DNA viruses, double or single stranded DNA usually replicate in the nucleus of the host cell via polymerase, not incorporated into the host genetic material. Examples being double stranded, herpes, adenovirus, poxvirus and single stranded, parvovirus. In comparison, RNA viruses, single strand and have 2 different reproduction strategies, being RNA sense(positive) and RNA antisense(negative), an example is paramyxovirus. For retroviruses, the single stranded RNA can't act as mRNA and is transcribed into DNA by a reverse transcriptase. This DNA is incorporated into the host DNA, so the host makes the viral RNA, for example HIV. Candidates were also expected to briefly mention capsids and viral envelopes.

In relation to the second part of the question, candidates were expected to mention that acyclovir inhibits DNA polymerase in the terminal nucleic acid chain and that oseltamivir is a neuraminidase inhibitor which prevents the budding of new viruses from the infected cells. Most candidates had very little knowledge of this area.

Syllabus: M2 2a&d

Reference: Medical Microbiology and Infection at a Glance, Gillespie &, Bamford pgs 58,59, Basic and Clinical Pharmacology, Katzung pgs791,815

1 (10%) of candidates passed this question

SAQ PAPER 2

1. Describe the physiological basis of the effects seen in the serotonin syndrome (80% marks). List the classes of drugs that may cause the serotonin syndrome (20% marks).

For a good answer candidates were expected to mention the role of serotonin (5 hydroxytryptamine) is an important neurotransmitter, a local hormone in the GIT and involved in platelet reactions. It is formed from tryptophan and metabolised by MAO (thus the potential effect of a combination SSRI with MAO inhibitor, or concurrent use of several serotonin affecting drugs). Typically the serotonin syndrome is a predictable effect of increased CNS levels of serotonin with a consequence of hyper reflexia, tremor, clonus, skeletal muscle contraction and hyperthermia (but in serotonin syndrome these effects are probably CNS mediated), hypertension, and diarrhoea.

The expected list of drugs included **the** SSRI's themselves, combination of SSRI's and MAOI's, antidepressants (2^{nd} generation [e.g Venlafaxine]) ,Tramadol (blocks serotonin re-uptake), pethidine, fentanyl, ondansetron, sumatriptan (5-HT1 agonist).

Syllabus: M3
References: Basic and Clinical Pharmacology, Katsung pg 264 – 269

7 (70%) of candidates passed this question

2. Describe the basic principles of ultrasound imaging including the Doppler effect.

It was expected candidates would outline the underlying principles of ultrasound imaging (reflection, scattering , refraction, and attenuation) and discuss that the basic image is the result of reflection of the transmitted ultrasound wave. Most candidates appreciated that the amplitude of the reflected echo is a function of the acoustic mismatch of the tissues and the angle of incidence and many candidates provided details mathematical descriptions concerning these principles.

While high levels of technical details were not required the answer should include a mention of the use a piezoelectric transducer and that an ultrasound beam has 3 dimensions – Axial, Elevation and Lateral. Some comment of the modes of Display (A= Amplitude , M = Time Motion , 2D , etc) was expected.

Extra credit was given for answers that included details regarding limits of depth of penetration (longer wavelength penetrate deeper , but loose image quality with longer wavelengths) and the varying properties of human tissue regarding refraction and attenuation (little refraction (path deviation) in human tissue and air attenuates).

Specific comment on the Doppler Effect was required. It was expected candidates would described that it refers to the change in frequency of a sound wave reflected by a moving target and that the reflected frequency differs if moving toward or away. Correctly stating that the reflected Frequency is HIGHER TOWARDS and LOWER AWAY scored additional marks Comments concerning obtaining the best Doppler

images with lower frequencies (opposite to u/s) and colour Doppler attracted additional marks.

Syllabus: R2f
References: Foundations of Anaesthesia – Basic Sciences for clinical practice, Hemmings and Hopkins –Chapter 17

7 (70%) of candidates passed this question

3. Discuss the important factors in exchange of gases and substrates between capillaries and tissue cells.

Good answers were based around Fick's Law, Starling forces and the Gibb's Donnan effect.

It was expected that candidates would give Fick's equation and describe the components :

Fick's Law $J = -DA\, dc/dx$

Candidates were also expected to describe Starlings equation and the equation for Osmotic Pressure. Starling Equation:

Fluid movement = $k[(Pc-Pi) – s(\pi_p – \pi_i)]$
Osmotic pressure : $sRT(Ci-Co)$.

Gibb's Donnan effect and, other mechanisms of transport (filtration and pinocytosis) was also expected for a good answer.

Syllabus: A combination C1c2.d, C21 2.e, C2b2.c, C2b2.e
References: Pharmacology and Physiology in Anesthetic Practice, Stoelting pgs 294-300, 322- 325

4 (40%) of candidates passed this question

4. Define the mechanisms of action and adverse effects of metoprolol and glyceryl trinitrate when used to manage myocardial ischaemia.

For a good answer candidates were expected to make some mention of the link between myocardial O2 demand / heart rate / contractilty. This was often overlooked, and candidates who did tended to not respond to what the question was asking, that is "when used to manage myocardial ischaemia".

Good answers had a structured response. For a good answers candidateswere expected to mention metoprolol effects of reducing left ventricular wall stress , decreased C AMP / mechanism, decreased hear rate, contractility, resultant decreased O2 demand as well as adverse effects include Bradycardia / heart block / hypotension / bronchconctriction, etc. In relation to Glyceryl trinitrate, to mention dilation via nitric oxide, predominately venodilatation, decreased venous return, LVEDP, Wall stress, decreased demand O2 demand and increased supply via

coronary vasodilation and adverse effects include hypotension / tachycardia tolerance / headache.
Candidates are reminded that if they are to use non standard abbreviations, then those abbreviations must be defined somewhere within their answer.

Syllabus: C1c, 2d, C2b, 2e, C2a, 2d
References: Goodman and Gilman's the Pharmacological Basis of Therapeutics, Chp 32

8 (80%) of candidates passed this question

5. With regard to ORAL drug dosing, describe the factors that affect the fraction of drug reaching the systemic circulation (80% marks). How may these factors be altered in a patient with shock (20% marks)?

For a good answer candidates were expected to define bioavailability and the factors that affected a drugs oral bioavailability. This was often overlooked by candidates. For example, factors affecting absorption (Metabolism by gut flora, drug / drug interactions with in the gut, lipophilicity and hydrophilicity of the drug (drug that are markedly lipophilic or hydrophilic cross the mucus layer or villous membrane poorly), First Pass clearance and sites and mechanism of possible metabolism, to define hepatic clearance, extraction ratio (providing a formula proved helpful to many candidates) and factors that affected hepatic drug clearance. Candidates often lacked an understanding of this area, or failed to mention it. In relation to the second part of the question, candidates were expected to mention the effects of reduced absorption and altered first pass metabolism resulting in uncertain bioavailability of oral drugs.

Syllabus: Section II, 2a, b
References: Pharmacology, Rang, Ritter and Dale, Chp 7. Goodman and Gilman's the Pharmacological Basis of Therapeutics, Chp 1

6 (60%) of candidates passed this question

6. Describe the physiology of intracranial pressure and the physiological mechanisms that limit a rise in intracranial pressure.

Candidates who did well in this question used graphs to describe the various concepts, described normal physiology and covered the breadth of the topic. A good answer made mention of normal values of ICP, it’s variation with respiration and blood pressure and illustrated a trace of the ICP. An explanation of the Monroe Kelly doctrine was expected, CSF production and absorption and it’s relationship to raised ICP as well other compensatory mechanisms for a high ICP (eg displacement of CSF into spinal canal, displacement of venous blood into the jugular veins, rise in ICP leads to ischaemia if the brain. Critical ischaemia invokes the Cushing reflex.

Major omissions by candidates was the use of diagrams, description of normal variation and only a superficial knowledge of compensatory mechanisms.

Syllabus: G1, 2d,g
References: Textbook of Medical Physiology, Guyton, Chp 61

7 (70%) of candidates passed this question

7. Describe the types of dead space in the respiratory system (50% marks). Explain the consequences of increased dead space on gas exchange (50% mark).

A definition of dead space incorporating subtypes (anatomical, apparatus, alveolar, physiological) was expected. Explanation of measurement methods attracted additional marks. Changes to End-tidal CO_2 relative to $PaCO_2$ were relevant to the question. The Bohr equation was stated and variables defined in better answers. Causes of an increased dead space should have been described including hypoperfusion and increased alveolar pressure.

Increased dead space primarily results in CO_2 retention, unless minute ventilation is increased commensurately. The physiological effects of increased $PaCO_2$, increased respiratory rate and work of breathing are central to the question.

Many candidates predicted severe hypoxemia; however the alveolar gas equation was not stated to explain this observation. Hypoxemia is a relatively late effect of significant hypo-ventilation, especially if the patient is breathing supplemental O_2.

Syllabus: B1e 2c
Reference: Nunn's Applied Respiratory Physiology p310-311. Principles of Physiology for the Anaesthetist, Power & Kam p84-87

5 (50%) of candidates passed this question

8. Explain the role of urea in the body.

This question invited candidates to describe the Urea Cycle in the liver. Urea is a waste product derived from deamination of amino acids and the detoxification of NH_3. Many candidates did not outline the major steps in the biochemical process.

The kidneys excrete up to 60% of the filtered urea load. The counter-current exchange mechanism in the renal medulla traps urea in the interstitium and generates a concentration gradient, essential for reabsorption of water. The handling of urea by the Loop of Henle and collecting duct, as well as the effect of ADH, should have been discussed.

Many candidates did not include sufficient detail in their answers.

Syllabus: D1 2c,g. I2a.
References: Textbook of Medical Physiology, Guyton p 795, 319.

1 (10%) of candidates passed this question

9. Define preload and describe the determinants of preload.

A definition based on stretch of the isolated myocyte prior to contraction, and extrapolation to the human heart, was expected. Surrogate measures of preload used in clinical practice needed to be explained and related to the definition (for example, end-diastolic volume and central venous pressure). The Frank-Starling Law was relevant to discussion of the significance of preload to cardiac performance.

A diagram illustrating the interaction of important factors would have been helpful in answering this question. At a minimum, detail should have included atrial contractility, diastolic filling time, ventricular compliance, and the determinants of venous return.

Better answers included discussion of the effects of afterload, arrhythmias, and valvular pathology. A distinction between the factors determining left and right ventricular preload would have demonstrated a more sophisticated understanding of the physiology.

Syllabus: C1c, 2b,c.
Reference: Cardiovascular Physiology, Berne and Levy, p64-65.

1 (10%) of candidates passed this question

10. Describe the physiology of vomiting.

For a good answer, candidates were expected to take the following approach and content of information.

Triggers or initiators of vomiting include:

- Excessive distension or irritation of the upper GI tract, in particular the duodenum
- Stimulation of the chemoreceptor trigger zone (CTZ)
    - Directly by certain drugs eg apomorphine, morphin
    - Rhythmic motion of the body stimulating the vestibular labyrinth of the inner ear
- Cerebral excitation of vomiting by stimuli such as disquieting scenes, odors

Neuronal pathways:

Stimuli of the GI tract conveyed by vagal and sympathetic afferents to the bilateral vomiting centre within the medulla. Efferent arc from the vomiting centre via the 5^{th},7^{th},9^{th},10^{th} and 12^{th} cranial nerves, and spinal nerves to the abdominal wall muscles (and the diaphragm).

Vomiting act:

Antiperistalsis as the prelude to vomiting
At the onset of vomiting, strong intrinsic contractions occur in both the duodenum and the stomach
Partial relaxation of the lower oesophageal sphincter (LOS)
Deep breath
Raising of the hyoid/larynx to open the upper oesophageal sphincter

Glottic closure
Lifting of the soft palate to close the posterior nares
Strong down ward contraction of diaphragm and simultaneous contraction of all the abdominal wall muscles
Complete relaxation of the LOS

Most candidates answered this question well. Antiemetic drugs and their mechanism of action gained no marks.

Syllabus: Q1.2e
Reference: Textbook of Medical Physiology, Guyton Pg 768

8 (80%) of candidates passed this question

11. Describe and or illustrate the anatomy relevant to the insertion of an arterial line into the femoral artery.

The femoral artery lies in the femoral triangle. Candidates were expected to describe the content of the triangle. The upper medial and lateral borders of the triangle, the anterior and the posterior relationships of the femoral artery should also be described. The femoral artery is an extension of the external iliac artery and has an important branch, the profunda femoris artery which comes off on the lateral side.
Diagrams gained marks as did mention of common anatomical landmarks to locate the artery. Candidates who failed did not have enough knowledge. Description of how to place an arterial line gained no marks.

Syllabus: C1d2g
References: Grays Anatomy pages 379,526-27,587,497

3 (30%) of candidates passed this question

12. Describe the mechanism of action of the analgesic effect of opiates (70% marks). Explain the mechanisms by which morphine causes respiratory depression and constipation (30% marks).

This was a multi-part question, for which many candidates failed to apportion their time as indicated by the question. Most patients who enter Intensive Care receive opioid analgesia so candidates were expected to have detailed knowledge about the mechanics of action of opiates. For a good answer candidates were expected to mention that opiate agonists produce analgesia by binding to Mu receptors (which are G protein coupled) in the central and peripheral nervous system and spinal cord and their cellular mechanism of action eg presynaptic neurone - close voltage gated Ca channels and prevent neurotransmitter release and post synaptic neurone - hyperpolarise and inhibit post synaptic neurone. The fact that opiates also affect emotional side of pain and cause euphoria which may help with pain perception was often omitted.

Mechanism of respiratory depression is mediated via mu receptor. It occurs at normal analgesic doses, and decreases the chemosensitivity of the respiratory centre to PaCO2

Mechanism of constipation results from increased tone and decreased motility of the GIT via action on visceral smooth muscle mediated by intramural nerve plexus and all three opioid receptors.

Many candidates had poor organisation and poor knowledge of all aspects of this question.

Syllabus: G2d 2b
Reference: Pharmacology, Rang and Dale pgs 600-601, Basic and Clinical Pharmacology, Katzung pg 492

3 (30%) of candidates passed this question

PAPER 1 and 2 CLOZE QUESTIONS

10 (100%) of candidates passed these questions

PAPER 1 and 2 RANK QUESTIONS

7 (70%) of candidates passed these questions
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PAPER 1 and 2 MATCH QUESTIONS

9 (90%) of candidates passed these questions
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ORAL SECTION

8 candidates were invited to attend the oral section based on their written marks.

Candidates were presented with the following information (shown in *Italics*) during the two minute reading time.

VIVA 1

This viva will discuss dose response curves and the information that can be gained from them.

Candidates were asked to draw a dose response curve for morphine and to describe the information that relates to it. Areas of basic pharmacology including ED50/potency, efficacy, effect of competitive and non competitive antagonists were also tested

8 (100%) of candidates passed this VIVA

VIVA 2

This viva will test your knowledge of hypoxemia, oxygen therapy and pulse oximetry

The following is a blood gas of a young person who has taken a sedative drug overdose.

pH	***7.2***
PO2	***40 mmHg***
PCO2	***80 mmHg***
HCO3-	***28 mmols/L***

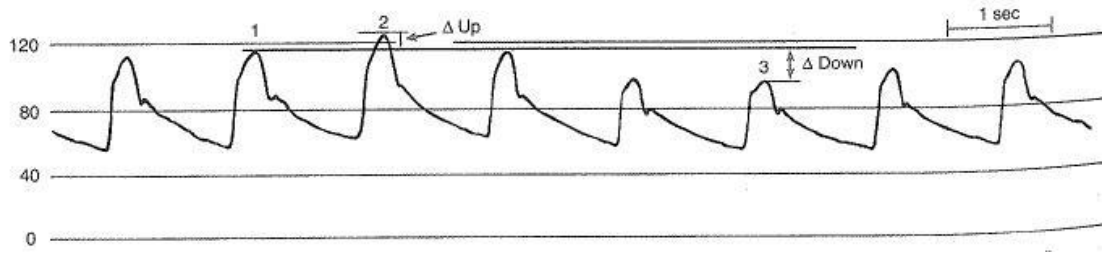
Describe this blood gas

Apart from being asked to describe the blood gas, candidates were also asked about the Henderson-Hasselbach equation, causes of hypoxaemia, pulmonary shunt, response to supplemental oxygen and pulse oximetry.

5 (62.5%) of candidates passed this VIVA

VIVA 3

This station will explore cardiovascular physiology, positive pressure ventilation and aspects of measurement.



This is a trace of the arterial blood pressure in a mechanically ventilated patient. It is well known that variations in blood pressure can occur with respiration.

Outline the physiology that explains why these blood pressure changes occur?

Candidates were asked to explain the physiological principles that contribute to these blood pressure changes, in addition to the cardiovascular consequences of positive pressure ventilation, regulation of myocardial contractility and a series of questions relating to invasive pressure monitoring. These included being asked to describe a transducer, accuracy and calibration

8 (100%) of candidates passed this VIVA

VIVA 4

This station is concerned with the physiology and pharmacology related to the musculoskeletal system

Candidates were asked to draw and label a sacromere, outline the physiological events relating to muscle contraction, length – tension relationship, muscle relaxants, malignant hyperthermia and dantrolene

2 (25%) of candidates passed this VIVA

VIVA 5

This Viva will examine knowledge of intravenous fluids, colligative properties

What is in a bag of Normal Saline?

Areas of knowledge that candidates were tested on included concepts of osmolality, osmolarity, anion gap, mannitol, and colligative properties of fluid. In addition this

viva tested knowledge of the pituatary gland, specifically anatomy, hormones secreted and in particular, Anti Diuretic Hormone.

7 (87.5%) of candidates passed this VIVA

VIVA 6

This Viva will examine liver physiology and diuretics.

During this Viva candidates were asked about the functions of the liver, liver drug metabolism, blood supply and the physiological consequences of cirrhosis upon liver blood flow. Candidates were also asked about frusemide, frusemide associated biochemical disturbances

7 (87.5%) of candidates passed this VIVA

VIVA 7

This viva will test knowledge of pharmacokinetics and statistics

Draw the concentration time curve for an intravenous bolus of fentanyl.

At this Viva candidates were asked to draw a concentration – time curve for an intravenous bolus of fentanyl, to label it and describe the information relating to that curve. Candidates were also asked about volume of distribution, half-life and clearance. In the second part to this Viva candidates were shown and asked to describe various types of data, mean and median values, normal distribution and critical evaluation of a study.

7 (87.5%) of candidates passed this VIVA

VIVA 8

This Viva will test knowledge of spinal cord anatomy, local anaesthetics and analgesics

Draw a cross-sectional figure of the spinal cord, at the level of C3, and describe the functional anatomy and blood supply of the spinal cord at that level.

Candidates were asked to draw a cross-sectional figure of the spinal cord, at the level of C3, and tested on their ability to describe the functional anatomy and blood supply of the spinal cord at that level. Candidates were also asked about local anaesthetic drugs, their mechanism of action, pain (and asked to define pain) and non-opioid analgesics, in particularly ketamine and the pharmacology of ketamine.

3 (37.5%) of candidates passed this VIVA

Summary of Examination

The CICM Primary Examination explores knowledge of the basic science that forms the foundation to Intensive Care practice. A detailed syllabus has been developed and forms the foundation for the knowledge base for the JFICM Primary Examination. All questions are sourced directly from that syllabus. The candidates should be able to integrate and express basic physiological and pharmacological principles as to how they relate to various scenarios relevant to Intensive Care practice.

Candidates appeared to be better prepared for this Examination and this is reflected in the higher than usual pass rate and higher scores achieved in similar areas of knowledge that have been examined in prior examinations.

Future candidates are reminded to read the question carefully, and tailor their answer to the question asked. Multi-part questions will always show how marks will be distributed and candidates should apportion their time accordingly. Anatomy is an important component of this exam, and was a general area of weakness amongst all candidates on this occasion. Candidates are also encouraged to use illustrations where possible and to have some form of structure to their written responses. A structured and organised answer will enhance the possibility that a candidate's answer is inclusive, shows understanding and less likely to have omissions in knowledge.

Candidates are 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 Primary Examination.

On behalf of the Examination Panel I would like to congratulate the successful candidates at this CICM Primary Examination.

A/Prof Arthas Flabouris
Deputy Chair
Primary Examination Committee

Circulation:	Board of College	Panel of Examiners
	Supervisors of Intensive Care Training	Course Supervisors
	Regional Education Offices	Registered Trainees