The European Examination in General Cardiology

Question Writing Guide

Reviewed 2\textsuperscript{nd} February 2019
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Background

The ESC Education Committee with the Task Force Certification at ESC have recorded in the present document essential guidance for producing sound robust MCQs (multiple choice questions).

The MCQs are designed to test core knowledge as described in a core curriculum and will be derived largely, but not exclusively, from the ESC and ESC Associations’ educational resources. It is important to emphasise that knowledge is only one of the competencies required of a cardiologist, and that tests of knowledge form only part of the assessment of suitability for certification. Knowledge assessment complements work-based methods that are more appropriate for assessing other aspects of professionalism such as teaching, the performance of procedures and the ability to apply knowledge to derive diagnoses and formulate management plans.

Currently the MCQs described in this guide are ‘Best-of-Five’. To ensure the knowledge items tested are of clinical relevance the questions are set in the context of a clinically plausible scenario. This question style has been rigorously assessed for its reliability and validity and has been used for all diets of the European Exam General Cardiology (EEGC) taken to date. It has also been used for some years for the UK Membership of the Royal Colleges of Physicians (MRCP) examination.
Guide to ‘Best-of-Five’ Question Writing

Each question consists of three parts: a clinically-based stem, the question itself, and five options for the candidate to choose from, one of which is the ‘best’ answer and the others of which are plausible alternatives (‘distracters’). Questions may consist of text alone or can include up to one still image or video clip.
The Stem

In the exam, the candidates have limited time to read each scenario so it is essential that question stems are clear and concise, avoiding unnecessary detail. It is also very helpful to the candidates if all of the questions follow the same style and format. Guidance on question length is given below.

The stem comprises a clinical scenario that provides the background to the knowledge item being tested. The stem must be clinically plausible and comprise a few lines or paragraphs providing all the information required for the correct answer. It should also include information that makes each of the distracters plausible. It may incorporate laboratory results as well as a still image (eg an electrocardiogram, pressure tracing or scan) or a video clip. Images should only be included if their interpretation helps in identifying the correct answer.

The stem should be written in the past tense, be brief, unambiguous and include (in the following order):

- The age and gender of the patient (eg ‘A 68-year-old man…..’)
- If relevant, the patient’s occupation and/or ethnic origin
- The clinical setting (eg ‘…presented to the Emergency Department….’)
- The presenting complaint (eg ‘…..with acute central chest pain…….’)
- Relevant past medical, family and social history
- Relevant drug treatment (use generic names and give doses if relevant)
- Relevant physical examination findings (in the following order):
  - Vital signs (in the following order):
    - Pulse rate
    - Blood pressure
    - Temperature
    - Oxygen saturation
  - Peripheral cardiac signs (eg pulse character/volume)
  - Jugular venous pulse
  - Precordial impulses
  - Auscultatory signs (in the following order):
    - Heart sounds
    - Added sounds
    - Murmurs

   NB if there are no abnormal examination features a statement that ‘Physical examination was normal’ is acceptable
- Relevant laboratory investigations
  - Should be given in a logical order
  - Up to 2 ‘results’ can be included in the question text
  - If there are more than 2 ‘results’, give as a table after the question text
  - Results should be given using the units stated in Appendix 4
    - If only one unit is given, state the value and the unit, eg:
      ‘serum sodium 140 mmol/L’
    - If multiple units are given in Appendix 4, state the primary unit first with the secondary unit in parentheses, eg:
      ‘serum urea 7.0 mmol/L (18 mg/dL)’
    - See below for further examples.
- Image or video
  - Ideally no more than 1 image or video should be included in each question (except under exceptional circumstances)
  - If necessary, images/videos can be amalgamated into a single image/video
  - Where an image is included state ‘(see Image)’ in the text
  - Where a video is included state ‘(see Video)’ in the text
- Clinical progress

Irrelevant information and tricks to confuse the candidate should be avoided. It is important to avoid the use of abbreviations (see Appendix 1) or terms that may not be understood by those whose first language is not English. In many cases a single stem may be used to lead in to several separate questions.
Still Images

Still images and videos must be of high resolution and in digital format. File compression can be applied but there is an inevitable trade-off between image quality and file size. It is essential, however, that images are of diagnostic quality when shown at full-size on a standard computer screen with a resolution of 1024 x 768 pixels. All images should be modified to remove patient names and other identifiers such as hospital numbers.

Accepted formats are JPG, GIF, PNG, TIFF and BMP.

When scanning items, scan at a minimum of 200dpi for an A4 sheet (or 300dpi for an A5 sheet). ECGs should be scanned at 300dpi for an A4 sheet (lower resolutions lead to aliasing of the grid lines). Scanning ECGs at 256 colours (rather than 24 bit colour) reduces file size significantly. Images can then be cropped and files compressed using standard graphics editing software (e.g. Corel Photopaint/Adobe Photoshop). Bear in mind that images are displayed at a maximum resolution of 720 by 576 pixels. As a general rule diagnostic quality can be retained with file sizes of c. 200-500 kB.

Clinical photographs that include potentially identifiable features must be accompanied by written permission from the patient (or their legal representative) to use the image for educational purposes (in accordance with the relevant national regulations). Ideally photographs should be modified (eg by covering the eyes) to prevent identification.
Videos

Video files can be very problematic due to the wide range of formats and codecs available. Also, files can be very large and therefore difficult to upload on the ESC MCQ DATABASE so should ideally be compressed: again there is a trade-off between image quality and file size.

Accepted formats are MP4, WMV, MPEG, AVI and MOV.

Files in other formats must be converted using software. Free versions of conversion software can be downloaded and installed from internet (we recommend ‘Any Video Convertor’ and ‘Free MP4 Converter’ available for MS Windows and Mac). For any codec required, we recommend downloading and installing the ‘K-Lite Codec Pack’).

The following is a recommended system for producing video files for the ESC MCQ DATABASE exam.

1. Install ‘Any Video Convertor’ (or other video conversion software)
2. Install ‘K-Lite Codec Pack’ if required
3. Save a copy of the file in its original high definition format (eg DICOM/AVI)
4. Open ‘Any Video Convertor’ and drag the video file onto the conversion window
5. In the top right hand corner choose the output format (‘Customised MP4 movie (*.mp4)’)
6. In the basic settings box choose:
   a. Video size: 720 x 576 (this is the optimum size for playback in the exam centres)
   b. Quality: High (larger file size)
7. Click ‘Convert now’
8. Check converted video size (ideally less than 2Mb)
9. Play the video in Windows Media Player and ensure it is of diagnostic quality

NB: It is worthwhile bringing a copy of both the original video file and the compressed file to the question review sessions in case there are problems with file size or quality.
The Question

The question should be direct, unambiguous and should address a single issue. The knowledgeable candidate should be able to anticipate the question and the answer from the stem before reading the options.

Examples are:
- What is the most likely cause/diagnosis/explanation?
- What is the most appropriate investigation/treatment/next step in management?
- What observation is most predictive of a poor prognosis/adverse outcome?
- What is the most reliable way of assessing the severity of the......?

As the candidates can only choose from the options available the phrase ‘.... of the following...’ in the question is unnecessary.

Negatively worded questions can confuse candidates, do not reflect clinical reality and should be avoided, eg:
- What is not a feature of....?
- What is the least likely cause/diagnosis/explanation?
- What investigation/treatment/next step in management should be avoided?
The Five Options

Five options should be given for the candidates to choose from, one of which should be clearly correct.

The options should:

- start in lower case unless a proper name or acronym
- be presented in alphabetical order
- be capable of being anticipated from the clinical scenario in the Stem
- follow grammatically from the Question
- be related to the Question
- be plausible and realistic
  - avoid ‘multiple true/false’ options (see Appendix 3)
- be of similar length
  - longer answers tend to be the correct ones
- relate to the same modality
  - eg avoid mixing investigations and treatments
- avoid multiple management steps
  - eg ‘treat with amoxicillin, flucloxacillin and refer for valve replacement’
- avoid precise numerical answers/ranges unless these have a very strong and consistent evidence base to support the correct answer

Always remember to provide the correct answer!
Comments, Educational Resources, Explanation and Feedback

Questions are reviewed at multiple levels before they are used in an exam. To help the exam boards understand the rationale for a question, in the ‘References’ box:

1. Specify the educational resource used for the knowledge base for the question (e.g. ESC textbook chapter, ESC guideline, research paper etc.).
2. Provide feedback for each question with a brief – one or at the most three sentences – explanation of the correct and incorrect answers, referred back, where applicable to the educational resource. Some questions may be specific to individual countries, for example those relating to national guidelines (e.g. the UK NICE guidelines or regulations from national driving licensing authorities) and it is important that such questions are identified.
Classification Tags

Accurate question classification is essential to facilitate the work of the ESC MCQ DATABASE boards in setting a balanced assessment that covers all elements of the curriculum. It also enables subjects without sufficient questions to be identified easily. Classification is greatly facilitated by the online question submission portal and is mandatory before questions can be submitted online. Please categorise each question under the following headings:

1) **Level of difficulty** (for a trainee who has just completed core cardiology training)
   - easy (likely to be answered correctly by >80% of candidates)
   - medium
   - hard (likely to be answered correctly by <40% of candidates, remember that 20% of candidates will get the correct answer by random guesswork!)

2) **Length**
   - short (<5 lines in the stem)
   - medium (6-10 lines)
   - long (>10 lines)

   NB ‘Lines’ refers to lines of text on A4 in 12-point font. Questions that include an image or video should be classified as ‘Long’ irrespective of the text length.

3) **Curriculum Topic**

   To facilitate question selection for the ESC MCQ DATABASE each question must be categorised against ONE core curriculum topic. **Please refer to your respective curriculum topic list.** For example, below is the general cardiology curriculum topic list.

   - 01 – History Taking and Clinical Examination
   - 02 – Electrocardiogram (Standard ECG, Ambulatory ECG, Exercise ECG, CPX)
   - 03 – Non-invasive imaging:
     - 3.1 Non-invasive Imaging in General
     - 3.2 Echocardiography
     - 3.3 Cardiac Magnetic Resonance (CMR)
     - 3.4 Cardiac X-ray Computed Tomography
     - 3.5 Nuclear Techniques
   - 04 – Invasive imaging – Cardiac Catheterisation and Angiography
   - 05 – Genetics
   - 06 – Clinical Pharmacology
   - 07 – Cardiovascular Prevention
     - 7.1 Cardiovascular Risk Factors, Assessment and Management
     - 7.2 Arterial Hypertension
   - 08 – Acute Coronary Syndromes (ACS)
   - 09 – Chronic Ischaemic Heart Disease
   - 10 – Myocardial Diseases
   - 11 – Pericardial Diseases
   - 12 – Oncology and the Heart
   - 13 – Congenital Heart Disease in Adult Patients
• 14 – Pregnancy and Heart Disease
• 15 – Valvular Heart Disease
• 16 – Infective Endocarditis
• 17 – Heart failure
• 18 – Pulmonary Arterial Hypertension
• 19 – Physical activity and sport in primary and secondary prevention
  o 19.1 Sports Cardiology
  o 19.2 Cardiac Rehabilitation
• 20 – Arrhythmias
• 21 – Atrial Fibrillation and Flutter
• 22 – Syncope
• 23 – Sudden Cardiac Death and Resuscitation
• 24 – Diseases of the Aorta and Trauma to the Aorta and Heart
• 25 – Peripheral Arterial Disease
• 26 – Thromboembolic Venous Disease
• 27 – Acute Cardiovascular Care
• 28 – Cardiac consult
  o 28.1 The patient undergoing non-cardiac surgery
  o 28.2 The patient with neurological symptoms
  o 28.3 The patient with conditions not presenting primarily as cardiovascular disease
Tips for Good Question Writing

1. Before starting to write a question, identify the area of knowledge that you wish to test and decide whether you wish to test only factual knowledge or the ability to synthesise information and/or reach a judgement.
2. Identify the precise knowledge item you wish to test. Your own clinical practice is often the most useful source of inspiration (e.g. where a trainee has demonstrated an unexpected misconception or lack of knowledge, where a diagnosis has been missed or a suboptimal management strategy has been adopted).
3. Create a scenario in the stem that is clinically plausible and likely to reflect normal clinical practice.
4. A well written scenario can, with subtle changes, produce more than one MCQ (e.g. by changing the lead-in question, changing the stem so that one of the distracters becomes the correct answer or by testing for knowledge in different modalities (e.g. diagnosis, treatment, prognosis)).
5. Ensure that there is an evidence base supporting the correct answer.
6. Remember that a rare condition is unlikely to be the ‘most likely’ diagnosis unless the scenario gives a classic clinical presentation or a clearly diagnostic investigation.
7. Do not despair if you cannot identify 4 good distracters to the correct answer. Whilst this is ideal questions can still work with 3 or even 2 good distracters (although it is essential that all questions are written with 5 options even if 1 or 2 are weak).
8. Check that the question is written in the ESC House Style (see Appendices 1 and 2 below).
SUGGESTED READING

Case SM, Swanson DB. Constructing Written Test Questions for the Basic and Clinical Sciences, 3rd edn Philadelphia: National Board of Medical Examiners, 2001. Can be downloaded free from NBME website:

ESC MCQ Database

Question writing for the exams has been greatly facilitated by the development of an online portal for question submission:

To access the portal, please find below the list of links to access the database:

(To ensure optimal performances of the system please ensure you are using: Google chrome, Internet explorer (from version 11) or Mozilla Firefox (from version 45))

General Cardiology


EHRA:


HFA:


ACCA:


EACVI:


EAPCI:


To log in, enter your MyESC credentials:

login: email address

password: same password as for your MyESC account

Questions submitted via this portal are added directly to the ESC question database and are made available for review at the next question writers’ meeting.

It is possible to write questions using conventional word-processing software and then pasted into the ESC MCQ Database text boxes but this action may impact formatting.

Large image and video files can be slow to upload on the ESC MCQ Database.

A complete user guide on how to use the ESC MCQ Database detailing all functionalities available is available in Appendix 6.
APPENDIX 1 - House Style

It is very helpful for exam candidates to be presented with questions constructed in the same format and style. The following recommendations are conventions used by most publishers and form the basis of the ESC House Style for MCQs.

Grammar/Language

The following represent examples of preferred grammar:

<table>
<thead>
<tr>
<th>Preferred</th>
<th>Rather Than</th>
</tr>
</thead>
<tbody>
<tr>
<td>man</td>
<td>male</td>
</tr>
<tr>
<td>woman</td>
<td>female</td>
</tr>
<tr>
<td>emergency department</td>
<td>Accident and Emergency, A&amp;E</td>
</tr>
<tr>
<td>outpatient clinic</td>
<td>clinic, outpatients</td>
</tr>
<tr>
<td>he was taking</td>
<td>he was on, he was prescribed, his medication comprised</td>
</tr>
<tr>
<td>...with..., or ...with a past history of...</td>
<td>...with known...., ....known to have....</td>
</tr>
<tr>
<td>...ise</td>
<td>...ize</td>
</tr>
<tr>
<td>he was treated with</td>
<td>he was given, he was started on, he received</td>
</tr>
<tr>
<td>he underwent cardiac catheterisation</td>
<td>he was catheterised, he had a cardiac catheter</td>
</tr>
</tbody>
</table>

Proper names (e.g. Doppler echocardiogram) should be capitalised but other nouns should be in lower case including job titles and wards/departments (e.g. cardiologist, coronary care unit).

Examination Findings

The following represent examples of preferred language in describing physical signs:

Spell out pulse and blood pressure. Pulse is preferred to pulse rate or heart rate. E.g. ‘His pulse was XX beats per minute and his blood pressure was 140/80 mmHg.

...jugular venous pulse is preferred to JVP. Height is given as ‘+XXcm’ +/- waveform description if required (e.g. ‘...the jugular venous pulse was +9cm with a prominent diastolic descent...’).

Precordial impulses should be described in some variation of the forms given below:

<table>
<thead>
<tr>
<th>Impulse</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apex beat (normal)</td>
<td>...was not displaced....</td>
</tr>
<tr>
<td>Apex beat (displaced)</td>
<td>...was displaced to the 6th left intercostal space in the mid-clavicular line...</td>
</tr>
<tr>
<td>Apex beat (forceful)</td>
<td>...and/but was heaving/thrusting/forceful.</td>
</tr>
<tr>
<td>Apex beat (thrill)</td>
<td>...There was an apical systolic thrill</td>
</tr>
<tr>
<td>Left sternal border (heave)</td>
<td>...there was a parasternal heave....</td>
</tr>
<tr>
<td>Left sternal border (thrill)</td>
<td>... there was a parasternal thrill....</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>---------------------------------------</td>
</tr>
<tr>
<td>Pulmonary area (palpable P2)</td>
<td>....there was a palpable impulse in the second left intercostal space...</td>
</tr>
<tr>
<td>Pulmonary area (thrill)</td>
<td>....there was a thrill in the second left intercostal space</td>
</tr>
<tr>
<td>Aortic thrill</td>
<td>....there was a thrill in the second right intercostal space/over the manubrium...</td>
</tr>
</tbody>
</table>

### Investigations

'X-ray' is preferred to ‘x-ray’ or ‘X-Ray’ or ‘radiograph’.

'ECG' is preferred to ‘EKG’

‘CT scan of (the) head’ is preferred to ‘CT head’ or ‘CT head scan’

‘MR scan of (the) brain’ is preferred to ‘MR brain scan’

‘Ultrasound scan of (the) abdomen’ is preferred to ‘abdominal ultrasound’.

### Answer/Distracter Options

These should start with lower case letters unless they are a proper name (eg ‘Judkins catheter’ but ‘myocardial infarction’) or an acronym (eg PCI) and should be listed in alphabetical order. Distracters starting with numbers precede those starting with letters.

### Abbreviations

Generally abbreviations should be avoided, and the words spelt out in full the first time they appear in the text. An abbreviation may be defined if a phrase is repeated in the stem (eg you could define ‘....patent foramen ovale (PFO)....’ the first time it is used and then use the abbreviation ‘ PFO...’ subsequently) but avoid confusion with other common abbreviations (eg cardiac nurse specialist (CNS)).

Exceptions include commonly used items that are widely understood, eg: ECG, CT, MR, PCI, PET, MUGA, DC (cardioversion), MIBI, ACE, LDL, HDL, MCV, MCH, MRSA.

Abbreviations with more than one capital letter do not take full stops (eg MRSA not M.R.S.A.). ‘ST-elevation MI’ and ‘non-ST-elevation MI’ are preferred forms.

Units of measurement are usually abbreviated: eg mm, cm, m, mmHg, mL, L and are separated by a space from the numerical measurement (eg 140/80 mmHg).

Units of time should be written in full in the stem (hours, minutes, seconds) but may be abbreviated (h, min, s) in investigation lists and the answers.

For blood gasses, PCO₂ and PO₂ are preferred. For temperature ‘C’ is preferred over ‘°C’. For diabetes, HbA1c.

For oxygen saturation given as part of the vital signs this is assumed to be transcutaneous: spell out and give inhaled oxygen level and route, eg ‘...oxygen saturation was 88% on room air.’ or
‘...oxygen saturation was 96% on 35% oxygen via a face mask...’

Hospital ward/departmental names should be spelled out in full and do not require capitals, eg: outpatient clinic, coronary care unit, cardiac catheter laboratory, intensive care unit, emergency department.

**Punctuation and Spacing**

A single space is preferred after all punctuation marks including full stops and other marks at the end of sentences. A single space is preferred between measurements and their units (eg 50 mg). No space is preferred between <, > or % and numbers (eg 57%).

Double quotation marks are only preferred for reporting direct speech (eg ...he described his pain as “crushing”...) otherwise (eg quoting from a written text) use single quotation marks.

**Numbers**

Generally, in blocks of text such as the stem, numbers one to nine should be spelled out, with numbers 10 and above given as figures. Exceptions to this include:
- The start of a sentence (numbers should be spelled out unless very large)
- Drug regimens (see below)
- Measurements with units (eg 7 minutes, 5.3 L).

For large numbers use a comma to separate into blocks of ‘000s, (eg 2,550,432 ml)

**Drug Regimens**

Generic RINN drug names are preferred and should be in lower case (eg bisoprolol) unless at the start of a sentence. Proprietary names may be given also by way of clarification if required (eg ‘abciximab (ReoPro)’). For medicine doses give the dose as a number and the dosing regimen as words (eg lisinopril 20 mg three times daily).
APPENDIX 2 - Examples of ‘Best of Five’ MCQs

These questions were devised for the assessment of trainees who had completed three years of core training in cardiology. Some examples of feedback are also shown; they do not all relate directly to ESC educational materials.

1. A 52-year-old man presented to the emergency department with breathlessness. He had a history of multiple myeloma for 5 years, treated with melphalan and thalidomide. Examination revealed a jugular venous pressure of +8cm and oedema of the mid-thigh bilaterally. An echocardiogram showed mild left ventricular systolic dysfunction, left ventricular posterior wall and septal thickness of 1.4cm and a 0.8cm pericardial effusion. His fluid retention persisted despite intravenous furosemide 80mg twice daily.

What is the most likely cause of his heart failure?

A anthracycline cardiotoxicity  
B cardiac amyloid  
C cardiac metastases  
D constrictive pericarditis.  
E hypertrophic cardiomyopathy

Answer: B

2. A 50-year-old woman with hypertension was referred to the clinic for investigation of chest pain. She had significant osteoarthritis of both knees. Physical examination was normal and her blood pressure was 150/90 mm Hg. Her electrocardiogram showed minor non-specific T wave flattening.

What is the most appropriate initial investigation for her suspected coronary artery disease?

A bicycle exercise ECG  
B coronary calcium score  
C myocardial perfusion scintigraphy  
D selective coronary arteriography  
E treadmill exercise ECG

Answer: C

3. A 68-year-old woman presented to the Emergency Department after a fall. She remembered walking across her living room and then regaining consciousness lying face down on the carpet. She recovered rapidly and there was no incontinence. On examination she had minor abrasions
and bruising to her nose and face. Her pulse was 72 beats per minute, her blood pressure was 125/75mmHg with no postural drop and she had normal heart sounds.

What is the most appropriate initial investigation?

A  12-lead ECG  
B  carotid sinus massage  
C  CT scan of head  
D  head-up tilt testing  
E  Holter recording

Answer: A

Feedback: The ESC guidelines on the investigation of syncope state that the initial evaluation of a patient presenting with syncope consists of: careful history, physical examination including orthostatic blood pressure measurements and standard electrocardiogram (ECG).

4. A 63-year-old man was discharged from hospital on standard secondary prevention medication 5 days after suffering an acute myocardial infarction. When reviewed in clinic 6 weeks later he complaining that his psoriasis had become intolerable.

What drug is most likely to be responsible for this adverse effect?

A  aspirin  
B  bisoprolol  
C  clopidogrel  
D  ramipril  
E  simvastatin

Answer: B

Feedback: Exacerbation of psoriasis is a well-described class effect of beta-blockers.

5. A 19-year-old man presented to the Emergency Department with a 4-hour history of palpitation after drinking 6 pints of beer. He said he had a Fontan operation in childhood. On examination he appeared breathless and had cool peripheries. His pulse was 120 beats per minute and regular. His systolic blood pressure was 80 mmHg. His ECG showed a regular narrow complex tachycardia at 120 bpm with abnormal p waves.

What is the most appropriate management of his arrhythmia?

A  direct current cardioversion  
B  intravenous adenosine
C intravenous flecainide
D intravenous metoprolol
E intravenous verapamil

Answer A

Feedback: Rapid restoration to sinus rhythm is important to maintain cardiac output. DC cardioversion is the safest way to achieve this. Flecainide, metoprolol and verapamil may result in further hypotension and cardiovascular collapse. Adenosine is unlikely to terminate the arrhythmia which is most likely to be an atrial tachycardia.

6. A 68-year-old man was undergoing a complex coronary interventional procedure. He was obese and the radiographer expressed concern about the patient’s radiation exposure.

What is the best way of reducing the entrance dose rate?

A narrowing the collimation
B magnification using digital image zoom
C moving the patient closer to the X-ray tube
D using a high kV acquisition
E using shallow angle projections

Answer: E

7. A 58-year-old man attended the outpatient clinic. He had been discharged from hospital 2 weeks earlier after treatment for congestive cardiac failure. He had severe left ventricular systolic dysfunction and atrial fibrillation. He was taking furosemide 80 mg twice daily, perindopril 8 mg daily, carvedilol 12.5 mg twice daily and adjusted-dose warfarin. He complained of increasingly severe weakness, dizziness and effort intolerance. On examination his pulse was 56 beats per minute. His blood pressure was 90/50 mmHg (lying) and 70/50 mmHg (standing). His jugular venous pressure was not raised. There were no added heart sounds or murmurs. His chest was clear to auscultation and there was no peripheral oedema.

Investigations:
serum sodium 130 mmol/L
serum potassium 5.6 mmol/L
serum creatinine 190 μmol/L
serum urea 38 mmol/L (98 mg/dL)

chest X-ray cardiothoracic ratio 24/38, normal lung fields

What is the most appropriate next step in his management?
A  add spironolactone
B  add valsartan
C  reduce carvedilol
D  reduce furosemide
E  reduce perindopril

Answer: D

8.
A 73-year-old man was seen in the outpatient clinic with breathlessness and chest tightness provoked by exertion. On examination he had an ejection systolic murmur. His electrocardiogram showed evidence of left ventricular hypertrophy. An echocardiogram was performed.

What measurement most specifically indicates the severity of his valvular heart disease?

A  analysis of proximal isovolumic surface area (PISA)
B  calculation of valve area using the continuity equation
C  end-diastolic left ventricular diameter
D  pressure half-time
E  width of vena contracta

Answer B

9.
A 55-year-old man attended the outpatient clinic with aortic stenosis. An echocardiogram was performed including an assessment of the trans-valvular gradient.

What is the best way of achieving optimal alignment between blood flow across the valve and the ultrasound beam?

A  applying an angle correction algorithm
B  minimising high-pass filtration
C  using high-pulse repetition frequency
D  using imaging/continuous wave transducer
E  using multiple transducer positions

Answer: E

10.
A 28-year-old man presented to the clinic with a 6-week history of haemoptysis. He had recently returned from a holiday in the Far East. He smoked 20 cigarettes per day. He had had Dacron patch repair of coarctation of the aorta aged 2 years. On examination he was afebrile. His pulse was 70 beats per minute in sinus rhythm and his blood pressure was 125/70 mmHg.
What is the most likely cause of his haemoptysis?

A aneurysm at site of coarctation repair  
B atypical pneumonia  
C carcinoma of the bronchus  
D pulmonary embolism  
E tuberculosis

Answer: A

Feedback: Late aneurysm formation is most common after Dacron patch repair of coarctation of the aorta, and erosion in to the bronchial tree causing haemoptysis is a well-recognised complication.

11. A 26-year-old man was seen in the outpatient clinic. He had undergone radical repair of tetralogy of Fallot with a transannular patch at the age of 3 years. He presented with fatigue and was no longer able to keep up with his friends playing football. On examination he was pink, had a right ventricular heave and a soft ejection systolic murmur at the upper left sternal border.

Investigations:  
chest X-ray: cardiomegaly, cardiothoracic ratio 16/31  
ECG: sinus rhythm and right bundle branch block

What is the most likely cause of his deterioration?

A pulmonary hypertension  
B pulmonary regurgitation  
C pulmonary stenosis  
D residual ventricular septal defect  
E tricuspid regurgitation

Answer: B

Feedback: Pulmonary regurgitation is almost universal in patients who have had a transannular patch at the time of repair. It is often silent, since the pulmonary artery pressure is low and the regurgitation is laminar. Symptoms usually develop in the 3rd decade.
APPENDIX 3 - Common Errors in ‘Best of Five’ Question Writing

The questions below provide examples of common errors made by less experienced writers when constructing questions.

Multiple True/False
A 52-year-old woman was reviewed in the clinic with mitral stenosis. She complained of increasing breathlessness. On examination she had an elevated jugular venous pulse at +8cm and peripheral oedema.

Which of the following is a clinical examination finding in mitral stenosis?

A. ejection click
B. fixed splitting of the second heart sound
C. fourth heart sound
D. loud first heart sound
E. third heart sound

Answer: D

In this question the stem is irrelevant: it provides a clinical context but does not assist in the choice between the five options. The five options are independent of each other and the question is therefore a ‘multiple true/false’ rather than a true ‘best-of-five’ question. It is also best to avoid the terms ‘all of the above’ or ‘none of the above’ as options as these invariably indicate multiple true/false questions.

Negatively Worded Questions
A 52-year-old woman was brought to the emergency department with acute chest pain and breathlessness. Her ECG showed widespread ST segment elevation and she was diagnosed with an acute myocardial infarct.

On examination she was in distress. Her pulse was 120 beats per minute, her blood pressure was 70/60 mmHg, her respiratory rate was 36 per minute and oxygen saturations were 88% on high flow oxygen via a re-breathing mask. Heart sounds were normal. There were extensive crackles audible throughout both lung fields.

What drug treatment should not be given?
A buccal nitrate  
B intravenous furosemide  
C oral aspirin  
D oral bisoprolol  
E oral clopidogrel  

Answer: D

Candidates find negatively worded questions (e.g., ‘what treatment should not be given?’, ‘what is the most unlikely diagnosis?’, ‘what investigation is least appropriate?’) confusing and they can lead to errors when the question is read quickly in an exam setting. They also tend to bear less relevance to clinical practice. Questions should always be positively worded for the KBA exam (e.g., ‘what is the most appropriate treatment?’, ‘what is the most likely diagnosis?’, ‘what investigation is most likely to provide the diagnosis?’).

‘Trivial’ Knowledge Examined

A 50-year-old woman with pulmonary hypertension was reviewed in the clinic. She complained of fatigue and breathlessness. On examination her pulse was 88 beats per minute and her blood pressure was 155/85 mmHg. She had a para-sternal heave and a loud second heart sound with an early diastolic murmur loudest at the right sternal border.

What is name given to this murmur?

A Austin Flint  
B Carey Coombs  
C Graham Steell  
D Libman-Sacks  
E Starr-Edwards

Answer: C

Instead of testing candidates understanding of the patho-physiology of pulmonary hypertension, the question asks for knowledge of an eponymous term which is, of itself, has no practical clinical value. The question could easily be rectified by asking for the most likely source of the murmur.

‘Keying’ the Correct Answer

A 37-year-old woman presented to the emergency department with acute palpitations that had started 4 days earlier. Her symptoms had deteriorated with breathlessness and orthopnoea and on arrival she was distressed. One year earlier she had an episode of transient dysphasia for which no cause was identified.

On examination she was agitated. Her pulse was 280 beats per minute, her blood pressure was 125/75 mmHg and her oxygen saturation was 99% on 35% O2 via a face mask. Heart sounds were normal and the chest was clear.
Her ECG showed atrial flutter with 1:1 AV conduction and normal QRST complexes.

What is the most appropriate treatment to restore sinus rhythm?

A DC cardioversion  
B intravenous digoxin  
C oral amiodarone  
D overdrive pacing  
E transoesophageal echocardiography guided DC cardioversion

Answer: E

The correct answer includes two steps and is substantially longer than the distracters. There are also two options that include DC cardioversion. These all ‘key’ the candidates to the correct answer. Generally it is best to avoid multiple steps in the options (eg avoid answers like ‘give amoxicillin and gentamicin and refer for urgent valve surgery’) and to try to ensure that the options are of similar length.

**Distracters with Mixed Modalities**

A 67-year-old woman presented to the emergency department with breathlessness and palpitations. She had a history of hypertension for which she took lisinopril 10mg once daily.

On examination her pulse was 130 beats per minute, her blood pressure was 170/85mmHg and her oxygen saturation was 96% on 35% O\textsubscript{2} via a face mask. Heart sounds were normal and the chest was clear.

Her ECG showed atrial fibrillation with left ventricular hypertrophy on voltage criteria and non-specific T wave changes.

What is the most important management step?

A DC cardioversion  
B echocardiogram  
C intravenous amiodarone  
D oral bisoprolol  
E subcutaneous low molecular weight heparin

Answer: E

The options here include a combination of investigations and treatments. The treatments given include a combination of both procedures and drug options. The drug options address different aspects of the patient’s care. All of these may be appropriate but it is impossible to give and objective comparison of their individual importance. The question writer here took the view that protection against thromboembolism was more important than controlling the heart rate, restoring sinus rhythm or investigating the cause of AF but that is a value judgement and has no evidence base. Generally the options in an individual question should all come from a single
modality (ie all investigations, or all drug treatments, or all physical procedures).

**Numerical Lists**

A 67-year-old man attended the clinic for cardiovascular risk screening. He was asymptomatic. He had a history of hypertension for which he took lisinopril 5mg once daily. He had no history of vascular disease. He was a non-smoker. There was no family history of cardiovascular disease.

On examination his pulse was 76 beats per minute in sinus rhythm and his blood pressure was 125/75 mmHg. His body mass index was 30 kg/m². Physical examination was otherwise normal.

Investigations:

- serum cholesterol 6.4 mmol/L (246 mg/dL)
- serum LDL cholesterol 4.8 mmol/L (184 mg/dL)
- serum HDL cholesterol 1.4 mmol/L (56 mg/dL)

What is the best estimate of his 10-year risk of adverse cardiovascular events?

A 10%
B 20%
C 30%
D 40%
E 50%

Answer: C

This patient has a Framingham Risk Score of c.30% but it its calculation requires the use of a regression formula and the candidates will not have access to a calculation tool in the KBA exam. More importantly, other tools exist to estimate cardiovascular risk (eg a Q-Score would estimate his risk at c.20%). Questions where the options come in the form of numerical lists, even when given as ranges, are inherently difficult as there is often contradictory data in the evidence base. Conversely, it is unreasonable to expect candidates to recall an exact number from a specific study.
APPENDIX 4 - Reference Ranges

This is the list below that is used for the European General Cardiology Exam. The reference ranges given here are in the order in which laboratory values should appear in lists of investigations in the question stem. Results should be given in the question text without reference ranges – the candidates will have access to a PFD document giving the reference ranges. As different units are used in different European countries some results need to be given with 2 different units (typically SI and mass units). These should be stated with the primary unit first (given in black text below) and the secondary unit (given in red text below) in parentheses, eg

- serum sodium 130 mmol/L
- serum potassium 5.9 mmol/L
- serum creatinine 250 µmol/L (3.0 mg/dL)
- serum urea 21 mmol/L (54 mg/dL)

If you include a laboratory result where no reference range is given below, please state a reference range in parentheses after the result in the question text in the following format, eg

- serum myoglobin 250 ng/mL (17–106)
- serum testosterone 1.1 nmol/L (6.2–26)

Wikipedia has a comprehensive set of reference ranges which can be used if needed:

https://en.wikipedia.org/wiki/Reference_ranges_for_blood_tests

Haematology

- haemoglobin
  - men 13–18 g/dL
  - women 2.0–2.6 mmol/L
- red cell count
  - men 4.3–5.9 \times 10^{12}/L
  - women 3.5–5.0 \times 10^{12}/L
- haematocrit
  - men 0.40–0.52
  - women 0.36–0.47
- MCV 80–96 fl
- MCH 28–32 pg
- MCHC 32–35 g/dL
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>white cell count</td>
<td>$4 - 11 \times 10^9/L$</td>
</tr>
<tr>
<td>neutrophil count</td>
<td>$1.5 - 7.0 \times 10^9/L$</td>
</tr>
<tr>
<td>lymphocyte count</td>
<td>$1.5 - 4.0 \times 10^9/L$</td>
</tr>
<tr>
<td>monocyte count</td>
<td>$&lt;0.8 \times 10^9/L$</td>
</tr>
<tr>
<td>eosinophil count</td>
<td>$0.04 - 0.40 \times 10^9/L$</td>
</tr>
<tr>
<td>basophil count</td>
<td>$&lt;0.1 \times 10^9/L$</td>
</tr>
<tr>
<td>platelet count</td>
<td>$150 - 400 \times 10^9/L$</td>
</tr>
<tr>
<td>reticulocyte count</td>
<td>$25 - 85 \times 10^9/L$</td>
</tr>
<tr>
<td>reticulocyte count</td>
<td>$0.5 - 2.4%$</td>
</tr>
<tr>
<td>erythrocyte sedimentation rate</td>
<td></td>
</tr>
<tr>
<td>under 50 years:</td>
<td></td>
</tr>
<tr>
<td>men</td>
<td>$&lt;15\text{mm} /1\text{st h}$</td>
</tr>
<tr>
<td>women</td>
<td>$&lt;20\text{mm}/1\text{st h}$</td>
</tr>
<tr>
<td>over 50 years:</td>
<td></td>
</tr>
<tr>
<td>men</td>
<td>$&lt;20\text{mm}/1\text{st h}$</td>
</tr>
<tr>
<td>women</td>
<td>$&lt;30\text{mm}/1\text{st h}$</td>
</tr>
<tr>
<td>Coagulation</td>
<td></td>
</tr>
<tr>
<td>international normalised ratio</td>
<td>$&lt;1.4$</td>
</tr>
<tr>
<td>prothrombin time</td>
<td>$11.5 - 15.5\text{s}$</td>
</tr>
<tr>
<td>activated partial thromboplastin time</td>
<td>$30 - 40\text{s}$</td>
</tr>
<tr>
<td>thrombin time</td>
<td>$15 - 19\text{s}$</td>
</tr>
<tr>
<td>fibrinogen</td>
<td>$1.8 - 5.4\text{g/L}$</td>
</tr>
<tr>
<td>bleeding time</td>
<td>$3 - 8\text{ min}$</td>
</tr>
<tr>
<td>Coagulation factors</td>
<td></td>
</tr>
<tr>
<td>factors II, V, VII, VIII, IX, X, XI, XII</td>
<td>$50 - 150\text{ IU/dL}$</td>
</tr>
<tr>
<td>von Willebrand factor</td>
<td>$45 - 150\text{ IU/dL}$</td>
</tr>
<tr>
<td>von Willebrand factor antigen</td>
<td>$50 - 150\text{ IU/dL}$</td>
</tr>
<tr>
<td>protein C</td>
<td>$80 - 135\text{ IU/dL}$</td>
</tr>
<tr>
<td>protein S</td>
<td>$80 - 120\text{ IU/dL}$</td>
</tr>
<tr>
<td>antithrombin</td>
<td>$80 - 120\text{ IU/dL}$</td>
</tr>
<tr>
<td>activated protein C resistance</td>
<td>$2.12 - 4.00 \text{ (NB: a ratio so has no unit)}$</td>
</tr>
<tr>
<td>fibrin degradation products</td>
<td>$&lt;100\text{ mg/L}$</td>
</tr>
<tr>
<td>D-dimer concentration</td>
<td>$&lt;0.5\text{ mg/L}$</td>
</tr>
<tr>
<td></td>
<td>$&lt;500\text{ ng/mL}$</td>
</tr>
</tbody>
</table>

**Haematinics**
<table>
<thead>
<tr>
<th>Analyte</th>
<th>Normal Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serum iron</td>
<td>12–30 µmol/L</td>
</tr>
<tr>
<td>Serum iron-binding capacity</td>
<td>45–75 µmol/L</td>
</tr>
<tr>
<td>Serum ferritin</td>
<td>15–300 µg/L</td>
</tr>
<tr>
<td>Serum transferrin</td>
<td>2–4 g/L</td>
</tr>
<tr>
<td>Transferrin saturation</td>
<td>20–50%</td>
</tr>
<tr>
<td>Serum vitamin B₁₂</td>
<td>160–760 ng/L</td>
</tr>
<tr>
<td>Serum folate</td>
<td>2–11 µg/L</td>
</tr>
<tr>
<td>Red cell folate</td>
<td>160–640 µg/L</td>
</tr>
<tr>
<td>Serum haptoglobin</td>
<td>0.13–1.63 g/L</td>
</tr>
<tr>
<td>Methaemoglobin</td>
<td>&lt;1%</td>
</tr>
</tbody>
</table>

**Chemistry**

**Blood**

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Normal Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serum sodium</td>
<td>137–144 mmol/L</td>
</tr>
<tr>
<td>Serum potassium</td>
<td>3.5–4.9 mmol/L</td>
</tr>
<tr>
<td>Serum urea</td>
<td>2.5–7.0 mmol/L</td>
</tr>
<tr>
<td>Serum creatinine</td>
<td>60–110 µmol/L</td>
</tr>
<tr>
<td>Estimated glomerular filtration rate (MDRD)</td>
<td>&gt;60 mL/min</td>
</tr>
<tr>
<td>Serum corrected calcium</td>
<td>2.2–2.6 mmol/L</td>
</tr>
<tr>
<td>Serum ionised calcium</td>
<td>1.13–1.32 mmol/L</td>
</tr>
<tr>
<td>Serum phosphate</td>
<td>0.8–1.4 mmol/L</td>
</tr>
<tr>
<td>Serum magnesium</td>
<td>0.6–0.9 mmol/L</td>
</tr>
<tr>
<td>Serum creatine kinase</td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td>24–195 U/L</td>
</tr>
<tr>
<td>Women</td>
<td>24–170 U/L</td>
</tr>
<tr>
<td>Serum creatine kinase MB fraction</td>
<td>&lt;5%</td>
</tr>
<tr>
<td>Serum troponin I</td>
<td>&lt;26 ng/L (high-sensitivity assay)</td>
</tr>
<tr>
<td>Serum troponin T</td>
<td>&lt;14 ng/L (high-sensitivity assay)</td>
</tr>
<tr>
<td>NB: please specify ‘high sensitivity assay’ in parentheses, as above, for Troponin results</td>
<td></td>
</tr>
<tr>
<td>Fasting plasma glucose</td>
<td>3–6 mmol/L</td>
</tr>
<tr>
<td>Random plasma glucose</td>
<td>3.9–7.8 mmol/L</td>
</tr>
<tr>
<td>Haemoglobin A₁c</td>
<td>3.8–6.4%</td>
</tr>
<tr>
<td>Plasma uric acid</td>
<td>0.18–0.48 mmol/L</td>
</tr>
<tr>
<td>Serum total protein</td>
<td>61–76 g/L</td>
</tr>
<tr>
<td>Serum albumin</td>
<td>37–49 g/L</td>
</tr>
<tr>
<td>Serum globulin</td>
<td>24–27 g/L</td>
</tr>
<tr>
<td>Serum total bilirubin</td>
<td>1–22 µmol/L</td>
</tr>
<tr>
<td>Serum conjugated bilirubin</td>
<td>&lt;3.4 µmol/L</td>
</tr>
</tbody>
</table>
serum alanine aminotransferase 5–35 U/L
serum aspartate aminotransferase 1–31 U/L
serum alkaline phosphatase 45–105 U/L
serum gamma glutamyl transferase
  men <50 U/L
  women 4–35 U/L
plasma lactate 0.6–1.8 mmol/L
serum angiotensin-converting enzyme 25–82 U/L
serum amylase 60–180 U/L
serum brain natriuretic peptide <100 pg/ml
serum N-terminal pro brain natriuretic peptide
  <75yrs <125 pg/ml
  >75yrs <450 pg/ml
C-reactive protein<200 nmol/L
  <5 mg/L

Urine

24-h urinary total protein <0.2 g
24-h urinary albumin <30 mg
24-h urinary creatinine 9–18 mmol
urinary albumin:creatinine ratio
  men <3.5 mg/mmol
  women <2.5 mg/mmol
urinary protein:creatinine ratio <15 mg/mmol
urine microscopy:
  white cells <10/µL

Lipids and Lipoproteins

serum cholesterol <5.2 mmol/L
  <200 mg/dL
serum LDL cholesterol <3.36 mmol/L
  <130 mg/dL
serum HDL cholesterol >1.55 mmol/L
  <60 mg/dL
fasting serum triglycerides 0.45–1.69 mmol/L
  50–150 mg/dL

Arterial blood gases, breathing air

PO_{2} 11.3–12.6 kPa
  80–100 mmHg
PCO_{2} 4.7–6.0 kPa
pH: 7.36–7.44
H⁺: 35–45 nmol/L
bicarbonate: 19–24 mmol/L
base excess: ±2 mmol/L
lactate: 0.5–1.6 mmol/L
carboxyhaemoglobin:
non-smoker: <2%
smoker: 3–15%
oxygen saturation: 94–99%

Endocrinology

**Adrenal steroids (blood)**

- plasma aldosterone (normal diet)
  - (supine after 30 min): 135–400 pmol/L
  - (upright after 4 h): 330–830 pmol/L
- plasma angiotensin II: 5–35 pmol/L
- plasma renin activity
  - (supine): 1.1–2.7 pmol/mL/h
  - (upright after 30 min): 3.0–4.3 pmol/mL/h
- serum cortisol (09.00 h): 200–700 nmol/L
- serum cortisol (22.00 h): 50–250 nmol/L

- overnight dexamethasone suppression test (after 1 mg dexamethasone)
  - serum cortisol: <50 nmol/L
- low-dose dexamethasone suppression test (2 mg/day for 48 h)
  - serum cortisol: <50 nmol/L
- high-dose dexamethasone suppression test (8 mg/day for 48 h)
  - serum cortisol: should suppress to <50% of day 0 value
- short tetracosactide test (250 µg)
  - serum cortisol: >550 nmol/L and 200 nmol/L greater than baseline

24-h urinary aldosterone: 14–53 nmol
24-h urinary cortisol: 55–250 nmol
plasma adrenocorticotropic hormone (09.00 h): <18 pmol/L
plasma antidiuretic hormone: 0.9–4.6 pmol/L

Thyroid hormones

- plasma thyroid-stimulating hormone: 0.4–5.0 mU/L
- plasma thyroid binding globulin: 13–28 mg/L
plasma thyroxine (T4)  58–174 nmol/L
                4.0–12.5 µg/dL
plasma tri-iodothyronine (T3)  0.9–2.8 nmol/L
                       70–180 ng/dL
plasma free T4  10–22 pmol/L
            0.8–1.7 ng/dL
plasma free T3  5–10 pmol/L
              0.2–0.5 ng/dL

Catecholamines (urine)

<table>
<thead>
<tr>
<th>Substance</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>24-h urinary vanillylmandelic acid</td>
<td>5–35 µmol</td>
</tr>
<tr>
<td>24-h urinary dopamine</td>
<td>&lt;3100 nmol</td>
</tr>
<tr>
<td>24-h urinary adrenaline</td>
<td>&lt;144 nmol</td>
</tr>
<tr>
<td>24-h urinary noradrenaline</td>
<td>&lt;570 nmol</td>
</tr>
</tbody>
</table>

Catecholamines (blood)

<table>
<thead>
<tr>
<th>Substance</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>adrenaline</td>
<td>0.03–1.31 nmol/L</td>
</tr>
<tr>
<td>noradrenaline</td>
<td>0.47–4.14 nmol/L</td>
</tr>
</tbody>
</table>

Immunology

<table>
<thead>
<tr>
<th>Antibody</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>IgA</td>
<td>70–360 mg/dL</td>
</tr>
<tr>
<td>IgD</td>
<td>0.5–3.0 mg/dL</td>
</tr>
<tr>
<td>IgE</td>
<td>0.01–0.04 mg/dL</td>
</tr>
<tr>
<td>IgG</td>
<td>800–1800 mg/dL</td>
</tr>
<tr>
<td>IgM</td>
<td>54–220 mg/dL</td>
</tr>
<tr>
<td>anti-streptolysin O titre</td>
<td>&gt;125 U/ml</td>
</tr>
<tr>
<td>anti-ds-DNA</td>
<td>&gt;60 U/ml</td>
</tr>
<tr>
<td>anti-phospholipid IgG</td>
<td>&gt;50 U/ml</td>
</tr>
<tr>
<td>antiphospholipid IgM</td>
<td>&gt;10 U/ml</td>
</tr>
</tbody>
</table>

Therapeutic Drug Concentrations

<table>
<thead>
<tr>
<th>Substance</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>plasma digoxin (taken at least 6 h post dose)</td>
<td>1–2 nmol/L</td>
</tr>
</tbody>
</table>

Pulmonary Function

<table>
<thead>
<tr>
<th>Function</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>forced expiratory volume in 1 second (FVC)</td>
<td>&gt;80% of predicted value</td>
</tr>
<tr>
<td>forced vital capacity in 1 second (FEV1)</td>
<td>&gt;80% of predicted value</td>
</tr>
<tr>
<td>FEV1 : FVC ratio</td>
<td>60–80%</td>
</tr>
<tr>
<td>transfer factor for CO</td>
<td>% (80–120)</td>
</tr>
<tr>
<td>transfer coefficient (KCO)</td>
<td>% (100)</td>
</tr>
</tbody>
</table>
## Cardiac Haemodynamics

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>right atrium (mean)</td>
<td>1–8 mmHg</td>
</tr>
<tr>
<td>right ventricle (systolic)</td>
<td>15–30 mmHg</td>
</tr>
<tr>
<td>right ventricle (diastole)</td>
<td>1–8 mmHg</td>
</tr>
<tr>
<td>pulmonary artery (systole)</td>
<td>15–30 mmHg</td>
</tr>
<tr>
<td>pulmonary artery (diastole)</td>
<td>8–15 mmHg</td>
</tr>
<tr>
<td>pulmonary artery (mean)</td>
<td>10–20 mmHg</td>
</tr>
<tr>
<td>left atrium / pulmonary arterial wedge (mean)</td>
<td>4–12 mmHg</td>
</tr>
<tr>
<td>left ventricle (systole)</td>
<td>100–140 mmHg</td>
</tr>
<tr>
<td>left ventricle (diastole)</td>
<td>4–12 mmHg</td>
</tr>
<tr>
<td>aorta (systole)</td>
<td>100–140 mmHg</td>
</tr>
<tr>
<td>aorta (diastole)</td>
<td>60–90 mmHg</td>
</tr>
<tr>
<td>aorta (mean)</td>
<td>70–105 mmHg</td>
</tr>
<tr>
<td>cardiac output</td>
<td>4.0–7.0 L/min</td>
</tr>
<tr>
<td>systemic vascular resistance</td>
<td>10–15 Wood units</td>
</tr>
<tr>
<td></td>
<td>800–1200 dynes.s.cm$^{-5}$</td>
</tr>
<tr>
<td>pulmonary vascular resistance</td>
<td>&lt;3.5 Wood units</td>
</tr>
<tr>
<td></td>
<td>&lt;250 dynes.s.cm$^{-5}$</td>
</tr>
</tbody>
</table>
APPENDIX 5 - Classification for the Core Curriculum in General Cardiology

Topic list from ESC Core Curriculum in General Cardiology (2013 edition)

1  History Taking and Clinical Examination
2  The Electrocardiogram (Standard ECG, Ambulatory ECG, Exercise ECG, CPX)
3  3.1. Non-invasive Imaging in General
    3.2. Echocardiography
    3.3. Cardiac Magnetic Resonance (CMR)
    3.4. Cardiac X-ray Computed Tomography
    3.5. Nuclear Techniques
4  Invasive Imaging – Cardiac Catheterisation and Angiography
5  Genetics
6  Clinical Pharmacology
7  7.1. Cardiovascular Risk Factors, Assessment and Management
    7.2. Arterial Hypertension
8  Acute Coronary Syndromes (ACS)
9  Chronic Ischaemic Heart Disease
10 Myocardial Diseases
11 Pericardial Diseases
12 Oncology and the Heart
13 Congenital Heart Disease in Adult Patients
14 Pregnancy and Heart Disease
15 Valvular heart disease
16 Infective endocarditis
17 Heart Failure (HF)
18 Pulmonary Arterial hypertension
19 19.1. Sports Cardiology
    19.2. Cardiac Rehabilitation
20 Arrhythmias
21 Atrial Fibrillation and Flutter
22 Syncope
23 Sudden Cardiac Death (SCD) and Resuscitation
24 Diseases of the Aorta and Trauma to the Aorta and Heart
25 Peripheral Artery Diseases (PAD)
26 Thromboembolic Venous Disease
27 Acute Cardiovascular Care
28 28.1. The patient undergoing non-cardiac surgery
    28.2. The patient with neurological symptoms
    28.3. The patient with conditions not presenting primarily as cardiovascular disease
MCQ Database:  
Authoring module:  
front office  

Quick user guide
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1. Overview

After accessing to the authoring module, the main screen is displayed:

![Authoring Screen]

Description of this screen is below:

- On the left (1), icons to access to menu:

<table>
<thead>
<tr>
<th>Icon</th>
<th>Menu</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Icon]</td>
<td>Filters: Status, Topic, Media, Difficulty level, Clinical Context length</td>
</tr>
</tbody>
</table>

- Above MCQs list (2):
  - Search field: to search by reference, question, clinical context
  - Total number of MCQs
  - Number of results per page
  - "Add" button to add a new MCQ

- MCQs list (3):
  It is possible to sort MCQs by reference, topic, author, modification date and status.

For each MCQ, 5 actions are possible:

<table>
<thead>
<tr>
<th>Icon</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Icon]</td>
<td>MCQ visualisation</td>
</tr>
<tr>
<td>![Icon]</td>
<td>MCQ modification</td>
</tr>
<tr>
<td>![Icon]</td>
<td>MCQ history visualisation</td>
</tr>
<tr>
<td>![Icon]</td>
<td>MCQ deletion</td>
</tr>
<tr>
<td>![Icon]</td>
<td>MCQ duplication: copy the MCQ to create a new MCQ from another one: the new MCQ form is displayed</td>
</tr>
</tbody>
</table>
2. Workflow

Here is the MCQ workflow which is described through this document:

Create ➔ Save as draft ➔ Preview ➔ Submit

3. MCQ adding

Click on “Add” button (2) to add a new MCQ.

The following screen is displayed:

3.1 Clinical context

Complete clinical context (4)

3.2 Media

It’s possible to add media (5) to illustrate a MCQ (optional).
By clicking on "Add" button, the following screen is displayed:

- Choose a media (8) from your computer or from an external storage.
- A thumbnail of the chosen media is displayed (9).
- Media can be permanently deleted through bin icon next to the thumbnail.
- Drag and drop the media to the main area (10).
- By mousing over the image, cropping and deletion icons are displayed:

By clicking on cropping icon and then clicking on one of the 4 corners cursors you can move vertical and horizontal sliders to adjust media.

By clicking on deletion icon, media disappears from main area (10) but stays on media's list on the right (9).

You can upload and drag and drop several media and place them as needed in main area (10).

### 3.3 Question & answers

- 1- Complete question and answers (6)

Clinical context and question aren’t both mandatory, but at least one of them needs to be completed.

By default, only one line is displayed for answers, click on "Add" button to add other answers. To display answers in alphabetical order, click on the appropriate button.
2. Tick the radio button of the correct answer

To delete an answer, click on bin icon

### 3.4 Other actions

Through the right area (7), other information/actions are available:

<table>
<thead>
<tr>
<th>Item</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status</td>
<td>Last update information</td>
</tr>
<tr>
<td>Tags</td>
<td>Topic, Difficulty level and Clinical context length</td>
</tr>
<tr>
<td>Comments</td>
<td>Add a comment</td>
</tr>
<tr>
<td>Duplicate</td>
<td>Duplicate a question to create a new one: after clicking on Duplicate, you are redirected to the new MCQ</td>
</tr>
<tr>
<td>Save</td>
<td>Save the MCQ</td>
</tr>
</tbody>
</table>

Create ➔ Save as draft ➔ Preview ➔ Submit

### 4. MCQ checking

Create ➔ Save as draft ➔ Preview ➔ Submit
After saving a MCQ, a window is displayed allowing to check all items of the MCQ:

Here is a description of this screen:

<table>
<thead>
<tr>
<th>Area</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>Clinical context</td>
</tr>
<tr>
<td>12</td>
<td>Question</td>
</tr>
<tr>
<td>13</td>
<td>Answers</td>
</tr>
<tr>
<td>14</td>
<td>Other items</td>
</tr>
</tbody>
</table>

An iPad screen is simulated to preview the MCQ (11, 12, 13).

(13) Click on left/right arrows to browse from a MCQ to another MCQ.

(14) Click on "Modify" button to return to the MCQ modification page.

Select one of the 2 available status (the selected status is green):

- **Draft**: Save the MCQ as a draft (by default status). This will allow you to come back later to this question to finish it before you decide to submit it to the MCQ review group.
- **Submitted**: Submit the MCQ to the MCQ review group so the question can be reviewed by peers.
Click on the cross button to return to the MCQs list

5. MCQ modification

By clicking on "Modify" icon/button (3)(14), a MCQ can be modified. Form is identical to the one used to add a MCQ.

6. MCQ history

By clicking on "History" icon (3), modifications of a MCQ can be consulted:

Here is a description of this screen:

<table>
<thead>
<tr>
<th>Area</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>Clinical context</td>
</tr>
<tr>
<td>16</td>
<td>Question</td>
</tr>
<tr>
<td>17</td>
<td>Answers</td>
</tr>
</tbody>
</table>

List of modification dates are on the right (17). Select 2 dates to compare versions.
The oldest selected version is displayed on the right area (16) and the most recent selected version is on the left (15):
Differences between the 2 versions are highlighted in green and red.

Click on Restore for the version you want to display. The restored version will replace the current version.

7. MCQ Deletion

By clicking on "Delete" icon (3), a MCQ can be deleted.

A confirmation message is displayed to confirm or not the deletion:

<table>
<thead>
<tr>
<th>ID</th>
<th>Title</th>
<th>Question</th>
<th>Type</th>
<th>Status</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>31</td>
<td>Test your knowledge</td>
<td>question</td>
<td>question</td>
<td>published</td>
<td>2018-07-15 13:14:24 Published</td>
</tr>
<tr>
<td>32</td>
<td>test your knowledge</td>
<td>question</td>
<td>question</td>
<td>published</td>
<td>2018-07-15 13:14:24 Published</td>
</tr>
<tr>
<td>33</td>
<td>question test on the back shelf</td>
<td>test the modifications</td>
<td>2.Pairs, 20 items, Limited</td>
<td>published</td>
<td>2018-05-13 13:11:24 Draft</td>
</tr>
<tr>
<td>34</td>
<td>Ensen.tapppment le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le dernier le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last le last 22</td>
<td>AAFP open test on the back shelf (3)</td>
<td>December 3</td>
<td>London, London</td>
<td>published</td>
</tr>
<tr>
<td>24</td>
<td>What is the number of football teams in London?</td>
<td>question</td>
<td>e2e</td>
<td>published</td>
<td>2018-04-25 13:21:09 Draft</td>
</tr>
</tbody>
</table>

By choosing "Yes", the MCQ is deleted: it remains displayed in the list with the status "Deleted".