

FELLOWSHIP CAI EXAMINATION CHANGES DUE TO COVID-19



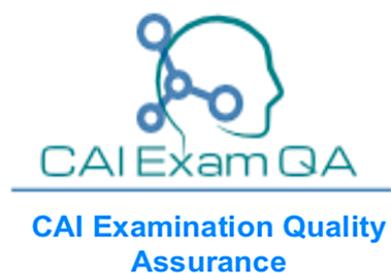
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College of Anaesthesiologists of Ireland

CAI
SALUS DUM VIGILAMUS



1 Introduction

The COVID-19 pandemic has presented **significant challenges** for Medical Schools and Postgraduate Medical Colleges. The requirements for social distancing, restricted travelling and avoidance of large gatherings have made running face-to-face examinations highly undesirable.

The College of Anaesthesiologists of Ireland (CAI) endorses patient care, patient safety and maintaining a healthy workforce as our fundamental priorities at this time. Trainee and examiner **wellbeing** is also paramount. Given the uncertainty over future restrictions, the CAI formed an **examination working group** to review our examinations, and make appropriate changes that will still allow the correct assessment domain to be tested, but utilising a different format and construct to comply with the COVID-19 restrictions and regulations.

We have made **numerous adjustments** to our examinations to ensure the validity and reliability of such high-stakes assessments, whilst protecting the safety of all candidates, minimising risk and maintaining defensibility to key stakeholders.

The **purpose** of this document is to describe and explain the evidence-based changes which have been made to the **fellowship** of the College of Anaesthesiologists examinations to facilitate their conduct on a digital platform. These changes have been reviewed and approved by the Irish Medical Council (IMC).

The College of Anaesthesiologists totally appreciates the anxiety that examinations can place on doctors, especially given the number of changes outlined below. Let us reassure you that these alterations will make the new examination as safe, fair and consistent as prior to COVID-19.

The major changes to the Fellowship (FCAI) Examination include:

- Candidates will sit **all components** of the FCAI examinations **online** at a place of their choosing, such as their home or workplace, using their own hardware.
- The CAI will use **online remote invigilation** which essentially recreates the examination hall experience online.
- The FCAI **single best answer** and **short answer question examinations** will remain unchanged in terms of format and content.
- The **structured oral examinations** (SOEs) will be replaced by constructed response questions (CRQs) and very short answer questions (VSAQs).

Changes to each examination component due to COVID-19

The SBA and SAQ examination will be completed on the same day.

2 FCAI Single Best Answer (SBA) examination

There will be **no change** to the composition, blueprint or marking of this examination.

For the Fellowship examination, we expect candidates to be able to show us that they can **apply knowledge** and **interpret data** etc. This is where SBAs are invaluable and have a robust evidence base.

The SBA questions are written by a core group of examiners who are highly experienced in producing them. We use 5 distractors and develop questions with a fairly detailed clinical scenario.

The SBA paper has **90 compulsory questions** in it and is completed in **180 minutes**. The paper will be **split** into two sections, each containing **45 questions** to be completed in **90 minutes**.

Example FCAI Single Best Answer Question

A 58-year-old man who had an elective right-sided hemicolectomy develops a tachyarrhythmia in the post anaesthesia care unit. He has a past history of hypertension treated with bendroflumethiazide and ischaemic heart disease.

Which of the following serum electrolyte abnormalities is most likely to contribute to the arrhythmia?

- A. Ionised calcium 1.43 mmol L⁻¹
- B. Magnesium 0.4 mmol L⁻¹
- C. Phosphate 0.6 mmol L⁻¹
- D. Potassium 3.3 mmol L⁻¹
- E. Sodium 129 mmol L⁻¹

Answer: B: Magnesium 0.4 mmol L⁻¹

2.1 Blueprint

All questions are mapped to a detailed blueprint, with explicit coverage of the **entire** fellowship curriculum. Advanced sciences which underpin anaesthesiology will also be tested.

2.2 Testing format

This examination will be **completed online** using **remote proctoring**.



Proctoring or a **proctored examination** is defined as a mechanism to ensure the authenticity of the assessment taker and prevent them from cheating as a proctor is present during the duration of the exam. A proctor is a person who is trained and qualified to undertake candidate authentication and prevent them from doing any form of cheating.

Remote proctoring enables candidates to complete an examination online in a remote location, while maintaining the **integrity of the assessment**. Candidates must confirm their identity and they will be monitored through video. This video is then used to flag any irregular candidate behaviour.

This avoids the need for a cohort of candidates to come together in an examination hall, as the examination can be taken at home, in the workplace etc.

Since some candidates may find the idea of being watched by a proctor off putting, the **proctor is not visible to candidates**.

2.4 Pass mark determination

The cut score (pass mark) for the SBA paper is determined by **Angoff referencing**. This is undertaken by a group of examiners who have completed training in this method of standard setting, which is internationally recognised.

3 FCAI Short Answer Question (SAQ) examination

There will be **no change** to the composition or blueprint or marking of this examination.

The aim of the SAQ paper is to test higher level thinking and cognition including:

- Judgment and common sense
- Clarity of thought
- Safety
- Ability to prioritise and summarise
- Ability to express oneself clearly
- Capability to present an argument clearly and succinctly in writing.

3.1 SAQ Structure

There are **10 short** and **structured questions** in the paper, all of which **must be answered** – failure to submit an attempt to a question will result in a fail.

Candidates have **200 minutes** to complete the examination, approximating 20 minutes per question. The paper will split into two sections (5 questions in 100 minutes).

SAQ examinations have long been a **contentious issue** with educationalists, the **main criticism** that such assessments **lack reliability** for a high-stakes postgraduate examination. However, the following changes we have implemented have resulted in excellent reliability.

1. The short answer questions are **highly structured**. Each of the 10 questions contains at least **3 – 6 subparts**.
2. Questions are written containing **verbs** from **Bloom's taxonomy**, to aid **higher-level cognitive testing**. For the Fellowship examination, the Bloom levels of analysis, synthesis and evaluation are particularly sought after.

Bloom's Level	Description	Verbs
Knowledge	Rote memorization, recognition, or recall of facts	Define, repeat, record, list, recall, name, relate, underline.
Comprehension	Understanding what the facts mean	Translate, restate, discuss, describe, recognise, explain, express, identify, locate, report, review, tell.
Application	Correct use of the facts, rules, or ideas	Interpret, apply, employ, use, demonstrate, dramatise, practice, illustrate, operate, schedule, sketch.
Analysis	Breaking down information into component parts	Distinguish, analyse, differentiate, appraise, calculate, experiment, test, compare, contrast, criticise, diagram, inspect, debate, question, relate, solve, examine, categorise.
Synthesis	Combining parts to make a new whole	Judge, appraise, evaluate, rate, compare, revise, assess, estimate
Evaluation	Judging the values or worth of information or ideas	Compose, plan, propose, design, formulate, arrange, assemble, collect, construct, create, set-up, organise, manage, prepare.

3. The **blueprint** for this examination contains the following number of questions from each unit of training:

Fellowship Syllabus Area	Minimum number of questions
<p>Specialist units:</p> <ul style="list-style-type: none"> • Anaesthesia for neurosurgery, neuroradiology and neurocritical care • Cardiothoracic • Intensive care medicine • Obstetrics • Paediatrics • Pain medicine 	5
<p>General units:</p> <ul style="list-style-type: none"> • Airway management • Critical incidents • Day surgery • ENT, Maxillo-facial & dental surgery • General, urological & gynaecological surgery • Management of respiratory & cardiac arrest • Non-theatre • Ophthalmic • Orthopaedic surgery • Plastics / burns • Regional • Sedation • Transfer medicine • Trauma & stabilisation • Vascular surgery 	4
<p>Advanced sciences which underpin anaesthesiology practice:</p> <ul style="list-style-type: none"> • Anatomy • Pharmacology • Physiology & biochemistry • Physics & clinical measurement • Statistical basis for trial management 	1*

***Advanced sciences** are tested within most questions. For example, an obstetric question testing knowledge on the management of post dural

puncture headache could start with a question on “describe how CSF is made”.

4. **Each question** is marked out of **25**, giving a total of **250 marks** for the **entire examination paper**. Each component of one of the ten questions can have marks awarded proportionately to help guide candidates on which parts to spend more time on.

5. **Highly structured model answers** have been developed making marking easier and more acceptable to examiners.

6. A **greater integration** of the **syllabus** within the 10 questions. For example, a question assessing the management of a head injury, which resulted in an acute subdural haemorrhage presented to a district general hospital. The patient needs urgent surgery and so must be transferred to a tertiary referral centre. This question therefore can assess learning outcomes from the neurosurgery and transfer medicine units of the FCAI examination curriculum.

7. The SAQ is marked by **ten different examiners**, enhancing reliability and fairness.

Example FCAI Short Answer Question

A 38-year-old woman with Grave's disease and a palpable goitre presents for an elective total thyroidectomy.

- a) Outline the regulation of thyroid hormone synthesis and secretion. [6 marks]
- b) Name four drugs that can be used to treat hyperthyroidism and briefly describe their mechanism of action. [8 marks]
- c) What are the main anaesthesiology priorities in assessing a patient with thyrotoxicosis who is presenting for a thyroidectomy? [6 marks]
- d) List the procedure specific complications that may present in the perioperative period in a thyroidectomy patient? [5 marks]

3.2 Standard setting

The **pass mark** for every question will be calculated by the **Angoff method**. Therefore, this will take into account how difficult each question is. The **overall SAQ pass mark** is calculated by totalling the Angoff cut score for each question.

3.3 FCAI SAQ format

This examination will be **completed online** using **remote proctoring**. The paper will split into two sections (100 minutes per section and 200 minutes in total) to facilitate a short break in between).



3.4 What if I am slow at typing?

The **FCAI SAQ** examination only **requires short answers** therefore candidates should not anticipate an issue with timing. Typing will also remove the legibility issues associated with handwriting. You will not be penalised for poor spelling but should ensure that the answer you wish to put is recognisable. If you require adjustments for a computer-based exam such as additional time, you will need an educational psychologist assessment with recommendations for adjustments to support your request. This should be submitted to the College on application.

3.5 Outcome

Candidates will not find out their result on the same day following completion of the online examination. The questions have to be marked and a rigorous quality assurance process will take place prior to the issue of results.

You will be notified by the CAI examinations department of the issue of results date, which will be available on the CAI website → Examinations → Recent results.

Candidates **must pass** both the SBA and SAQ components individually. There is no compensation between these two examinations.



If you are successful, you will be eligible to apply for FCAI written components which are replacing the SOE and clinical components.

4 FCAI Clinical Case (replacing Clinical Case Structured Oral Examination)

The structured Oral Examination (SOE) component of the FCAI will change to an **online proctored written examination**.

- This will be composed predominantly of constructed response questions (CRQs) and some very short answer questions (VSAQs).
- Data including blood tests, electrocardiograms etc. will be included.
- *The key focus of the final fellowship clinical case and SOEs is to assess clinical reasoning, judgement, decision making and management skills.*

Clinical reasoning is usually defined in a very general sense as “The thinking and decision -making processes associated with clinical practice” or simply “diagnostic problem solving”. The College of Anaesthesiologists feel that this is a very important skill to be assessed at this level.

The new written questions will also focus on the following high-level domains.

High-Level Domain	Description
Diagnostics	<ul style="list-style-type: none">• Being able to generate a diagnosis / differential diagnosis• Ability to interpret investigation results.
Clinical judgment	<ul style="list-style-type: none">• Ability to use higher order thinking to guide decision making and management strategies
Management	<ul style="list-style-type: none">• Ability to generate anaesthesiology / ICU / pain management plans, which employ up-to-date EBM.
Medical knowledge	<ul style="list-style-type: none">• Understanding of the breadth and depth of the FCAI syllabus, and the literature
Safety	<ul style="list-style-type: none">• Can provide safe and highly effective care.

4.1 How can we replace the clinical case?

The **clinical case** (oral), will be replaced by a clinical case (written). The **case-based questions** all follow the course of the clinical encounter, starting with appropriate case information that reflects the initial facts the anaesthesiologist normally would have (age, gender, and presenting complaint, past medical history, medication history etc.) and a short clinical presentation vignette. Then, a series of questions about the case unfolds.

This examination will contain a **consistent structure** and **blueprint** for its content:

Examination time	Examination Focus
0-10 minutes	<ul style="list-style-type: none"> • Candidate summarising case • Outlining the key anaesthesiology issues
10-20 minutes	<ul style="list-style-type: none"> • Exploration of anaesthesiology issues e.g. the impact of ischaemic heart disease • Scoring/risk assessment systems
20-30 minutes	<ul style="list-style-type: none"> • Data interpretation • Any pre-optimisation?
30-40 minutes	<ul style="list-style-type: none"> • Anaesthesiology plan including airway management etc. • Intraoperative management key points
40-50 minutes	<ul style="list-style-type: none"> • Plan for post-op analgesia including regional anaesthesia
50-60 minutes	<ul style="list-style-type: none"> • Critical incident management e.g. post-op laryngospasm

Data will be included (e.g. 12-lead ECGs, Chest x-ray, pulmonary function tests) requiring interpretation).

The questions that follow will be a **mixture** of **CRQs** and **VSAQs**. They will be structured in such a way that the higher cognitive levels of learning will be tested.

4.2 What are Constructed Response Questions (CRQs) / Very Short Answer Questions (VSAQs)?

CRQs are **open-ended** short answer questions with precise answer templates which are most commonly used to measure **knowledge, reasoning** and **application-level** cognitive skills. We will be able to include “real world” artefacts (graphs, images, scenarios, cases) in them. They typically consist of 5+ sub-sections often including a clinical scenario. The Sub-sections increase in complexity and difficulty as the question progresses. They will be graded against a mark scheme with guidance as to specifically how marks are gained or lost.

Examiners will receive **detailed guidance** on the construction of these questions, and all will be reviewed by the Lead examiner and a medical educationalist.

VSAQs consist of a **clinical vignette** followed by a question (usually about diagnosis or management), which requires candidates to generate a short

response, typically one to four words long. The advantage of this is that candidates must demonstrate their knowledge, which is more representative of **real-life scenarios**. VSAs are not subject to cueing or guessing in the same way that SBAs and true/false MCQs are.

4.3 Number of questions and time

There will be many subparts totalling **80 marks**. Candidates will have **60 minutes** to complete this component in.

4.4 Standard setting

The cut score will be determined using **Angoff referencing**.

4.5 FCAI Written clinical case format

This examination will be **completed online** using **remote proctoring** on the same day as the written examination replacing SOE 1 and SOE 2.



Example Clinical Case (Written)

A 23-year-old primigravida is 8 hours post caesarean section for failure to progress. Her labour was long, and she had a 4kg baby. Since the operation, she has been continuously bleeding and has passed large amounts of blood clots vaginally.

She is pale, sweaty and drowsy. She has been reviewed by the consultant obstetrician who wishes to perform an emergency laparotomy. She has received a transfusion of two units of packed red cells and 1 litre of Hartman's solution. An intravenous infusion of oxytocin was commenced 4 hours ago.

Clinical examination:

Weight:	69kg
Height:	170 cm
Respiratory rate:	24 breaths per minute
Heart rate:	140 beats per minute (low volume pulse)
Blood pressure:	70/40 mmHg
Temperature:	36.7°C
SpO ₂ :	94% breathing room air

Laboratory results:

	Pre-caesarean section	Now	Reference range
Haemoglobin	118	64	110-160 g L ⁻¹
Platelets	130	80	150-450 ×10 ⁹
Prothrombin time	12	18	10-13 Secs
Activated partial thromboplastin time	26	40	23-30 Secs
Fibrinogen	2	0.6	1.5-4.5g L ⁻¹
Fibrinogen degradation	4	6	<10 µg ml ⁻¹
Sodium	137	140	mmol L ⁻¹
Potassium	4.2	4.1	mmol L ⁻¹
Chloride	111	113	mmol L ⁻¹
Urea	7	14	mmol L ⁻¹
Creatinine	60	120	µmol L ⁻¹

- a) List the key anaesthesiology issues which this case presents? [8 marks]
- b) What is a primary post-partum haemorrhage? [2 marks]
- c) Recall the four causes of primary post-partum haemorrhage and which is the most likely cause in this case? [5 marks]
- d) Comment on the findings of the patient's haematology and biochemistry blood results? [6 marks]
- e) Outline your immediate management of this patient prior to return to theatre. [14 marks]

Following your immediate management, the patients' heart rate is now 136 beats per minute and blood pressure is 83/46 mmHg.

- f) Describe and justify your choice of anaesthetic technique for this patient. [5 marks]
- g) List the appropriate monitoring that this patient would require. [8 marks]
- h) During the laparotomy, the patient requires a massive blood transfusion. What is meant by this term? [2 marks]
- i) What haematological targets would you aim for in such a case, and what blood/clotting products etc. would you use? [8 marks]
- j) What are the complications of a massive blood transfusion? [6 marks]

During the original caesarean section, the patient had received 150 μ g preservative free morphine intrathecally.

- k) Describe your plan for intra-operative and postoperative analgesia. [6 marks]

As the patient remains profoundly acidotic at the end of the laparotomy, you decide to admit her to the intensive care unit. During the next 5 hours, she required mechanical ventilatory support. You are called to review her as her temperature has started to increase to 37.8C, and her oxygen requirements have also increased to FiO₂ 0.8, giving a PaO₂ of 9.3KPa. You request a chest x-ray.



- l) Report on the Chest x-ray shown above. [5 marks]
- m) What is your differential diagnosis, starting with the most likely? [4 marks]

5 FCAI Structured Oral Examination 1 & 2

As with the clinical case, these will move to a **written format**, with a strong focus on **clinical cases** and **scenarios**.

The questions that follow will be a **mixture** of **CRQs** and **VSAQs**. They will be structured in such a way that the higher cognitive levels of learning will be tested. The questions will be designed to create clinical reasoning problems. These questions contain a case vignette and ask for (a) a most likely diagnosis and (b) features from the vignette that support or oppose the hypothesis, (c) options for management etc.

The **case is the unit of focus** for these test items. The question starts with a **short case vignette** that usually resembles an initial presentation of the patient at the preoperative assessment clinic, elective surgery list, intensive care and so on.

5.1 Number of questions

There will be **10 questions**, each attracting 24 marks. So, in total, this examination will be out of 240 marks. Candidates will have **180 minutes** to complete this examination in.

5.2 Structure and Blueprint

The cases will be structured to **mirror the current SOE 1** (clinical anaesthesia and pain management, and SOE 2: intensive care medicine and advanced sciences which underpin anaesthesiology).

5.3 Outcome

Candidates will not find out their result on the same day following completion of the online examination. The questions have to be marked and a rigorous quality assurance process will take place prior to the issue of results.

You will be notified by the CAI examinations department of the issue of results date, which will be available on the CAI website → Examinations → Recent results.

If you are successful, you will be admitted a Fellow of the College of Anaesthesiologists of Ireland (FCAI).

Fellowship by Examination

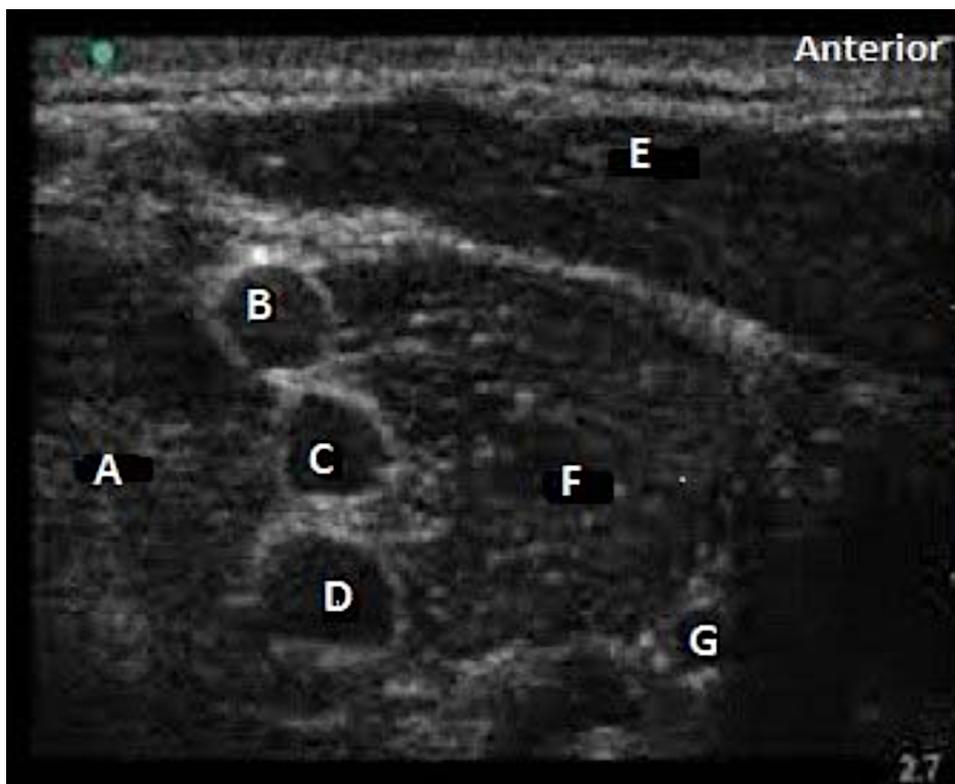
In accordance with the Standing Orders of the College of Anaesthesiologists of Ireland, a candidate who has successfully passed the Final Fellowship Examination of the College and who has complied with such provisions as determined by the Council shall be entitled to be admitted a Fellow of the College. On conferring, the Fellow shall be entitled to use the post-nominal letters FCAI.

Example question

A 72-year-old woman is listed for a total shoulder replacement. She has a long history of rheumatoid arthritis, and you have decided to perform an awake interscalene brachial plexus block for postoperative analgesia.

- From which nerve roots does the brachial plexus arise? [1 mark]
- Describe the key complications of an interscalene nerve block which you would consent the patient for. [6 marks]

Look at the ultrasound image obtained prior to performing the nerve block.



- Label A – G [7 marks]
- What length of block needle should be used to perform this block? [1 mark]

- e) What position would you put the patient in to perform the block? [2 marks]
- f) The patient develops a Horner's syndrome following the administration of the nerve block. What are the three features you would expect to find? [3 marks]

6 Summary of the New FCAI Examination

	SBA	SAQ	Clinical case	Clinical written
Number of questions	90 questions – split between two papers each containing 45 questions	10 questions (3 – 6 subparts) – split between two papers each containing 5 questions	Multiple	10 questions (5 – 8 subparts)
Timing (minutes)	180	200	60	180
Number of marks	90	250	80	240
Format	Written	Written	Written	Written
Test administration	Online	Online	Online	Online
Standard setting method	Angoff	Angoff	Angoff	Angoff

7 Psychometric and Quality Assurance Issues

The College of Anaesthesiologists are fully aware of the anxiety that this new examination process might create for candidates. Let us reassure you that no one will be disadvantaged by these changes.

A detailed **psychometric analysis** will take place after each examination and the quality of questions reviewed in detail.

As there are many changes to our examinations, the CAI will carry out a **sense check** on the outcomes. A sense check is necessary to ensure that the standard was set appropriately.

This will be done by:

- Triangulating the pass rate and pass marks to previous diets
- How do the pass/fail decisions compare to other information available about the candidate?

The ultimate responsibility for setting the pass mark will reside with the Chairman of the Examinations Committee and Lead Examiners of membership and fellowship. In all cases it will be essential that the process is transparent and clearly recorded.

8 Disability

All requests from candidates with a disability must include a written statement of support from the employer's Occupational Health Department (OHD) and/or College Tutor confirming that the candidate's difficulties warrant special examination arrangements. Each request will be considered individually.

8.1 Dyslexia

The following provisions will normally be made:

SBA Paper: Additional time 15 minutes per hour.

SAQ Paper: an additional 15 minutes per hour.

CRQ/VSAQ Papers replacing SOEs: an additional 15 minutes per hour

Candidates must supply:

A written assessment within the last 12 months from an educational psychologist which includes a statement confirming that the candidate's difficulties warrant special examination arrangements.

Such an application will be considered by the Chairman of the relevant examination. If a candidate is not able to supply the above documents before the commencement of the examination, the candidate may choose to: (a) withdraw without penalty as per the standard procedure, or (b) proceed without special arrangements.

Guidance from Examiners on how to answer written questions

The short answer, constructed response and very short answer questions will be new to many of you. We are aware that typing your answer rather than writing them may be daunting for those who type perhaps more slowly. The questions have been designed not to require extensive essay type answers.

Please take note of the following guidance:

A. Mark allocation of questions

Where examiners have indicated the way marks are allocated in brackets [marks], candidates are advised to spend their time accordingly.

For example, all CRQ/VSAQ questions carry equal marks [24 marks], and these will be distributed amongst the subparts. So, in total, the FCAI written paper replacing the SOE will attract 320 marks.

The pass mark for each question will vary and takes into account the level of difficulty.

B. How to answer the questions

Type your answers in the space provided.

Read the question carefully, it is useful to identify key words in the question. The examiners may have underlined key words in the question.

Take note of the proportion of marks allocated to each section of a question – this indicates how much time should be spent on each section. For example, a question worth [5 marks] should be answered in approximately 3.7 minutes for the FCAI written components.

Pay attention to the **verbs** in the question e.g. name, state, explain, outline, describe, list. Decide what exactly you are being asked to do to answer this question.

Below is a **glossary** of some commonly used verbs in the FCAI SAQ / CRQ / VSAQ papers:

Critically evaluate: Evaluate the evidence available to support the hypothesis

Outline: Provide a summary of the important points

List: Provide a list

Compare and contrast: Provide a description of similarities and differences (e.g. in table format). This type of question will likely have a table for you to complete.

Management: Generic term that implies overall plan. Where appropriate, may include diagnosis as well as treatment

Discuss: Explain the underlying key principles. Where appropriate, this may include controversies and/or pros and cons.

Be concise – essays are not required for each answer; use single words or short phrases in response to ‘state, name or list’ questions and a short paragraph (several sentences) for ‘briefly describe, explain or outline’ questions.

Bullet points are acceptable and **encouraged** as long as sufficient information is provided and that you demonstrate an understanding of the topic.

Resist the temptation to elaborate if it's not relevant to the question – in doing this, candidates often demonstrate a lack of understanding and lose marks.

When asked to list for example investigations of anaemia, look at the marks awarded. If there are [3 marks], the examiner will expect you to list three investigations.

For example:

With respect to nociceptive pathways:

a) Name the TWO types of nerve fibres that transduce noxious stimuli in action potentials? [2 marks]

Answer:

- A δ fibre
- C fibre

b) Name THREE types of stimuli that activate primary afferent neurons? [3 marks]

Answer:

- Thermal
- Mechanical
- Chemical

Appendix 1: An example FCAI Short Answer Question (SAQ), with model answer:

A 35-year-old woman has a major haemorrhage following significant trauma and is admitted to your emergency department. She does not have a head injury.

- a) Give one definition of major haemorrhage. [1 mark]
- b) What are the principles of management of major haemorrhage in this patient? [12 marks]
- c) What complications might follow a massive blood transfusion? [8 marks]
- d) List the transfusion targets that you would aim for in major haemorrhage [4 mark]

Question	Marks
<p>a) Candidates must give one of these definitions to get the mark</p> <ul style="list-style-type: none"> • Loss of > one blood volume within 24 hours (approx. 70ml/kg, >5L in 70 kg adult) • 50% of total blood volume lost in less than 3 hours • Bleeding in excess of 150 ml/minute • Bleeding leading to a systolic blood pressure of <90mmHg and pulse of >110bpm 	1
<p>b)</p> <ul style="list-style-type: none"> • Ensure appropriate team members are contacted (not just "call for help") • Activation of major haemorrhage protocol • Identification of source of bleeding • Control/prevention of further blood loss • High flow oxygen/airway control • Establish IV or IO access • Baseline bloods • Frequent measurement of Hb & coagulation using point- of-care tests – TEG / ROTEM / Haemocue / arterial blood gases to direct transfusion (must mention POC tests) • Frequent measurement and correction of electrolytes abnormalities • Transfusion of blood and coagulation products to restore organ perfusion • Strict compliance with patient identification procedures, product handling & traceability • Measures to maintain/achieve normothermia 	12

<ul style="list-style-type: none"> • Consider imaging and/or damage control surgery • Consider the use of anti-fibrinolytics e.g. tranexamic acid <p>(Award 1 mark for each bullet point to a maximum of 12)</p>	
<p>c)</p> <ul style="list-style-type: none"> • Coagulopathy • Acid base abnormalities • Hypothermia • Circulatory overload • Electrolyte abnormalities - hypocalcaemia, hyperkalaemia/hypokalaemia, hypomagnesaemia, citrate toxicity (give 3 to get the mark) • Transfusion related lung injury (TRALI) • Immediate haemolytic transfusion reactions and non- haemolytic febrile reactions • Allergic reactions • Transfusion related infections • Transfusion related graft-vs-host disease • Immunomodulation <p>(Award 1 mark for each bullet point to a maximum of 8)</p>	8
<p>d)</p> <ul style="list-style-type: none"> • Hb 70-90 g L⁻¹ • Platelets >75 × 10⁹/L • PT/aPPT <1.5 × normal • Fibrinogen > 1.5-2 g L⁻¹ <p>(Award 1 mark for each bullet point to a maximum of 4)</p>	4
Total	25 marks